IBM

UniVerse

BASIC Extensions

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Preface

This manual describes the following extensions to UniVerse BASIC:

Chapter 1, "Using the Socket Interface," discusses the UniVerse BASIC Socket API, which provides the capability of interacting with an application running on another mafhine via the sockets interface.

Chapter 2, "Using CallHTTP," discusses using CallHTTP with UniVerse. CallHTTP provides customers with the capability of interacting with a web server from UniVerse BASIC through the standard HTTP protocol. In order to effectively use the CallHTTP functions, you should have a working knowledge of the HTTP standard.

Chapter 3, "Using WebSphere MQ with UniVerse," describes how to set up and configure the WebSphere MQ API for UniVerse.

Chapter 4, "Creating XML Documents," describes how to create XML documents from RetrieVe, UniVerse BASIC, and UniVerse SQL

Chapter 5, "Receiving XML Documents," describes how to receive an XML document, then read the document through UniVerse BASIC, and execute UniVerse BASIC commands against the XML data.

Chapter 6, "The Simple Object Access Protocol," describes how to use the Simple Object Access Protocol (SOAP), an XML-based protocol for exchanging structured information in a distributed environment, with UniData.

Chapter 7, "The Document Object Model," describes the Document Object Model (DOM), a standard way for you to manipulate XML documents. You can use the DOM API to delete, remove, and update an XML document, as well as create new XML documents.

Chapter 8, "Data Transfer Between XML Documents and UniVerse Files," describes the XMLDB data transfer capability, which extends the existing XML support in UniData. It consists of the data transfer utilities and the UniBasic XMAP API. The data transfer utilities consist of two TCL commands, XML.TODB and DB.TOXML, and two UniBasic functions, XMLTODB() and DBTOXML().

Chapter 9, "The XML/DB Tool," describes the XML/DB tool, which enables you to create a mapping file to use when creating XML documents from the UniVerse database, or when extracting data from an XML document and updating the UniVerse database.

Documentation Conventions

This manual uses the following conventions:

Convention	Usage
Bold	In syntax, bold indicates commands, function names, and options. In text, bold indicates keys to press, function names, menu selections, and MS-DOS commands.
UPPERCASE	In syntax, uppercase indicates UniVerse commands, keywords, and options; BASIC statements and functions; and SQL statements and keywords. In text, uppercase also indicates UniVerse identifiers such as filenames, account names, schema names, and Windows platform filenames and pathnames.
Italic	In syntax, italic indicates information that you supply. In text, italic also indicates UNIX commands and options, filenames, and pathnames.
`Courier`	Courier indicates examples of source code and system output.
`Courier Bold`	In examples, courier bold indicates characters that the user types or keys the user presses (for example, **`<Return>`**).
[ ]	Brackets enclose optional items. Do not type the brackets unless indicated.
{ }	Braces enclose nonoptional items from which you must select at least one. Do not type the braces.
itemA | itemB	A vertical bar separating items indicates that you can choose only one item. Do not type the vertical bar.
...	Three periods indicate that more of the same type of item can optionally follow.
ä	A right arrow between menu options indicates you should choose each option in sequence. For example, "Choose **File** ä **Exit**" means you should choose **File** from the menu bar, then choose **Exit** from the File pull-down menu.
`I`	Item mark. For example, the item mark (`I`) in the following string delimits elements 1 and 2, and elements 3 and 4: `1I2F3I4V5`

Documentation Conventions

Convention	Usage
F	Field mark. For example, the field mark (**F**) in the following string delimits elements FLD1 and VAL1: `FLD1FVAL1VSUBV1SSUBV2`
V	Value mark. For example, the value mark (**V**) in the following string delimits elements VAL1 and SUBV1: `FLD1FVAL1VSUBV1SSUBV2`
S	Subvalue mark. For example, the subvalue mark (**S**) in the following string delimits elements SUBV1 and SUBV2: `FLD1FVAL1VSUBV1SSUBV2`
T	Text mark. For example, the text mark (**T**) in the following string delimits elements 4 and 5: `1F2S3V4T5`

Documentation Conventions (Continued)

The following conventions are also used:

- Syntax definitions and examples are indented for ease in reading.
- All punctuation marks included in the syntax—for example, commas, parentheses, or quotation marks—are required unless otherwise indicated.
- Syntax lines that do not fit on one line in this manual are continued on subsequent lines. The continuation lines are indented. When entering syntax, type the entire syntax entry, including the continuation lines, on the same input line.

UniVerse Documentation

UniVerse documentation includes the following:

UniVerse Installation Guide: Contains instructions for installing UniVerse 10.3.

UniVerse New Features Version 10.3: Describes enhancements and changes made in the UniVerse 10.3 release for all UniVerse products.

UniVerse BASIC: Contains comprehensive information about the UniVerse BASIC language. It includes reference pages for all BASIC statements and functions. It is for experienced programmers.

UniVerse BASIC Commands Reference: Provides syntax, descriptions, and examples of all UniVerse BASIC commands and functions.

UniVerse BASIC Extensions: Describes the following extensions to UniVerse BASIC: UniVerse BASIC Socket API, Using CallHTTP, Using WebSphere MQ with UniVerse, using XML with UniVerse, and the XML/DB Tool.

UniVerse BASIC SQL Client Interface Guide: Describes how to use the BASIC SQL Client Interface (BCI), an interface to UniVerse and non-UniVerse databases from UniVerse BASIC. The BASIC SQL Client Interface uses ODBC-like function calls to execute SQL statements on local or remote database servers such as UniVerse, IBM, SYBASE, or INFORMIX. This book is for experienced SQL programmers.

Administering UniVerse: Describes tasks performed by UniVerse administrators, such as starting up and shutting down the system, system configuration and maintenance, system security, maintaining and transferring UniVerse accounts, maintaining peripherals, backing up and restoring files, and managing file and record locks, and network services. This book includes descriptions of how to use the UniVerse Admin program on a Windows client and how to use shell commands on UNIX systems to administer UniVerse.

Using UniAdmin: Describes the UniAdmin tool, which enables you to configure UniVerse, configure and manager servers and databases, and monitor UniVerse performance and locks.

UniVerse Transaction Logging and Recovery: Describes the UniVerse transaction logging subsystem, including both transaction and warmstart logging and recovery. This book is for system administrators.

UniVerse Security Features: Describes security features in UniVerse, including configuring SSL through UniAdmin, using SSL with the CallHttp and Socket interfaces, using SSL UniObjects for Java, and automatic date encryption.

UniVerse System Description: Provides detailed and advanced information about UniVerse features and capabilities for experienced users. This book describes how to use UniVerse commands, work in a UniVerse environment, create a UniVerse database, and maintain UniVerse files.

UniVerse User Reference: Contains reference pages for all UniVerse commands, keywords, and user records, allowing experienced users to refer to syntax details quickly.

Guide to RetrieVe: Describes RetrieVe, the UniVerse query language that lets users select, sort, process, and display data in UniVerse files. This book is for users who are familiar with UniVerse.

Guide to ProVerb: Describes ProVerb, a UniVerse processor used by application developers to execute prestored procedures called procs. This book describes tasks such as relational data testing, arithmetic processing, and transfers to subroutines. It also includes reference pages for all ProVerb commands.

Guide to the UniVerse Editor: Describes in detail how to use the Editor, allowing users to modify UniVerse files or programs. This book also includes reference pages for all UniVerse Editor commands.

UniVerse NLS Guide: Describes how to use and manage UniVerse's National Language Support (NLS). This book is for users, programmers, and administrators.

UniVerse SQL Administration for DBAs: Describes administrative tasks typically performed by DBAs, such as maintaining database integrity and security, and creating and modifying databases. This book is for database administrators (DBAs) who are familiar with UniVerse.

UniVerse SQL User Guide: Describes how to use SQL functionality in UniVerse applications. This book is for application developers who are familiar with UniVerse.

UniVerse SQL Reference: Contains reference pages for all SQL statements and keywords, allowing experienced SQL users to refer to syntax details quickly. It includes the complete UniVerse SQL grammar in Backus Naur Form (BNF).

Related Documentation

The following documentation is also available:

UniVerse GCI Guide: Describes how to use the General Calling Interface (GCI) to call subroutines written in C, C++, or FORTRAN from BASIC programs. This book is for experienced programmers who are familiar with UniVerse.

UniVerse ODBC Guide: Describes how to install and configure a UniVerse ODBC server on a UniVerse host system. It also describes how to use UniVerse ODBC Config and how to install, configure, and use UniVerse ODBC drivers on client systems. This book is for experienced UniVerse developers who are familiar with SQL and ODBC.

UV/NET II Guide: Describes UV/Net II, the UniVerse transparent database networking facility that lets users access UniVerse files on remote systems. This book is for experienced UniVerse administrators.

UniVerse Guide for Pick Users: Describes UniVerse for new UniVerse users familiar with Pick-based systems.

Moving to UniVerse from PI/open: Describes how to prepare the PI/open environment before converting PI/open applications to run under UniVerse. This book includes step-by-step procedures for converting INFO/BASIC programs, accounts, and files. This book is for experienced PI/open users and does not assume detailed knowledge of UniVerse.

API Documentation

The following books document application programming interfaces (APIs) used for developing client applications that connect to UniVerse and UniData servers.

Administrative Supplement for APIs: Introduces IBM's seven common APIs, and provides important information that developers using any of the common APIs will need. It includes information about the UniRPC, the UCI Config Editor, the *ud_database* file, and device licensing.

UCI Developer's Guide: Describes how to use UCI (Uni Call Interface), an interface to UniVerse and UniData databases from C-based client programs. UCI uses ODBC-like function calls to execute SQL statements on local or remote UniVerse and UniData servers. This book is for experienced SQL programmers.

IBM JDBC Driver for UniData and UniVerse: Describes UniJDBC, an interface to UniData and UniVerse databases from JDBC applications. This book is for experienced programmers and application developers who are familiar with UniData and UniVerse, Java, JDBC, and who want to write JDBC applications that access these databases.

InterCall Developer's Guide: Describes how to use the InterCall API to access data on UniVerse and UniData systems from external programs. This book is for experienced programmers who are familiar with UniVerse or UniData.

UniObjects Developer's Guide: Describes UniObjects, an interface to UniVerse and UniData systems from Visual Basic. This book is for experienced programmers and application developers who are familiar with UniVerse or UniData, and with Visual Basic, and who want to write Visual Basic programs that access these databases.

UniObjects for Java Developer's Guide: Describes UniObjects for Java, an interface to UniVerse and UniData systems from Java. This book is for experienced programmers and application developers who are familiar with UniVerse or UniData, and with Java, and who want to write Java programs that access these databases.

UniObjects for .NET Developer's Guide: Describes UniObjects, an interface to UniVerse and UniData systems from .NET. This book is for experienced programmers and application developers who are familiar with UniVerse or UniData, and with .NET, and who want to write .NET programs that access these databases.

Using UniOLEDB: Describes how to use UniOLEDB, an interface to UniVerse and UniData systems for OLE DB consumers. This book is for experienced programmers and application developers who are familiar with UniVerse or UniData, and with OLE DB, and who want to write OLE DB programs that access these databases.

Chapter

Using the Socket Interface

1

The UniVerse BASIC Socket API provides the user with the capability of interacting with an application running on another machine via the sockets interface. The Socket API enables you to write distributed UniVerse applications. For example, one application, written in the server side socket interface can function as the server while others can function as clients. The server and the clients can cooperate on tasks through socket communication. This is an efficient way for UniVerse BASIC applications to communicate, and is easy to implement. The Socket functions are not in order of how they would normally be implemented. Refer to "Socket API Example" for more information on using the Socket API functions.

Socket Function Error Return Codes

The following error return codes are used for all socket-related functions described below. Note that only numeric code should be used in UniVerse BASIC programs.

The following table describes each error code and its meaning.

Error Code	Definition
0 -SCK_ENOERROR	No error.
1 - SCK_ENOINITIALISED	On Windows platforms, a successful WSAStartup() call must occur before using this function.
2 - SCK_ENETDOWN	The network subsystem has failed.
3 - SCK_EFAULT	The *addrlen* parameter is too small or *addr* is not a valid part of the user address space.
4 - SCK_ENOTCONN	The socket is not connected.
5 - SCK_EINTR	The (blocking) call was cancelled. (NT: through WSACancelBlockign-Call).
6 - SCK_EINPROGRESS	A blocking Windows Sockets 1.1 call is in progress, or the service provider is still processing a callback function.
7 - SCK_EINVAL	This can be caused by several conditions. The listen function was not invoked prior to accept, the socket has not been bound with bind, an unknown flag was specified, or MSG_OOB was specified for a socket with SO_OOBINLINE enabled or (for byte stream sockets only) len was zero or negative.
8 - SCK_EMFILE	The queue is nonempty upon entry to accept and there are no descriptors available.
9 - SCK_ENOBUFS	No buffer space is available.
10 - SCK_ENOTSOCK	The descriptor is not a socket.

Socket Function Error Return Codes

Error Code	Definition
11 - SCK_EOPNOTSUPP	The referenced socket is not a type that supports connection-oriented service.
12 - SCK_EWOULDBLOCK	The socket is marked as nonblocking and the requested operation would block.
13 - SCK_ENETRESET	The connection has been broken due to the keep-alive activity detecting a failure while the operation was in progress.
14 - SCK_ESHUTDOWN	The socket has been shut down.
15 - SCK_EMSGSIZE	(For recv()) The message was too large to fit into the specified buffer and was truncated, or (for send()) the socket is message oriented, and the message is larger than the maximum supported by the underlying transport.
16 - SCK_ETIMEDOUT	The virtual circuit was terminated due to a time-out or other failure.
17 - SCK_ECONNABORTED	The connection has been dropped, because of a network failure or because the system on the other end went down without notice.
18 - SCK_ECONNRESET	The virtual circuit was reset by the remote side executing a hard or abortive close. For UPD sockets, the remote host was unable to deliver a previously sent UDP datagram and responded with a “Port Unreachable” ICMP packet. The application should close the socket as it is no longer usable.
19 - SCK_EACCES	The requested address is a broadcast address, but the appropriate flag was not set. Call **setSocketOption()** with the BROADCAST parameter to allow the use of the broadcast address.
20 - SCK_EHOSTUNREACH	The remote host cannot be reached from this host at this time.
21 - SCK_ENOPROTOOPT	The option is unknown or unsupported for the specified provider or socket.

Socket Function Error Return Codes (Continued)

Error Code	Definition
22 - SCK_ESYSNOTREADY	Indicates that the underlying network subsystem is not ready for network communication.
23 -SCK_EVER NOTSUPPORTED	The version of Windows Sockets support requested is not provided by this particular Windows Sockets implementation.
24 - SCK_EPROCLIM	Limit on the number of tasks supported by the Windows Sockets implementation has been reached.
25 - SCK_EAFNOSUPPORT	The specified address family is not supported.
26 - SCK_EPROTONOSUPPORT	The specifed protocol is not supported.
27 - SCK_EPROTOTYPE	The specified protocol is the wrong type for this socket.
28 - SCK_ESOCKTNOSUPPORT	The specified socket type is not supported in this address family.
29 - SCK_EBADF	Descriptor socket is not valid.
30 - SCK_EHOST_NOT_FOUND	Authoritative Answer Host not found.
31 - SCK_ETRY_AGAIN	Nonauthoritative Host not found, or server failure.
32 - SCK_ENO_RECOVERY	A nonrecoverable error occurred.
33 - SCK_ENO_DATA	Valid name, no data record of requested type.
34 - SCK_EACCESS	Attempt to connect datagram socket to broadcast address failed because **setSocketOption()** BROADCAST is not enabled.
35 - SCK_EADDRINUSE	A process on the machine is already bound to the same fully-qualified address and the socket has not been marked to allow address reuse with REUSEADDR. (See the REUSEADDR socket option under **setSocketOption()**).
36 - SCK_EADDRNOTAVAIL	The specified address is not a valid address for this machine.

Socket Function Error Return Codes (Continued)

Error Code	Definition
37 - SCK_EISCONN	The socket is already connected.
38 - SCK_EALREADY	A nonblocking connect call is in progress on the specified socket.
39 - SCK_ECONNREFUSED	The attempt to connect was forcefully rejected.
40 - SCK_EMALLOC	Memory allocation error.
41 - SCK_ENSLMAP	NLS map not found, or unmapped characters encountered.
42 - SCK_EUNKNOWN	Other unknown errors.
101	Invalid security context handle.
102	SSL/TLS handshake failure (unspecified, peer is not SSL aware).
103	Requires client authentication but does not have a certificate in context.
104	Unable to authenticate server.
105	Client authentication failure.
106	Peer not speaking SSL.
107	Encryption error.
108	Decryption error.

Socket Function Error Return Codes (Continued)

Getting a Socket Error Message

Use the **getSocketErrorMessage()** function to translate an error code into a text error message.

This function works with all socket functions. The return status of those functions can be passed into this function to get ther corresponding error message.

Syntax

getSocketErrorMessage(*errCode, errMsg*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
errCode	The status return code sent by the socket functions.
errMsg	A string containing corresponding error text.

getSocketErrorMessage Parameters

The following table describes the return status of each mode.

Return Code	Description
0	Success.
1	Invalid error code.

Return Code Status

Opening a Socket

Use the **openSocket()** function to open a socket connection in a specified mode and return the status.

Syntax

openSocket(*name_or_IP, port, mode, timeout, socket_handle*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
name_or_IP	DNS name (x.com) or IP address of a server.
port	Port number. If the port number is specified as a value <= 0, CallHTTP defaults to a port number of 40001.
mode	2: non-blocking mode 1: blocking mode
timeout	The timeout value, expressed in milliseconds. If you specify mode as 0, timeout will be ignored.
socket_handle	A handle to the open socket.

openSocket Parameters

The following table describes the return status of each mode.

Return Code	Description
0	Success.
Non-zero	See Socket Function Error Return Codes.

Return Code Status

Opening a Secure Socket

Use the **openSecureSocket()** function to open a secure socket connection in a specified mode and return the status.

This function behaves exactly the same as the **openSocket()** function, except that it returns the handle to a socket that transfers data in a secured mode (SSL/TLS).

All parameters (with the exception of *context*) have the exact meaning as the **openSocket()** parameters. *Context* must be a valid security context handle.

Once the socket is opened, any change in the associated security context will not affect the established connection.

Syntax

openSecureSocket(*name_or_IP, port, mode, timeout, socket_handle, context*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
name_or_IP	DNS name (x.com) or IP address of a server.
port	Port number. If the port number is specified as a value <= 0, CallHTTP defaults to a port number of 40001.
mode	0:non-blocking mode 1:blocking mode
timeout	The timeout value, expressed in milliseconds. If you specify mode as 0, timeout will be ignored.
socket_handle	A handle to the open socket.
context	A handle to the security context

openSecureSocket Parameters

The following table describes the return status of each mode.

Return Code	Description
0	Success.
1-41	See Socket Function Error Return Codes.
101	Invalid security context handle.
102	SSL/TLS handshake failure (unspecified, peer is not SSL aware).
103	Requires client authentication but does not have a certificate in the security context.
104	Unable to authenticate server.

Return Code Status

Closing a Socket

Use the **closeSocket()** function to close a socket connection.

Syntax

closeSocket(*socket_handle*)

Where *socket_handle* is the handle to the socket you want to close.

The following table describes the status of each return code.

Return Code	Description
0	Success.
Non-zero	See Socket Function Error Return Codes.

Return Code Status

Getting Information From a Socket

Use the **getSocketInformation()** function to obtain information about a socket connection.

Syntax

getSocketInformation(*socket_handle, self_ or_ peer, socket_info*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
socket_handle	The handle to the open socket.
self_ or_ peer	Get information on the self end or the peer end of the socket. Specify 0 to return information from the peer end and non-zero for information from the self end.
socket_info	Dynamic Array containing information about the socket connection. Forinformation about the elements of this dynamic array, see the following table.

getSocketInformation Parameters

The following table describes each element of the socket_info dynamic array. The

Element	Description
1	Open or closed
2	Name or IP
3	Port number
4	Secure or nonsecure
5	Blocking mode

following table describes the status of each return code.

Element	Description
1	Open or closed
2	Name or IP
3	Port number
4	Secure or nonsecure
5	Blocking mode

Return Code Status

Reading From a Socket

Use the **readSocket()** function to read data in the socket buffer up to max_read_size characters.

Syntax

readSocket(*socket_handle, socket_data, max_read_size, time_out, blocking_mode, actual_read_size*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
socket_handle	The handle to the open socket.
socket_data	The data to be read from the socket.
max_read_size	The maximum mumber of characters to return. If this is 0, then the entire buffer should be returned.
time_out	The time (in milliseconds) before a return in blocking mode. This is ignored for non-blocking read.
blocking_mode	0:using current mode 1:blocking 2:non-blocking
actual_read_size	The number of characters actually read. -1 if error.

readSocket Parameters

The following table describes the return status of each mode.

Mode	Return Status
Non-Blocking	The function will return immediately if there is no data in the socket. If the*max_read_size* parameter is greater than the socket buffer then just the socket buffer will be returned.
Blocking	If there is no data in the socket, the function will block until data is put into the socket on the other end. It will return up to the max_read_size character setting.

Return Mode Status

The following table describes the status of each return code.

Return Code	Status
0	Success.
1-41	See Socket Function Error Return Codes.
107	Encryption error.
108	Decryption error.

Return Code Status

Writing to a Socket

Use the **writeSocket()** function to write data to a socket connection.

Syntax

writeSocket(*socket_handle, socket_data, time_out, blocking_mode, actual_write_size*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
socket_handle	The handle to the open socket.
socket_data	The data to be written to the socket.
time_out	The allowable time (in milliseconds) for blocking. This is ignored for a nonblocking write.
blocking_mode	0:using current mode 1:blocking 2:nonblocking
actual_write_size	The number of characters actually written.

writeSocket Parameters

The following table describes the return status of each mode.

Mode	Return Status
Blocking	The function will return only after all characters in socket_data are written to the socket.
Non-Blocking	The function may return with fewer character written than the actual length (in the case that the socket is full).

Return Mode Status

The following table describes the status of each return code.

Return Code	Status
0	Success.
1-41	See Socket Function Error Return Codes.
107	Encryption error.
108	Decryption error.

Return Code Status

Setting the Value for a Socket Option

The **setSocketOptions()** function sets the current value for a socket option associated with a socket of any type.

Syntax

setSocketOptions(*socket_handle, options*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
socket_handle	The socket handle from openSocket(), acceptSocket(), or initServer-Socket().
options	Dynamic Array containing information about the socket options and their current settings. The dynamic array is configured as: optName1<VM>optValue1a[<VM>optValue1b]<FM> optName2<VM>optValue2a[<VM>optValue2b]<FM> optName3... Where optName is specified by the caller and must be an option name string listed below. The first optValue specifies if the option is ON or OFF and must be one of two possible values: “1” for ON or “2” for OFF. The second optValue is optional and may hold additional data for a specific option. Currently, for the “LINGER” option it contains the delayed time (in milliseconds) before closing the socket. For all other options, it should not be specified as it will be ignored.

setSocketOptions Parameters

The following table describes the available options (case-sensitive) for **setSocketOptions**.

Option	Description
DEBUG	Enable/disable recording of debug information.
REUSEADDR	Enable/disable the reuse of a location address (default)
KEEPALIVE	Enable/disable keeping connections alive.
DONTROUTE	Enable/disable routing bypass for outgoing messages.
LINGER	Linger on close if data is present.
BROADCAST	Enable/disable permission to transmit broadcast messages.
OOBINLINE	Enable/disable reception of out-of-band data in band.
SNDBUF	Set buffer size for output (the default value depends on OS type).
RCVBUF	Set buffer size for input (the default value depends on OS type).

setSocketOptions Options

The following table describes the status of each return code.

Return Code	Status
0	Success.
Non-zero	See Socket Function Error Return Codes.

Return Code Status

Getting the Value of a Socket Option

The **getSocketOptions()** function gets the current value for a socket option associated with a socket of any type.

Syntax

getSocketOptions(*socket_handle, Options*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
socket_handle	The socket handle from openSocket(), acceptSocket(), or initServer-Socket().
options	A dynamic array containing information about the socket options and their current settings. When querying for options, the dynamic array is configured as: optName1<FM> optName2<FM> optName... When the options are returned, the dynamic array is configured as: optName1<VM>optValue1a[<VM>optValue1b]<FM> optName2<VM>optValue2a[<VM>optValue2b]<FM> optName3... Where optName contains an option name string listed below. The first optValue describes if the option is ON or OFF and must be one of two possible values: “1” for ON or “2” for OFF. The second optValue is optional and may hold additional data for a specific option. Currently, for option “LINGER,” it contains the delayed time (in milliseconds) before closing the socket.

getSocketOptions Parameters

The following table describes the available options (case-sensitive) for getSocketOptions().

Option	Description
DEBUG	Enable/disable recording of debug information.
REUSEADDR	Enable/disable the reuse of a location address (default).
KEEPALIVE	Enable/disable keeping connections alive.
DONTROUTE	Enable/disable routing bypass for outgoing messages.
LINGER	Linger on close if data is present.
BROADCAST	Enable/disable permission to transmit broadcast messages.
OOBINLINE	Enable/disable reception of out-of-band data in band.
SNDBUF	Get buffer size for output (default 4KB).
RCVBUF	Get buffer size for input (default 4KB).
TYPE	Get the type of the socket. *Refer to the socket.h file for more information.*
ERROR	Get and clear error on the socket.

getSocketOptions Options

The following table describes the status of each return code.

Return Code	Status
0	Success.
Non-zero	See Socket Function Error Return Codes.

Return Code Status

Initializing a Server Side Socket Connection

Use the **initServerSocket()** function to create a connection-oriented (stream) socket. Associate this socket with an address (name_or_IP) and port number (port), and specify the maximum length the queue of pending connections may grow to.

Syntax

initServerSocket(*name_or_IP, port, backlog, svr_socket*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
name_or_IP	DNS name (x.com) or IP address of a server or empty. Empty is equivalent to INADDR_ANY which means the system will choose one for you. Generally, this parameter should be left empty.
port	Port number. If the port number is specified as a value <= 0, CallHTTP defaults to a port number of 40001.
backlog	The maximum length of the queue of pending connections (for example, concurrent client-side connections).
svr_socket	The handle to the server side socket.

initServerSocket Parameters

The following table describes the status of each return code.

Return Code	Status
0	Success.
Nonzero	See Socket Function Error Return Codes.

Return Code Status

Initializing a Secure Server Side Socket Connection

Use the **initSecureServerSocket()** function to create a secured connection-oriented stream server socket. It does exactly the same as the initServerSocket() function except that the connection will be secure.

Once the server socket is opened, any change in the associated security context will not affect the opened socket.

Syntax

initSecureServerSocket(*name_or_IP, port, backlog, svr_socket, context*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
name_or_IP	DNS name (x.com) or IP address of a server or empty. Empty is equivalent to INADDR_ANY which means the system will choose one for you. Generally, this parameter should be left empty.
port	Port number. If the port number is specified as a value <= 0, CallHTTP defaults to a port number of 40001.
backlog	The maximum length of the queue of pending connections (for example, concurrent client-side connections).
svr_socket	The handle to the server side socket.
context	The handle to the security context.

initSecureServerSocket Parameters

The following table describes the status of each return code.

Return Code	Status
0	Success.
1 - 41	See Socket Function Error Return Codes.
101	Invalid security context handle.

Return Code Status

Accepting an Incoming Connection Attempt on the Server Side

Use the **acceptConnection()** function to accept an incoming connection attempt on the server side socket.

Syntax

acceptConnection(*svr_socket, blocking_mode, timeout, in_addr, in_name, socket_handle*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
svr_socket	The handle to the server side socket which is returned by initServerSocket().
blocking_mode	*blocking_mode* is one of the following: ■ 0 – default (blocking) ■ 1 – blocking. If this mode and the current blocking mode of *svr_socket* is set to blocking, acceptConnection() blocks the caller until a connection request is received or the specified *time_out* has expired. ■ 2 – nonblocking. In this mode, if there are no pending connections present in the queue, acceptConnection() returns an error status code. If this mode, *time_out* is ignored.
time_out	Timeout in milliseconds.

acceptConnection Parameters

Parameter	Description
in_addr	The buffer that receives the address of the incoming connection. If NULL, it will return nothing.
in_name	The variable that receives the name of the incoming connection. If NULL, it will return nothing.
socket_handle	The handle to the newly created socket on which the actual connection will be made. The server will use readSocket(), writeSocket(), and so forth with this handle to communicate with the client.

acceptConnection Parameters (Continued)

The following table describes the status of each return code.

Return Code	Status
0	Success.
1-41	See Socket Function Error Return Codes.
102	SSL Handshake failure.
103	No client certificate.
105	Client authentication failure.
106	Peer not speaking SSL.

Return Code Status

Protocol Logging

This function will start or stop logging and can be used for both the Socket API and CallHTTP API.

Syntax

protocolLogging(*log_file, log_action, log_level*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
log_file	The name of the file the logs will be recorded to. The default log file name is httplog and will be created under the current directory.
log_action	Either ON or OFF. The default is OFF.
log_level	The detail level of logging from 0 - 10. See table below.

protocolLogging Parameters

Level	Detail
0	No logging.
1	Socket open/read/write/close action (no real data) HTTP request: hostinfo(URL)
2	Level 1 logging plus socket data statistics (size, and so forth).
3	Level 2 logging plus all data actually transferred.
4-10	More detailed status data to assist debugging.

protocolLogging Log Levels

The following table describes the status of each return code.

Return Code	Status
0	Success.
1	Failed to start logging.

Return Status

Socket API Example

The BASIC code example below demonstrates how each function can be used and their order in a typical implementation. The following functions are used in this example:

- protocolLogging()
- initServerSocket()
- openSocket()
- getSocketInformation()
- acceptConnection()
- writeSocket()
- readSocket()
- getSocketOptions()
- setSockeOptions()
- closeSocket()

```
**** Declare variables
*
reoptVar="DEBUG,REUSEADDR,KEEPALIVE,DONTROUTE,LINGER,OOBINLINE,SND
BUF,RCVBUF,TYPE,ERROR"
REUSEADDR="1"
CONVERT "," TO @FM IN reoptVar
POP3=@(0,0)
*
*
*
**** Specify Protocol Logging information
*
RESULT=protocolLogging("","ON",10)
CRT "Logging started =  ":RESULT
*
INADDR=""
INNAME=""
*
**** Specify server name and assign handles to each socket
*
SERVER.IP.ADDRESS="127.0.0.1" ;*myHostName
SOCKET.PORT="8555"
MODE="1"; * 0=non-blocking, 1=blocking
SOCKETHANDLE1="";* Client handle
SOCKETHANDLE2="";* Server handle
SOCKETHANDLE3="";* Acceptor handle
TIMEOUT=10000; * milliseconds
*
BACKLOG="2048"
CRT
SERFLAG="-1";* Self end = Server
CRT "Starting Servers"
*
**** Initialize the Server Socket
*
RESULT=initServerSocket(SERVER.IP.ADDRESS,SOCKET.PORT,BACKLOG,SOCK
ETHANDLE2)
CRT "Init server 1 result = ":RESULT
*
**** Get information from the socket
*
RESULT=getSocketInformation(SOCKETHANDLE2,SERFLAG,SOCKETINFO)
CRT  "Server Socket Info"
CRT  "-----------"
CRT  "Status : ":SOCKETINFO<1,1>
CRT  "Host : ":SOCKETINFO<1,2>
CRT  "Port :":SOCKETINFO<1,3>
CRT  "Secure : ":SOCKETINFO<1,4>
CRT  "Mode :":SOCKETINFO<1,5>
*
PEERFLAG="0"
*
**** Open a Client Socket
```

```
*
CRT "Opening Client"
RESULT=openSocket(SERVER.IP.ADDRESS,SOCKET.PORT,MODE,TIMEOUT,SOCKE
THANDLE1)
CRT "Result of client open = ":RESULT
*
**** Get information from the Client Socket
*
RESULT=getSocketInformation(SOCKETHANDLE1,PEERFLAG,SOCKETINFO)
CRT  "Client Socket Info"
CRT  "-----------"
CRT  "Status : ":SOCKETINFO<1,1>
CRT  "Host : ":SOCKETINFO<1,2>
CRT  "Port :":SOCKETINFO<1,3>
CRT  "Secure : ":SOCKETINFO<1,4>
CRT  "Mode :":SOCKETINFO<1,5>
CRT ""
*
**** Accept Connections on Server
*
CRT "Server Accepting connections"
RESULT=acceptConnection(SOCKETHANDLE2,MODE,TIMEOUT,INADDR,INNAME,S
OCKETHANDLE3)
CRT "Connection ACCEPT Status = ":RESULT
CRT
*
**** Write to and Read from the Socket
*
SDATLEN=""
CDATLEN=""
SRDATA="Hello Server with this test to see the display and count"
CLDATA=""
ACTSIZ=""
*
RESULT=writeSocket(SOCKETHANDLE1,SRDATA,TIMEOUT,MODE,SDATLEN)
CRT "Wrote status = ":RESULT
RESULT=readSocket(SOCKETHANDLE3,CLDATA,CDATLEN,TIMEOUT,MODE,ACTSIZ
)
CRT "Read status = ":RESULT
*CRT
CRT " Value of inbuf = ":CLDATA
CRT " Actual size of data = ":ACTSIZ
CRT " Value of in_addr = ":INADDR
CRT " Value of in_name = ":INNAME
CRT
*
**** Set the socket options
*
*wroptVar=”SNDBUF”:@VM:8192:@FM:”RCVBUF”:@VM:16384
RESULT=setSocketOptions(SOCKETHANDLE2, wroptVar)
CRT " Set options is : ":RESULT
*
**** Get the socket options
*
```

```
RESULT=getSocketOptions(SOCKETHANDLE1, reoptVar)
PRINT "Result of get socket handle Options is : ":RESULT
PRINT "get socket options list"
LIMIT = DCOUNT(reoptVar,@FM)
FOR I = 1 TO LIMIT
PRINT FMT(reoptVar<I,1>,"L#10"),reoptVar<I,2>,reoptVar<I,3>
NEXT I
CRT
*
**** Close each of the Sockets
*
RESULT=closeSocket(SOCKETHANDLE1)
CRT "result of close client = ":RESULT
RESULT=closeSocket(SOCKETHANDLE2)
CRT "result of close server = ":RESULT
RESULT=closeSocket(SOCKETHANDLE3)
CRT "result of close Acceptor = ":RESULT
CRT
END
```

Chapter

Using CallHTTP

2

CallHTTP provides users with the capability of interacting with a web server from UniVerse BASIC through the standard HTTP protocol. In order to effectively use the CallHTTP functions, you should have a working knowledge of the HTTP standard.

Internet and web technologies have rapidly changed the way business is conducted by enterprises of all categories. E-commerce is increasingly becoming an essential part of any business. Many companies desire the capability to “call out” to the web from UniVerse BASIC so that their now stand-alone applications can be integrated with other applications through the web.

There are many scenarios where this capability can be beneficial. For example, you may want to integrate a general ledger application with a third-party application that has already been web-enabled. When an account number is given, the general ledger application has to send it to the web application through an HTTP request for validation. The web application then returns a confirmation to the UniVerse BASIC application.

HTTP is a complex standard with a large number of components and methods. The goal for CallHTTP is to provide a basic yet general implementation that enables UniVerse BASIC to act as an HTTP client so that data can be exchanged between a UniVerse BASIC application and a web server. CallHTTP provides the “plumbing” for users to build a specific client, not make UniVerse BASIC a browser of its own.

CallHTTP is implemented with the Socket Interface as its network transport, and this lower level API is also available for direct access by the user.

Configuring the Default HTTP Settings

The **setHTTPDefault** function configures the default HTTP settings, including proxy server and port, buffer size, authentication credential, HTTP version, and request header values. These settings are used with every HTTP request that follows.

Syntax

setHTTPDefault(*option*, *value*)

If you require all outgoing network traffic to go through a proxy server, setHTTPDefault() should be called with value containing the proxy server name or IP address, as well as the port (if other than the default of 80).

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
option	A string containing an option name. See the table below for the options currently defined.
value	A string containing the appropriate option value.

setHTTPDefault Parameters

The following table describes the available options for **setHTTPDefault**.

Option	Description
PROXY_NAME	Name or IP address of the proxy server.
PROXY_PORT	The port number to be used on the proxy server. This only needs to be specified if the port is other than the default of 80.
VERSION	The version of HTTP to be used. The default version is 1.0, but it can be set to 1.1 for web servers that understand the newer protocol. The string should be “1.0” or “1.1.”

setHTTPDefault Options

Option	Description
BUFSIZE	The size of the buffer for HTTP data transfer between UniVerse and the web server. The default is 4096. The buffer size can be increased to improve performance. It should be entered as an integer greater than or equal to 4096.
AUTHENTICATE	The user name and password to gain access. The string should be “user-name:password.” Default Basic authentication can also be set. If a request is denied (HTTP status 401/407), UniVerse BASIC will search for the default credential to automatically resubmit the request.
HEADERS	The header to be sent with the HTTP request. If *default_headers* contains an empty string, any current user-specified default header will be cleared. Currently, the only default header UniVerse BASIC sets automatically is “User-Agent UniVerse 9.6.” If you do not want to send out this header you should overwrite it with setHTTPDefault(). Per RFC 2616, for “net politeness,” an HTTP client should always send out this header. UniBasic will also send a date/time stamp with every HTTP request. According to RFC 2616, the stamp represents time in Universal Time (UT) format. A header should be entered as a dynamic array in the form of <Header-Name>@VM<HeaderValue>@Fm<HeaderName>@VM<Header-Value>.

setHTTPDefault Options (Continued)

The following table describes the status of each return code.

Return Code	Status
0	Success
1	Invalid option.
2	Invalid value.

Return Code Status

***Note**: All defaults set by setHTTPDefault() will be in effect until the end of the current UniVerse session. If you do not want the setting to affect subsequent programs, you will need to clear it before exiting the current program. If the user wishes to set the "Authorization" or "Proxy-Authorization" header as defaults, see the description under setRequestHeader(). To clear the default settings, pass an empty string with PROXY_NAME, AUTHENTICATE and HEADERS, and 0 for PROXY_PORT and BUFSIZE.*

Getting the Current HTTP Default Settings

The **getHTTPDefault** function returns the default values of the HTTP settings. See the section under setHTTPDefault for additional information.

Syntax

getHTTPDefault(*option, value*)

Parameters

The following table describes each parameter of the syntax:

Parameter	Description
option	Currently, the following options are defined: PROXY_NAME PROXY_PORT VERSION BUFSIZE AUTHENTICATE HEADERS
value	A string containing the appropriate option value.

getHTTPDefault Parameters

The following table describes the status of each return code.

Return Code	Status
0	Success.
1	Invalid option.

Return Code Status

Creating an HTTP Request

The **createRequest** function creates an HTTP request and returns a handle to the request.

Syntax

createRequest(*URL, http_method, request_handle*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
URL	A string containing the URL for a resource on a web server. An accepted URL must follow the specified syntax defined in RFC 1738. The general format is: http://<host>:<port>/<path>?<searchpart>. The host can be either a name string or IP address. The port is the port number to connect to, which usually defaults to 80 and is often omitted, along with the preceding colon. The path tells the web server which file you want, and, if omitted, means "home page" for the system. The searchpart can be used to send additional information to a web server.
http_method	A string which indicates the method to be performed on the resource. See the table below for the available (case-sensitive) methods.
request_handle	A handle to the request object.

createRequest Parameters

The following table describes the available methods for *http_method*.

Method	Description
GET	Retrieves whatever information, in the form of an entity, identified by the Request-URI. If the Request-URI refers to a data-producing process, it is the produced data which shall be returned as the entity in the response and not the source text of the process, unless that text happens to be the output of the process.
POST	[:<MIME-type>] For this method, it can also have an optional **MIME**-type to indicate the content type of the data the request intends to send. If no MIME-type is given, the default content type will be "application/x-www-form-urlencoded." Currently, only "multipart/form-data" is internally supported, as described in function addRequestParameter() and submitRequest(), although other "multipart/*" data can also be sent if the user can assemble it on his/her own. (The multipart/form-data format itself is thoroughly described in RFC 2388).
HEAD	The HEAD method is identical to GET except that the server MUST NOT return a message-body in the response. The metainformation contained in the HTTP headers in response to a HEAD request SHOULD be identical to the information sent in response to a GET request. This method can be used for obtaining metainformation about the entity implied by the request without transferring the entity-body itself. This method is often used for testing hypertext links for validity, accessibility, and recent modification.
OPTIONS	The OPTIONS method represents a request for information about the communication options available on the request/response chain identified by the Request-URI. This method allows the client to determine the options and/or requirements associated with a resource, or the capabilities of a server, without implying a resource action or initiating a resource retrieval. HTTP 1.1 and later.
DELETE	The DELETE method requests that the origin server delete the resource identified by the Request-URI. HTTP 1.1 and later.

http_method Methods

Method	Description
TRACE	The TRACE method is used to invoke a remote, application-layer loop-back of the request message. HTTP 1.1 and later.
PUT	The PUT method requests that the enclosed entity be stored under the supplied Request-URI. HTTP 1.1 and later but not supported.
CONNECT	/* HTTP/1.1 and later but not supported */

http_method Methods (Continued)

The following table describes the status of each return code.

Return Code	Status
0	Success.
1	Invalid URL (Syntactically).
2	Invalid method (For HTTP 1.0, only GET/POST/HEAD)

Return Code Status

***Note**: If URL does include a searchpart, it must be in its encoded format (space is converted into +, and other non-alphanumeric characters are converted into %HH format. See addRequestParameter() for more details). However, host and path are allowed to have these "unsafe" characters. UniVerse BASIC will encode them before communicating with the web server.*

Creating a Secure HTTP Request

The **createSecureRequest** function behaves exactly the same as the **createRequest()** function, except for the fourth parameter, a handle to a security context, which is used to associate the security context with the request. If the URL does not start with “https” then the parameter is ignored. If the URL starts with “https” but an invalid context handle or no handle is provided, the function will abort and return with an error status.

Syntax

createSecureRequest(*URL, http_method, request_handle, security_context*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
URL	A string containing the URL for a resource on a web server. An accepted URL must follow the specified syntax defined in RFC 1738. The general format is: http://<host>:<port>/<path>?<searchpart>. The host can be either a name string or IP address. The port is the port number to connect to, which usually defaults to 80 and is often omitted, along with the preceding colon. The path tells the web server which file you want, and, if omitted, means “home page” for the system. The searchpart can be used to send additional information to a web server.
http_method	A string which indicates the method to be performed on the resource. See the table below for the available (case-sensitive) methods.
request_handle	A handle to the request object.
securityContext	A handle to the security context.

createSecureRequest Parameters

The following table describes the status of each return code.

Return Code	Status
0	Success.
1	Invalid URL (Syntactically).
2	Invalid method (For HTTP 1.0, only GET/POST/HEAD)

Return Code Status

***Note**: If URL does include a searchpart, it must be in its encoded format (space is converted into +, and other non-alphanumeric characters are converted into %HH format. See addRequestParameter() for more details). However, host and path are allowed to have these "unsafe" characters. UniVerse BASIC will encode them before communicating with the web server.*

Setting Additional Headers for a Request

The **setRequestHeader** function enables you to set additional headers for a request.

Syntax

setRequestHeader(*request_handle, header_name, header_value*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
request_handle	The handle to the request returned by createRequest().
header_name	The name of the header.
header_value	The value of the header.

setRequestHeader Parameters

The following table describes the status of each return code.

Return Code	Status
0	Success.
1	Invalid request handle.
2	Invalid header (Incompatible with method).
3	Invalid header value.

Return Code Status

***Note**: Since a user-defined header or header value can be transferred, it is difficult to check the validity of parameters passed to the function. UniVerse BASIC currently will not perform syntax checking on the parameters, although it will reject setting a response header to a request. Refer to RFC 2616 for valid request headers.*

*The header set by this function will overwrite settings by **setHTTPDefault()**.*

This function supports Base64 encoding for Basic authentication. If header_name contains either "Authorization" or "Proxy-Authorization,"the header_value should then contain ASCII text user credential information in the format of "userid:password" as specified by RFC 2617. This function will then encode the text based on Base64 encoding.

Only Basic authentication is supported. Digest authentication may be supported in the future. Basic authentication is not safe and is not recommended for use with transferring secured data.

Adding a Parameter to the Request

The **addRequestParameter** function adds a parameter to the request.

Syntax

addRequestParameter(*request_handle, parameter_name, parameter_value, content_handling*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
request_handle	The handle to the request.
parameter_name	The name of the parameter.
parameter_value	The value of the parameter.
content_handling	The dynamic MIME type for the parameter value.

addRequestParameter Parameters

The following table describes the status of each return code.

Return Code	Status
0	Success.
1	Invalid request handle.
2	Invalid parameter.
3	Bad content type.

Return Code Status

***Note**: For a GET request, content_handling is ignored.*

For a POST request with default content type, the default for content_handling is “ContentType:text/plain” if content_handling is not specified. For a POST request with “Multipart/*” content-type, content_handling is a dynamic array containing Content-* strings separated by field marks (@FM). They will be included in the multipart message before the data contained in parameter_value is sent. An example of content_handling:

```
Content-Type: application/XML @FM
Content-Dispostion: attachment; file=”C:\drive\test.dat @FM
Content-Length: 1923
```

Specifically, for a POST request with content type “multipart/form-data,” a “Content-Disposition:form-data” header will be created (or, in the case of Content-Disposition already in *content_handling*, “form-data” will be added to it).

For both a GET and a POST request with either no content type specified or specified as “application/x-www-form-urlencoded,” as described in createRequest(), URL encoding is performed on data in *parameter_value* automatically. Basically, any character other than alphanumeric is considered “unsafe” and will be replaced by %HH, where HH is the ASCII value of the character in question. For example, “#” is replaced by %23, and “/” is replaced by %2F, and so forth. One exception is that by convention, spaces (‘ ‘) are converted into “+”.

For a POST method with other MIME-type specified, no encoding is done on data contained in *parameter_value*.

Submitting a Request

The **submitRequest** function will submit a request and get a response.

The request is formed on the basis of default HTTP settings and previous **setRequestHeader()** and **addRequestParameter()** values. Specifically, for a GET method with parameters added, a parameter string (properly encoded) is created and attached to the URL string after the "?" character.

For a POST request with non-empty post_data, the data is attached to the request message as is. No encoding is performed, and any parameters added through **addRequestParameter()** will be totally ignored. Otherwise the following processing will be performed.

For a POST request with default content type, the parameter string is assembled, a Content-Length header created, and then the string is attached as the last part of the request message.

For a POST request with multipart/* content type, a unique boundary string is created and then multiple parts are generated in the sequence they were added through calling **addRequestParameter**(). Each will have a unique boundary, followed by optional Content-* headers, and data part. The total length is calculated and a Content-Length header is added to the message header.

The request is then sent to the Web server identified by the URL supplied with the request and created through **createRequest()** (maybe via a proxy server). UniVerse Basic then waits for the web server to respond. Once the response message is received, the status contained in the response is analyzed.

If the response status indicates that redirection is needed (status 301, 302, 305 or 307), it will be performed automatically, up to ten consecutive redirections (the limit is set to prevent looping, suggested by RFC 2616).

If the response status is 401 or 407 (access denied), the response headers are examined to see if the server requires (or accepts) Basic authentication. If no Basic authentication request is found, the function returns with an error. Otherwise, default Authentication (set by **setHTTPDefault**) is used to re-send the request. If no default authentication is set, and no other cached user authentication is found, the function will return with an error.

If the user provides authentication information through “Authorization” or “Proxy-Authorization” header, the encoded information is cached. If later, a Basic authentication request is raised, no default authentication is found, and only one user/password encoding is cached, it will be used to re-send the request.

The response from the HTTP server is disposed into *response_header* and *response_data*. It is the user’s responsibility to parse the headers and data. UniVerse Basic only performs transfer encoding (chunked encoding), and nothing else is done on the data. In other words, content-encoding (gzip, compress, deflate, and so forth) are supposed to be handled by the user, as with all MIME types.

Also, if a response contains header “Content-type: multipart/*”, all the data (multiple bodies enclosed in “boundary delimiters,” see RFC 2046) is stored in *response_data*. It is the user’s responsibility to parse it according to “boundary” parameter.

Syntax

submitRequest(*request_handle, time_out, post_data,response_headers,response_data, http_status)*

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
request_handle	The handle to the request.
time_out	The time-out value (in milliseconds) before the wait response is abandoned.
post_data	The data sent with the POST request.
response_headers	A dynamic array to store header/value pairs.
response_data	The resultant data (may be in binary format).
http_status	A dynamic array containing the status code and explanatory text.

submitRequest Parameters

The following table describes the status of each return code.

Return Code	Status
0	Success.
1	Invalid request handle.
2	Timed out.
3	Network Error.
4	Other Errors.

Return Code Status

Chapter

Using WebSphere MQ with UniVerse

3

In This Chapter

This chapter describes how to set up and configure the WebSphere MQ API for UniData and UniVerse.

This chapter consists of the following sections:

Preface

The WebSphere MQ API for UniData and UniVerse makes use of the MQSeries Application Messaging Interface (AMI).

***Note**: WebSphere MQ was formerly named MQSeries and as such, much of the documentation references the former name.*

The AMI is available for download as a WebSphere MQ SupportPac from http://www-3.ibm.com/software/ts/mqseries/txppacs/ma0f.html. You need to download and install this SupportPac before you can use the WebSphere MQ API for UniData and UniVerse. Detailed information on the AMI can be found in the *MQSeries Application Messaging Interface* manual, which you can download from the same location.

This manual assumes you have a general understanding of WebSphere MQ. Numerous documents for WebSphere MQ are available for download from the IBM Publications Center at:

http://www.ibm.com/shop/publications/order

Overview of Messaging

Distributed applications are a common occurrence in companies today. They may come about from business acquisitions that bring together disparate systems which must then interact with each other, or from the purchase of new software systems that must interact with existing facilities. Other distributed systems are intentionally designed as such in order to improve scalability and overall reliability.

Regardless of the circumstances of how these heterogeneous systems come about, they require a means for internal communication. A common solution to this challenge is messaging. Messaging middleware products provide the concept of message queues, which applications can use to communicate with each other through the exchange of messages. When one application has information to deliver, it places a message in a queue. Another application can then retrieve the message and act upon it. This is a flexible paradigm, allowing many different types of communication. Examples include the Datagram ("send-and-forget") messaging style, where an application simply delivers a message and then disconnects, and the Request/Response messaging style, which follows a client-server style of communication.

A core feature of messaging middleware products is guaranteed, once-only message delivery. This frees applications from having to take on this burden themselves with low-level communication details. An application making use of the services of a messaging middleware product is guaranteed that its message will be delivered to the destination queue, and that the message will be delivered one time only.

Another feature that message-based applications take advantage of is the benefits of being loosely-coupled. One application can go offline without affecting other applications in the system. When the application comes back online, it can then retrieve any messages that have been waiting for it from the message queue. Allowing components to be loosely-coupled can improve overall system reliability.

Overview of IBM WebSphere MQ

IBM WebSphere MQ (renamed from IBM MQSeries) is IBM's messaging middleware product. Through its services, applications can communicate with each other as messaging clients.

WebSphere MQ makes use of message queues and queue managers in providing its services to message-based applications. A queue manager is a service that allows access to and administration of message queues. It handles the details of message delivery, such as guaranteeing once-only delivery, and forwarding messages across a network to other queue managers when required. Message queues act as the destinations for message delivery, holding the incoming messages until retrieved by another application.

With WebSphere MQ, when an application needs to deliver a message, it connects to a WebSphere MQ queue manager, opens a message queue, and places the message on the queue. If required, the queue manager then forwards the message to a queue running under a different queue manager on another machine. A receiving application can then connect to that second queue manager, open the destination queue, and retrieve the message.

The following excerpt from *The MQSeries Application Programming Guide* provides a description of WebSphere MQ queue managers and message queues:

What is a message queue?

A message queue, known simply as a queue, is a named destination to which messages can be sent. Messages accumulate on queues until they are retrieved by programs that service those queues. Queues reside in, and are managed by, a queue manager (see "What is a queue manager?" on page 5). The physical nature of a queue depends on the operating system on which the queue manager is running. A queue can either be a volatile buffer area in the memory of a computer, or a data set on a permanent storage device (such as a disk). The physical management of queues is the responsibility of the queue manager and is not made apparent to the participating application programs.

What is a queue manager?

A queue manager is a system program that provides queuing services to applications. It provides an application programming interface so that programs can put messages on, and get messages from, queues. A queue manager provides additional functions so that administrators can create new queues, alter the properties of existing queues, and control the operation of the queue manager. Many different applications can make use of the queue manager's services at the same time and these applications can be entirely unrelated. For a program to use the services of a queue manager, it must establish a connection to that queue manager. For applications to be able to send messages to applications that are connected to other queue managers, the queue managers must be able to communicate among themselves. MQSeries implements a store-and-forward protocol to ensure the safe delivery of messages between such applications.

WebSphere MQ API for UniData and UniVerse

MQSeries Application Messaging Interface

The WebSphere MQ API for UniData and UniVerse makes use of the MQSeries Application Messaging Interface (AMI), available as a WebSphere MQ SupportPac (SupportPac ma0f) at
http://www-3.ibm.com/software/ts/mqseries/txppacs/ma0f.html.

The MQSeries AMI utilizes a repository of definitions that describe how and where messages are to be delivered. Service definitions determine where messages are to be delivered, and policy definitions govern how those messages are delivered. Typically, a WebSphere MQ administrator creates and administers the definitions. AMI-based programs can then reference the definitions by name. This simplifies software development and maintenance by moving messaging complexity away from the program and into the repository. The repository itself exists as an XML file on the machine running the application (although LDAP-based repositories are supported as well).

The WebSphere MQ API for UniData and UniVerse utilizes service and policy definitions by accepting them as parameters to the various API calls. For example, when placing a message on a queue with **amSendMsg**, the properties defined by the service name and policy name passed in to the function determine where and how the message is sent.

For Windows platforms, WebSphere MQ AMI provides the AMI Administration Tool to manage the repository. It allows administration of the AMI repository through a GUI interface, rather than through direct editing of the XML file. For more information about the WebSphere MQ AMI repository, and about the AMI Administration Tool, see the *MQSeries Application Messaging Interface* manual.

Session

In the WebSphere MQ API for UniData and UniVerse, the sending and receiving of messages takes place within a session. You start sessions via the API call **amInitialize**, and end them with **amTerminate**. Upon successful completion, **amInitialize** returns a valid session handle in the *hsession* output variable. You then use this session handle in all subsequent WebSphere API for UniData and UniVerse calls, until you close the session with **amTerminate**. Only one session may be active at a time from within a given instance of a running BASIC program.

Services

The WebSphere MQ API for UniData and UniVerse makes use of AMI *services* in its API calls. An AMI service represents a destination from where a message is to be sent to or retrieved. In other words, a service represents a particular message queue running under a particular queue manager.

Interacting with queues can be complex, owing to the many variables associated with them. Services hide this complexity by encapsulating queue parameters within the service definitions themselves. Thus, rather than explicitly setting all of the message queue parameters directly in the program, you simply reference a particular service definition by name in the WebSphere MQ API for UniData and UniVerse function call.

A WebSphere MQ administrator creates service definitions, and they are stored in the AMI repository. Default services are also available, and can be referenced by using an empty string ("") in place of an actual service name in the WebSphere MQ API for UniData and UniVerse API calls. See the *MQSeries Application Messaging Interface* manual, Chapter 19: Defining Services, Policies, and Policy Handlers, under the section “Service Definitions,” for default values of service properties.

For more information about AMI *services*, and about the AMI Repository, see the *MQSeries Application Messaging Interface* manual.

Policies

The WebSphere MQ API for UniData and UniVerse makes use of AMI *policies* in its API calls. A policy represents how a message is to be sent or retrieved. For example, a policy can dictate whether truncated messages are allowed, or how many times a failed message delivery should be automatically retried. By referencing policies directly by name in the various WebSphere MQ API for UniData and UniVerse function calls, you avoid having to explicitly code message delivery details in your programs. Instead, this complexity is embedded in the policies themselves.

A WebSphere MQ administrator creates policy definitions, and they are stored in the AMI repository. Default policies are also available, and you can reference them by using an empty string ("") in place of an actual policy name in the WebSphere MQ API for UniData and UniVerse API calls. See the *WebSphere MQ Application Messaging Interface* manual, Chapter 19: Defining Services, Policies, and Policy Handlers under the section “Policy Definitions,” for default policy values.

For more information about AMI *policies*, and about the AMI repository, see the *MQSeries Application Messaging Interface* manual.

Message Objects

When a message is sent or received via the WebSphere MQ API for UniData and UniVerse calls, an AMI message object is created implicitly, behind the scenes. The message object encapsulates details of the message, such as its MQSeries message headers, including the Message ID and Correlation ID, along with the message data itself. You can name, or *tag,* these message objects by providing names for them in the API calls. For example, in the **amSendRequest** function, you can use the *sndMsgName* parameter to specify a name for the underlying message object that gets created during the call. By tagging a message object in this manner, you can later reference that same message object in subsequent API calls. This is particularly important when correlating requests and responses in the Request/Response messaging style.

Note*: It is not required to name the underlying message objects. You can use an empty string ("""), especially in cases where the message object will not need to be referenced later, as is often the case for the Datagram messaging style.*

Messaging Styles

The WebSphere MQ API for UniData and UniVerse supports two messaging styles, Datagram and Request/Response.

Datagram Messaging Style

The Datagram messaging style, also known as "Send-and-Forget," is the simplest type of messaging. It involves an application placing a message on a queue without requiring a response back. A receiving application picks up the message and performs work based on the message contents, but does not respond back to the sending application.

Datagram messaging involves the use of two functions:

- amSendMsg
- amReceiveMsg

Request/Response Messaging Style

Request/Response messaging follows the client/server paradigm. One application, acting as the client, sends a *request message* to a queue. A server application picks up and processes the message, and then sends a *response message* to another queue, which the client monitors for a reply. The client then picks up the response message and acts on it appropriately.

Request/Response messaging relies on four functions, separated according to client or server functionality.

Client Request/Response Functions

- amSendRequest
- amReceiveMsg

Server Request/Response Functions

- amReceiveRequest
- amSendResponse

Due to the nature of messaging, where communication is accomplished through an intermediary—for example, a message queue—the notion of correlating requests and responses is important for the Request/Response messaging style. Without a means for this correlation, a requesting application would not be able to differentiate the response message from any other message appearing on the queue. WebSphere MQ accomplishes this correlation through the use of Correlation ID's, which are stored in the message header. In Request/Response messaging, the responding application copies the request message's Message ID into the Correlation ID field of the response message. The requesting application can then select the correct response message from the queue through the use of this Correlation ID.

The WebSphere MQ API for UniData and UniVerse handles this correlation process transparently through the use of AMI *message objects*. Thus, you need not be concerned with the details of copying Message ID's to Correlation ID fields, or filtering messages based on their Correlation ID.

In the client application, this is accomplished by using the message object created in **amSendRequest** as the message selection criteria in **amReceiveMsg**. So, in the call to **amSendRequest**, you tag the underlying request message object by giving it a name via the *sndMsgName* parameter. This name is then used as the *selMsgName* parameter in the subsequent call to **amReceiveMsg**. Behind the scenes, the Message ID of the request message sent out via **amSendRequest**, is used by **amReceiveMsg** to select the correct response message based on its Correlation ID field.

In the server application, a similar process takes place between the calls **amReceiveRequest** and **amSendResponse**. When receiving a request message throgh **amReceiveRequest**, you tag the underlying request message object by giving it a name via the *rcvMsgName* parameter. This named message object is then used in the subsequent call to **amSendResponse**, through that function's *rcvMsgName* parameter. Behind the scenes, the Message ID from the request message is copied over to the Correlation ID field of the response message, which is then sent out through **amSendResponse**.

Setup and Configuration for the WebSphere MQ API

Requirements

- UniData 6.0 or later
- UniVerse 10.1 or later
- WebSphere MQ version 5.2 (Formerly MQSeries version 5.2)
- WebSphere MQ Application Messaging Interface SupportPac SupportPac ma0f - available for download from http://www3.ibm.com/software/ts/mqseries/txppacs/ma0f.html

Platform Availability

The WebSphere MQ API for UniData and UniVerse is available on the following platforms.

- AIX - V4.3.3 (non-threaded and pthreads)
- SUN Solaris - V2.6, V7, and V8 (pthreads)
- HP-UX - V11.0 PA2 (pthreads)
- Windows NT/2000

Setting up the Environment for UniData and WebSphere MQ

You must complete the following steps in order to set up your environment to utilize WebSphere MQ for UniData. First you must install either MQSeries, or MQSeries Client on the UniData machine. For information about installing MQSeries, see the *MQSeries Quick Beginnings* manual that ships with your copy of MQSeries. For information about installing the MQSeries Client, see the MQSeries manual *MQSeries Clients*. These manuals are also available for download from http://www.ibm.com/shop/publications/order.

Once MQSeries or the MQSeries Client is installed on the UniData machine, you should install the MQSeries AMI SupportPac. The AMI is available for download from:

http://www-3.ibm.com/software/ts/mqseries/txppacs/ma0f.html.

For information about installing the MQSeries AMI SupportPac, see the *MQSeries Application Messaging Interface* manual, available for download from the same location, and from:

http://www.ibm.com/shop/publications/order.

More information on using MQSeries Client from within UniData or UniVerse can be found in "WebSphere MQ and UniData or UniVerse on Separate Machines."

For Windows platforms, this is all that is required for enabling WebSphere MQ support for UniData. For UNIX platforms, you must run the script file *makeu2mqs* to complete the process, as described in "Enabling WebSphere MQ Support in UniData on UNIX."

Enabling WebSphere MQ Support in UniData on UNIX

You can use the script file *makeu2mqs*, located in the `$UDTHOME/work` directory, to enable WebSphere MQ support in UniData. Before running *makeu2mqs*, you will need to verify the following.

1. The $UDTHOME environment variable is set.
2. You know the location of the WebSphere MQ AMI library file. The names and default locations of the AMI library files for the supported platforms are listed here:
   - AIX
     AMI library file: libamt.a
     Default location: /usr/mqm/lib
   - HP-UX
     AMI library file: libamt.sl
     Default location: /opt/mqm/lib
   - Solaris
     AMI library file: libamt.so
     Default location: /opt/mqm/lib

Once you are ready to begin, change to the `$UDTHOME/work` directory and run the *makeu2mqs* script with the *enabled* option. It is important to be in this directory when running the script. You need to have sufficient privileges to overwrite the file `$UDTBIN/u2amiproxy` in order to successfully enable WebSphere MQ support.

Invoke the following commands:

```
cd $UDTHOME/work
./makeu2mqs enabled
```

At this point, you will be given a chance to confirm the values for the UniData bin and lib directories, and then will be asked to supply the directory holding the AMI library file. *makeu2mqs* then completes the process of enabling WebSphere MQ support in UniData.

Disabling WebSphere MQ Support in UniData on UNIX

You can also use the script file *makeu2mqs*, located in the `$UDTHOME/work` directory, to later disable WebSphere MQ support in UniData. To disable WebSphere MQ support in UniData, change directories to the `$UDTHOME/work` directory and run *makeu2mqs disabled*. It is important that you be in this directory when running *makeu2mqs*. You need to have sufficient privileges to overwrite the file `$UDTBIN/u2amiproxy` in order to successfully disable WebSphere MQ support.

Invoke the following commands:

```
cd $UDTHOME/work
./makeu2mqs disabled
```

You will be given a chance to confirm the values for the UniData bin and lib directories, after which makeu2mqs completes the process of disabling WebSphere MQ support in UniData.

Configurations

Although in most cases a WebSphere MQ queue manager runs on the same machine as the UniData or UniVerse database, this is not strictly necessary. Instead, UniData or UniVerse can communicate directly with a queue manager running on a different machine by acting as a WebSphere MQ Client. In this configuration, WebSphere MQ API for UniData and UniVerse function calls make use of WebSphere MQ client libraries that marshall the calls across the network to the remote queue manager.

Both scenarios have their particular benefits, and the choice of configuration depends on the particular application. For more information about running an application as a WebSphere MQ Client, see the *MQSeries Clients* manual, which ships with WebSphere MQ, and is also available for download from http://www.ibm.com/shop/publications/order.

WebSphere MQ and UniData or UniVerse on the Same Machine

To connect to a WebSphere MQ queue manager running on the same machine as UniData or UniVerse, no special steps are required. This is often referred to in various WebSphere MQ documentation as connecting via the MQSeries "server libraries." By default, AMI policy settings are such that the MQSeries server libraries are used if they are installed on the given machine (the machine running UniData or UniVerse). The server libraries are installed when the full version of WebSphere MQ is installed. The server libraries allow applications to connect only to queue managers running on the local machine. When messages must be delivered across a network, the queue managers handle this automatically (after being configured appropriately by the WebSphere MQ Administrator). Running the application on the same machine as the queue manager is the typical WebSphere MQ configuration.

WebSphere MQ and UniData or UniVerse on Separate Machines

It is also possible to run WebSphere MQ on a separate machine from the UniData or UniVerse database. In this scenario, you must install the WebSphere MQ Client on the machine running UniData or UniVerse. In addition to the WebSphere MQ Client, you must also install the MQSeries AMI SupportPac on the UniData or UniVerse machine. With the WebSphere MQ Client installed, the UniData or UniVerse database can connect to a remote queue manager via the WebSphere MQ "client libraries." To connect to a queue manager via the WebSphere MQ client libraries, the AMI policy governing the connection must be configured appropriately.

Complete the following steps to connect to a remote queue manager:

1. Install the WebSphere MQ Client on the database server.
2. Install the WebSphere MQ AMI SupportPac on the database server.
3. Configure your AMI policy to connect as a WebSphere MQ Client.
4. Set up a listener for the queue manager on the remote machine.

Install the MQSeries Client on the UniData/UniVerse machine

For MQSeries Client installation instructions, see the *MQSeries Client* manual, available with the WebSphere MQ installation, and also for download from http://www.ibm.com/shop/publications/order.

Install the MQSeries AMI SupportPac on the UniData/UniVerse machine

For MQSeries AMI installation instructions, see the *MQSeries Application Messaging Interface* manual, available from the MQSeries AMI SupportPac page (http://www-3.ibm.com/software/ts/mqseries/txppacs/ma0f.html), and also from http://www.ibm.com/shop/publications/order.

Configure your AMI policy to connect as an MQSeries Client

The following AMI Policy attributes are used when connecting through the WebSphere MQ client libraries:

Connection Type

If Connection Type is set to “Auto” (the default), the application automatically detects if it should connect directly (via the server libraries), or as a client. If Connection Type is “Client,” the application connects as a client. If Connection Type is “Server,” the application connects directly to the local queue manager.

Client Channel Name

For a WebSphere MQ client connection, the name of the server-connection channel. See the *MQSeries Client* manual for more information about MQSeries Channels. You can use this attribute, in combination with the Client TCP Server Address attribute, instead of the MQSERVER environment variable on the MQSeries client. For more information about the MQSERVER environment variable, see the *MQSeries Clients* manual.

Client TCP Server Address

For an MQSeries client connection, the TCP/IP host name or IP address, and optional port, of the WebSphere MQ server, in the form *hostname(portnumber)*. You can use this attribute, in combination with the Client Channel Name attribute, instead of the MQSERVER environment variable on the WebSphere MQ client. For more information about the MQSERVER environment variable, see the *MQSeries Clients* manual.

Setup a Listener for the Queue Manager on the Remote Machine

The queue manager running on the remote machine must have a listener configured to accept the requests from the WebSphere MQ client application. See the *MQSeries Clients* manual, available with the WebSphere MQ installation, and also for download from http://www.ibm.com/shop/publications/order, for information on setting up an MQSeries listener.

WebSphere MQ API Programmatic Interfaces

This section provides information on the WebSphere MQ functions and parameters for UniData and UniVerse.

***Note**: A set of named constants are available in the include file INCLUDE/U2AMI.H.*

Initialize an AMI Session

The **amInitialize()** function creates and opens an AMI session. The output parameter *hSession* is a session handle which is valid until the session is terminated. The function returns a status code indicating success, warning or failure. You can also use The BASIC STATUS() function to obtain this value.

Syntax

ret = **amInitialize**(*hSession, appName, policyName, reasonCode*)

The following table describes each parameter of the syntax.

Parameter	Description
hSession	Upon successful return, holds a handle to a session. You can then use this handle in other UniData and UniVerse WebSphere MQ API calls. [OUT]
appName	An optional name you can use to identify the session. [IN]
policyName	The name of a policy. If you specify as "" (null), amInitialize uses the system default policy name. [IN]
reasonCode	Holds an AMI Reason Code when the function returns a status indicating an AMI warning or an AMI error occurred. You can use the AMI Reason Code to obtain more information about the cause of the warning or error. See Appendix A, " MQSeries API for UniData and UniVerse Reason Codes" for a list of AMI Reason Codes and their descriptions. [OUT]

amInitialize Parameters

The following table describes the status of each return code.

Return Code	Status
0 - AMCC_SUCCESS	Function completed successfully.
1 - AMCC_WARNING	A warning was returned from AMI. The reasonCode output parameter contains an AMI reason code with further details about the warning.
2 - AMCC_FAILED	An error was returned from AMI. The reasonCode output parameter contains an AMI reason code with further details about the error.
115 - U2AMI_ERR_SESSION_IN_USE	An active session already exists (under a different *hSession* variable than the one being passed in – see Usage Notes for more details).
Other	A non-AMI error occurred.

Return Code Status

Usage Notes

Only one session may be active at one time. If you call amInitialize while another session is active, an error code of U2AMI_ERR_SESSION_IN_USE is returned. The one exception to this case is if the subsequent call to amInitialize uses the same *hSession* variable from the first call. In this case, the session is automatically terminated using the same AMI policy with which it was initialized, and a new session is started in its place.

Receiving a Message

The **amReceiveMsg()** function receives a message sent by the **amSendMsg()** function.

Syntax

ret = **amReceiveMsg**(*hSession, receiverName, policyName, selMsgName, maxMsgLen, dataLen, data, rcvMsgName, reasonCode*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
hSession	The session handle returned by **amInitialize**. [IN]
receiverName	The name of a receiver service. If you specify “” (null), amReceiveMsg uses the system default receiver name. [IN]
policyName	The name of a policy. If you specify “” (null), amReceiveMsg uses the system default policy name. [IN]
selMsgName	Optional parameter specifying the name of a message object containing information (such as a Correl ID) to use to retrieve the required message from the queue. See the Usage Notes for additional information about the use of this parameter.[IN]
maxMsgLen	The maximum message length the application will accept. Specify as -1 to accept messages of any length, or use the optional parameter U2AMI_RESIZEBUFFER. See the Usage Notes for additional information about the use of this parameter. [IN]
dataLen	The length of the received message data, in bytes. Specify as “” (null) if you do not require this parameter. [OUT]
data	The received message data. [OUT]

amReceiveMsg parameters

Parameter	Description	
rcvMsgName	The name of a message object for the retrieved message. If you specify “““ (null) for this parameter, amReceiveMsg uses the system default name (constant AMSD_RCV_MSG). See the Usage Notes for additional information about the use of this parameter. [IN]	
reasonCode	Holds an AMI Reason Code when the function returns a status indicating an AMI warning or an AMI error occurred. You can use the AMI Reason Code to obtain more information about the cause of the warning or error. See Appendix A, “MQSeries API for UniData and UniVerse Reason Codes,” for a list of AMI Reason Codes and their descriptions. [OUT]	
optional parameter	U2AMI_LEAVEMSG	If you specify U2AMI_LEAVEMSG for this parameter, and Accept Truncated Messages is not set in the policy receive attributes, UniVerse returns the message length in the *dataLen* parameter, but the message itself remains on the queue.
	U2AMI_DISCARDMSG	If you specify U2AMI_DISCARDMSG for this parameter and Accept Truncated Messages is set in the policy receive attributes, UniVerse discards the message at the MQSeries level with an AMRC_MSG_TRUNCATED warning. This behavior is preferable to discarding the message at the UniVerse level.
	U2AMI_RESIZEBUFFER	If you specify U2AMI_RESIZEBUFFER for this parameter, UniVerse handles the details of the buffer size used to retrieve the message. If you do not specify this parameter, you must specify the buffer size. See Usage Notes for more information about this option.

amReceiveMsg parameters (Continued)

The following table describes the status of each return code.

Return Code	Status
0 - AMCC_SUCCESS	Function completed successfully.
1 - AMCC_WARNING	A warning was returned from AMI. The *reasonCode* output parameter contains an AMI reason code with further details about the warning.
2 - AMCC_FAILED	An error was returned from AMI. The *reasonCode* output parameter contains an AMI reason code with further details about the error.
Other	A non-AMI error occurred.

Return Code Status

Usage Notes

selMsgName – You can use this parameter in Request/Reply messaging to tell **amReceiveMsg** to retrieve from the queue only those messages that correlate with a message previously placed on the queue with *amSendRequest*. When used in this manner, use the *sndMsgName* parameter of the *amSendRequest* call as the value for *selMsgName* in *amReceiveMsg*. Message correlation occurs here due to the following:

1. The underlying message object that was created when the request message was sent, and referenced by the name sndMsgName, holds information about the sent message, such as its Correlation Id and Message Id.
2. When you use this message object (*sndMsgName*) as the *selMsgName* parameter to **amReceiveMsg**, the information held in this message object will be used to ensure that only correlating response messages are retrieved from the queue.

maxMsgLen – You can use this parameter to define the maximum length message that **amReceiveMsg** retrieves from the queue. If the value of *maxMsgLen* is less than the length of the message to be retrieved, behavior depends on whether you set the *Accept Truncated Message* parameter in the policy receive attributes to true. If *Accept Truncated Message* is set to true, the data is truncated and there is an *AMRC_MSG_TRUNCATED* warning in the *reasonCode* parameter. If you set *Accept Truncated Message* to false (the default), **amReceiveMsg** fails with return status *AMCC_FAILED (2)*, and reasonCode *AMRC_RECEIVE_BUFF_LEN_ERR*.

***Note**: If amReceiveMsg returns AMRC_RECEIVE_BUFF_LEN_ERR as the reasonCode, the message length value is contained in dataLen parameter, even though the call failed with return value MQCC_FAILED.*

If you do not specify the U2AMI_RESIZE BUFFER optional parameter and the buffer size you specify with the *maxMsgLen* parameter is too small, the function fails with the AMRC_RECEIVE_BUFF_LEN_ERR. If this happens, UniVerse returns the necessary buffer size in the *dataLen* parameter so you can reissue the request with the correct size.

If you specify the U2AMI_RESIZEBUFFER parameter, UniVerse uses a default buffer size of 8K. If this buffer size is too small, UniVerse automatically reissues the request with the correct buffer size. While convenient, this behavior can result in performance degradation for the following reasons:

- If the default buffer size is larger than necessary for the received message, UniVerse incurs an unnecessary overhead.
- If the default buffer size is too small for the received message, UniVerse must issue to requests to the queue before successfully retrieving the message.

For performance reasons, IBM recommends you set the *maxMsgLen* parameter to the expected size of the message whenever possible.

rcvMsgName – This parameter allows the application to attach a name to the underlying message object used to retrieve the message. Though supported, this parameter is mainly intended for use in conjunction with future additions to the WebSphere MQ for UniData and UniVerse API.

Receiving a Request

The **amReceiveRequest()** function receives a request message.

Syntax

ret = **amReceiveRequest**(*hSession, receiverName, policyName, maxMsgLen, dataLen, data, rcvMsgName, senderName, reasonCode* [*U2AMI_LEAVEMSG* | *U2AMI_DISCARDMSG* | *U2AMI_RESIZEBUFFER*])

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
hSession	The session handle returned by **amInitialize**. [IN]
receiverName	The name of a receiver service. If you specify “” (null), amReceiveRequest uses the system default receiver name. [IN]
policyName	The name of a policy. If you specify “” (null), amReceiveRequest uses the system default policy name. [IN]
maxMsgLen	The maximum message length the application will accept. Specify as -1 to accept messages of any length, or use the optional parameter U2AMI_RESIZEBUFFER. See Usage Notes for additional information about the use of this parameter. [IN]
dataLen	The length of the received message data, in bytes. Specify “” (null) if you do not require this parameter. [OUT]
data	The received message data. [OUT]
rcvMsgName	The name of the message object for the received message. If you specify “” (null), amReceiveRequest uses the system default receiver service. The value for *rcvMsgName* will be used in the subsequent call to **amSendResponse**. [IN]

amReceiveRequest parameters

Parameter	Description	
senderName	The name of a special type of sender service known as a response sender, to which the response message will be sent. If you do not specify a name, amReceiveRequest uses the system default response sender service. [IN] **Note**: The sender name you specify must ot exist in your AMI repository.	
reasonCode	Holds an AMI Reason Code when the function returns a status indicating an AMI warning or an AMI error occurred. You can use the AMI Reason Code to obtain more information about the cause of the warning or error. See Appendix A, "MQSeries API for UniData and UniVerse Reason Codes," for a list of AMI Reason Codes and their descriptions. [OUT]	
optional parameter	U2AMI_LEAVEMSG	If you specify U2AMI_LEAVEMSG for this parameter, and Accept Truncated Messages is not set in the policy receive attributes, UniVerse returns the message length in the *dataLen* parameter, but the message itself remains on the queue.
	U2AMI_DISCARDMSG	If you specify U2_DISCARDMSG for this parameter and Accept Truncated Messages is set in the policy receive attributes, UniVerse discards the message at the MQSeries level with an AMRC_MSG_TRUNCATED warning. This behavior is preferable to discarding the message at the UniVerse level.
	U2AMI_RESIZEBUFFER	If you specify U2AMI_RESIZEBUFFER for this parameter, UniVerse handles the details of the buffer size used to retrieve the message. If you do not specify this parameter, you must specify the buffer size. See Usage Notes for more information about this option.

amReceiveRequest parameters (Continued)

The following table describes the status of each return code.

Return Code	Status
0 - AMCC_SUCCESS	Function completed successfully.
1 - AMCC_WARNING	A warning was returned from AMI. The reasonCode output parameter contains an AMI reason code with further details about the warning.
2 - AMCC_FAILED	An error was returned from AMI. The reasonCode output parameter contains an AMI reason code with further details about the error.
other	A non-AMI error occurred.

Return Code Status

Usage Notes

maxMsgLen – You can use this parameter to define the maximum length message that **amReceiveRequest** retrieves from the queue. If the value of *maxMsgLen* is less than the length of the message to retrieve, behavior depends on whether you set *Accept Truncated Message* in the policy receive attributes to true. If *Accept Truncated Message* is set to true, the data is truncated and there is an *AMRC_MSG_TRUNCATED* warning in the *reasonCode* parameter. If *Accept Truncated Message* is false (the default), **amReceiveRequest** fails with return status *AMCC_FAILED* (2), and *reasonCode AMRC_RECEIVE_BUFF_LEN_ERR*.

***Note**: If AMRC_RECEIVE_BUFF_LEN_ERR is returned as the reasonCode, the message length value is contained in dataLen parameter, even though the call failed with return value MQCC_FAILED.*

If you do not specify the U2AMI_RESIZEBUFFER optional parameter and the buffer size you specify with the *maxMsgLen* parameter is too small, the function fails with the AMRC_RECEIVE_ BUFF_LEN_ERR. If this happens, UniVerse returns the necessary buffer size in the *dataLen* parameter so you can reissue the request with the correct size.

If you specify the U2AMI_RESIZEBUFFER parameter, UniVerse uses a default buffer size of 8K. If this buffer size is too small, UniVerse automatically reissues the request with the correct buffer size. While convenient, this behavior can result in performance degradation for the following reasons:

- If the default buffer size is larger than necessary for the received message, UniVerse incurs an unnecessary overhead.
- If the default buffer size is too small for the received message, UniVerse must issue two requests to the queue before successfully retrieving the message.

For performance reasons, IBM recommends you set the *maxMsgLen* parameter to the expected size of the message whenever possible.

Sending a Message

The **amSendMsg()** function sends a datagram (send and forget) message.

Syntax

ret = **amSendMsg**(*hSession, senderName, policyName, data, sndMsgName, reasonCode*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
hSession	The session handle returned by **amInitialize**. [IN]
senderName	The name of a sender service. If you specify “” (null), amSendMsg uses the system default receiver name. [IN]
policyName	The name of a policy. If you specify “” (null), amSendMsg uses the system default policy name. [IN]
data	The message data to be sent. [IN]
sndMsgName	The name of a message object for the message being sent. If you specify “” (null), amSendMsg uses the system default policy name. [IN]
reasonCode	Holds an AMI Reason Code when the function returns a status indicating an AMI warning or an AMI error occurred. You can use the AMI Reason Code to obtain more information on the cause of the warning or error. See Appendix A, “MQSeries API for UniData and UniVerse Reason Codes,” for a list of AMI Reason Codes and their descriptions. [OUT]

amSendMsg Parameters

The following table describes the status of each return code.

Return Code	Status
0 - AMCC_SUCCESS	Function completed successfully.
1 - AMCC_WARNING	A warning was returned from AMI. The *reasonCode* output parameter contains an AMI reason code with further details about the warning.
2 - AMCC_FAILED	An error was returned from AMI. The reasonCode output parameter contains an AMI reason code with further details about the error.
Other	A non-AMI error occurred.

Return Code Status

You can also use the BASIC STATUS() to obtain the return status from the function.

Sending a Request

The **amSendRequest()** function sends a request message.

Syntax

ret = **amSendRequest**(*hSession, senderName, policyName, data, sndMsgName, reasonCode*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
hSession	The session handle returned by amInitialize. [IN]
senderName	The name of a sender service. If you specify “““ (null), amSendRequest uses the system default sender name. [IN]
policyName	The name of a policy. If you specify “““ (null), amSendRequest uses the system default policy name. [IN]
responseName	The name of the receiver service to which the response to this send request should be sent. Specify “““ (null) if no response is required. [IN]
dataLen	The length of the message data, in bytes. [IN]
data	The message data to be sent. [IN]
sndMsgName	The name of a message object for the message being sent. If you specify “““ (null), amSendRequest uses the system default message name (constant AMSD_SND_MSG). [IN]
reasonCode	Holds an AMI Reason Code when the function returns a status indicating an AMI warning or an AMI error occurred. You can use the AMI Reason Code to obtain more information about the cause of the warning or error. See Appendix A, “MQSeries API for UniData and UniVerse Reason Codes,” for a list of AMI Reason Codes and their descriptions. [OUT]

amSendRequest Parameters

The following table describes the status of each return code.

Return Code	Status
0 - AMCC_SUCCESS	Function completed successfully.
1 - AMCC_WARNING	A warning was returned from AMI. The reasonCode output parameter contains an AMI reason code with further details about the warning.
2 - AMCC_FAILED	An error was returned from AMI. The reasonCode output parameter contains an AMI reason code with further details about the error.
Other	A non-AMI error occurred.

Return Code Status

You can also use the BASIC STATUS() function to obtain the return status from the function.

Sending a Response

The **amSendResponse()** function sends a request message.

Syntax

ret = **amSendResponse**(*hSession, senderName, policyName, rcvMsgName, data, sndMsgName, reasonCode*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
hSession	The session handle returned by **amInitialize**. [IN]
senderName	The name of the sender service. You must set this parameter to the senderName specified for the **amReceiveRequest** function. [IN]
policyName	The name of a policy. If you specify "" (null), amSendResponse uses the system default policy name. [IN]
rcvMsgName	The name of the received message to which this message is a response. You must set this parameter to the **rcvMsgName** specified for the **amReceiveRequest** function. [IN]
dataLen	The length of the message data, in bytes. [IN]
data	The message data to be sent. [IN]
sndMsgName	The name of a message object for the message being sent. If you specify "" (null), amSendResponse uses the system default message name (constant AMSD_SND_MSG). [IN]
reasonCode	Holds an AMI Reason Code when the function returns a status indicating an AMI warning or an AMI error occurred. You can use the AMI Reason Code can be used to obtain more information about the cause of the warning error. See Appendix A, "MQSeries API for UniData and UniVerse Reason Codes," for a list of AMI Reason Codes and their descriptions.[OUT]

amSendResponse Parameters

The following table describes the status of each return code.

Return Code	Status
0 - AMCC_SUCCESS	Function completed successfully.
1 - AMCC_WARNING	A warning was returned from AMI. The *reasonCode* output parameter contains an AMI reason code with further details about the warning.
2 - AMCC_FAILED	An error was returned from AMI. the reasonCode output parameter contains an AMI reason code with further details about the error.
Other	A non-AMI error occurred.

Return Code Status

You can also use the BASIC STATUS() function to obtain the return status from the function.

Terminating a Session

The **amTerminate()** function closes a session.

Syntax

ret = **amTerminate**(*hSession, policyName, reasonCode*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
hSession	The session handle returned by **amInitialize**. [IN/OUT]
policyName	The name of a policy. If you specify “” (null), amTerminate uses the system default policy name. [IN]
reasonCode	Holds an AMI Reason Code when the function returns a status indicating an AMI warning or an AMI error occurred. You can use the AMI Reason Code to obtain more information about the cause of the warning or error. See Appendix A, “MQSeries API for UniData and UniVerse Reason Codes,” for a list of AMI Reason Codes and their descriptions. [OUT]

amTerminate Parameters

The following table describes the status of each return code.

Return Code	Status
0 - AMCC_SUCCESS	Function completed successfully.
1 - AMCC_WARNING	A warning was returned from AMI. The *reasonCode* output parameter contains an AMI reason code with further details about the warning.
2 - AMCC_FAILED	An error was returned from AMI. The *reasonCode* output parameter contains an AMI reason code with further details about the error.
Other	A non-AMI error occurred.

Return Code Status

You can also use the BASIC STATUS() function to obtain the return status from the function.

Programming Examples

Sending a Message

The following example demonstrates sending a message to a message queue. The message is sent using the policy and service rules set forth in "AMT.SAMPLE.POLICY" and "AMT.SAMPLE.SERVICE".

```
$INCLUDE INCLUDE U2AMI.H

ret = amInitialize(hSess, "SAMPLE.APP", "AMT.SAMPLE.POLICY",
reasonCode)

msg = "Sample Message sent at " : TIMEDATE()
ret = amSendMsg(hSess, "AMT.SAMPLE.SERVICE", "AMT.SAMPLE.POLICY",
msg, "", reasonCode)

ret = amTerminate(hSess, "AMT.SAMPLE.POLICY", reasonCode)
```

Retrieving a Message

The following example demonstrates retrieving a message from a message queue. The message, of maximum length 1024, is retrieved into the variable *msg* using the policy and service rules set forth in "AMT.SAMPLE.POLICY" and "AMT.SAMPLE.SERVICE". The message selection criteria is "", meaning the next available message will be retrieved from the queue.

```
$INCLUDE INCLUDE U2AMI.H

retCode = amInitialize(hSess, "SAMPLE.APP", "AMT.SAMPLE.POLICY",
reasonCode)

retCode = amReceiveMsg(hSess, "AMT.SAMPLE.SERVICE",
"AMT.SAMPLE.POLICY", "", 1024, dataLen, msg, "", reasonCode)

retCode = amTerminate(hSess, "AMT.SAMPLE.POLICY", reasonCode)
```

Request/Response Messaging

The following client and server samples demonstrate use of the Request/Response messaging style. The client sends a message to the server, and the server then echoes that message back to the client.

Note that the repository definitions named in the program can be created via the amtsamp.tst script that ships with the MQSeries AMI SupportPac. See the chapter "Installation and Sample Programs" in the *MQSeries Application Messaging Interface* manual for more details.

Sample Request/Response Client

```
$INCLUDE INCLUDE U2AMI.H


APP_NAME             = "SAMPLE.CLIENT"
SENDER_SERVICE       = "AMT.SAMPLE.REQUEST.SERVICE"
RECEIVER_SERVICE     = "AMT.SAMPLE.RESPONSE.RECEIVER"
SEND_MESSAGE_NAME    = "AMT.SAMPLE.SEND.MESSAGE"
RECEIVE_MESSAGE_NAME = "AMT.SAMPLE.RECEIVE.MESSAGE"
POLICY               = "AMT.SAMPLE.POLICY"


hSession    = 0
retCode     = 0
reasonCode  = 0

reqMessage  = ""
respMessage = ""

respMsgLen  = 0
MAX_MSG_LEN = 1024




********************************
*  Initialize the Session
*
********************************

retCode = amInitialize(hSession, APP_NAME, POLICY, reasonCode)
IF retCode # AMCC_OK THEN
    function = "amInitialize"
    GOTO ErrorExit
END



********************************
*  Send the Request Message
*
*
* amSendRequest INPUTS
*
*    hSession             - Session handle.
*    SENDER_SERVICE       - Service definition used to send
*                           the request message.
*    POLICY               - Policy definition used to send
*                           the request message.
*    RECEIVER_SERVICE     - Service definition describing where
*                           the response message should be sent
*    reqMessage           - Request message.
*    SEND_MESSAGE_NAME    - Name we're giving to the the
```

```
*                           underlying
*                           message object used to send the
*                           request message.
*
* amSendRequest OUTPUTS
*
*    retCode              - Holds return code indicating status of
*                           function:
*                              AMCC_OK      (0) - Success
*                              AMCC_WARNING (1) - WebSphere MQ AMI
*                              Warning
*                              AMCC_FAILED  (2) - WebSphere MQ AMI
*                              Error
*                              Other            - Other error
*    reasonCode           - Holds additional information if
*                           WebSphere MQ AMI error or warning
*                           occurs.
*
********************************

PRINT "Please enter a message to send to the server. "
PRINT "The server will echo the message back: "
INPUT reqMessage

PRINT "Sending Request Message: "
PRINT "   << " : reqMessage
PRINT ""


retCode = amSendRequest(hSession, SENDER_SERVICE, POLICY,
RECEIVER_SERVICE, reqMessage, SEND_MESSAGE_NAME, reasonCode)
IF retCode # AMCC_OK THEN
    function = "amSendRequest"
    GOTO ErrorExit
END



********************************
*  Receive the Response Message
*
*
* amReceiveMsg INPUTS
*
*    hSession             - Session handle.
*    RECEIVER_SERVICE     - Service definition describing where
*                           the response message is to be
*                           retrieved from.
*    POLICY               - Policy definition used to retrieve
*                           the response message.
*    SEND_MESSAGE_NAME    - Name we gave to the the underlying
*                           message object used to send the
*                           request
*                           message. This message object is now
```

```
*                           used as the message selection criteria
*                           to ensure that we retrieve only the
*                           message
*                           that is sent in response to our
*                           request.
*    MAX_MSG_LEN          - Max allowed length for retrieved
*                           message.
*    RECEIVE_MESSAGE_NAME - Name we're giving to the the
*                           underlying
*                           message object used to receive the
*                           response message.
*
* amReceiveMsg OUTPUTS
*
*    retCode              - Holds return code indicating status of
*                           function:
*                              AMCC_OK      (0) - Success
*                              AMCC_WARNING (1) - WebSphere MQ AMI
*                              Warning
*                              AMCC_FAILED  (2) - WebSphere MQ AMI
*                              Error
*                              Other            - Other error
*    respMsgLen           - Length of received message.
*    respMessage          - Response message.
*    reasonCode           - Holds additional information if
*                           WebSphere MQ AMI error or warning
*                           occurs.
*
*********************************

retCode = amReceiveMsg(hSession, RECEIVER_SERVICE, POLICY,
SEND_MESSAGE_NAME, MAX_MSG_LEN, respMsgLen, respMessage,
RECEIVE_MESSAGE_NAME, reasonCode)
IF retCode # AMCC_OK THEN
    function = "amReceiveMsg"
    GOTO ErrorExit
END

PRINT "Received Response Message: "
PRINT "   >> " : respMessage
PRINT ""



*********************************
*  Terminate the Session
*
*********************************

retCode = amTerminate(hSession, POLICY, reasonCode)
IF retCode # AMCC_OK THEN
    function = "amTerminate"
    GOTO ErrorExit
END
```

```
STOP


ErrorExit:
    PRINT "Error/Warning encountered in function " : function
    PRINT "   retCode    = " : retCode
    IF retCode = AMCC_WARNING OR retCode = AMCC_FAILED THEN
        PRINT "   reasonCode = " : reasonCode
    END



END
```

Sample Request/Response Server

```
$INCLUDE INCLUDE U2AMI.H


APP_NAME             = "SAMPLE.SERVER"
SENDER_SERVICE       = "AMT.SAMPLE.RESPONDER"
RECEIVER_SERVICE     = "AMT.SAMPLE.REQUEST.SERVICE"
SEND_MESSAGE_NAME    = "AMT.SAMPLE.SEND.MESSAGE"
RECEIVE_MESSAGE_NAME = "AMT.SAMPLE.RECEIVE.MESSAGE"
POLICY               = "AMT.SAMPLE.POLICY"


hSession     = 0
retCode      = 0
reasonCode   = 0

MAX_REQUESTS = 5
msgCount     = 0

reqMessage   = ""
respMessage  = ""

reqMsgLen    = 0
MAX_MSG_LEN  = 1024


*********************************
*  Initialize the Session
*
*********************************

retCode = amInitialize(hSession, APP_NAME, POLICY, reasonCode)
IF retCode # AMCC_OK THEN
    function = "amInitialize"
    GOTO ErrorExit
END


************************************
*  Service up to MAX_REQUESTS
*
************************************

FOR msgCount = 1 TO MAX_REQUESTS


*********************************
*  Receive the Request Message
*
*
* amReceiveRequest INPUTS
*
*  hSession             - Session handle.
```

```
*  RECEIVER_SERVICE     - Service definition describing  where
*                         the request message is to be
*                         retrieved from.
*  POLICY               - Policy definition used to retrieve
*                         the request message.
*  MAX_MSG_LEN          - Max allowed length for retrieved
*                         message.
*  RECEIVE_MESSAGE_NAME - Name we're giving to the the
*                         underlying
*                           message object used to receive the
*                           request message.
*  SENDER_SERVICE       - Name we're giving to the special
*                         internally-defined "response sender"
*                           service. Note that because of the
*                           special status of
*                           response-senders, the
*                           name we give the service must not
*                           be defined in the AMI repository.
*
* amReceiveRequest OUTPUTS
*
* retCode              - Holds return code indicating status of
*                        function:
*                           AMCC_OK      (0) - Success
*                           AMCC_WARNING (1) - WebSphere MQ AMI
*                                              Warning
*                           AMCC_FAILED  (2) - WebSphere MQ AMI
*                                              Error
*                           Other            - Other error
* reqMsgLen            - Length of received message.
* reqMessage           - Request message.
* reasonCode           - Holds additional information if
*                        WebSphere MQ AMI error or warning occurs.
*
********************************

  retCode = amReceiveRequest(hSession, RECEIVER_SERVICE, POLICY,
MAX_MSG_LEN, reqMsgLen, reqMessage, RECEIVE_MESSAGE_NAME,
SENDER_SERVICE, reasonCode)
    IF retCode # AMCC_OK THEN
        function = "amReceiveRequest"
        GOTO ErrorExit
    END

    PRINT "Received Request Message: "
    PRINT "   >> " : reqMessage
    PRINT ""




********************************
*  Send the Response Message
```

```
*
*
* amSendResponse INPUTS
*
*    hSession              - Session handle.
*    SENDER_SERVICE        - The response-sender we named
*                            previously
*                            in the call to amReceiveRequest.
*    POLICY                - Policy definition used to send
*                            the response message.
*    RECEIVE_MESSAGE_NAME - Name we gave to the the underlying
*                            message object used to receive the
*                            request message. This message object
*                            is
*                            now used to correlate the response
*                            message with the initial request
*                            message.
*    respMessage           - Response message.
*    SEND_MESSAGE_NAME     - Name we're giving to the the
*                            underlying
*                            message object used to send the
*                            response message.
*
* amSendResponse OUTPUTS
*
*    retCode               - Holds return code indicating status of
*                            function:
*                               AMCC_OK      (0) - Success
*                              AMCC_WARNING (1) - WebSphere MQ AMI
*                                                  Warning
*                              AMCC_FAILED  (2) - WebSphere MQ AMI
*                                                  Error
*                               Other            - Other error
*    reasonCode            - Holds additional information if
*                            WebSphere MQ AMI error or warning
*                            occurs.
*
********************************

    respMessage = reqMessage

    retCode = amSendResponse(hSession, SENDER_SERVICE, POLICY,
RECEIVE_MESSAGE_NAME, respMessage, SEND_MESSAGE_NAME, reasonCode)
    IF retCode # AMCC_OK THEN
        function = "amSendResponse"
        GOTO ErrorExit
    END

    PRINT "Sent Response Message: "
    PRINT "   << " : respMessage
    PRINT ""
```

```
NEXT



*********************************
*  Terminate the Session
*
*********************************

retCode = amTerminate(hSession, POLICY, reasonCode)
IF retCode # AMCC_OK THEN
    function = "amTerminate"
    GOTO ErrorExit
END



STOP
ErrorExit:
    PRINT "Error/Warning encountered in function " : function
    PRINT "   retCode    = " : retCode
    IF retCode = AMCC_WARNING OR retCode = AMCC_FAILED THEN
        PRINT "   reasonCode = " : reasonCode
    END
END
```

Additional Reading

Interested readers are encouraged to refer to the following publications, which are available for download from http://www.ibm.com/shop/publications/order.

MQSeries Primer

MQSeries Application Messaging Interface

MQSeries Application Programming Guide

MQSeries Clients

Chapter

Creating XML Documents

4

XML for IBM UniVerse

The Extensible Markup Language (XML) is a markup language used to define, validate, and share document formats. It enables you to tailor document formats to specifications unique to your application by defining your own elements, tags, and attributes.

***Note**: XML describes how a document is structured, not how a document is displayed.*

XML was developed by the World Wide Web Consortium (W3C), who describe XML as:

> The Exnsible Markup Language (XML) is the universal format for structured documents and data on the Web.

XML documents are text documents, intended to be processed by an application, such as a web browser.

An XML document consists of a set of tags that describe the structure of data. Unlike HTML, you can write your own tags. You can use XML to describe any type of data so that it is cross-platform and machine independent.

For detailed information about XML, see the W3C Web site at http://www.w3.org/TR/REC-xml.

UniVerse enables you to receive and create XML documents, and process them through UniVerse Basic, UniVerse SQL, or RetrieVe. In order to work with the XML documents in UniVerse, you will need to know some key terms:

- Document Type Definitions
- XML Schema
- Document Object Model
- Well-Formed and Valid Documents

Document Type Definitions

You must define the rules of the structure of your XML document. These rules may be part of the XML document, and are called the Document Type Definition, or DTD. The DTD provides a list of elements, tags, attributes, and entities contained in the document, and describes their relationship to each other.

A DTD can be external or internal.

- External DTD — An external DTD is a separate document from the XML document, residing outside of your XML document. External DTDs can be applied to many different XML documents.
- Internal DTD — An internal DTD resides in the XML document as part of the header of the document, and applies only to that XML document.

You can combine external DTDs with internal DTDs in an XML document, and you can create DTDs in an XML document.

XML Schema

The structure of the XML document can also be defined using XML Schema, which is an XML-based alternative to the DTD. An XML Schema defines a class of XML documents, including the structure, content and meaning of the XML document. XML Schema is useful because it is written in XML and is extensible to future additions. You can create schema with XML, and you can use schema to validate XML. The XML Schema language can also be referred to as XML Schema Definition (XSD).

The Document Object Model (DOM)

The Document Object Model (DOM) is a platform- and language-independent interface that enables programs and scripts to dynamically access and update the content, structure, and style of documents. A DOM is a formal way to describe an XML document to another application or programming language. You can describe the XML document as a tree, with nodes representing elements, attributes, entities, an text.

Well-Formed and Valid XML Documents

An XML document is either well-formed or valid:

- Well-formed XML documents must follow XML rules. All XML documents must be well-formed.
- Valid XML documents are both well-formed, and follow the rules of a specific DTD or schema. Not all XML documents must be valid.

For optimum exchange of data, you should try to ensure that your XML documents are valid.

Creating an XML Document from RetrieVe

You can create an XML document from UniVerse files through RetrieVe. To create an XML document through RetrieVe, complete the following steps:

1. If you are the originator of the DTD or XML Schema, use RetrieVe to create the DTD or XML Schema.
   If you are not the originator of the DTD or XML Schema, analyze the DTD or XML Schema associated with the application to which you are sending the XML file. Determine which of your dictionary attributes correspond to the DTD or XML Schema elements. You can also refer to Mapping to an External Schema at the end of this section.
2. Create an XML mapping file, if necessary. The mapping file will enable users to create many different forms of XML.
3. List the appropriate fields using the LIST command.
4. Add the TOXML command to generate the XML document.

Create the &XML& File

UniVerse stores XML mapping files in the &XML& directory file. This directory is automatically created with new accounts. If you have an older account, you can create this file for PICK flavor accounts using the following command:

```
CREATE.FILE &XML& 3,1,18 1,1,19
```

To create the &XML& account in other flavor accounts, use the following command:

```
CREATE.FILE &XML& 19
```

Mapping Modes

UniVerse supports three modes for mapping data to XML files. These modes are:

- Attribute-centric
- Element-centric
- Mixed

Attribute-centric Mode

In the attribute-centric mode, which is the default mode, each record displayed in the query statement becomes an XML element. The following rules apply to the record fields:

- Each singlevalued field becomes an attribute within the element.
- Each multivalued or multi-subvalued field becomes a sub-element of the record element. The name of the sub-element, if there is no association, is *fieldname_MV* or *_MS*.
- Within a sub-element, each multivalued field becomes an attribute of the sub-element.
  - Associated multi-subvalued fields become another nested sub-element of the sub-element. The name of this nested sub-element is *association_name*-MS.
  - If there are no associated multi-subvalued fields, the sub-element name is field_name-MV/MS.

This is the default mapping scheme. You can change the default by defining maps in the &XML& directory.

The following example shows data created in attribute mode:

```
>LIST STUDENT.F LNAME CGA TOXML SAMPLE 1

<?xml version="1.0" encoding="UTF-8"?>
<ROOT>
<STUDENT.F _ID = "424325656" LNAME = "Martin">
  <CGA_MV SEMESTER = "SP94" COURSE_HOURS = "3" TEACHER = "Masters"
COURSE_HOURS = "3" TEACHER = "Fisher">
    <CGA_MS COURSE_GRD = "C" COURSE_NBR = "PY100" COURSE_NAME =
"Introduction to Psychology"/>
    <CGA_MS COURSE_GRD = "C" COURSE_NBR = "PE100" COURSE_NAME =
"Golf - I"/>
  </CGA_MV>
</STUDENT.F>
</ROOT>
>
```

Element-centric Mode

In the element-centric mode, as in the attribute-centric mode, each record becomes an XML element. The following rules apply:

- Each singlevalued field becomes a simple sub-element of the element, containing no nested sub-elements. The value of the field becomes the value of the sub-element.
- Each association whose multivalued and multi-subvalued fields are included in the query statement form a complex sub-element. In the sub-element, each multivalued field belonging to the association becomes a sub-element that may contain multi-subvalued sub-elements. There are two ways to display empty values in multivalued fields belonging to an association. For detailed information, see Displaying Empty Values in Multivalued Fields in An Association.
- By default, UniVerse converts text marks to an empty space.

Specify that you want to use element-centric mapping by using the ELEMENTS keyword in the RetrieVe statement. You can also define treated-as = “ELEMENT” in the U2XMLOUT.map file, so that all XML will be created in element mode.

The following example shows data created in element mode:

```
>LIST STUDENT.F LNAME CGA TOXML ELEMENTS SAMPLE 1

<?xml version="1.0" encoding="UTF-8"?>
<ROOT>
<STUDENT.F>
  <_ID>424325656</_ID>
  <LNAME>Martin</LNAME>
  <CGA_MV>
    <SEMESTER>SP94</SEMESTER>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Masters</TEACHER>
    <CGA_MS>
      <COURSE_GRD>C</COURSE_GRD>
      <COURSE_NBR>PY100</COURSE_NBR>
      <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
    </CGA_MS>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Fisher</TEACHER>
    <CGA_MS>
      <COURSE_GRD>C</COURSE_GRD>
      <COURSE_NBR>PE100</COURSE_NBR>
      <COURSE_NAME>Golf - I</COURSE_NAME>
    </CGA_MS>
  </CGA_MV>
</STUDENT.F>
</ROOT>
>
```

Displaying Empty Values in Multivalued Fields in An Association

UniVerse displays empty values in multivalued fields belonging to an association depending on the setting of the Matchelement field in the U2XMLOUT.map file.

Emptyattribute

This attribute determines how to display the empty attributes for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XML Schema. This option can be specified in the U2XMLOUT.map file, or in an individual mapping file.

0 - Hides the empty attributes in the multivalued fields.
1 - Shows the empty attributes in the multivalued fields.

Matchelement

This element specifies how UniVerse displays empty values in multivalued fields belonging to an association in the XML output.

If Matchelement is set to 1 (the default), matching values or subvalues belonging to the same association display as empty elements for matching pairs.

Consider the following example:

```
LIST STUDENT.F LNAME FNAME COURSE_NBR COURSE_GRD COURSE_NAME
SEMESTER
01:04:52pm  06 Jan 2009  PAGE    1

STUDENT....  424-32-5656
Last Name.. Martin
First Name. Sally
Crs #........................ GD. Course Name.... Term
PY100                        C   Introduction to SP94
                                 Psychology
PE100                            Golf - I

STUDENT....  521-81-4564
Last Name.. Smith
First Name. Harry
Crs #........................ GD. Course Name.... Term
CS130                        A   Intro to        FA93
                                 Operating
                                 Systems
CS100                            Intro to
                                 Computer
                                 Science
PY100                        B   Introduction to
                                 Psychology

CS131                        B   Intro to        SP94
                                 Operating
                                 Systems
CS101                        B   Intro to
                                 Computer
                                 Science
PE220                            Racquetball

...
>
```

Notice that three of the GRADE fields are empty, while their associated values for COURSE # and COURSE NAME are not.

When Matchelement is set to 1, the missing values for COURSE _GRD, `<COURSE_GRD></COURSE_GRD>`, display as a empty values in the XML document, as shown in the following example:

```
>LIST STUDENT.F LNAME CGA TOXML ELEMENTS

<?xml version="1.0" encoding="UTF-8"?>
<ROOT>
<STUDENT.F>
  <_ID>424325656</_ID>
  <LNAME>Martin</LNAME>
  <CGA_MV>
    <SEMESTER>SP94</SEMESTER>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Masters</TEACHER>
    <CGA_MS>
      <COURSE_GRD>C</COURSE_GRD>
      <COURSE_NBR>PY100</COURSE_NBR>
      <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
    </CGA_MS>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Fisher</TEACHER>
    <CGA_MS>
      <COURSE_GRD/>  <------ empty value
      <COURSE_NBR>PE100</COURSE_NBR>
      <COURSE_NAME>Golf - I</COURSE_NAME>
    </CGA_MS>
  </CGA_MV>
</STUDENT.F>
<STUDENT.F>
  <_ID>521814564</_ID>
  <LNAME>Smith</LNAME>
  <CGA_MV>
    <SEMESTER>FA93</SEMESTER>
    <COURSE_HOURS>5</COURSE_HOURS>
    <TEACHER>James</TEACHER>
    <CGA_MS>
      <COURSE_GRD>A</COURSE_GRD>
      <COURSE_NBR>CS130</COURSE_NBR>
      <COURSE_NAME>Intro to Operating Systems</COURSE_NAME>
    </CGA_MS>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Gibson</TEACHER>
    <CGA_MS>
      <COURSE_GRD/>  <------ empty value
      <COURSE_NBR>CS100</COURSE_NBR>
      <COURSE_NAME>Intro to Computer Science</COURSE_NAME>
    </CGA_MS>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Masters</TEACHER>
    <CGA_MS>
      <COURSE_GRD>B</COURSE_GRD>
      <COURSE_NBR>PY100</COURSE_NBR>
```

```
        <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
      </CGA_MS>
    </CGA_MV>
    <CGA_MV>
      <SEMESTER>SP94</SEMESTER>
      <COURSE_HOURS>5</COURSE_HOURS>
      <TEACHER>Aaron</TEACHER>
      <CGA_MS>
        <COURSE_GRD>B</COURSE_GRD>
        <COURSE_NBR>CS131</COURSE_NBR>
        <COURSE_NAME>Intro to Operating Systems</COURSE_NAME>
      </CGA_MS>
      <COURSE_HOURS>4</COURSE_HOURS>
      <TEACHER>Gibson</TEACHER>
      <CGA_MS>
        <COURSE_GRD>B</COURSE_GRD>
        <COURSE_NBR>CS101</COURSE_NBR>
        <COURSE_NAME>Intro to Computer Science</COURSE_NAME>
      </CGA_MS>
      <COURSE_HOURS>3</COURSE_HOURS>
      <TEACHER>Fisher</TEACHER>
      <CGA_MS>
        <COURSE_GRD/>  <---- empty value
        <COURSE_NBR>PE220</COURSE_NBR>
        <COURSE_NAME>Racquetball</COURSE_NAME>
      </CGA_MS>
    </CGA_MV>
  </STUDENT.F>
  ...
```

This is the default behavior.

When Matchelement is set to 0, the missing value for COURSE_GRD, `<COURSE_GRD></COURSE_GRD>`, is ignored in the XML document, as shown in the following example:

```
LIST STUDENT.F LNAME CGA TOXML ELEMENTS
<?xml version="1.0" encoding="UTF-8"?>
<ROOT>
<STUDENT.F>
  <_ID>424325656</_ID>
  <LNAME>Martin</LNAME>
  <CGA_MV>
    <SEMESTER>SP94</SEMESTER>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Masters</TEACHER>
    <CGA_MS>
      <COURSE_GRD>C</COURSE_GRD>
      <COURSE_NBR>PY100</COURSE_NBR>
      <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
    </CGA_MS>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Fisher</TEACHER>
    <CGA_MS>
            ←—— missing value
      <COURSE_NBR>PE100</COURSE_NBR>
      <COURSE_NAME>Golf - I</COURSE_NAME>
    </CGA_MS>
  </CGA_MV>
</STUDENT.F>
<STUDENT.F>
  <_ID>521814564</_ID>
  <LNAME>Smith</LNAME>
  <CGA_MV>
    <SEMESTER>FA93</SEMESTER>
    <COURSE_HOURS>5</COURSE_HOURS>
    <TEACHER>James</TEACHER>
    <CGA_MS>
      <COURSE_GRD>A</COURSE_GRD>
      <COURSE_NBR>CS130</COURSE_NBR>
      <COURSE_NAME>Intro to Operating Systems</COURSE_NAME>
    </CGA_MS>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Gibson</TEACHER>
    <CGA_MS>
            ←—— missing value
      <COURSE_NBR>CS100</COURSE_NBR>
      <COURSE_NAME>Intro to Computer Science</COURSE_NAME>
    </CGA_MS>
    <COURSE_HOURS>3</COURSE_HOURS>
    <TEACHER>Masters</TEACHER>
    <CGA_MS>
      <COURSE_GRD>B</COURSE_GRD>
      <COURSE_NBR>PY100</COURSE_NBR>
      <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
```

```
      </CGA_MS>
    </CGA_MV>
    <CGA_MV>
      <SEMESTER>SP94</SEMESTER>
      <COURSE_HOURS>5</COURSE_HOURS>
      <TEACHER>Aaron</TEACHER>
      <CGA_MS>
        <COURSE_GRD>B</COURSE_GRD>
        <COURSE_NBR>CS131</COURSE_NBR>
        <COURSE_NAME>Intro to Operating Systems</COURSE_NAME>
      </CGA_MS>
      <COURSE_HOURS>4</COURSE_HOURS>
      <TEACHER>Gibson</TEACHER>
      <CGA_MS>
        <COURSE_GRD>B</COURSE_GRD>
        <COURSE_NBR>CS101</COURSE_NBR>
        <COURSE_NAME>Intro to Computer Science</COURSE_NAME>
      </CGA_MS>
      <COURSE_HOURS>3</COURSE_HOURS>
      <TEACHER>Fisher</TEACHER>
      <CGA_MS>
                ←— missing value
        <COURSE_NBR>PE220</COURSE_NBR>
        <COURSE_NAME>Racquetball</COURSE_NAME>
      </CGA_MS>
    </CGA_MV>
  </STUDENT.F>

  </MAIN>
```

Mixed Mode

In the mixed-mode, you create your own map file, where you specify which fields are treated as attribute-centric and which fields are treated as element-centric.

Field-level mapping overrides the mode you specify in the RetrieVe statement.

XML Configuration File

The xmlconfig file allows you to specify the encoding used in XML documents and to set other XML options. There are two levels of XML configuration files:

- System level. The default location of the system-level xmlconfig file is the UniVerse home directory.
- Account level. The default location of the account-level xmlconfig file is under the account directory. Configuration parameters in the account-level xmlconfig file override the settings in the system-level xmlconfig file.

The xmlconfig file is a text file in which each line is a key/value pair, as shown in the following example:

```
encoding=utf-8
in-encoding=EUC-JP
out-encoding=uft-8
out-xml-declaration=true
out-pretty-format=true
out-newline=CR-LF
```

Keys and values are case-insensitive.

When you start a UniVerse session, UniVerse loads the xmlconfig files and validates the options. If it finds an error in an xmlconfig file, it reports one of the following error messages in errlog, if errlog exists in the UniVerse home directory:

- 38 Invalid XML config key 'key_name' at line line_number in xmlconfig file(xmlconfig_filename)
- 39 Invalid XML config value 'value_string' at line line_number in xmlconfig file(xmlconfig_filename)
- 40 Invalid XML config format 'name_value_string' at line line_number in xmlconfig file(xmlconfig_filename)

If an error is found in an xmlconfig file, no part of its content is loaded.

xmlconfig Parameters

The following XML options are available in the system-level and account-level xmlconfig files.

Parameter	Description	Default
encoding	Specifies a setting for the encoding to be used in general in XML documents, such as UTF-8. If the setting is **default**, XML documents use the operating system's default encoding. Valid encoding settings can be found at http://www.iana.org/assignments/character-sets	default

xmlconfig Parameters

Parameter	Description	Default
in-encoding	Specifies a setting for the encoding to be used for strings that are imported to XML libraries. If NULL, strings imported to XML libraries use the same encoding as specified in the general encoding parameter (see above).	default
out-encoding	Specifies a setting for the encoding to be used for strings exported from XML libraries. If NULL, strings exported from XML libraries use the same encoding as specified in the general encoding parameter.	default
version	Specifies the XML version number. Currently, 1.0 is the only version supported.	1.0
standalone	A flag that specifies whether the XML document is dependent on another XML document. yes – The XML document is standalone no – The XML document is dependent on another XML document	yes
out-newline	Specifies the newline character to be used in XML documents. NULL – Uses the operating system default (CR-LF for Windows or CR for UNIX) CR – Carriage return character (xD). CR-LF – Carriage return and linefeed characters (xD xA). LF – Linefeed character (xA).	NULL
out-xml-declaration	Specifies whether the XML declaration is to appear in output. true – The XML declaration appears in output. false – The XML declaration does not appear in output.	true

xmlconfig Parameters (Continued)

Parameter	Description	Default
out-format-pretty-print	Specifies whether to add white space to produce an indented, human-readable XML document. The exact nature of the transformations is not specified by this parameter. true – Pretty-prints XML documents. Setting this state also sets the out-format-canonical parameter to false. false – Does not pretty-print XML documents. Setting this state also sets the out-format-canonical parameter to true.	true
out-normalize-characters	Specifies whether to perform W3C text normalization of the characters in the document at the time they are written in output. Only those characters that are written are subject to change in the normalization process. The DOM document itself remains unchanged. true – Performs W3C text normalization. false – Does not perform text normalization.	true
out-split-cdata-sections	Specifies whether to split character data (CDATA) sections of XML documents containing the CDATA termination marker]]> or characters that cannot be represented in the output encoding. true – Splits CDATA sections containing the termination marker]]> or characters that cannot be represented in the output encoding, and output the characters as their Unicode numeric character references. If a CDATA section is split, a warning is issued. false – Does not split CDATA sections. Issues an error if a CDTA section contains an unrepresentable character.	true

xmlconfig Parameters (Continued)

Parameter	Description	Default
out-validation	Specifies whether to validate the XML document against the abstract schema while the document is being serialized. true – Validates the XML document while it is being serialized. If validation errors are found during the serialization process, the error handler is notified. Setting this state also sets the use-abstract-schema parameter to true. false – Does not validate the XML document while it is being serialized.	false
out-expand-entity-references	Specifies whether to expand EntityReference nodes while an XML document is being serialized. true – Expands EntityReference nodes in the XML document while it is being serialized. false – Does not expand EntityReference nodes in the XML document while it is being serialized.	false
out-whitespace-in-element-content	Specifies whether to output all white space in an XML document. true – Outputs all white space. false – Outputs only the white space that is not within element content.	true
out-discard-default-content	Specifies whether to suppress output of default content in the Attr nodes of an XML document. true – Suppresses output of default content in Attr nodes. false – Outputs all attributes and all content.	true

xmlconfig Parameters (Continued)

Parameter	Description	Default
out-format-canonical	Specifies whether the formatting process writes the XML document according to the rules specified in the Canonical XML specification, rather than pretty-prints the document. true – Prints XML documents in canonical format. Setting this state also sets the out-format-pretty-print parameter to false. false – Pretty-prints XML documents. Setting this state also sets the out-format-pretty-print parameter to true.	false
out-write-BOM	A nonstandard extension was added in Xerces-C++ 2.2 (or XML4C 5.1) to enable writing the byte order mark (BOM) in the XML stream. Specifies whether to enable writing the byte order mark in the XML stream under certain conditions. true – Enables writing the byte order mark if a DOMDocumentNode is rendered for serialization and if the output encoding is one of the following: UTF-16 UTF-16LE UTF-16BE UCS-4 UCS-4LE UCS-4BE false – Disables writing the byte order mark.	false

xmlconfig Parameters (Continued)

Parameter	Description	Default
matchelement	Specifies how UniVerse displays empty values in multivalued fields belonging to an association in XML output. 0 – For matching values or subvalues belonging to the same association, the empty value is ignored in the generated XML document. 1 – For matching values or subvalues belonging to the same association, the second value is displayed as an empty element in the generated XML document.	1

elementmode	Specifies whether to create XML documents in element mode.
	0 – Create XML documents in attribute mode. This mode does not produce an extra level of element tags. The display name of each field is used as an element tag. The content of the field is shown as attribute/value pairs within the field's element tag. For example:
	`:LIST MYSTUDENT '1111' TOXML`
	`<?xml version="1.0"?>`
	`<ROOT>`
	`<MYSTUDENT _ID = "1111"/>`
	`</ROOT>`
	1 – Create XML documents in element mode. This mode produces an extra level of element tags. All fields referenced in the query are represented as XML elements. The display name of the field is used for the field's element tags. The display name of each field is used as a nested element tag. The content of the field is shown within the element tags. For example:
	`:LIST MYSTUDENT '1111' TOXML`
	`<?xml version="1.0"?>`
	`<ROOT>`
	`<MYSTUDENT>`
	`  <_ID>1111</_ID>`
	`</MYSTUDENT>`
	`</ROOT>`
		1

xmlconfig Parameters (Continued)

Parameter	Description	Default
schematype	Specifies the format of the schema used in XML output. inline – Only the top-level element (the record element) is defined globally. All other elements are children of the record element. A drawback of this format is that it is difficult for other schemas to reference child elements. ref – All elements are global; every element is a child of the root element. This format is somewhat restrictive: all elements are at the same level, so the element names must be unique. However, this format includes a ref tag for every element, which makes it easier for other schemas to reference elements.	ref
hidemv	Specifies whether to hide <MV> and </MV> tags for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode. By default, the MV tag is generated as “association name_MV”. 0 – Show MV tags for multivalued fields. 1 – Hide MV tags for multivalued fields.	0
hidems	Specifies whether to hide <MS> and </MS> tags for multi-subvalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode. 0 – Show MS tags for multi-subvalued fields. 1 – Hide MS tags for multi-subvalued fields.	0

xmlconfig Parameters (Continued)

Parameter	Description	Default
collapsemv	Specifies whether to collapse <MV> and </MV> tags, using only one set of these tags for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode. 0 – Expand MV tags for multivalued fields. 1 – Collapse MV tags multivalued fields.	0
collapsems	Specifies whether to collapse <MS> and </MS> tags, using only one set of these tags for multi-subvalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode. 0 – Expand MS tags for multi-subvalued fields. 1 – Collapse MS tags multi-subvalued fields.	0
hideroot	Specifies whether to create the entire XML document or only a section of it. 0 – UniVerse creates the entire XML document as well as a DTD and an XMLSchema. 1 – UniVerse creates only the record portion of the XML document; it does not create a DTD or an XMLSchema. For example, you may want only a section of the XML document if you are using the SAMPLE keyword and other conditional clauses	0
root	Specifies the name of the root element in XML output.	NULL

xmlconfig Parameters (Continued)

Parameter	Description	Default
encode	Specifies the ASCII code for the character to be encoded.	NULL
target	Specifies the URL of the target namespace for XML output.	NULL
xmlns:namespace	Specifies the URL of the XML namespace for XML output.	NULL

xmlconfig Parameters (Continued)

The Mapping File

You can create the U2XMLOUT.map file in $UVHOME/&XML& to define commonly used global settings for creating XML documents. UniVerse reads and processes this mapping file each time UniVerse is started. For example, if you normally create element-centric output, and display empty elements for missing values or subvalues belonging to the same association, you can define these settings in the U2XMLOUT.map file, as shown in the following example:

```
<U2
  matchelement = "1"
  treated-as = "element"
/>
```

Defining these settings in the mapping file eliminates the need to specify them in each RetrieVe statement.

UniVerse processes XML options as follows:

1. Reads options defined in the U2XMLOUT.map file when UniVerse starts.
2. Reads the $UVHome\xmlconfig file.
3. Reads the account information from the XMLConfig file.
4. Reads any options defined in a mapping file. This mapping file resides in the &XML& directory in the current account, and is specified in the RetrieVe statement, as shown in the following example:

   ```
   LIST STUDENT.F SEMESTER TOXML XMLMAPPING mystudent.map
   ```
5. Processes any options you specify in the RetrieVe statement.

Options you specify in the RetrieVe statement override options defined in the mapping file. Options defined in the mapping file override options defined in the U2XMLOUT.map file.

A mapping file has the following format:

```
<?XML version="1.0"?>
<!--there can be multiple <U2xml:mapping> elements -->
  <U2xml:mapping file="file_name"
```

Note: *We suggest that you only put individual field options in the mapping file. Global options should be set in either the U2XMLOUT.map file or the xmlconfig file.*

```
        hidemv="0"
        hidems="0"
        hideroot="0"
        collapsemv="0"
        collapsems="0"
        emptyattribute="0"
        hastm="yes" | "1"
        matchelement="0" |"1"
        schematype="ref"
        targetnamespace="targetURL"
        xmlns:NAME="URL"
        field="dictionary_display_name"
        map-to="name_in_xml_douniversec"
        type="MV" | "MS"
        treated-as="attribute" | "element"
        root="root_element_name"
        record="record_element_name"
        association-mv="mv_level_assoc_name"
        association-ms="ms_level_assoc_name"
        format (or Fmt)= "format -pattern"..
        conversion (or Conv)= "conversion code"
        encode="encoding characters"
        />

...

</U2xml-mapping>
```

The XML mapping file is, in itself, in XML format. There are three types of significant elements: the root element, the field element, and the association element.

- **The root Element –** The root element describes the global options that control different output formats, such as the schema type, targetNamespace, hideroot, hidemv, and hidems. You can also use the root element to change the default root element name, or the record element name. You should have only one root element in the mapping file.
- **The field Element** – UniVerse uses the field element to change the characteristics of a particular field's XML output attributes, such as the display name, the format, or the conversion.
- **The association Element** – UniVerse uses the association element to change the display name of an association. By default, this name is the association phrase name, together with "-MV" or "-MS."

Distinguishing Elements

You can distinguish the root element from the field and association elements because the root element does not define a field or association element.

Both the field element and the association element must have the file and field attribute to define the file name and the field name in the file that has been processed. Generally, the field name is a data-descriptor or I-descriptor defined in the dict file, making it a field element. If the field name is an association phrase, it is an association element.

The Mapping File Example section shows this in more detail.

Root Element Attributes

The default root element name in an XML document is ROOT. You can change the name of the root element, as shown in the following example:

```
root="root-element-name"
```

Record Name Attribute

The default record name is FILENAME. The record attribute in the root element changes the record name. The following example illustrates the record attribute:

```
record="record-element-name"
```

Hideroot Attribute

The Hideroot attribute allows you to specify whether to create the entire XML document or only a section of it. For example, using the SAMPLE keyword or other conditional clauses. If Hideroot is set to 1, UniVerse only creates the record portion of the XML document, it does not create a DTD or XMLSchema. The default value is 0.

```
Hideroot="1"/"0"
```

Hidemv Attribute

This attribute specifies whether to hide <MV> and </MV> tags for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XML Schema. This parameter applies only if the XML document is created in element mode.

0 - Show MV tags for multivalued fields.
1 - HideMV tags for multivalued fields.

You can also use this option with XMLEXECUTE().

***Note**: If the document is created in attribute mode, it is not possible to eliminate the extra level of element tags.*

Hidems Attribute

This attribute specifies whether to hide <MS> and </MS> tags for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XML Schema. This parameter applies only if the XML document is created in element mode.

0 - ShowMS tags for multi-subvalued fields.
1 - Hide MS tags for multi-subvalued fields.

You can also use this option with XMLEXECUTE().

***Note**: If the document is created in attribute mode, it is not possible to eliminate the extra level of element tags.*

Collapsemv Attribute

This attribute specifies whether to collapse <MV> and </MV> tags, using only one set of these tags for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode.

0 - Expand MV tags for each set of multivalued fields.
1 - CollapseMV tags for each set of multivalued fields.

Collapsems Attribute

This attribute specifies whether to collapse <MS> and </MS> tags, using only one set of these tags for multi-subvalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode.

0 - Expand MS tags for multi-subvalued fields.
1 - Collapse MS tags for multi-subvalued fields.

Emptyattribute

This attribute determines how to display the empty attributes for multivalued fields belonging to an association in the generated XML document. This option can be specified in the U2XMLOUT.map file, or in an individual mapping file.

0 - Ignores the empty attributes in the multivalued fields.
1 - Shows the empty attributes in the multivalued fields.

Namespace Attributes

UniVerse provides the following attributes for defining namespaces:

- xmlns:name-space-name=”URL”
- targetnamespace=”URL”

UniVerse displays the targetnamespace attribute in the XMLSchema as targetNamespace, and uses the URL you define in the XML document to define the schema location.

If you define the targetnamespace and other explicit namespace definitions, UniVerse checks if the explicitly defined namespace has the same URL as the targetnamespace. If it does, UniVerse uses the namespace name to qualify the schema element, and the XML document element name.

In this case, UniVerse does not qualify the schema element or the XML document element.

UniVerse uses the namespace attributes and xmlns:name-space-name together to define the namespace. All namespaces defined in the root element are for global element namespace qualifiers only.

Note**:** *Namespace is used primarily for XMLSchema. If you do not specify XMLSchema in the command line, UniVerse will not use a global namespace to qualify any element in the document.*

The following example shows the output if the TARGETNAMESPACE attribute is set to “www.ibm.com”:

```
XMLSETOPTIONS TARGETNAMESPACE = “http:://www.ibm.com”

>LIST STUDENT.F LNAME COURSE_NBR COURSE_GRD COURSE_NAME SEMESTER
FNAME TOXML WITHSCHEMA XMLMAPPING student.map
<?xml version="1.0"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  targetNamespace="www.ibm.com"
  xmlns:ibm="http://www.ibm.com"
  xmlns="www.ibm.com"
  elementFormDefault="qualified">
  <xsd:annotation>
  <xsd:documentation xml:lang="en">
    account: C:\IBM\ud71\XMLDemo\udxml
    command: LIST STUDENT.F LNAME COURSE_NBR COURSE_GRD
COURSE_NAME SEMESTER FNAME TOXML WITHSCHEMA XMLMAPPING student.map
  </xsd:documentation>
  </xsd:annotation>
  <xsd:element name="MAIN">
    <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="STUDENT" type="STUDENTType" minOccurs="0"
maxOccurs="un
bounded"/>
    </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
    <xsd:complexType name="STUDENTType">
      <xsd:sequence>
        <xsd:element name="_ID" type="xsd:string"/>
        <xsd:element name="LNAME" type="xsd:string"/>
        <xsd:sequence minOccurs="0" maxOccurs="unbounded">
        <xsd:element name="SEMESTER" type="xsd:string"/>
        <xsd:sequence minOccurs="0" maxOccurs="unbounded">
        <xsd:element name="COURSE_GRD" type="xsd:string"/>
        <xsd:element name="COURSE_NAME" type="xsd:string"/>
        <xsd:element name="COURSE_NBR" type="xsd:string"/>
        </xsd:sequence>
        </xsd:sequence>
        <xsd:element name="FNAME" type="xsd:string"/>
      </xsd:sequence>
    </xsd:complexType>
</xsd:schema>
<?xml version="1.0"?>
<MAIN
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="www.ibm.com"
  xmlns:ibm="http://www.ibm.com"
>
<STUDENT>
  <_ID>123456789</_ID>
  <LNAME>Martin</LNAME>
```

```
      <SEMESTER>SP94</SEMESTER>
        <COURSE_GRD></COURSE_GRD>  ◄── empty value
        <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
        <COURSE_NBR>PY100</COURSE_NBR>
        <COURSE_GRD>C</COURSE_GRD>
        <COURSE_NAME>Golf - I</COURSE_NAME>
        <COURSE_NBR>PE100</COURSE_NBR>
    <FNAME>Sally</FNAME>
  </STUDENT>

  <STUDENT>
    <_ID>987654321</_ID>
    <LNAME>Miller</LNAME>
      <SEMESTER>FA93</SEMESTER>
        <COURSE_GRD>C</COURSE_GRD>
        <COURSE_NAME>Engineering Principles</COURSE_NAME>
        <COURSE_NBR>EG110</COURSE_NBR>
        <COURSE_GRD></COURSE_GRD>  ◄── empty value
        <COURSE_NAME>Calculus- I</COURSE_NAME>
        <COURSE_NBR>MA220</COURSE_NBR>
        <COURSE_GRD>B</COURSE_GRD>
        <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
        <COURSE_NBR>PY100</COURSE_NBR>
      <SEMESTER>SP94</SEMESTER>
        <COURSE_GRD>B</COURSE_GRD>
        <COURSE_NAME>Fluid Mechanics</COURSE_NAME>
        <COURSE_NBR>EG140</COURSE_NBR>
        <COURSE_GRD>B</COURSE_GRD>
        <COURSE_NAME>Circut Theory</COURSE_NAME>
        <COURSE_NBR>EG240</COURSE_NBR>
        <COURSE_GRD></COURSE_GRD>  ◄── empty value
        <COURSE_NAME>Calculus - II</COURSE_NAME>
        <COURSE_NBR>MA221</COURSE_NBR>
    <FNAME>Susan</FNAME>
  </STUDENT>

  </MAIN>
  >
```

Schema Attribute

The default schema format is ref type schema. You can use the schema attribute to define a different schema format.

```
schema="inline"|"ref"|"type"
```

Elementformdefault and Attributeformdefault Attributes

UniVerse uses the elementformdefault and attributeformdefault attributes in the XML Schema. If you use them together with the namespace attribute in the root element, you can indicate all of the local elements and local attributes that need to be qualified with the namespace.

File Attribute

UniVerse uses the File attribute to process both RetrieVe and UniVerse SQL commands. If you do not define the file attribute exactly as it is used on the command line, the field element will not be properly processed.

```
File="filename"
```

Field Attribute

The Field attribute defines the field name. The field can be either a data-descriptor, an I-descriptor, or an 'association phrase name'. For more information, see Association Elements.

```
Field="field-name"
```

Note**:** *The* file *and* field *attributes are used to identify the query file and field needed to change the default directions. Use these attributes in the same element of the XML mapping file to pinpoint the database file and field.*

Map-to Attribute

The Map-to attribute allows you to define a new attribute tag or element tag name for the field. By default, UniVerse uses the dictionary display field name for the element or attribute name tag.

Type Attribute

The Type attribute defines how to treat the field in the XML document, either as a multivalued field or a multi-subvalued field.

```
type="MV"|"MS"
```

Treated-as Attribute

The Treated-as attribute determines if the field should be treated as an element or an attribute in the generated XML document.

Matchelement Attribute

The Matchelement attribute specifies whether to display empty elements for missing values or subvalues belonging to the same association, or to ignore the missing values.

Encode Attribute

The Encode attribute encodes unprintable characters, or characters that have special meanings in XML, such as { : }, with a macro.

```
encode="0x7B 0x7D"
```

Conv Attribute

The Conv attribute changes the conversion defined in the dictionary record to the conversion you define.

```
conv="new conv code" | conversion = "new conversion code"
```

Fmt Attribute

The Fmt attribute changes the format defined in the dictionary record to the format you define.

```
fmt="new format code" | format = "new format code"
```

Association Elements

An association element contains the following four attributes:

- file = “file name”
- field = “association phrase name”
- association-mv = “new multivalue element tag”
- association-ms = “new multi-subvalue element tag”

Mapping File Example

The following example illustrates the student.map mapping file:

```
<!-- this is for STUDENT.F file -->
 <U2
       root="main"
       collapsemv='1'
       collapsems='1'
       schema="ref"
       hidemv="1"
       hidems="1"
       hideroot="0"
       elementformdefault="qualified"
       attributeformdefault="qualified"
       treated-as="element"
 />
 <U2 file="STUDENT.F"
         field = "CGA"
         association-mv="Term"
         association-ms="Courses_Taken"
 />
 <U2 file="STUDENT.F"
         field = "COURSE_NBR"
         type="MS"
         treated-as="element"
 />
 <U2 file="STUDENT.F"
         field = "SEMESTER"
         map-to="SEMESTER"
         type="MV"
         treated-as="element"
 />
 <U2 file="STUDENT.F"
         field = "COURSE_GRD"
         map-to="COURSE_GRD"
         type="ms"
         treated-as="element"
 />
 <U2 file="STUDENT.F"
         field = "COURSE_NAME"
         type="ms"
         treated-as="element"
 />
 <U2 file="STUDENT.F"
         field = "TEACHER"
         type="ms"
         treated-as="element"
 />
```

Notice that the SEMESTER, COURSE_NBR, COURSE_GRD, and COURSE_NAME fields are to be treated as elements. When you create the XML document, these fields will produce element-centric XML data. Any other fields listed in the query statement will produce attribute-centric XML data, since attribute-centric is the default mode.

Additionally, COURSE_NBR, COURSE_GRD, and COURSE_NAME are defined as multi-subvalued fields. If they were not, UniVerse would create the XML data as if they were multivalued attributes.

***Note**: The global attributes listed above are not defined because they are set to "1".*

The next example illustrates an XMLSchema using the mapping file in the previous example.

Use the following command to create the .xsd schema:

```
>LIST STUDENT.F LNAME SEMESTER COURSE_NBR TOXML XMLMAPPING
student.map SCHEMAONLY

<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  targetNamespace="www.ibm.com"
  xmlns:intf="www.ibm.com"
  xmlns="www.ibm.com"
  elementFormDefault="qualified"
  attributeFormDefault="qualified">
  <xsd:annotation>
  <xsd:documentation xml:lang="en">
    account: C:\IBM\UV
    command: LIST STUDENT.F LNAME SEMESTER COURSE_NBR TOXML
XMLMAPPING student.map SCHEMAONLY
  </xsd:documentation>
  </xsd:annotation>
  <xsd:element name="main">
    <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="intf:STUDENT.F" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
    <xsd:element name="STUDENT.F">
      <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="_ID" minOccurs="0" type="xsd:string"/>
        <xsd:element name="LNAME" minOccurs="0"
type="xsd:string"/>
        <xsd:sequence minOccurs="0" maxOccurs='unbounded'>
        <xsd:element name="SEMESTER" minOccurs="0"
type="xsd:string"/>
        <xsd:sequence minOccurs="0" maxOccurs='unbounded'>
        <xsd:element name="COURSE_NBR" minOccurs="0"
type="xsd:string"/>
        </xsd:sequence>
        </xsd:sequence>
      </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
</xsd:schema>
>
```

The next example illustrates an XML document created using the mapping file in the previous example. Use the following command to display the XML to the screen:

```
>LIST STUDENT.F LNAME SEMESTER COURSE_NBR TOXML XMLMAPPING
student.map

<?xml version="1.0" encoding="UTF-8"?>
<main>
<STUDENT.F>
  <_ID>424325656</_ID>
  <LNAME>Martin</LNAME>
    <SEMESTER>SP94</SEMESTER>
      <COURSE_NBR>PY100</COURSE_NBR>
      <COURSE_NBR>PE100</COURSE_NBR>
</STUDENT.F>
<STUDENT.F>
  <_ID>521814564</_ID>
  <LNAME>Smith</LNAME>
    <SEMESTER>FA93</SEMESTER>
      <COURSE_NBR>CS130</COURSE_NBR>
      <COURSE_NBR>CS100</COURSE_NBR>
      <COURSE_NBR>PY100</COURSE_NBR>
    <SEMESTER>SP94</SEMESTER>
      <COURSE_NBR>CS131</COURSE_NBR>
      <COURSE_NBR>CS101</COURSE_NBR>
      <COURSE_NBR>PE220</COURSE_NBR>
</STUDENT.F>
...
</main>
```

Conversion Code Considerations

UniVerse uses the following rules when extracting data from database files:

- If the dictionary record of a field you are extracting contains a conversion code, UniVerse uses that conversion code when extracting data from database files.
- If you specify a conversion code in the mapping file, the conversion code in the mapping file overrides the conversion code specified in the dictionary record.
- If you specify a conversion code using the CONV keyword during the execution of a RetrieVe statement, that conversion code overrides both the conversion code specified in the mapping file and the conversion code specified in the dictionary record.

Formatting Considerations

UniVerse does not generally apply the dictionary format pattern to the extracted data. To specify a format, define it in the mapping file. If you specify a format using the FMT keyword in a RetrieVe statement, that format will override the format defined in the mapping file.

Mapping File Encoding

For special characters encountered in data, UniVerse uses the default XML entities to encode the data. For example, ‘<‘ becomes <, ‘>’ becomes >, ‘&’ becomes &, and ‘ “ ‘ becomes ". However, UniVerse does not convert ‘ to ', unless you specify it in attribute encode. (<, >, &, ', and " are all built-in entities for the XML parser).

Use the encode field in the mapping file to add flexibility to the output. You can define special characters to encode in hexadecimal form. UniVerse encodes these special characters to &#x##;. For example, if you want the character ‘{‘ to be encoded for field FIELD1, specify the following encode value in the mapping file for FIELD1:

```
encode=”0x7B”
```

In this case, UniVerse will convert ‘{‘ found in the data of FIELD1 to &#x7B.

You can also use this type of encoding for any nonprintable character. If you need to define more than one character for a field, add a space between the hexadecimal definitions. For example, if you want to encode both ‘{‘ and ‘}’, the encode value in the mapping file should look like the following example:

```
encode=”0x7B 0x7D”
```

How Data is Mapped

Regardless of the mapping mode you choose, the outer-most element in the XML document is created as <ROOT>, by default. The name of each record element defaults to <*file_name*>.

You can change these mapping defaults in the mapping file, as shown in the following example:

```
<U2xml:mapping root="root_name"
               record="record_name"/>
```

Mapping Example

The following example illustrates the creation of XML documents. These examples use the STUDENT.F file, which contains the following fields:

```
>LIST DICT STUDENT.F

DICT STUDENT.F    11:39:32am  11 Sep 2007  Page    1
               Type &
Field......... Field. Field........ Conversion.. Column......... Output
Depth &
Name.......... Number Definition... Code........ Heading........ Format
Assoc..

@ID            D    0                            STUDENT         10L    S
ID             D    0                            STUDENT         12R### S
                                                                   -##-##
                                                                   ##
LNAME          D    1                            Last Name       40T    S
FNAME          D    2                            First Name      10L    S
MAJOR          D    3                            Major           20L    S
MINOR          D    4                            Minor           4L     S
ADVISOR        D    5                            Advisor         8L     S
SEMESTER       D    6                            Term            4L     S
CGA
TESTSEME       D    6                            Term            4L     S
COURSE_NBR     D    7                            Crs #           10L    S
CGA
TESTCOURSE     D    7                            Crs #           5L     S
COURSE_GRD     D    8                            GD              3L     S
CGA
?¼
     ? ` ?
GPA1           I      SUBR('GPA1',C MD3          GPA             5R     S

               Type &
Field......... Field. Field........ Conversion.. Column......... Output
Depth &
Name.......... Number Definition... Code........ Heading........ Format
Assoc..

                      OURSE_HOURS,C
                      OURSE_GRD)
TEACHER        I      TRANS('COURSE              Teacher         10L    M
CGA
                      S',COURSE_NBR
                      ,'TEACHER','X
                      ')
COURSE_NAME    I      TRANS('COURSE              Course Name     15T    S
CGA
                      S',COURSE_NBR
                      ,'NAME','X')
COURSE_HOURS   I      TRANS('COURSE              Hours           5R     M
CGA
                      S',COURSE_NBR
                      ,CREDITS,'X')
@              PH      LNAME FNAME
                      MAJOR MINOR
                      ADVISOR
```

```
                        SEMESTER
                        COURSE_NBR
                Type &
Field......... Field. Field........ Conversion.. Column......... Output
Depth &
Name.......... Number Definition... Code........ Heading........ Format
Assoc..

                        COURSE_GRD
CGA             PH      SEMESTER
                        COURSE_NBR
                        COURSE_NAME
                        COURSE_GRD
                        COURSE_HOURS
                        TEACHER
@ORIGINAL       S  @ID                                                  M
@SYNONYM        S   ID                                                  M

22 records listed.
```

TCL Commands for XML

You can enter TCL commands to specify the encoding and other parameters for use in XML documents during the current session.

This section discusses the following TCL commands:

- Session-level TCL Commands
- Existing TCL Command Affected by XMLSETOPTIONS Command or XMLSetOptions() API

Session-level TCL Commands

Three XML commands are available from the TCL command line:

- XMLSETOPTIONS
- XMLGETOPTIONS
- XMLGETOPTIONVALUE

XMLSETOPTIONS

Syntax

XMLSETOPTIONS <*options*>

Description

Use this command to set the encoding parameter and other options for XML documents in the current session. XML settings entered with this command override the settings in the system-level and account-level xmlconfig files during the current UniVerse session.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
options	A string in the format of space-delimited key/value pairs. The XML options are the same as those in the xmlconfig file and accept the same values. Keys and values are case-insensitive. For a complete list of valid UniVerse XML options and settings, see xmlconfig Parameters. The XMLSETOPTIONS command also accepts three special strings as the *options* parameter. A special string must be entered as the only option: ■ `defaults` – Sets all XML options to their default settings in the current session. ■ `reload` – Reloads the current system-level and account-level xmlconfig files, since they may have changed after you started your UniVerse session. ■ `reset` – Resets XML options to the original settings that were loaded when you started the UniVerse session. ***Note:*** *If UniVerse encounters a problem such as a syntax error or an invalid value in the options string, it displays an error message and none of the XML parameters are changed.*

XMLSETOPTIONS Parameters

Examples

The following example shows the format for entering the XML options as key/value pairs in the TCL command.

```
XMLSETOPTIONS matchelement=1
```

The next example shows the format for entering a special string as the *options* parameter:

```
XMLSETOPTIONS defaults
```

XMLGETOPTIONS

Syntax

XMLGETOPTIONS <*delimiterString*>

Description

Use this command to return the values of the encoding parameter and other XML options in effect in the current UniVerse session.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
delimiterString	Specifies the string to be used to separate the key/value pairs returned by the command.

XMLGETOPTIONS Parameters

Examples

The following example shows the format for entering *delimiterString* as the string used to separate the key/value pairs returned by the command. Key/value pairs can be separated by a space or by any string, such as <>, as shown in this example:

```
XMLGETOPTIONS <>

standalone=yes<>out-xml-declaration=true<>out-format-pretty-
print=true<>out-norm
alize-characters=true<>out-split-cdata-sections=true<>out-
validation=false<>out-
expand-entity-references=false<>out-whitespace-in-element-
content=true<>out-disc
ard-default-content=true<>out-format-canonical=false<>out-write-
bom=false
matchelement=1<>emptyattribute=0<>elementmode=0<>schematype=ref<>h
idemv=0<>hidem
s=0<>collapsemv=0<>collapsems=0<>hideroot=0<>
```

If you enter the `XMLSETOPTIONS` command with no *delimiterString*, the key/value pairs are separated by a space, as shown in the next example:

```
XMLGETOPTIONS

standalone=yes out-xml-declaration=true
out-format-pretty-print=true out-normalize-characters=true
out-split-cdata-sections=true out-validation=false
out-expand-entity-references=false
out-whitespace-in-element-content=true
out-discard-default-content=true out-format-canonical=false out-
write-bom=false matchelement=1 emptyattribute=0
elementmode=0 schematype=ref hidemv=0 hidems=0 collapsemv=0
collapsems=0 hideroot=0
```

For a complete list of the standard UniVerse XML options and values returned by this command, see xmlconfig Parameters.

XMLGETOPTIONVALUE

Syntax

XMLGETOPTIONVALUE *<optionName>*

Description

Use this command to return the value of the encoding parameter or any other XML option in effect in the current UniVerse session.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
optionName	Specifies the name of the XML option for which you want to return the current value. For a complete list of valid UniVerse XML options, see xmlconfig Parameters.

XMLGETOPTIONVALUE Parameters

Example

The following example shows the format for entering *optionName* to specify the XML parameter for which you want to return the current value.

```
XMLGETOPTIONVALUE encoding
```

This command returns the value of the encoding option, as shown below:

```
XMLGETOPTIONVALUE encoding

UTF-8
```

Existing TCL Command Affected by XMLSETOPTIONS Command or XMLSetOptions() API

The syntax of the following TCL command remains unchanged. However, the command is affected by the XML options you set previously at the session level through the XMLSETOPTIONS command or through the XMLSetOptions() API.

DB.TOXML

Syntax

DB.TOXML *"xml_doc_filename" "xmap_filename" "condition"*

Description

Use the DB.TOXML command to create an XML document from the UniVerse database.

Note: *The XML options set previously at the session level through the XMLSETOPTIONS command or through the XMLSetOptions() API are used when you run the DB.TOXML command in the current UniVerse session.*

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xml_doc_filename	The name of the XML document to create. If you do not enter a full path, the file is written to the &XML& directory.
xmap_filename	The file name for the XMAP file.
condition	A RetrieVe condition string, for example, WITH CLASSID = “Class002”

DB.TOXML Parameters

Example

The following example illustrates using DB.TOXML from TCL to create an XML document.

```
DB.TOXML SCHOOL_STUDENT.XML SCHOOL.MAP WITH CLASSID = “Class002”
```

Creating an XML Document Using RetrieVe

To create an XML document using RetrieVe, use the LIST command.

> LIST [DICT | USING [DICT] *dictname*] *filename* ... [TOXML [ELEMENTS] [WITHDTD] [WITHSCHEMA | SCHEMAONLY] [XML-MAPPING ***mapping_file***] [TO xmlfile]]

The following table describes each parameter of the syntax.

Parameter	Description
DICT	Lists records in the file dictionary of *filename*. If you do not specify DICT, records in the data file are listed.
USING [DICT] *dictname*	If DICT is not specified, uses the data portion of *dictname* as the dictionary of *filename*. If DICT is specified, the dictionary of *dictname* is used as the dictionary of *filename*.
filename	The file whose records you want to list. You can specify *filename* anywhere in the sentence. LIST uses the first word in the sentence that has a file descriptor in the VOC file as the file name.
TOXML	Outputs LIST results in XML format.
ELEMENTS	Outputs results in element-centric format.
WITHDTD	Output produces a DTD corresponding to the XML output.
WITHSCHEMA	The output produces an XML schema corresponding to the XML output.
SCHEMAONLY	The output produces a schema for the corresponding query.
XMLMAPPING *mapping_file*	Specifies a mapping file containing transformation rules for display. This file must exist in the &XML& file.
TO *xmlfile*	This option redirects the query xml output from the screen to the &XML& file. This file has a .xml suffix. If you specify WITHSCHEMA in the query, UniVerse creates an xmlfile.xsd in the &XML& directory. If you specify WITHDTD, UniVerse creates an xmlfile.dtd.

LIST Parameters

For detailed information about the LIST command, see the *Using RetrieVe*.

Examples

Creating an Attribute-centric XML Document

Using the mapping file described in the Mapping File Example, the following example creates an attribute-centric XML document. To use a mapping file, specify the XMLMAPPING keyword in the RetrieVe statement.

```
>LIST STUDENT.F LNAME FNAME SEMESTER COURSE_NBR COURSE_GRD
COURSE_NAME TOXML XMLMAPPING student.map

<?xml version="1.0" encoding="UTF-8"?>
<main>
<STUDENT _ID = "987654321" LNAME = "Miller" FNAME = "Susan">
  <Term SEMESTER = "FA93">
    <Courses_Taken COURSE_NBR = "EG110" COURSE_GRD = "C"
COURSE_NAME = "Engineer
ing Principles"/>
    <Courses_Taken COURSE_NBR = "MA220" COURSE_NAME = "Calculus-
I"/>
    <Courses_Taken COURSE_NBR = "PY100" COURSE_GRD = "B"
COURSE_NAME = "Introduc
tion to Psychology"/>
  </Term>
  <Term SEMESTER = "SP94">
    <Courses_Taken COURSE_NBR = "EG140" COURSE_GRD = "B"
COURSE_NAME = "Fluid Me
chanics"/>
    <Courses_Taken COURSE_NBR = "EG240" COURSE_GRD = "B"
COURSE_NAME = "Circut T
heory"/>
    <Courses_Taken COURSE_NBR = "MA221" COURSE_NAME = "Calculus -
II"/>
  </Term>
</STUDENT>
<STUDENT _ID = "123456789" LNAME = "Martin" FNAME = "Sally">
  <Term SEMESTER = "SP94">
    <Courses_Taken COURSE_NBR = "PY100" COURSE_NAME =
"Introduction to Psycholog
y"/>
    <Courses_Taken COURSE_NBR = "PE100" COURSE_GRD = "C"
COURSE_NAME = "Golf - I
"/>
  </Term>
</STUDENT>
</main>
>
```

Creating an XML Document with a DTD or XML Schema

If you only include the TOXML keyword in the RetrieVe statement, the resulting XML document does not include a DTD or XML Schema. To create an XML document that includes a DTD, use the WITHDTD keyword. To create an XML document that includes an XML Schema, use the WITHSCHEMA keyword.

The following example illustrates an XML document that includes a DTD:

```
>LIST STUDENT.F SEMESTER COURSE_NBR COURSE_GRD COURSE_NAME TOXML
WITHDTD

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE ROOT[
<!ELEMENT ROOT (STUDENT.F*)>
<!ELEMENT STUDENT.F ( CGA_MV* )>
<!ATTLIST STUDENT.F
        _ID CDATA #REQUIRED
>
<!ELEMENT CGA_MV ( CGA_MS* )>
<!ATTLIST CGA_MV
        SEMESTER CDATA #IMPLIED
>
<!ELEMENT CGA_MS  EMPTY>
<!ATTLIST CGA_MS
        COURSE_NBR CDATA #IMPLIED
        COURSE_GRD CDATA #IMPLIED
        COURSE_NAME CDATA #IMPLIED
>
]>

<ROOT>
<STUDENT.F _ID = "424325656">
  <CGA_MV SEMESTER = "SP94">
    <CGA_MS COURSE_NBR = "PY100" COURSE_NAME = "Introduction to
Psychology"/>
    <CGA_MS COURSE_NBR = "PE100" COURSE_GRD = "C"
      COURSE_NAME = "Golf - I"/>
  </CGA_MV>
</STUDENT.F>
<STUDENT.F _ID = "521814564">
  <CGA_MV SEMESTER = "FA93">
    <CGA_MS COURSE_NBR = "CS130" COURSE_GRD = "A"
      COURSE_NAME = "Intro to Operating Systems"/>
    <CGA_MS COURSE_NBR = "CS100" COURSE_GRD = "B"
      COURSE_NAME = "Intro to Computer Science"/>
    <CGA_MS COURSE_NBR = "PY100" COURSE_GRD = "B"
      COURSE_NAME = "Introduction to Psychology"/>
  </CGA_MV>
  <CGA_MV SEMESTER = "SP94">
    <CGA_MS COURSE_NBR = "CS131" COURSE_GRD = "B"
      COURSE_NAME = "Intro to Operating Systems"/>
    <CGA_MS COURSE_NBR = "CS101" COURSE_GRD = "B"
      COURSE_NAME = "Intro to Computer Science"/>
    <CGA_MS COURSE_NBR = "PE220" COURSE_GRD = "A"
   COURSE_NAME = "Racquetball"/>
  </CGA_MV>
</STUDENT.F>
...
>
```

Using WITHSCHEMA

Use the WITHSCHEMA keyword with the RetrieVe LIST command to create an XML schema.

The syntax for the LIST command is:

LIST [DICT | USING [DICT] *dictname*] *filename* ... [TOXML [ELEMENTS][WITHSCHEMA][WITHDTD] [SCHEMAONLY] TO *filename* [XMLMAPPING ***mapping_file***] [TO xmlfile]]...

***Note**: If you specify both WITHDTD and WITHSCHEMA in the same RetrieVe statement, UniVerse does not produce an XML schema.*

WITHSCHEMA creates an XML schema *filename*.xsd. By default, UniVerse writes this file to the &XML& directory when the TO xmlfile command is used. The information is displayed on the screen if the TO xmlfile command is not used. If you do not specify a targetNamespace in the mapping file, the filename.xml's root element contains the following command to define the schema location:

```
noNamespaceSchemaLocation=filename.xsd
```

If you specify the targetNamespace in the mapping file, UniVerse generates the following:

```
schemaLocation="namespaceURL filename.xsd"
```

In both of these cases, you can validate the files using the XML schema validator, or the UniVerse Basic API XDOMValidate() function.

Mapping to an External Schema

A mapping file enables users to define how the dictionary attributes correspond to the DTD or XML Schema elements. This allows you to create many different forms of XML. Defining settings in the mapping file eliminates the need to specify them in each RetrieVe statement. The following example illustrates how to map to an external schema.

Assume you are trying to map to the following schema:

```
:<?xml version="1.0"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:ibm="http://www.ibm.com"
  elementFormDefault="qualified">
  <xsd:annotation>
  <xsd:documentation xml:lang="en">
    This is a sample schema
  </xsd:documentation>
  </xsd:annotation>
  <xsd:element name="transcript">
    <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="student" type="studentType" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
    <xsd:complexType name="studentType">
      <xsd:sequence>
        <xsd:element name="semesterReport"
type="semesterReportType" minOccurs="0" maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:attribute name="ref" type="xsd:string"/>
      <xsd:attribute name="firstName" type="xsd:string"/>
      <xsd:attribute name="lastName" type="xsd:string"/>
    </xsd:complexType>
      <xsd:complexType name="semesterReportType">
        <xsd:sequence>
          <xsd:element name="results" type="resultsType"
minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attribute name="term" type="xsd:string"/>
      </xsd:complexType>
        <xsd:complexType name="resultsType">
          <xsd:sequence>
            <xsd:element name="courseGrade" type="xsd:string"/>
            <xsd:element name="courseHours" type="xsd:string"/>
          </xsd:sequence>
          <xsd:attribute name="courseNumber" type="xsd:string"/>
          <xsd:attribute name="courseName" type="xsd:string"/>
          <xsd:attribute name="courseInstructor"
type="xsd:string"/>
        </xsd:complexType>
</xsd:schema>
```

The following map illustrates how to map your student file to this schema. Use the steps shown below to create the map:

1. Set the default settings for the map.
2. Rename singlevalued fields to match the schema names.
3. Rename the element tags used for the association.
4. Rename the multivalued fields.
5. Rename the multi-subvalued fields.

The following mapping file is the transcript.map file.

```
>
<u2
<!-- First set the default settings for the map -->
   root="transcript"
   record="student"
   schema="type"
   xmlns:ibm="http://www.ibm.com"
   treated-as="element"
   collaosemv="1"
/>

<!-- Rename singlevalued fields to match the schema names -->

<u2
file="STUDENT.F"
field="@ID"
map-to="ref"
type="S"
treated-as="attribute"
/>

<u2
file="STUDENT.F"
field="FNAME"
map-to="firstName"
type="S"
treated-as="attribute"
/>

<u2
file="STUDENT.F"
field="LNAME"
map-to="lastName"
type="S"
treated-as="attribute"
/>

<!-- Rename the element tags used for the association -->
<u2
file="STUDENT.F"
field="CGA"
association-mv="semesterReport"
association-ms="results"
/>

<!-- Rename the multivalued fields -->
<u2
file="STUDENT.F"
field="SEMESTER"
map-to="term"
type="MV"
treated-as="attribute"
```

```
/>

<!-- Rename the multi-subvalued fields -->

<u2
file="STUDENT.F"
field="COURSE_NBR"
map-to="courseNumber"
type="MSV"
treated-as="attribute"
/>

<u2
file="STUDENT.F"
field="COURSE_NAME"
map-to="courseName"
treated-as="attribute"
type="MSV"
/>

<u2
file="STUDENT.F"
field="COURSE_GRD"
map-to="courseGrade"
type="MSV"
/>

<u2
file="STUDENT.F"
field="COURSE_HOURS"
map-to="courseHours"
type="MSV"
/>

<u2
file="STUDENT.F"
field="TEACHER"
map-to="courseInstructor"
type="MSV"
treated-as="attribute"
/>
```

You can now view the output from the schema using the following command:

```
>LIST STUDENT.F FNAME LNAME CGA SAMPLE 1 TOXML XMLMAPPING
transcript.map

<?xml version="1.0" encoding="UTF-8"?>
<transcript
  xmlns:ibm="http://www.ibm.com"
>
<student ref = "424325656" firstName = "Sally" lastName =
"Martin">
  <semesterReport term = "SP94" courseNumber = "PY100"
      courseName = "Introduction to Psychology"
      courseInstructor = "Masters"
      courseNumber = "PE100"
      courseName= "Golf - I"
      courseInstructor = "Fisher">
    <courseGrade>C</courseGrade>
    <courseHours>3</courseHours>
    <courseHours>3</courseHours>
  </semesterReport>
</student>
</transcript>
>
```

Creating an XML Document with UniVerse SQL

In addition to RetrieVe, you can also create XML documents using UniVerse SQL. To create an XML document through UniVerse SQL, complete the following steps:

1. Analyze the DTD or XML schema associated with the application to which you are sending the XML file. Determine which of your dictionary attributes correspond to the DTD or XML schema elements.
2. Create an XML mapping file, if necessary.
3. List the appropriate fields using the UniVerse SQL SELECT command.

To create an XML document from UniVerse SQL, use the UniVerse SQL SELECT command.

The following table describes each parameter of the syntax.

Parameter	Description
SELECT clause	Specifies the columns to select from the database.
FROM clause	Specifies the tables containing the selected columns.
WHERE clause	Specifies the criteria that rows must meet to be selected.
WHEN clause	Specifies the criteria that values in a multivalued column must meet for an association row to be output.
GROUP BY clause	Groups rows to summarize results.
HAVING clause	Specifies the criteria that grouped rows must meet to be selected.
ORDER BY clause	Sorts selected rows.
report_qualifiers	Formats a report generated by the SELECT statement.
processing_qualifiers	Modifies or reports on the processing of the SELECT statement.
TOXML	Outputs SELECT results in XML format.
ELEMENTS	Outputs results in element-centric format.
WITHDTD	Output produces a DTD corresponding to the query.

SELECT Parameters

Parameter	Description
WITHSCHEMA	Output produces an XML schema corresponding to the query.
SCHEMAONLY	The output will produce a schema for the corresponding query.
XMLMAPPING '*mapping_file*'	Specifies a mapping file containing transformation rules for display. This file must exist in the &XML& file.
XMLDATA '*extraction_mapping_file*'	Specifies the file containing the extraction rules for the XML document. This file is used for receiving an XML file.
TO '*xmlfile*'	This option redirects the query xml output from the screen to the &XML& file. This file has a .xml suffix. If you specify WITHSCHEMA in the query, UniVerse creates an xmlfile.xsd in the &XML& directory. If you specify WITHDTD, UniVerse creates an xmlfile.dtd as well.

SELECT Parameters (Continued)

You must specify clauses in the SELECT statement in the order shown in the syntax.

For a full discussion of the UniVerse SQL SELECT statement clauses, see *Using UniVerse SQL*.

Processing Rules for UniVerse SQL SELECT Statements

UniVerse processes SELECT statements much the same as it processes LIST statements, with a few exceptions.

The processing rules for a UniVerse SQL SELECT statement against a single table are the same as the RetrieVe LIST rules. For a discussion of how UniVerse SQL processes these statements, see Creating an XML Document from RetrieVe.

Processing Multiple Tables

When processing a UniVerse SQL SELECT statement involving multiple files, UniVerse attempts to keep the nesting inherited in the query in the resulting XML document. Because of this, the order in which you specify the fields in the UniVerse SQL SELECT statement is important for determining how the elements are nested.

Processing in Attribute-centric Mode

As with RetrieVe, the attribute-centric mode is the default mapping mode. For more information about the attribute-centric mode, see the Attribute-centric Mode section.

- In this mode, UniVerse uses the name of the file containing the first field you specify in the SELECT statement as the outer-most element in the XML output. Any singlevalued fields you specify in the SELECT statement that belong to this file become attributes of this element.
- UniVerse processes the SELECT statement in the order you specify. If it finds a field that belongs to another file, UniVerse creates a sub-element. The name of this sub-element is the new file name. All singlevalued fields found in the SELECT statement that belong to this file are created as attributes for the sub-element.
- If UniVerse finds a multivalued or multi-subvalued field in the SELECT statement, it creates a sub-element. The name of this element is the name of the association of which this field is a member.
- When you execute UNNEST against an SQL table, it flattens the multivalues into single values.

UniVerse processes the ELEMENTS, WITHDTD, WITHSCHEMA, SCHEMAONLY and XMLMAPPING keywords in the same manner as it processes them for the RetrieVe LIST command.

Processing in Element-centric Mode

When using the element-centric mode, UniVerse automatically prefixes each file name to the association name. For example, the CGA association in the STUDENT file is named STUDENT_CGA in the resulting XML file.

XML Limitations in UniVerse SQL

The TOXML keyword is not allowed in the following cases:

- In a sub-query
- In a SELECT statement that is part of an INSERT statement.
- In a SELECT statement that is part of a UNION definition.
- In a SELECT statement that is part of a VIEW definition.

Examples

This section illustrates XML output from the UniVerse SQL SELECT statement. The examples use sample CUSTOMER, TAPES, and STUDENT files.

The following example lists the dictionary records from the CUSTOMER file that are used in the examples:

```
>LIST DICT CUSTOMER.F

DICT CUSTOMER    02:11:01pm  11 Sep 2007  Page    1

               Type &
Field......... Field. Field........ Conversion.. Column......... Output
Depth &
Name.......... Number Definition... Code........ Heading........ Format
Assoc..

@ID            D    0                            CUSTOMER        10L    S
NAME           D    1                            Customer Name   15T    S
TAPES_RENTED   D    7                            Tapes           10L    M

TAPE_INFO      PH     TAPES_RENTED
               Type &
                      DATE_OUT
                      DATE_DUE
                      DAYS_BETWEEN
                      TAPE_COST
                      TAPE_NAME
                      UP_NAMES
29 records listed.

>LIST DICT TAPES.F

DICT TAPES.F    07:51:38am  07 Jan 2009  Page    1

               Type &
Field......... Field. Field........ Conversion.. Column......... Output
Depth &
Name.......... Number Definition... Code........ Heading........ Format
Assoc..

@ID            D    0                            TAPES           10L    S
ID             D    0                            TAPES           10L    S
NAME           D    1                            Tape Name       20T    S
RENTAL_PRICE   D    2               MD2          Retail Charge   8R     S
COPIES         D    3                            Copies Owned    4R     S
COPIES_OUT     D    4                            Rented          4R     S
NUM_RENTALS    D    5               MD0          Times Rented    6R     S
COST           D    6               MD2          Tape Cost       6R2$,  S
ACTORS         D    7                            Actors          12L    S
DIRECTOR       D    8                            Director        12L    S
CATEGORIES     D    9                            Type of Video   12L    S
CATS
NEW_PRICE      I      IF @ID[1,1] = MD2          Upgrade         5R     S
                      'B' THEN 0
                      ELSE
                      NUM_RENTALS;I
                      F @1 > 10
...
>
```

Using WITHSCHEMA

The syntax for the UniVerse SQL SELECT command is:

```
SELECT command.
SELECT clause FROM clause
[WHERE clause]
[WHEN clause [WHEN clause]...]
[GROUP BY clause]
[HAVING clause]
[ORDER BY clause]
[report_qualifiers]
[processing_qualifiers]
[TOXML [ELEMENTS] [WITHDTD][WITHSCHEMA][SCHEMAONLY]
[XMLMAPPING 'mapping_file']]
[XMLDATA extraction_mapping_file]
[TO 'xmlfile'];
```

When the TOXML command is used in SQL, both the mapping file and the TO xml file need to be quoted

Creating an XML Document From Multiple Files with a Multivalued Field

The next example illustrates creating an XML document from multiple files with a multivalued field. In the example, TAPES_RENTED is multivalued and belongs to the TAPE_INFO association in the CUSTOMER.F file. In the XML document, TAPES_RENTED appears in the CUSTOMER_TAPE_INFO_MV element.

```
>SELECT CUSTOMER.F.NAME, TAPES.F.CAT_NAME,TAPES_RENTED FROM
CUSTOMER.F,TAPES.F WHERE TAPES_RENTED = TAPES.F.@ID ORDER BY
CUSTOMER.F.NAME TOXML;
```

```
<?xml version="1.0" encoding="UTF-8"?>
<ROOT>
<CUSTOMER.F NAME = "Barrie, Dick">
  <TAPES.F>
    <TAPES.F_CATS_MV CAT_NAME = "Old Classic"/>
    <TAPES.F_CATS_MV CAT_NAME = "Drama"/>
    <TAPES.F_CATS_MV CAT_NAME = "Horror"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V996"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Best, George">
  <TAPES.F>
    <TAPES.F_CATS_MV CAT_NAME = "Romance"/>
    <TAPES.F_CATS_MV CAT_NAME = "Tear Jerker"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "B2297"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Bowie, David">
  <TAPES.F>
    <TAPES.F_CATS_MV CAT_NAME = "Avant Garde"/>
    <TAPES.F_CATS_MV CAT_NAME = "Science Fiction"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V9961"/>
</CUSTOMER.F>
...
</ROOT>
```

Creating an XML Document From Multiple Files with a DTD

The following example illustrates creating an XML document from multiple files with a DTD. To include the DTD, use the WITHDTD keyword.

```
>SELECT CUSTOMER.F.NAME, TAPES.F.CAT_NAME, TAPES_RENTED FROM
CUSTOMER.F, TAPES.F WHERE TAPES_RENTED = TAPES.F.@ID ORDER BY
CUSTOMER.F.NAME TOXML WITHDTD;
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE ROOT[
<!ELEMENT ROOT (CUSTOMER.F*)>
<!ELEMENT CUSTOMER.F ( TAPES.F* , CUSTOMER.F_TAPE_INFO_MV* )>
<!ATTLIST CUSTOMER.F
        NAME CDATA #REQUIRED
>
<!ELEMENT TAPES.F ( TAPES.F_CATS_MV* )>
<!ELEMENT TAPES.F_CATS_MV  EMPTY>
<!ATTLIST TAPES.F_CATS_MV
        CAT_NAME CDATA #IMPLIED
>
<!ELEMENT CUSTOMER.F_TAPE_INFO_MV  EMPTY>
<!ATTLIST CUSTOMER.F_TAPE_INFO_MV
        TAPES_RENTED CDATA #IMPLIED
>
]>

<ROOT>
<CUSTOMER.F NAME = "Barrie, Dick">
  <TAPES.F>
    <TAPES.F_CATS_MV CAT_NAME = "Old Classic"/>
    <TAPES.F_CATS_MV CAT_NAME = "Drama"/>
    <TAPES.F_CATS_MV CAT_NAME = "Horror"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V996"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Best, George">
  <TAPES.F>
    <TAPES.F_CATS_MV CAT_NAME = "Romance"/>
    <TAPES.F_CATS_MV CAT_NAME = "Tear Jerker"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "B2297"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Bowie, David">
  <TAPES.F>
    <TAPES.F_CATS_MV CAT_NAME = "Avant Garde"/>
    <TAPES.F_CATS_MV CAT_NAME = "Science Fiction"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V9961"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Chase, Carl">
  <TAPES.F>
```

```
    <TAPES.F_CATS_MV CAT_NAME = "Musical"/>
    <TAPES.F_CATS_MV CAT_NAME = "Drama"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V8481"/>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V1254"/>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V4951"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Chase, Carl">
  <TAPES.F>
    <TAPES.F_CATS_MV CAT_NAME = "Comedy"/>
    <TAPES.F_CATS_MV CAT_NAME = "Childrens Movie"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V8481"/>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V1254"/>
  <CUSTOMER.F_TAPE_INFO_MV TAPES_RENTED = "V4951"/>
</CUSTOMER.F>
...

</ROOT>
>
```

Creating an XML Document From Multiple Files Using a Mapping File

As with RetrieVe, you can create a mapping file to define transformation rules differing from the defaults. For information about creating the mapping file, see The Mapping File section.

The following mapping file defines rules for the CUSTOMER and TAPES file.

```
>ED &XML& CUST_TAPES.map
Top of "CUST_TAPES.map" in "&XML&", 22 lines, 259 characters.
*--: p
001: <U2xml
002:    file="TAPES.F"
003:    field = "CAT_NAME"
004:    map-to="Cat_name"
005:    type="mv"
006: />
007: <u2
008:    file="CUSTOMER.F"
009:    field="TAPES_RENTED"
010:    map-to="Tapes_rented"
011:    TYPE="mv"
012: />
013: <u2
014:    file="CUSTOMER.F"
015:    field="DATE_OUT"
016:    TYPE="mv"
017: />
018: <u2
019:    file="CUSTOMER.F"
020:    field="DATE_DUE"
021:    TYPE="mv"
022: />
```

To use this mapping file in the SELECT statement, specify the XMLMAPPING keyword, as shown in the following example:

Note: You must surround the name of the mapping file in single quotation marks.

```
>SELECT CUSTOMER.F.NAME, TAPES.F.NAME, CAT_NAME, DATE_OUT,
DATE_DUE FROM CUSTOMER.F, TAPES.F WHERE TAPES_RENTED = TAPES.F.@ID
ORDER BY CUSTOMER.F.NAME TOXML XMLMAPPING 'CUST_TAPES.MAP';
```

```
<?xml version="1.0" encoding="UTF-8"?>
<ROOT>
<CUSTOMER.F NAME = "Barrie, Dick">
  <TAPES.F NAME = "Citizen Kane">
    <TAPES.F_CATS_MV Cat_name = "Old Classic"/>
    <TAPES.F_CATS_MV Cat_name = "Drama"/>
    <TAPES.F_CATS_MV Cat_name = "Horror"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "03/29/94" DATE_DUE =
"03/31/94"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Best, George">
  <TAPES.F NAME = "Love Story">
    <TAPES.F_CATS_MV Cat_name = "Romance"/>
    <TAPES.F_CATS_MV Cat_name = "Tear Jerker"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "03/29/94" DATE_DUE =
"03/31/94"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Bowie, David">
  <TAPES.F NAME = "The Stalker">
    <TAPES.F_CATS_MV Cat_name = "Avant Garde"/>
    <TAPES.F_CATS_MV Cat_name = "Science Fiction"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/15/94" DATE_DUE =
"04/17/94"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Chase, Carl">
  <TAPES.F NAME = "'Round Midnight">
    <TAPES.F_CATS_MV Cat_name = "Musical"/>
    <TAPES.F_CATS_MV Cat_name = "Drama"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/20/94" DATE_DUE =
"04/22/94"/>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/20/94" DATE_DUE =
"04/22/94"/>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/21/94" DATE_DUE =
"04/23/94"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Chase, Carl">
  <TAPES.F NAME = "American Graffiti ">
    <TAPES.F_CATS_MV Cat_name = "Comedy"/>
    <TAPES.F_CATS_MV Cat_name = "Childrens Movie"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/20/94" DATE_DUE =
"04/22/94"/>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/20/94" DATE_DUE =
```

```
"04/22/94"/>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/21/94" DATE_DUE =
"04/23/94"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Chase, Carl">
  <TAPES.F NAME = "Flash Gordon">
    <TAPES.F_CATS_MV Cat_name = "Science Fiction"/>
    <TAPES.F_CATS_MV Cat_name = "Childrens Movie"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/20/94" DATE_DUE =
"04/22/94"/>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/20/94" DATE_DUE =
"04/22/94"/>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/21/94" DATE_DUE =
"04/23/94"/>
</CUSTOMER.F>
<CUSTOMER.F NAME = "Faber, Harry">
  <TAPES.F NAME = "To Kill A Mockingbird">
    <TAPES.F_CATS_MV Cat_name = "Horror"/>
    <TAPES.F_CATS_MV Cat_name = "Political"/>
    <TAPES.F_CATS_MV Cat_name = "Drama"/>
  </TAPES.F>
  <CUSTOMER.F_TAPE_INFO_MV DATE_OUT = "04/19/94" DATE_DUE =
"04/21/94"/>
</CUSTOMER.F>
...

</ROOT>
```

Creating an XML Document Through UniVerse Basic

Use the UniVerse Basic commands described in this section to create XML documents through UniVerse Basic.

Using the XMLExecute() Function

Syntax

XMLExecute(*cmd, options, xmlvar, xsdvar*)

Description

The XMLExecute function enables you to create an XML document using RetrieVe from UniVerse Basic and returns the xml and xsd schema in BASIC variables. By default, the XMLExecute command generates an XML Schema. The options can also be separated by a [space] command, using "=" to assign option values.

The following table describes each parameter of the syntax.

Parameter	Description	
cmd	Holds the text string of the RetrieVe LIST statement or the UniVerseUniVerse SQL SELECT statement. [IN]	
options	Each XML-related option is separated by a field mark (@FM), or space (" "). If the option requires a value, the values are contained in the same field, separated by value marks (@VM), or equal signs ("=").	
	WITHDTD	Creates a DTD and binds it with the XML document. By default, UniVerse creates an XML schema. However, if you include WITHDTD in your RetrieVe or UniVerse SQL statement, UniVerse does not create an XML schema, but only produces the DTD.
	ELEMENTS	The XML output is in element-centric format.
	XMLMAPPING = *'mapping_file_name'*	Specifies the mapping file containing transformation rules for display. This file must exist in the &XML& directory.
	SCHEMA = *'type'*	The default schema format is ref type schema. You can use the SCHEMA attribute to define a different schema format.

XMLExecute Parameters

Parameter	Description	
	HIDEMV, HIDEMS	Normally, when UniVerse processes multi-valued or multi-subvalued fields, UniVerse adds another level of elements to produce multiple levels of nesting. You have the option of disabling this additional level by adding the HIDEMV and HIDEMS attributes. When these options are on, the generated XML document and the associated DTD or XML schema have fewer levels of nesting.
	HIDEROOT = 1	Allows you to specify to only create a segment of an XML document, for example, using the SAMPLE keyword and other conditional clauses. If you specify HIDEROOT, UniVerse only creates the record portion of the XML document, it does not create a DTD or XML schema.
	RECORD = '*newrecords'*	The default record name is FILENAME_*record*. The record attribute in the ROOT element changes the record name.
	ROOT = '*newroot'*	The default root element name in an XML document is ROOT. You can change the name of the root element as shown in the following example: root="*root_element_name*"
	TARGETNAMESPACE = '*namespaceURL*'	UniVerse displays the targetnamespace attribute in the XMLSchema as *targetNamespace*, and uses the URL you specify to define *schemaLocation*. If you define the targetnamespace and other explicit namespace definitions, UniVerse checks if the explicitly defined namespace has the same URL and the targetnamespace. If it does, UniVerse uses the namespace name to qualify the schema element, and the XML document element name.

XMLExecute Parameters (Continued)

Parameter	Description	
	COLLAPSEMV, COLLAPSEMS	Normally, when UniVerse processes multi-valued or multi-subvalued fields, UniVerse adds another level of elements to produce multiple levels of nesting. You have the option of disabling this additional level by adding the COLLAPSEMV and COLLAPSEMS attributes. When these options are on, the generated XML document and the associated DTD or XML Schema have fewer levels of nesting.
	MATCHELEMENT	The Matchelement attribute specifies whether to display empty elements for missing values or subvalues belonging to the same association, or to ignore the missing values. When this option is on, the generated XML document and the associated DTD or XML Schema have fewer levels of nesting.
	EMPTYATTRIBUTE	This attribute determines how to display the empty attributes for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XML Schema. When this option is on, the generated XML document and the associated DTD or XML Schema have fewer levels of nesting.
XmlVar	The name of the variable to which to store the generated XML document [OUT]	
XsdVar	The name of the variable in which to store the XML Schema if one is generated along with the XML document.	

XMLExecute Parameters (Continued)

XMLSetOptions

Syntax

XMLSetOptions("*options*")

Description

Use this function in UniVerse Basic programs to set the encoding parameter and other XML options in the current UniVerse session. The settings specified in this API override the settings in the system-level and account-level xmlconfig files and in TCL commands during the current session.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
options	A string in the format of space-delimited key/value pairs. [IN] The XML options are the same as those in the xmlconfig file and accept the same values. Keys and values are case-insensitive. For a complete list of valid UniVerse XML options and settings, see xmlconfig Parameters. The XMLSetOptions function also accepts three special strings as the *options* parameter. ■ `defaults` – Sets all XML options to their default settings in the current session. ■ `reload` – Reloads the current system-level and account-level xmlconfig files, since they may have changed after you started your UniVerse session. ■ `reset` – Resets XML options to the original settings that were loaded when you started the UniVerse session. A special string must be entered as the only option.

XMLSetOptions Parameters

Examples

The following example shows the format for entering the XML options in this API.

```
XMLSetOptions("encoding=iso-8859-1 newline=CR-LF")
```

The next example shows the format for entering a special string as the *options* parameter:

```
XMLSetOptions("defaults")
```

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	When the return status is XML.ERROR, XMLGetError() returns one of the following error codes: ■ 38 Invalid XML config key: ‘key_name’ ■ 39 Invalid XML config value: ‘value_string’ ■ 40 Invalid XML config format: ‘name_value_string’41 Invalid XML config key 'key_name' at line line_number in xmlconfig file(xmlconfig_filename) ■ 42 Invalid XML config value 'value_string' at line line_number in xmlconfig file(xmlconfig_filename) ■ 43 Invalid XML config format 'name_value_string' at line line_number in xmlconfig file(xmlconfig_filename) ***Note:*** *When the return code is XML.ERROR, none of the XML parameters are changed.*

XMLSetOptions (defaults) Return Codes

The next example shows the format for entering a special string as the *options* parameter:

```
XMLSetOptions("reload")
```

XMLGetOptions

Syntax

XMLGetOptions(*outOptions*[, *delimiterString*])

Description

Use this function in UniVerse Basic programs to return the values for encoding and other XML options in effect in the current UniVerse session.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
outOptions	A variable used to retrieve the XML options key/value pairs in effect in the current UniVerse session. [OUT]
delimiterString	Optional. Specifies the string to be used to separate the key/value pairs returned by the command. By default, *delimiterString* is a space. [IN]

XMLGetOptions Parameters

Examples

The following example shows the format for entering *delimiterString* as the string used to separate the key/value pairs returned by the function. Key/value pairs can be separated by a space or by any string, such as <>, as shown in this example:

```
(xmlOptions, "<>")

encoding=default<>in-encoding=UTF-8<>version=1.1
```

If you enter the `XMLGetOptions` function with no *delimiterString*, the key/value pairs are separated by a space, as shown in the next example:

```
XMLGetOptions(xmlOptions)

encoding=default in-encoding=UTF-8 version=1.1
```

For a complete list of the standard UniVerse XML options and values returned by this function, see xmlconfig Parameters.

Return Codes

The return code indicates the status on completion of this function. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.

XMLGetOptions Return Codes

XMLGetOptionValue

Syntax

XMLGetOptionValue(*optionName, outOptionValue*)

Description

Use this function in UniVerse Basic programs to return the value of encoding or any other XML option in effect in the current UniVerse session.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
optionName	The name of the XML option for which you want to retrieve the current value. [IN] The XML options are the same as those in the xmlconfig file. For a complete list of valid UniVerse XML options, see xmlconfig Parameters.
outOptionValue	A variable used to retrieve the value of the specified XML option in the current UniVerse session. [OUT]

XMLGetOptionValue Parameters

Example

The following example shows the format for entering the *optionName* and *outOptionValue* variables:

```
XMLGetOptionValue("encoding", xmlOptionValue)
```

This function returns the value of the encoding option in the second argument, xmlOptionValue.

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	When the return status is XML.ERROR, XMLGetError() returns the following error code: ■ 38 Invalid XML config key: ‘key_name’

XMLGETOPTIONVALUE Return Codes

The following XML APIs accept additional parameters for encoding and other XML options, or other new parameters:

- XDOMCreateRoot
- XDOMTransform
- XDOMValidate
- XDOMValidateDom
- XDOMWrite
- XMAPToXMLDoc

XDOMCreateRoot

Syntax

XDOMCreateRoot(*domHandle*[, *xmlOptions*])

Description

XDOMCreateRoot creates a new DOM structure with root only. You can use the result handle in other functions where a DOM handle or node handle is needed. The default declaration for the XML document created by this function is as follows:

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
```

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
domHandle	Handle to the opened DOM structure. [OUT]

xmlOptions	A string specifying the key/value pairs for the encoding, standalone, and version options to be declared in the XML document created by this function. [IN]
	The string can be entered in either of the following formats:
	`"version=1.0 encoding=ISO-8859-1 standalone=yes"`
	or
	`'version="1.0" encoding="iso-8859-1" standalone="no"'`
	
	The encoding, standalone, and version options are the same as those in the xmlconfig file and accept the same values. For details, see the xmlconfig Parameters section. Keys and values are case-insensitive.
	Valid encoding settings can be found at http://www.iana.org/assignments/character-sets

XDOMCreateRoot Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred. If an error is encountered in *xmlOptions*, XMLGetError() returns one of the following error codes: ■ 38 Invalid XML config key: ‘key_name’ ■ 39 Invalid XML config value: ‘value_string’ ■ 40 Invalid XML config format: ‘name_value_string’

XDOMCreateRoot Return Codes

XDOMTransform

Syntax

XDOMTransform(*domHandle, styleSheet, ssLocation, outHandle*[, *outFormat*])

Description

XDOMTransform transforms the input DOM structure using the style sheet specified by *styleSheet* to output the DOM structure, file, or string.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
domHandle	Handle to the DOM structure. [IN]
styleSheet	Handle to the context. [IN]
ssLocation	A flag to specify whether styleSheet contains style sheet itself, or is just the style sheet file name. Value values are: XML.FROM.FILE XML.FROM.STRING [IN]
outHandle	Handle to the resulting DOM structure, file, or string. [OUT]
outFormat	Specifies one of the following values as the output format for the DOM structure: ■ XML.TO.DOM – Transforms the input DOM structure using the style sheet specified by *styleSheet*, and outputs the resulting document into a DOM structure. ■ XML.TO.FILE – Transforms the input DOM structure using the style sheet specified by *styleSheet*, and outputs the resulting document into a file. ■ XML.TO.STRING – Transforms the input DOM structure using the style sheet specified by *styleSheet*, and outputs the resulting document into a string.

XDOMTransform Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMTransform Return Codes

XDOMValidate

Syntax

XDOMValidate(*xmlDocument, docLocation,, noNsSchema, noNsSchemaLocation*[, *NsSchemas*])

Description

XDOMValidate validates the DOM document using an external no-namespace schema specified by *noNsSchema* and, optionally, external namespace schemas specified by *NsSchemas*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlDocument	The name of the XML document. [IN]
docLocation	A flag to specify whether xmlDocument is the document itself, or the document file name. Valid values are: XML.FROM.FILE XML.FROM.STRING XML.FROM.DOM [IN]
noNsSchema	The external no-namespace schema file. [IN]
noNsSchemaLocation	A flag to specify whether *noNsSchema* is the schema itself, or the schema file name. Valid values are: XML.FROM.FILE (default) XML.FROM.STRING [IN]
NsSchemas	The external namespace schema files. [IN]

XDOMValidate Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was passed to the function.

XDOMValidate Return Codes

XDOMValidateDom

Syntax

XDOMValidateDom(*domHandle, noNsSchema, noNsSchemaLocation*[, *NsSchemas*])

Description

XDOMValidateDom validates the DOM document using an external no-namespace schema specified by *noNsSchema* and, optionally, external namespace schemas specified by *NsSchemas*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
domHandle	Handle to the DOM structure. [IN]
noNsSchema	The external no-namespace schema file. [IN]
noNsSchemaLocation	A flag to specify whether *noNsSchema* is the schema itself, or the schema file name. Valid values are: XML.FROM.FILE (default) XML.FROM.STRING [IN]
NsSchemas	The external namespace schema files. [IN]

XDOMValidateDom Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was passed to the function.

XDOMValidateDom Return Codes

XDOMWrite

Syntax

XDOMWrite(*domHandle, xmlDocument, docLocation*[, *xmlOptions*])

Description

XDOMWrite writes the DOM structure to *xmlDocument*. *xmlDocument* can be a string or a file, depending on the value of the *docLocation* flag.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
domHandle	Handle to the opened DOM structure. [IN]
xmlDocument	The XML document [OUT]
docLocation	A flag to specify whether xmlDocument is an output string that should hold the XML document, or is a file to which the XML document should be written. Valid values are: XML.TO.FILE XML.TO.STRING [IN]

XDOMWrite Parameters

Parameter	Description

xmlOptions	A string specifying the key/value pairs of the XML options to be used in the XML document written by this function. [IN]
	The string can be entered in either of the following formats:
	`"encoding=ISO-8859-1 standalone=yes newline=CR-LF"`
	or
	`'encoding="iso-8859-1" standalone="no"'`
	
	The XML options are the same as those in the xmlconfig file and accept the same values. Keys and values are case-insensitive.
	For a complete list of valid UniVerse XML options and settings, see xmlconfig Parameters.
	Valid encoding settings can be found at http://www.iana.org/assignments/character-sets

XDOMWrite Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred. If an error is encountered in *xmlOptions*, XMLGetError() returns one of the following error codes: ■ 38 Invalid XML config key: 'key_name' ■ 39 Invalid XML config value: 'value_string' ■ 40 Invalid XML config format: 'name_value_string'
XML.INVALID.HANDLE	Invalid DOM handle passed to the function.

XDOMWrite Return Codes

XMAPToXMLDoc

Syntax

XMAPToXMLDoc(*XMAPhandle, xmlfile, doc_flag*[, *xmlOptions*])

Description

The XMAPToXMLDoc function generates an XML document from the data in the U2XMAP dataset using the mapping rules you define. The XML document can be either an XML DOM handle or an XML document. UniVerse writes the data to a file or a UniVerse Basic variable.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
XMAPhandle	The handle to the U2XMAP dataset.
xmlfile	The name of the XML file, or the name of a UniVerse Basic variable to hold the XML document.
doc_flag	Indicates where to write the XML document. Valid values are: ■ XML.TO.DOM - Writes the XML document to an XML DOM handle. ■ XML.TO.FILE - Writes the XML document to a file. ■ XML.TO.STRING - Writes the XML document to a UniVerse Basic variable.

XMAPToXMLDoc Parameters

Parameter	Description

xmlOptions	A string specifying the key/value pairs of the XML options to be used in the XML document generated by this function. [IN]
	The string can be entered in either of the following formats:
	`"encoding=ISO-8859-1 standalone=yes newline=CR-LF"`
	or
	`'encoding="iso-8859-1" standalone="no"'`
	
	The XML options are the same as those in the xmlconfig file and accept the same values. Keys and values are case-insensitive.
	For a complete list of valid UniVerse XML options and settings, see xmlconfig Parameters.
	Valid encoding settings can be found at http://www.iana.org/assignments/character-sets

XMAPToXMLDoc Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML_SUCCESS	The XML document was opened successfully.
XML_ERROR	An error occurred opening the XML document. If an error is encountered in *xmlOptions*, XMLGetError() returns one of the following error codes: ■ 38 Invalid XML config key: 'key_name' ■ 39 Invalid XML config value: 'value_string' ■ 40 Invalid XML config format: 'name_value_string'
XML_INVALID_HANDLE	The XMAP dataset was invalid.

XMAPToXMLDoc Return Codes

Existing APIs Affected by XML Options

One or more XML options set in the xmlconfig files, the XMLSETOPTIONS command, or the XMLSetOptions() API are used by the following APIs:

- DBTOXML
- XDOMAddChild
- XDOMAppend
- XDOMCreateNode
- XDOMEvaluate
- XDOMGetAttribute
- XDOMGetNodeName
- XDOMGetNodeValue
- XDOMInsert
- XDOMLocate
- XDOMRemove
- XDOMReplace
- XDOMSetNodeValue
- XMAPAppendRec
- XMAPOpen
- XMAPReadNext

DBTOXML

Syntax

DBTOXML(*xml_document, doc_location, u2xmap_file, u2xmap_location, condition,* status)

Description

Creates an XML document from the UniVerse database.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xml_document	The name of the XML document to create.
doc_flag	A flag defining the type of *xml_document*. Valid values are: ■ XML.FROM.FILE – *xml_document* is a file name. ■ XML.FROM.STRING – *xml_document* is the name of variable containing the XML document.
u2xmap_file	The name of the U2XMAP file to use to produce the XML document.
u2xmap_location	The location of the U2XMAP file. ■ XML.FROM.FILE – *u2xmap_file* is a file name. ■ XML.FROM.STRING – *u2xmap_file* is the name of a variable containing the mapping rules.
condition	A query condition for selecting data from the UniVerse file, for example, WHERE SCHOOL = "CO002"
Status	XML.SUCCESS or XML.FAILURE.

DBTOXML Parameters

Note: *The XML options set previously at the session level through the XMLSETOPTIONS command or through the XMLSetOptions() API are used when you run the DBTOXML API in the current UniVerse session.*

XDOMAddChild

Syntax

XDOMAddChild(*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

Finds the *xpathString* in the context *xmlHandle* in the DOM structure, and inserts a node as the last child of the found node. If the inserted node type is XDOM.ATTR.NODE, this node is inserted as an attribute.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute xpath string. [IN] The *xpathString* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nsMap	The map of namespaces that resolves the prefixes in the xpath string. Format is "xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url" For example: "xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com" [IN] The *nsMap* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nodeHandle	Handle to a DOM subtree. If nodeHandle points to a DOM document, all of its children are inserted, in the same order. [IN]

XDOMAddChild Parameters

Parameter	Description
dupFlag	XDOM.DUP: Clones nodeHandle, and inserts the duplicate node. XDOM.NODUP: Inserts the original node. The subtree is also removed from its original location. [IN]

XDOMAddChild Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMAddChild Return Codes

XDOMAppend

Syntax

XDOMAppend(*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

Finds the *xpathString* in the context *xmlHandle* in the DOM structure, and inserts *nodeHandle* into the DOM structure as the next sibling of the found node. If the inserted node type is XDOM.ATTR.NODE, this node is inserted as an attribute.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute XPath string. [IN] The *xpathString* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nsMap	The map of namespaces that resolves the prefixes in the *xpathString*. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN] The *nsMap* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nodeHandle	Handle to a DOM subtree. If *nodeHandle* points to a DOM document, all of its children are inserted, in the same order. [IN]

XDOMAppend Parameters

Parameter	Description
dupFlag	XDOM.DUP: Clones *nodeHandle*, and inserts the duplicate node. XDOM.NODUP: Inserts the original node. The subtree is also removed from its original location. [IN]

XDOMAppend Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMAppend Return Codes

XDOMCreateNode

Syntax

XDOMCreateNode(*xmlHandle, nodeName, nodeValue, nodeType, nodeHandle*)

Description

XDOMCreateNode creates a new node in the DOM structure.

Parameters

The following table describes each parameter of the syntax.

Parameters	Description
xmlHandle	A handle to the DOM structure. This handle acts as the context when resolving the namespace_uri from the prefix or resolving the prefix from the namespace_uri. [IN]
nodeName	The name of the node to be created. [IN] The name can be in any of the following formats: ■ Local_name ■ prefix: local_name:namespace_uri ■ prefix:local_name ■ :local_name:namespace_uri The *nodeName* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nodeValue	The string to hold the node value. [IN] The *nodeValue* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.

XDOMCreateNode Parameters

Parameters	Description
nodeType	The type of the node to be created. Valid values are: XDOM.ELEMENT.NODE XDOM.ATTR.NODE XDOM.TEXT.NODE XDOM.CDATA.NODE XDOM.ENTITY.REF.NODE XDOM.ENTITY.NODE XDOM.PROC.INST.NODE XDOM.COMMENT.NODE XDOM.DOC.NODE XDOM.DOC.TYPE.NODE XDOM.DOC.FRAG.NODE XDEOM.NOTATION.NODE XDOM.XML.DECL.NODE [IN]
nodeHandle	A handle to the node to be created in the DOM structure. [IN]

XDOMCreateNode Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.

XDOMCreateNode Return Codes

XDOMEvaluate

Syntax

XDOMEvaluate(*xmlHandle, xpathString, nsMap, aValue*)

Description

XDOMEvaluate returns the value of *xpathString* in the context *xmlHandle* in the DOM structure.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	Handle to the context. [IN]
xpathString	The relative or absolute XPath string. [IN] The *xpathString* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nsMap	The map of namespaces that resolves the prefixes in the *xpathString*. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN] The *nsMap* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
aValue	The value of *xpathString*. [OUT] The *aValue* parameter uses the *out-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.

XDOMEvaluate Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMEvaluate Return Codes

XDOMGetAttribute

Syntax

XDOMGetAttribute(*nodeHandle, attrName, nodeHandle*)

Description

XDOMGetAttribute gets the node's attribute node, whose attribute name is *attrName*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	Handle to the DOM node. [IN]
attrName	Attribute name. [IN] The *attrName* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSE-TOPTIONS command, or the XMLSetOptions() API.
nodeHandle	Handle to the found attribute node. [OUT]

XDOMGetAttribute Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetAttribute Return Codes

XDOMGetNodeName

Syntax

XDOMGetNodeName(*nodeHandle, nodeName*)

Description

XDOMGetNodeName returns the node name.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	Handle to the DOM node. [IN]
nodeName	String to store the node name. [OUT] The *nodeName* parameter uses the *out-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.

XDOMGetNodeName Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetNodeName Return Codes

XDOMGetNodeValue

Syntax

XDOMGetNodeValue(*nodeHandle, nodeValue*)

Description

XDOMGetNodeValue gets the node value.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	The handle to the DOM node. [IN]
nodeValue	The string to hold the node value. [OUT] The *nodeValue* parameter uses the *out-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.

XDOMGetNodeValue Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetNodeValue Return Codes

XDOMInsert

Syntax

XDOMInsert (*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

XDOMInsert finds the *xpathString* in the context *xmlHandle* in the DOM structure, and inserts *nodeHandle* into the DOM structure as the previous sibling of the found node. If the inserted node type is XDOM.ATTR.NODE, this node is inserted as an attribute.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute XPath string. [IN] The *xpathString* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nsMap	The map of namespaces that resolves the prefixes in the xpathString. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN] The *nsMap* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nodeHandle	The handle to a DOM subtree. If nodeHandle points to a DOM document, all of its children are inserted, in the same order. [IN]

XDOMInsert Parameters

Parameter	Description
dupFlag	XDOM.DUP: Clones nodeHandle, and inserts the duplicate node. XDOM.NODUP: Inserts the original node. The subtree is also removed from its original location.

XDOMInsert Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMInsert Return Codes

XDOMLocate

Syntax

XDOMLocate(*xmlHandle, xpathString, nsMap, nodeHandle*)

Description

XDOMLocate finds a starting point for relative XPath searching in context *xmlHandle* in the DOM structure. The *xpathString* should specify only one node; otherwise, this function will return an error.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	A handle to the DOM structure. [IN]
xpathString	A string to specify the starting point. [IN] The *xpathString* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nsMAP	The map of namespaces that resolves the prefixes in the *xpathString*. The format is: “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url For example: “xmlns=”http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com [IN] The *nsMap* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
noteHandle	Handle to the found node. [OUT]

XDOMLocate Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid handle was returned to the function.

XDOMLocate Return Codes

***Note**: In this document, xmlHandle is a generic type, it can be domHandle or nodeHandle. DomHandle stands for a whole document, while nodeHandle stands for a subtree. DomHandle is also a nodeHandle.*

XDOMRemove

Syntax

XDOMRemove(*xmlHandle, xpathString, nsMap, attrName, nodeHandle*)

Description

XDOMRemove finds the *xpathString* in the context *xmlHandle* in the DOM structure, and then removes the found node or its attribute with name *attrName*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	Handle to the context. [IN]
xpathString	Relative or absolute xpath string. [IN] The *xpathString* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.

XDOMRemove Parameters

Parameter	Description
nsMap	The map of namespaces that resolves the prefixes in the xpathString. Format is “xmlns=default_url xmlns:prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN] The *nsMap* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
attrName	The attribute name. [IN] The *attrName* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nodeHandle	The removed node, if nodeHandle is not NULL. [OUT]

XDOMRemove Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMRemove Return Codes

XDOMReplace

Syntax

XDOMReplace(*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

XDOMReplace finds the *xpathString* in the context *xmlHandle* in the DOM structure, and replaces the found node with *nodeHandle*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute XPath string. [IN] The *xpathString* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nsMap	The map of namespaces that resolves the prefixes in the xpathString. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN] The *nsMap* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.
nodeHandle	Handle to a DOM subtree. If nodeHandle points to a DOM document, the found node is replaced by all of nodeHandle children, which are inserted in the same order. [IN]

XDOMReplace Parameters

Parameter	Description
dupFlag	XDOM.DUP: Clones nodeHandle, and replaces it with the duplicate node. XDOM.NODUP: Replaces with the original node. The subtree is also removed from its original location. [IN]

XDOMReplace Parameters (Continued)

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMReplace Return Codes

XDOMSetNodeValue

Syntax

XDOMSetNodeValue(*nodeHandle, nodeValue*)

Description

XDOMSetNodeValue sets the node value.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	The handle to the DOM node. [IN]
nodeValue	The string to hold the node value. [IN] The *nodeValue* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API.

XDOMSetNodeValue Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMSetNodeValue Return Codes

XMAPAppendRec

Syntax

XMAPAppendRec(*XMAPhandle, file_name, record*)

Description

The XMAPAppendRec function formats the specified record from the UniVerse file as a U2XMAP dataset record and appends it to the U2XMAP dataset.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
XMAPhandle	The handle to the U2XMAP dataset. The *XMAPhandle* parameter uses the *in-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API for the input record value.
file_name	The name of the UniVerse file that is being mapped in the U2 XMAP dataset.
record	The data record formatted according to the dictionary record of the UniVerse file.

XMAPAppendRec Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML_SUCCESS	The XML document was opened successfully.
XML_ERROR	An error occurred opening the XML document.
XML_INVALID_HANDLE	The XMAP dataset was invalid.

XMAPAppendRec Return Codes

XMAPOpen

Syntax

XMAPOpen(*xml_document, doc_flag, u2xmapping_rules, u2xmap_flag, XMAPhandle*)

Description

The XMAPOpen function opens an XML document as a U2XMAP data set.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xml_document	The name of the XML document.
doc_flag	A flag defining the type of *xml_document*. Valid values are: ■ XML.FROM.DOM - *xml_document* is a DOM handle. ■ XML.FROM.FILE - *xml_document* is a file name. ■ XML.FROM.STRING - *xml_document* is the name of a variable containing the XML document.
u2xmapping_rules	The name of the U2XMAP file, or the UniVerse Basic variable containing the XML to Database mapping rules.
u2xmap_flag	A flag indicating if the mapping file is the U2XMAP file itself or a string located within the UniVerse Basic program. Valid values are: ■ XMAP.FROM.FILE - the mapping rules are contained in a U2XMAP file. ■ XMAP.FROM.STRING - *u2xmap_flag* is the name of the variable containing the mapping rules.
XMAPhandle	The handle to the XMAP dataset. This API registers the current *in-encoding* and *out-encoding* parameters in the *XMAPhandle*. These parameters are used throughout the life of the *XMAPhandle*.

XMAPOpen Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML_SUCCESS	The XML document was opened successfully.
XML_ERROR	An error occurred opening the XML document.

XMAPOpen Return Codes

XMAPReadNext

Syntax

XMAPReadNext(*XMAPhandle, file_name, record*)

Description

The XMAPReadNext function retrieves the next record from the U2XMAP dataset and formats it as a record of the UniVerse file that is being mapped.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
XMAPhandle	The U2XMAP dataset handle. The *XMAPhandle* parameter uses the *out-encoding* parameter set in the system-level or account-level xmlconfig file, the XMLSETOPTIONS command, or the XMLSetOptions() API for the record value.
file_name	The name of the UniVerse file that is being mapped in the U2XMAP dataset.
record	The data record formatted according to the dictionary record of the file.

XMAPReadNext Parameters

Return Codes

The return code indicates success or failure. The following table describes each return code.

Return Code	Description
XML_SUCCESS	The XMAPReadNext was executed successfully.

XMAPReadNext Return Codes

Return Code	Description
XML_ERROR	An error occurred in executing XMAPReadNext.
XML_INVALID_HANDLE	U2 XMAP dataset handle was invalid.
XML_EOF	The end of the U2XMAP dataset has been reached.

XMAPReadNext Return Codes (Continued)

UniVerse Basic Example

The following example illustrates a UniVerse Basic program that generates an XML document:

```
CT BP XML2
BP:

$INCLUDE UNIVERSE.INCLUDE XML.H
*
* Here we test different Options for HIDEMS, and also ELEMENT mode

CMD = "LIST STUDENT LNAME COURSE_NBR COURSE_GRD COURSE_NAME
SEMESTER"
OPTIONS ="XMLMAPPING=student.map"
OPTIONS = OPTIONS:' HIDEMS=1 ELEMENTS'
PRINT OPTIONS
STATUS = XMLExecute(CMD,OPTIONS,XMLVAR,XSDVAR)
IF  STATUS = 0 THEN
        STATUS =
XDOMValidate(XMLVAR,XML.FROM.STRING,XSDVAR,XML.FROM.STRING)
        IF STATUS <> XML.SUCCESS THEN
                STATUS = XMLGetError(code,msg)
                PRINT code,msg
                PRINT "Validate FAILED."
                PRINT XSDVAR
                PRINT XMLVAR
        END ELSE
        PRINT "Options ": OPTIONS
        PRINT "XML output"
        PRINT XMLVAR
        PRINT ""
        END
END
ELSE
        STATUS = XMLGetError(code,msg)
        PRINT code,msg
        PRINT "XMLExecute() failed"
END
```

The next example illustrates the output from the program described in the previous example:

```
>RUN BP XML2
XMLMAPPING=student.map HIDEMS=1 ELEMENTS
Options XMLMAPPING=student.map HIDEMS=1 ELEMENTS
XML output
<?xml version="1.0" encoding="UTF-8"?>
<STUDENT
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:ibm="http://www.ibm.com"
>
<STUDENT>
  <_ID>221345665</_ID>
  <LNAME>Miller</LNAME>
  <Term>
    <SEMESTER>FA93</SEMESTER>
      <COURSE_GRD>C</COURSE_GRD>
      <COURSE_NAME>Engineering Principles</COURSE_NAME>
      <COURSE_NBR>EG110</COURSE_NBR>
      <COURSE_GRD>B</COURSE_GRD>
      <COURSE_NAME>Calculus- I</COURSE_NAME>
      <COURSE_NBR>MA220</COURSE_NBR>
      <COURSE_GRD>B</COURSE_GRD>
      <COURSE_NAME>Introduction to Psychology</COURSE_NAME>
      <COURSE_NBR>PY100</COURSE_NBR>
  </Term>
  <Term>
    <SEMESTER>SP94</SEMESTER>
      <COURSE_GRD>B</COURSE_GRD>
      <COURSE_NAME>Fluid Mechanics</COURSE_NAME>
      <COURSE_NBR>EG140</COURSE_NBR>
      <COURSE_GRD>B</COURSE_GRD>
      <COURSE_NAME>Circut Theory</COURSE_NAME>
      <COURSE_NBR>EG240</COURSE_NBR>
      <COURSE_GRD>B</COURSE_GRD>
      <COURSE_NAME>Calculus - II</COURSE_NAME>
      <COURSE_NBR>MA221</COURSE_NBR>
  </Term>
</STUDENT>
...

</MAIN>
```

The following example shows the output if the HIDEMS attribute is set equal to “0”:

```
>LIST STUDENT SEMESTER COURSE_NBR TOXML XMLMAPPING student.map
ELEMENTS

<?xml version="1.0" encoding="UTF-8"?>
<STUDENT
  xmlns:ibm="http://www.ibm.com"
>
<STUDENT>
  <_ID>221345665</_ID>
  <Term>
    <SEMESTER>FA93</SEMESTER>
    <Courses_Taken>
      <COURSE_NBR>EG110</COURSE_NBR>
    </Courses_Taken>
    <Courses_Taken>
      <COURSE_NBR>MA220</COURSE_NBR>
    </Courses_Taken>
    <Courses_Taken>
      <COURSE_NBR>PY100</COURSE_NBR>
    </Courses_Taken>
  </Term>
  <Term>
    <SEMESTER>SP94</SEMESTER>
    <Courses_Taken>
      <COURSE_NBR>EG140</COURSE_NBR>
    </Courses_Taken>
    <Courses_Taken>
      <COURSE_NBR>EG240</COURSE_NBR>
    </Courses_Taken>
    <Courses_Taken>
      <COURSE_NBR>MA221</COURSE_NBR>
    </Courses_Taken>
  </Term>
</STUDENT>
```

The following example shows the output if the HIDEMS attribute is set equal to “1”:

```
XMLSETOPTIONS HIDEMS=1

>LIST STUDENT SEMESTER COURSE_NBR TOXML XMLMAPPING student.map
ELEMENTS

<?xml version="1.0" encoding="UTF-8"?>
<STUDENT
  xmlns:ibm="http://www.ibm.com"
>
<STUDENT>
  <_ID>221345665</_ID>
  <Term>
    <SEMESTER>FA93</SEMESTER>
      <COURSE_NBR>EG110</COURSE_NBR>
      <COURSE_NBR>MA220</COURSE_NBR>
      <COURSE_NBR>PY100</COURSE_NBR>
  </Term>
  <Term>
    <SEMESTER>SP94</SEMESTER>
      <COURSE_NBR>EG140</COURSE_NBR>
      <COURSE_NBR>EG240</COURSE_NBR>
      <COURSE_NBR>MA221</COURSE_NBR>
  </Term>
</STUDENT>
<STUDENT>
  <_ID>414446545</_ID>
  <Term>
    <SEMESTER>FA93</SEMESTER>
      <COURSE_NBR>CS104</COURSE_NBR>
      <COURSE_NBR>MA101</COURSE_NBR>
      <COURSE_NBR>FA100</COURSE_NBR>
  </Term>
  <Term>
    <SEMESTER>SP94</SEMESTER>
      <COURSE_NBR>CS105</COURSE_NBR>
      <COURSE_NBR>MA102</COURSE_NBR>
      <COURSE_NBR>PY100</COURSE_NBR>
  </Term>
</STUDENT>
<STUDENT>
  <_ID>424325656</_ID>
  <Term>
    <SEMESTER>SP94</SEMESTER>
      <COURSE_NBR>PY100</COURSE_NBR>
      <COURSE_NBR>PE100</COURSE_NBR>
  </Term>
</STUDENT>
...
>
```

Collapsemv Option

This option specifies whether to collapse <MV> and </MV> tags, using only one set of these tags for multivalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode.

0 - Expand MV tags for multivalued fields.
1 - CollapseMV tags for multivalued fields.

Collapsems Option

This attribute specifies whether to collapse <MS> and </MS> tags, using only one set of these tags for multi-subvalued fields belonging to an association in the generated XML document and in the associated DTD or XMLSchema. This parameter applies only if the XML document is created in element mode.

0 - Expand MS tags for multi-subvalued fields.
1 - Collapse MS tags for multi-subvalued fields.

The following example shows the output if the COLLAPSEMS attribute is set to “1”:

```
XMLSETOPTIONS COLLAPSEMS=1

>LIST STUDENT SEMESTER COURSE_NBR TOXML XMLMAPPING student.map
ELEMENTS


<?xml version="1.0" encoding="UTF-8"?>
<STUDENT
  xmlns:ibm="http://www.ibm.com"
>
<STUDENT>
  <_ID>221345665</_ID>
  <Term>
    <SEMESTER>FA93</SEMESTER>
    <Courses_Taken>
      <COURSE_NBR>EG110</COURSE_NBR>
      <COURSE_NBR>MA220</COURSE_NBR>
      <COURSE_NBR>PY100</COURSE_NBR>
    </Courses_Taken>
  </Term>
  <Term>
    <SEMESTER>SP94</SEMESTER>
    <Courses_Taken>
      <COURSE_NBR>EG140</COURSE_NBR>
      <COURSE_NBR>EG240</COURSE_NBR>
      <COURSE_NBR>MA221</COURSE_NBR>
    </Courses_Taken>
  </Term>
</STUDENT>
<STUDENT>
  <_ID>414446545</_ID>
  <Term>
    <SEMESTER>FA93</SEMESTER>
    <Courses_Taken>
      <COURSE_NBR>CS104</COURSE_NBR>
      <COURSE_NBR>MA101</COURSE_NBR>
      <COURSE_NBR>FA100</COURSE_NBR>
    </Courses_Taken>
  </Term>
  <Term>
    <SEMESTER>SP94</SEMESTER>
    <Courses_Taken>
      <COURSE_NBR>CS105</COURSE_NBR>
      <COURSE_NBR>MA102</COURSE_NBR>
      <COURSE_NBR>PY100</COURSE_NBR>
    </Courses_Taken>
  </Term>
</STUDENT>
...
>
```

Chapter

Receiving XML Documents

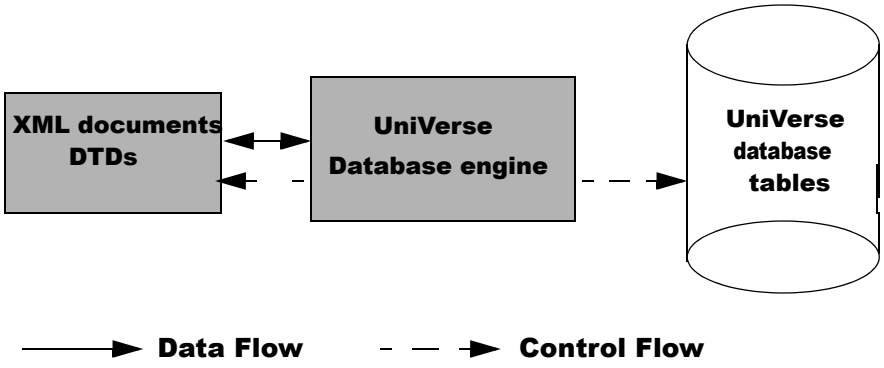
5

Receiving an XML Document through UniVerse BASIC

XML documents are text documents, intended to be processed by an application, such as a web browser. UniVerse enables you to receive and create XML documents, and process them through UniVerse BASIC, UniVerse SQL, or RetrieVe.

You can receive an XML document, then read the document through UniVerse BASIC, and execute UniVerse BASIC commands against the XML data.

The following example illustrates the UniVerse implementation of receiving XML documents:



Receiving XML Documents

Defining Extraction Rules

You must define the extraction rules for each XML document you receive. This extraction file defines where to start extracting data from the XML document, how to construct UniVerse data file fields from the data, the name of the data file dictionary to use, and how to treat a missing value.

***Note**: The extraction file can reside anywhere. We recommend that it reside in the &XML& file, and have a file extension of .ext.*

Extraction File Syntax

An extraction file has the following format:

```
<?XML version = “1.0”?>
<U2xml-extraction xmlns:U2xml=”http://www.ibm.com/U2-xml”>
 <!-- there must be one and only one <U2xml:extraction> element with
mode/start/dictionary -->
 <U2xml:extraction
                start=”xpath_expression”
                dictionary=”dict1 filename ...”
                null=”NULL” | “EMPTY”
/>
<! -- there can be zero or multiple <U2xml:extraction> elements with
field/path/format -->
 <U2xml:field_extraction
                field=”field name”
                path=”xpath_expression”
/>

...

</U2xml_extraction>
```

***Note**: UniVerse supports multiple cases of the U2XML_extraction tag. Valid cases are:*

- U2XML_extraction
- U2xml_extraction
- u2xml_extraction

The following tables describes the elements of the extraction file.

Element	Description
XML version	The XML version number.
Namespace	The name of the namespace. A namespace is a unique identifier that links an XML markup element to a specific DTD. They indicate to the processing application, for example, a browser, which DTD you are using.
start	Defines the starting node in the XML file. This specifies where UniVerse should begin extracting data from the XML file.
dictionary	Specifies the UniVerse dictionary of the file name to use when viewing the XML data.
null	Determines how to treat a missing node. If null is set to “NULL,” a missing node will be result in the null value in the resulting output. If null is set to EMPTY, a missing node will be replaced with an empty string.
field	The field name.
path	The XPath definition for the field you are extracting.
by_name	This element will map files to the field by name. Otherwise, the files will be mapped by location.

Extraction File Elements

Defining the XPath

In XML, the XPath language describes how to navigate an XML document, and describes a section of the document that needs to be transformed. It also enables you to point to certain part of the document.

***Note**: For the full XPath specification, see http:/www.w3.org/TR/xpath.*

At this release, UniVerse supports the following XPath syntax:

Parameter	Description
/	Node path divider.
.	Current node.
..	Parent node.
@	Attributes
text()	The contents of the element.
xmldata()	The remaining, unparsed, portion of the selected node.
,	Node path divider, and also specifies multivalue or multi-subvalued field.

Extraction File Parameters

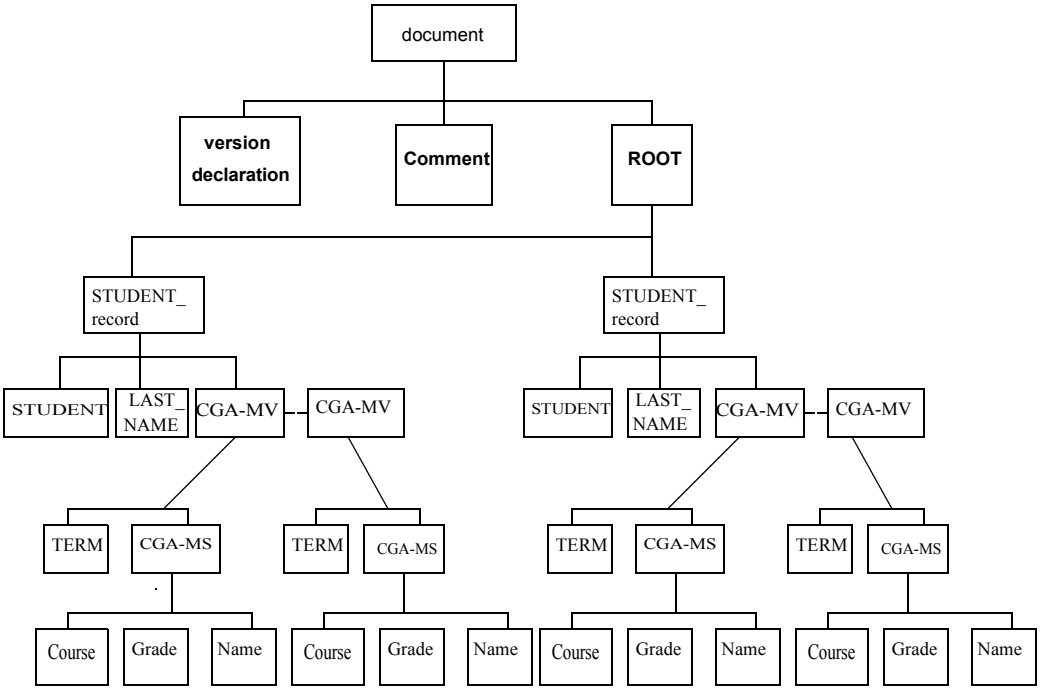
Consider the following DTD and XML document:

```
<?xml version="1.0"?>
<!DOCTYPE ROOT[
<!ELEMENT ROOT (STUDENT_record*)>
<!ELEMENT STUDENT_record ( STUDENT , Last_Name , CGA-MV* )>
<!ELEMENT STUDENT (#PCDATA) >
<!ELEMENT Last_Name (#PCDATA) >
<!ELEMENT CGA-MV ( Term* , CGA-MS* )
<!ELEMENT Term (#PCDATA) >
<!ELEMENT CGA-MS ( Crs__* , GD* , Course_Name* )>
<!ELEMENT Crs__ (#PCDATA) >
<!ELEMENT GD (#PCDATA) >
<!ELEMENT Course_Name (#PCDATA) >
]>

 <ROOT>
 <STUDENT_record>
   <STUDENT>424-32-5656</STUDENT>
   <Last_Name>Martin</Last_Name>
   <CGA-MV>
      <Term>SP94</Term>
      <CGA-MS>
        <Crs__>PY100</Crs__>
        <GD>C</GD>
        <Course_Name>Introduction to Psychology</Course_Name>
      </CGA-MS>
      <CGA-MS>
        <Crs__>PE100</Crs__>
        <GD>C</GD>
        <Course_Name>Golf - I </Course_Name>
      </CGA-MS>
    </CGA-MV>
 </STUDENT_record>
 <STUDENT_record>
   <STUDENT>414-44-6545</STUDENT>
   <Last_Name>Offenbach</Last_Name>
   <CGA-MV>
      <Term>FA93</Term>
      <CGA-MS>
        <Crs__>CS104</Crs__>
        <GD>D</GD>
        <Course_Name>Database Design</Course_Name>
      </CGA-MS>
      <CGA-MS>
        <Crs__>MA101</Crs__>
        <GD>C</GD>
        <Course_Name>Math Principles </Course_Name>
      </CGA-MS>
      <CGA-MS>
        <Crs__>FA100</Crs__>
        <GD>C</GD>
        <Course_Name>Visual Thinking </Course_Name>
      </CGA-MS>
```

```
        </CGA-MV>
       <CGA-MV>
          <Term>SP94</Term>
         <CGA-MS>
            <Crs__>CS105</Crs__>
            <GD>B</GD>
            <Course_Name>Database Design</Course_Name>
         <CGA-MS>
            <Crs__>MA102</Crs__>
            <GD>C</GD>
            <Course_Name>Introduction of Psychology</Course_Name>
         </CGA-MS>
       </CGA-MV>
      <STUDENT_record>
        <STUDENT>221-34-5665</STUDENT>
        <Last_Name>Miller</Last_Name>
        <CGA-MV>
          <Term>FA93</Term>
          <CGA-MS>
            <Crs__>EG110</Crs__>
            <GD>C</GD>
            <Course_Name>Engineering Principles</Course_Name>
          </CGA-MS>
          <CGA-MS>
            <Crs__>PY100</Crs__>
            <GD>B</GD>
            <Course_Name>Introduction to Psychology</Course_Name>
          </CGA-MS>
        </CGA-MV>
          <Term>SP94</Term>
          <CGA-MS>
            <Crs__>EG140</Crs__>
            <GD>B</GD>
            <Course_Name>Fluid Mechanics</Course_Name>
          </CGA-MS>
          <CGA-MS>
            <Crs__>MA221</Crs__>
            <GD>B</GD>
            <Course_Name>Calculus -- II</Course_Name>
          </CGA-MS>
        </CGA-MV>
      </STUDENT_record>
    </ROOT>
```

This document could be displayed as a tree, as shown in the following example:


document
version declaration
Comment
ROOT
STUDENT_ record
STUDENT_ record
STUDENT
LAST_ NAME
CGA-MV
CGA-MV
STUDENT
LAST_ NAME
CGA-MV
CGA-MV
TERM
CGA-MS
TERM
CGA-MS
TERM
CGA-MS
TERM
CGA-MS
Course
Grade
Name
Course
Grade
Name
Course
Grade
Name
Course
Grade
Name

In the previous example, each element in the XML document appears in a box. These boxes are called nodes when using XPath terminology. As shown in the example, nodes are related to each other. The relationships in this example are:

- The document node contains the entire XML document.
- The document node contains three children: the version declaration, the comment node, and the ROOT node. These three children are siblings.
- The ROOT node contains two STUDENT nodes, which are children of ROOT, and are siblings of each other.
- The STUDENT node contains three nodes: the ID, NAME, and CGA-MV. These nodes are children of the STUDENT node, and are siblings of each other.
- The CGA-MV node contains TERM nodes and CGA-MS nodes. These nodes are children of the CGA-MV node, and are siblings of each other.
- Finally, the CGA-MS node contains three nodes: the Course, Grade, and Name nodes. These three nodes are children of the CGA-MS node, and are siblings of each other.

When you define the XPath in the extraction file, you must indicate how to treat these different nodes.

Defining the Starting Location

The first thing to define in the extraction file is the starting node in the XML document from which you want to begin extracting data. In our example, we want to start at the STUDENT_record node. You can also define the dictionary file to use when executing RetrieVe LIST statements or UniVerse SQL SELECT statements against the data.

The following example illustrates how to specify the STUDENT_record node as the starting node, and use the STUDENT dictionary file:

```
<file_extraction start = "ROOT/STUDENT_record " dictionary =
"STUDENT"/>
```

If you want to start the extraction at the CGA-MV node, specify the file extraction node as follows:

```
<file_extraction start = "ROOT/STUDENT_record/CGA-MV" dictionary =
"STUDENT"/>
```

Specifying Field Equivalents

Next, you specify the rules for extracting fields from the XML document. In this example, there are six fields to extract (@ID, NAME, TERM, COURSE, GRADE and NAME).

Extracting Singlevalued Fields

The following example illustrates how to define the extraction rule for two singlevalued fields:

```
<field_extraction field = "@ID" path = "STUDENT/text()",/>
<field_extraction field = "LNAME" path = "Last_Name/text()",/>
```

In the first field extraction, the @ID value in the UniVerse record will be extracted from the STUDENT node. The text in the STUDENT node will be the value of @ID.

In the next field extraction rule, the LNAME field will be extracted from the text found in the Last_Name node in the XML document.

Extracting Multivalued Fields

To access multivalued data in the XML document, you must specify the location path relative to the start node (full location path).

UniVerse uses the "/" character to specify levels of the XML document. The "/" tells the xmlparser to go to the next level when searching for data.

Use a comma (",") to tell the xmlparser where to place marks in the data.

The following example illustrates how to define the path for a multivalued field (SEMESTER) in the XML document:

```
<field_extraction field "SEMESTER" path = "CGA-MV,Term/text()" />
```

In this example, the value of the SEMESTER field in the UniVerse data file will be the text in the Term node. The "/" in the path value specifies multiple levels in the XML document, as follows:

1. Start at the CGA-MV node in the XML document.
2. From the CGA-MV node, go to the next level, the Term node.
3. Return the text from the Term node as the first value of the SEMESTER field in the UniVerse data file.

4. Search for the next CGA-MV node under the same STUDENT, and extract the text from the Term node belonging to that CGA-MV node, and make it the next multivalue. The comma tells the xmlparser to get the node preceding the command for the next sibling.
5. Continue processing all the CGA-MV nodes belonging to the same parent.

The SEMESTER field will appear in the following manner:

Term<Value mark>Term<Value Mark>...

Extracting Multisubvalued Fields

As with multivalued fields, UniVerse uses the "/" character to specify levels of the XML document. The "/" tells the xmlparser to go to the next level when searching for data.

Use the comma (",") to define where to place marks in the data. You can specify 2 levels of marks, value marks and subvalue marks.

Consider the following example of a field extraction XPath definition:

```
<field_extraction field = "COURSE_NBR" path = "CGA-MV, CGA-MS,
Course_Name/ text()" />
```

In this case, the resulting data will appear as follows:

<Value Mark>Course_Name <subvalue mark>Course_Name<subvalue mark>Course_Name...<Value Mark>...

Suppose the XPath definition contains another level of data, as shown in the next example:

```
<field_extraction field = "COURSE_NBR" path = "CGA-MV/CGA-MS/
Course_Name/Comment/text()"/>
```

You must determine where you want the marks to appear in the resulting data. If you want Comment to represent the multi-subvalue, begin inserting commas after CGA-MS, since the Comment is three levels below CGA-MS.

```
<field_extraction field = "COURSE_NBR" path = "CGA-MV/CGA-MS,
Course_Name,Comment/text()" />
```

Suppose we add yet another level of data to XPath definition:

```
<field_extraction field = "COURSE_NBR" path = "CGA-MV/CGA-MS,
Course_Name,Comment,activities/text()" />
```

This is not a valid XPath, since there are more than three levels of XML data. If you want your data to have subvalue marks between Comment and activities, change the XPath definition as follows:

```
<field_extraction field = "COURSE_NBR" path = "CGA-MV/CGA-MS/
Course_Name,Comment,activities/text()" />
```

The "/" and the "," characters are synonymous when defining the navigation path, UniVerse still uses the "/" ***AND*** the "," to define the navigation path of the data, but only the "," to determine the location of the marks in the resulting data.

Like multivalued fields, you must start at the XPath with the parent node of the multivalue.

The next example illustrates how to extract data for a multi-subvalued field:

```
<field_extraction field = "COURSE_NBR" path = "CGA-MV, CGA-MS,
Crs__/text()" />
```

The COURSE_NBR field in the UniVerse data file will be extracted as follows:

1. Start at the CGA-MV node in the XML document, under the start node (ROOT/STUDENT_record).
2. From the first CGA-MV node, go to the next level, the CGA-MS node.
3. From the first CGA-MS node, go to the Crs__ node. Return the text from the Crs__node, and make that text the first multi-subvalue of COURSE_NBR.
4. Go back to the CGA-MS node, and search the siblings of the CGA-MS nodes to see if there are any more CGA-MS nodes of the same name. If any are found, return the Crs__/text() under these nodes, and make them the next multi-subvalues of COURSE_NBR.
5. Go back to the CGA-MV node and search for siblings of the CGA-MS node that have the same CGA-MV node name. If any are found, repeat steps 3 and 4 to get the values for these CGA-MV nodes, and make them multivalues.

The COURSE_NBR field will look like this:

<Field Mark>Crs__text() value under 1st CGA-MS node of 1st CGA-MV node<multi-subvalue mark>Crs__text() under 2nd CGA-MS node of 1st CGA-MV node<multi-subvalue mark>...<multivalue mark>Crs__text() under 1st CGA-MS node of the 2nd CGA-MV node<multi-subvalue mark>Crs__text() under 2nd CGA-MS node of the 2nd CGA-MV node<multi-subvalue mark>Crs__text() value under the 3rd CGS-MS node of the 2nd CGA-MV node>...<Field Mark>

The following example illustrates the complete extraction file for the above examples:

```
 <U2XML_extraction>
    <file_extraction start = "/ROOT/STUDENT_record" dictionary =
"D_MYSTUDENT"
    <!--field extraction rule in element mode-->
      <field_extraction field = "@ID" path = "STUDENT/text()"/>
     <field_extraction field = "LNAME" path = "Last_Name/text()"/>
     <field_extraction field = "SEMESTER" path = "CGA-MV/Term/text()"/>
      <field_extraction field = "COURSE_NBR" path = "CGA-MV, CGA-MS,
Crs__/text"/>
      <field_extraction field = "COURSE_GRD" path = "CGA-MV, CGA-MS,
GD/text()"/>
      <field_extraction field = "COURSE_NAME" path = "CGA-MV, CGA-MS,
Course_Name/text()"/>
 </U2XML_extraction>
```

Extracting XML Data through UniVerse BASIC

Complete the following steps to access the XML data through UniVerse BASIC:

1. Familiarize yourself with the elements of the DTD associated with the XML data you are receiving.
2. Create the extraction file for the XML data.
3. Prepare the XML document using the UniVerse BASIC PrepareXML function.
4. Open the XML document using the UniVerse BASIC OpenXMLData function.
5. Read the XML data using the UniVerse BASIC ReadXMLData function.
6. Close the XML document using the UniVerse BASIC CloseXMLData function.
7. Release the XML document using the UniVerse BASIC ReleaseXML function.

Preparing the XML Document

You must first prepare the XML document in the UniVerse BASIC program. This step allocates memory for the XML document, opens the document, determines the file structure of the document, and returns the file structure.

Status=PrepareXML(*xml_file*,*xml_handle*)

The following table describes each parameter of the syntax.

Parameter	Description
xml_file	The path to the file where the XML document resides.
xml_handle	The return value. The return value is the UniVerse BASIC variable for *xml_handle*. Status is one of the following return values: XML.SUCCESS Success XML.ERROR Error

PrepareXML Parameters

Example

The following example illustrates use of the PrepareXML function:

```
STATUS = PrepareXML("&XML&/MYSTUDENT.XML",STUDENT_XML)
IF STATUS=XML.ERROR THEN
   STATUS = XMLError(errmsg)
   PRINT "error message ":errmsg
   STOP "Error when preparing XML document "
END
```

Opening the XML Document

After you prepare the XML document, open it using the OpenXMLData function.

Status=OpenXMLData(*xml_handle*,*xml_data_extraction_rule*, *xml_data_handle*)

The following table describes each parameter of the syntax.

Parameter	Description
xml_handle	The XML handle generated by the PrepareXML() function.
xml_data_extraction_rule	The path to the XML extraction rule file.
xml_data_handle	The XML data file handle. The following are the possible return values: XML.SUCCESS Success. XML.ERROR Failed XML.INVALID.HANDLE Invalid XML handle

OpenXMLData Parameters

Example

The following example illustrates use of the OpenXMLData function:

```
status = OpenXMLData("STUDENT_XML",
"&XML&/MYSTUDENT.ext",STUDENT_XML_DATA)
If status = XML.ERROR THEN
   STOP "Error when opening the XML document. "
END
IF status = XML.INVALID.HANDLE THEN
   STOP "Error: Invalid parameter passed."
END
```

Reading the XML Document

After opening the XML document, read the document using the ReadXMLData function. UniVerse BASIC returns the XML data as a dynamic array.

Status=ReadXMLData(*xml_data_handle, rec*)

The following table describes each parameter of the syntax.

Parameter	Description
xml_data_handle	A variable that holds the XML data handle created by the OpenXMLData function.
rec	A mark-delimited dynamic array containing the extracted data. Status if one of the following: XML.SUCCESS — Success XML.ERROR — Failure XML.INVALID.HANDLE 2 — Invalid *xml_data_handle* XML.EOF — End of data

ReadXMLData Parameters

After you read the XML document, you can execute any UniVerse BASIC statement or function against the data.

Example

The following example illustrates use of the ReadXMLData function:

```
MOREDATA=1
LOOP WHILE (MOREDATA=1)
   status = ReadXMLData(STUDENT_XML,rec)
   IF status = XML.ERROR THEN
      STOP "Error when preparing the XML document. "
   END ELSE IF status = XML.EOF THEN
      PRINT "No more data"
      MOREDATA = 0
   END ELSE
      PRINT "rec = ":rec
   END
REPEAT
```

Closing the XML Document

After you finish using the XML data, use CloseXMLData to close the dynamic array variable.

Status=CloseXMLData(*xml_data_handle*)

where *xml_data_handle* is the name of the XML data file handle created by the OpenXMLData() function.

The return value is one of the following:

XML.SUCCESS	Success
XML.ERROR	Failure
XML.INVALID.HANDLE2	Invalid *xml_data_handle*

Example

The following example illustrates use of the CloseXMLData function:

```
status = CloseXMLData(STUDENT_XML)
```

Releasing the XML Document

Finally, release the dynamic array variable using the ReleaseXML function.

ReleaseXML(*XMLhandle*)

where *XMLhandle* is the XML handle created by the PrepareXML() function.

ReleaseXML destroys the internal DOM tree and releases the associated memory.

Getting Error Messages

Use the XMLError function to get the last error message.,

XMLError(errmsg)

Where errmsg is the error message string, or one of the following return values:

XML.SUCCESS	Success
XML.ERROR	Failure

Example

The following example illustrates a UniVerse BASIC program that prepares, opens, reads, closes, and releases an XML document:

```
# INCLUDE UNIVERSE.INCLUDE XML.H
STATUS=PrepareXML("&XML&/MYSTUDENT.XML",STUDENT_XML)
IF STATUS=XML.ERROR THEN
   STATUS = XMLError(errmsg)
   PRINT "error message ":errmsg
   STOP "Error when preparing XML document "
   END

STATUS =
OpenXMLData("STUDENT_XML","&XML&/MYSTUDENT.ext",STUDENT_XML_DATA)

IF STATUS = XML.ERROR THEN
   STOP "Error when opening the XML document. "
END

IF STATUS = XML.INVALID.HANDLE THEN
   STOP "Error: Invalid parameter passed." END

MOREDATA=1
  LOOP WHILE (MOREDATA=1)
   STATUS=ReadXMLData(STUDENT_XML_DATA,rec)
   IF STATUS = XML.ERROR THEN
        STOP "Error when preparing the XML document. "
   END ELSE IF STATUS = XML.EOF THEN
       PRINT "No more data"
       MOREDATA = 0
   END ELSE
       PRINT "rec = ":rec
       PRINT "rec = ":rec
   END
REPEAT
STATUS = CloseXMLData(STUDENT_XML_DATA)
STATUS = ReleaseXML(STUDENT_XML)
```

Displaying an XML Document through RetrieVe

You can display the contents of an XML file through RetrieVe by defining an extraction file, preparing the XML document, then using LIST to display the contents.

Preparing the XML Document

Before you execute the LIST statement against the XML data, you must first prepare the XML file using the PREPARE XML command.

PREPARE.XML *xml_file xml_data*

xml_file is the path to the location of the XML document.

xml_data is the name of the working file you assign to the XML data.

The following example illustrates preparing the MYSTUDENT.XML document:

```
PREPARE.XML "&XML&/MYSTUDENT.XML" STUDENT_XML
PREPARE.XML successful.
```

Listing the XML Data

Use the RetrieVe LIST command with the XMLDATA option to list the XML data.

LIST XMLDATA *xml_data* "***extraction_file" [fields]***

The following table describes each parameter of the syntax.

Parameter	Description
XMLDATA *xml_data*	Specifies to list the records from the *xml_data* you prepared.
extraction_file	The full path to the location of the extraction file. You must surround the path in quotation marks.
fields	The fields from the dictionary you specified in the extraction file that you want to display.

LIST Parameters for Listing XML Data

When you list an XML document, RetrieVe uses the dictionary you specify in the extraction file. The following example lists the dictionary records for the MYSTUDENT dictionary:

```
>LIST DICT MYSTUDENT

DICT MYSTUDENT    10:25:32am  19 Oct 2001  Page    1

                Type &
Field......... Field. Field........ Conversion.. Column......... Output
Depth &
Name.......... Number Definition... Code........ Heading........ Format
Assoc..

@ID             D    0                           MYSTUDENT       10L    S
LNAME           D    1                           Last Name       15T    S
SEMESTER        D    2                           Term            4L     M
CGA
COURSE_NBR      D    3                           Crs #           5L     M
CGA
COURSE_GRD      D    4                           GD              3L     M
CGA

5 records listed.
```

The fields in the dictionary record must correspond to the position of the fields in the XML extraction file. In the following extraction file, @ID is position 0, LNAME is position 1, SEMESTER is position 2, COURSE_NBR is position 3, COURSE_GRD is position 4, and COURSE_NAME is position 5. The dictionary of the MYSTUDENT file matches these positions.

The following example illustrates listing the fields from the MYSTUDENT XML document, using the MYSTUDENT.EXT extraction file:

```
LIST XMLDATA STUDENT_XML "&XML&/MYSTUDENT.EXT" LNAME SEMESTER COURSE_NBR
COURSE
_GRD COURSE_NAME 11:58:01am  19 Oct 2001  PAGE    1
MYSTUDENT.   Last Name......   Term   Crs #   GD.   Course
Name..............

424-32-565   Martin            SP94   PY100   C     Introduction to
Psycholog
6                                                   y
                                       PE100   C     Golf - I
414-44-654   Offenbach         FA93   CS104   D     Database Design
5
                                       MA101   C     Math Principals
                                       FA100   C     Visual Thinking
                                SP94   CS105   B     Database Design
                                       MA102   C     Algebra
                                       PY100   C     Introduction to
Psycholog
                                                    y
221-34-566   Miller            FA93   EG110   C     Engineering Principles
5
                                       MA220   B     Calculus- I
                                       PY100   B     Introduction to
Psycholog
                                                    y
                                SP94   EG140   B     Fluid Mechanics
                                       EG240   B     Circut Theory
                                       MA221   B     Calculus - II

978-76-667   Muller            FA93   FA120   A     Finger Painting
6
                                       FA230   C     Photography Principals
                                       HY101   C     Western Civilization
                                SP94   FA121   A     Watercorlors
                                       FA231   B     Photography Practicum
                                       HY102   I     Western Civilization -
15
                                                    00 to 1945
521-81-456   Smith             FA93   CS130   A     Intro to Operating
System
4                                                   s
                                       CS100   B     Intro to Computer
Science
                                       PY100   B     Introduction to
Psycholog
                                                    y
                                SP94   CS131   B     Intro to Operating
System
                                                    s
                                       CS101   B     Intro to Computer
Science
                                       PE220   A     Racquetball
291-22-202   Smith             SP94   FA100   B     Visual Thinking
1
6 records listed.
>
```

Release the XML Document

When you finish with the XML document, release it using RELEASE.XML.

RELEASE.XML *xml_data*

Displaying an XML Document through UniVerse SQL

You can display an XML document through UniVerse SQL using the SELECT statement.

Preparing the XML Document

Before you execute the SELECT statement against the XML data, you must first prepare the XML file using the PREPARE XML command.

PREPARE.XML *xml_file xml_data*

xml_file is the path to the location of the XML document.

xml_data is the name of the working file you assign to the XML data.

The following example illustrates preparing the MYSTUDENT.XML document:

```
PREPARE.XML "&XML&/MYSTUDENT.XML" STUDENT_XML
PREPARE.XML successful.
```

Listing the XML Data

Use the UniVerse SQL SELECT command with the XMLDATA option to list the XML data.

SELECT clause FROM XMLDATA *xml_data extraction_file*

[WHERE clause]
[WHEN clause [WHEN clause]...]
[GROUP BY clause]
[HAVING clause]
[ORDER BY clause]
[*report_qualifiers*]
[*processing_qualifiers*]

The following table describes each parameter of the syntax.

Parameter	Description
SELECT clause	Specifies the columns to select from the database.
FROM XMLDATA *xml_data*	Specifies the XML document you prepared from which you want to list data.
extraction_file	Specifies the file containing the extraction rules for the XML document.
WHERE clause	Specifies the criteria that rows must meet to be selected.
WHEN clause	Specifies the criteria that values in a multivalued column must meet for an association row to be output.
GROUP BY clause	Groups rows to summarize results.
HAVING clause	Specifies the criteria that grouped rows must meet to be selected.
ORDER BY clause	Sorts selected rows.
report_qualifiers	Formats a report generated by the SELECT statement.
processing_qualifiers	Modifies or reports on the processing of the SELECT statement.

SELECT Parameters

You must specify clauses in the SELECT statement in the order shown in the syntax. You can use the SELECT statement with type 1, type 19, and type 25 files only if the current isolation level is 0 or 1.

For a full discussion of the UniVerse SQL SELECT statement clauses, see the *UniVerse SQL Reference*.

The following example illustrates displaying the XML document using the UniVerse SQL SELECT statement:

```
>SELECT * FROM XMLDATA STUDENT_XML "&XML&/MYSTUDENT.EXT";
MYSTUDENT.   Last Name......   Term   Crs #   Course Name.............
GD.

424-32-565   Martin            SP94   PY100   Introduction to Psycholog   C
6                                             y
                                      PE100   Golf - I                    C
414-44-654   Offenbach         FA93   CS104   Database Design             D
5
                                      MA101   Math Principals             C
                                      FA100   Visual Thinking             C
                               SP94   CS105   Database Design             B
                                      MA102   Algebra                     C
                                      PY100   Introduction to Psycholog   C
                                              y
221-34-566   Miller            FA93   EG110   Engineering Principles      C
5
                                      MA220   Calculus- I                 B
                                      PY100   Introduction to Psycholog   B
                                              y
                               SP94   EG140   Fluid Mechanics             B
                                      EG240   Circut Theory               B
                                      MA221   Calculus - II               B
978-76-667   Muller            FA93   FA120   Finger Painting             A
6
Press any key to continue...

MYSTUDENT.   Last Name......   Term   Crs #   Course Name.............
GD.

                                      FA230   Photography Principals      C
                                      HY101   Western Civilization        C
                               SP94   FA121   Watercorlors                A
                                      FA231   Photography Practicum       B
                                      HY102   Western Civilization - 15   I
                                              00 to 1945
521-81-456   Smith             FA93   CS130   Intro to Operating System   A
4                                             s
                                      CS100   Intro to Computer Science   B
                                      PY100   Introduction to Psycholog   B
                                              y
                               SP94   CS131   Intro to Operating System   B
                                              s
                                      CS101   Intro to Computer Science   B
                                      PE220   Racquetball                 A
291-22-202   Smith             SP94   FA100   Visual Thinking             B
1

6 records listed.
>
```

Release the XML Document

When you finish with the XML document, release it using the RELEASE.XML.

RELEASE.XML *xml_data*

Chapter

The Simple Object Access Protocol

6

The Simple Object Access Protocol (SOAP) is an XML-based protocol for exchanging structured information in a distributed environment. It allows the sender and receiver of XML documents over the web to support a common data transfer protocol, and is language and platform independent. Its most common method of operation is as a means of issuing Remote Procedure Calls across a network. However, it can also be used in other manners, such as the posting of XML documents to servers for processing.

SOAP Components

A SOAP message contains three major blocks, the envelope, the header, and the body.

- Envelope – Defines the start and end of a SOAP message.
- Header – Carries application-defined information associated with the message, such as security tokens, message correlation mechanisms, and transaction identifiers. A header is optional in a SOAP message.
- Body – One or more body blocks containing the SOAP message itself.

The Envelope

The envelope is the outermost element in a SOAP message, and is the root element of the message. Use the *env* namespace prefix to specify the envelope, and the *Envelope* element. The envelope specifies the version of SOAP you are using. If you are using a v1.1-compliant SOAP processor, it generates a fault if it receives a message containing a v1.2 envelope namespace.

The envelope element namespace for the difference SOAP versions follows:

- v1.1 – <SOAP-ENV:Envelope xmlns:SOAP-ENV=”http://www.w3.org/2001/12/soap-envelope”
- v1.1 – SOAP-ENV:”http://schemas.xmlsoap.org/soap/envelope/”

You can also specify an encoding namespace in the SOAP envelope.

SOAP Header

The header is an optional part of a SOAP message, and is the first immediate child element of the envelope. You can have multiple SOAP headers.

SOAP headers are used to include additional functionality, such as security, and other attributes associated with the message. A SOAP header can have attributes for intermediary processing, such as a user name and password, that may not be processed at the final SOAP processor destination.

You can include a the *mustUnderstand* attribute in a SOAP header to require the receiver of the message to understand a header. If you include the *mustUnderstand* attribute with a value of *true*, the SOAP node you target must process the SOAP block using the requirements defined in the header, or not process the message and return an error code.

SOAP Body

The SOAP body contains the XML data defined by the application. You must define the SOAP body within the envelope, and it must appear after any SOAP headers.

For complete information about SOAP, see the W3C technical publications website at http://www.w3.org/TR.

The SOAP API for BASIC

The SOAP API for UniBasic provides the capability of issuing requests to SOAP servers from UniBasic through the standard HTTP protocol. The SOAP API for UniBasic makes use of UniData CallHTTP to send and receive SOAP messages. SOAP responses retrieved from a SOAP server can be parsed through the XML API for UniBasic.

Sending a SOAP Request

Sending a SOAP message to a server from the SOAP API for UniBasic typically involves some variation of the following procedure:

1. **Set Protocol Defaults** – You must define the SOAP default settings, including the version of SOAP you are using. Use SOAPSetDefault to define the SOAP version, and SetHTTPDefault to define any HTTP headers you may need.
2. **Create the SOAP Request** – Use the SOAPCreateRequest function to define the SOAP request.
3. **Set the SOAP Request Content** – Use one of the following functions to set the SOAP request content:
   - SOAPSetRequestHeader – You can use this function to set any SOAP header blocks for the SOAP request.
   - SOAPSetParameters – Sets the SOAP body according to the RPC style of communication, based on the input parameters to the function,
   - SOAPSetRequestBody – This function is similar to SOAPSetParameters, but you can also use this function for non-RPC styles of communication, and add multiple body elements to the SOAP request.
   - SOAPSetRequestContent – Sets the entire SOAP message content, either from an input string or from the contents of a file.
4. **Submit the SOAP Request** – Use the **SOAPSubmitRequest** to submit the SOAP request. The output parameters *respData* and *respHeaders* contain the response from the SOAP server. You can use the XML API for UniData BASIC to parse the resulting SOAP response.

SOAP API for UniBasic Programmatic Interfaces

This section describes the SOAP API for UniBasic functions.

SOAPSetDefault

Syntax

SOAPSetDefault(*option*, *value*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

Use the **SOAPSetDefault** function to define default SOAP settings, such as the SOAP version. By default, the SOAP version is 1.1, although you can specify version 1.2.

For SOAP version 1.1, the namespace prefixes "env" and "enc" are associated with the SOAP namespace names http://schemas.xmlsoap.org/soap/envelope/ and http://schemas.xmlsoap.org/soap/encoding/ respectively. The namespace prefixed "xsi" and "xsd" are associated with the namespace names http://www.w3.org/1999/XMLSchema-instance and http://www.w3.org/1999/XMLSchema respectively.

The SOAP version can be set to 1.2 to support the newer SOAP 1.2 protocol. The namespace prefixes "env" and "enc" are associated with the SOAP namespace names "http://www.w3.org/2001/12/soap-envelope" and "http://www.w3.org/2001/12/soap-encoding" respectively. The namespace prefixes "xsd" and "xsi" will be associated with the namespace names "http://www.w3.org/2001/XMLSchema" and "http://www.w3.org/2001/XMLSchema-instance" respectively.

Note: *All defaults set by SOAPSetDefault remain in effect until the end of the current UniData session. If you do not want the setting to affect subsequent programs, clear it before exiting the current program.*

Along with SOAPSetDefault, you can use the CallHTTP function setHTTPDefault to set HTTP-specific settings or headers, if the HTTP default settings are not sufficient.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
option	A string containing an option name. UniData currently only supports the "VERSION" option. [IN]
value	A string containing the appropriate option value. For the VERSION option, the string should be 1.0, 1.1, or 1.2. [IN]

SOAPSetDefault Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid option (currently, UniData only supports VERSION).
2	Invalid value. If you do not specify a value, UniData uses the default of 1.1.

SOAPSetDefault Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

SOAPGetDefault

Syntax

SOAPGetDefault(*option*, *value*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPGetDefault** function retrieves default SOAP settings, such as the SOAP version.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
option	A string containing an option name. UniData currently only supports the VERSION option. [IN]
value	A string returning the option value. [OUT]

SOAPGetDefault Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid option (currently, UniData only supports the VERSION option).

SOAPGetDefault Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

SOAPCreateRequest

Syntax

SOAPCreateRequest(*URL, soapAction, Request*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPCreateRequest** creates a SOAP request and returns a handle to the request.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
URL	A string containing the URL where the web service is located. UniData sends the SOAP request to this URL. For information about the format of the URL, see "URL Format" on page 6-8. [IN]
soapAction	A string UniData uses as the SOAPAction HTTP header for this SOAP request. [IN]
Request	The returned handle to the SOAP request. You can use this handle can be used in subsequent calls to the SOAP API for UniBasic. [OUT]

SOAPCreateRequest Parameters

URL Format

The URL you specify must follow the syntax defined in RFS 1738. The general format is:

http://*<host>*:*<port>*/*path*>?*<searchpart>*

The following table describes each parameter of the syntax.

Parameter	Description
host	Either a name string or an IP address of the host system.
port	The port number to which you want to connect. If you do not specify *port*, UniData defaults to 80. Omit the preceding colon if you do not specify this parameter.
path	Defines the file you want to retrieve on the web server. If you do not specify *path*, UniData defaults to the home page.
searchpart	Use *searchpart* to send additional information to a web server.

URL Parameters

***Note**: If the URL you define contains a searchpart, you must define it in its encoded format. For example, a space is converted to +, and other nonalphanumeric characters are converted to %HH format.*

You do not need to specify the host and path parameters in their encoded formats. UniBasic encodes these parameters prior to communicating with the web server.

Return Code

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function complete successfully.
1	Invalid URL syntax.
2	Invalid HTTP method (indicates the POST method is not supported by the HTTP server).

SOAPCreateRequest Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

Example

The following code segment illustrates the SOAPCreateRequest function:

```
* Create the Request
Ret = SoapCreateRequest(URL, SoapAction, SoapReq)
IF Ret <> 0 THEN
   STOP "Error in SoapCreateRequest: " : Ret
END
.
.
.
```

SOAPCreateSecureRequest

Syntax

SOAPCreateSecureRequest(*URL, soapAction, Request, security_context*)

Description

The **SOAPCreateSecureRequest** function creates a secure SOAP request and returns a handle to the request.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
URL	A string containing the URL where the web service is located. UniVerse sends the SOAP request to this URL. For information about the format of the URL, see URL Format. [IN]

SOAPCreateSecureRequest Parameters

Parameter	Description
soapAction	A string UniVerse uses as the SOAPAction HTTP header for this SOAP request. [IN]
Request	The returned handle to the SOAP request. You can use this handle can be used in subsequent calls to the SOAP API for UniVerse BASIC. [OUT]
security_context	A handle to the security context.

SOAPCreateSecureRequest Parameters (Continued)

URL Format

The URL you specify must follow the syntax defined in RFS 1738. The general format is:

http://<*host*>:<*port*>/*path*>?<*searchpart*>

The following table describes each parameter of the syntax.

Parameter	Description
host	Either a name string or an IP address of the host system.
port	The port number to which you want to connect. If you do not specify *port*, UniVerse defaults to 80. Omit the preceding colon if you do not specify this parameter.
path	Defines the file you want to retrieve on the web server. If you do not specify *path*, UniVerse defaults to the home page.
searchpart	Use *searchpart* to send additional information to a web server.

URL Parameters

***Note**: If the URL you define contains a searchpart, you must define it in its encoded format. For example, a space is converted to +, and other nonalphanumeric characters are converted to %HH format.*

You do not need to specify the host and path parameters in their encoded formats. UniVerse BASIC encodes these parameters prior to communicating with the web server.

Return Code

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function complete successfully.
1	Invalid URL syntax.
2	Invalid HTTP method (indicates the POST method is not supported by the HTTP server).
101	Invalid security context handle.

SOAPCreateSecureRequest Return Codes

You can also use the UniVerse BASIC STATUS() function to obtain the return status from the function.

SOAPSetParameters

Syntax

SOAPSetParameters(*Request, URI, serviceName, paramArray*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPSetParameters** function sets up the SOAP request body, specifying a remote method to call along with the method's parameter list.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
Request	Handle to the request created with SOAPCreateRequest. [IN]
namespace	A string is used as the namespace URI for the SOAP call. [IN]
serviceName	The name of the SOAP service. [IN]
paramArray	A dynamic array containing the method parameters for the SOAP call. Each method parameter consists of the following values: n A parameter name n A parameter value n A parameter type (if type is omitted, *xsd:string* will be used. name, value, and type are separated by @VM. Additional parameters are separated by @AM, as shown in the following example: <*param1Name*>@VM<*param1Value*>@VM<**param1Type**>@AM <*param2Name*>@VM<*param2Value*>@VM<*param2Type*>...[IN]

SOAPSetParameters Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid request handle was passed to the function.

SOAPSetParameters Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

Example

As an example, the following inputs:

Input	Description
serviceName	“getStockQuote”
namespace	“http://host/#StockQuoteService”
paramArray	“symbol”:@VM:”IBM”:@VM:”xsd:string”

SOAPSetParameter Example

set the SOAP body as follows:

```
<SOAP-ENV:Body>
    <ns1:getStockQuote
     xmlns:ns1="http://host/#StockQuoteService">
         <symbol xsi:type="xsd:string">IBM</symbol>
    </ns1:getQuote>
<SOAP-ENV:Body>
```

The following code example illustrates the SOAPSetParameters function:

```
* Set up the Request Body
Ret = SoapSetParameters(SoapReq, NameSpace, Method, MethodParms)
IF Ret <> 0 THEN
   STOP "Error in SoapSetParameters: " : Ret
END
```

SOAPSetRequestHeader

Syntax

SOAPSetRequestHeader(*Request, value*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPSetRequestHeader** sets up a SOAP request header. By default, there is no SOAP header.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
Request	Handle to the request created with SOAPCreateRequest. [IN]
value	A dynamic array containing SOAP header blocks, for example: <*header block*>@AM<*header block*>...[IN]

SOAPSetRequestHeader Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid request handle.

SOAPSetRequestHeader Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

SOAPSetRequestBody

Syntax

SOAPSetRequestBody(*Request, value*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPSetRequestBody** function sets up a SOAP request body directly, as opposed to having it constructed via the SOAPSetParameters function. With this function, you can also attach multiple body blocks to the SOAP request.

Each SOAP request should include at least one body block.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
Request	Handle to the request created with SOAPCreateRequest. [IN]
value	A dynamic array containing SOAP body blocks, for example: <*body block*>@AM<*body block*>... [IN]

SOAPSetRequestBody Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid request handle.

SOAPSetRequestBody Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

SOAPSetRequestContent

Syntax

SOAPSetRequestContent(*Request, reqDoc, docTypeFlag*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPSetRequestContent** function sets the entire SOAP request's content from an input string or from a file.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
Request	Handle to the request created with SOAPCreateRequest. [IN]
reqDoc	The input document to use as the SOAP request content. [IN]
docTypeFlag	A flag indicating whether *reqDoc* is a string holding the actual content, or the path to a file holding the content. n 0 – reqDoc is a file holding the request content. n 1 – reqDoc is a string holding the request content. [IN]

SOAPSetRequestContent Parameters

Return Codes

The return code indicating success or failure. The following table describes the status of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid request handle.
2	Unable to open the file named by reqDoc.
3	Unable to read the file named by reqDoc.

SOAPSetRequestContent Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

SOAPRequestWrite

Syntax

SOAPRequestWrite(*Request, reqDoc, docTypeFlag*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPRequestWrite** function outputs the SOAP request, in XML format, to a string or to a file.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
Request	Handle to the request created with SOAPCreateRequest. [IN]
reqDoc	Depending on *docTypeFlag*, either an output string containing the SOAP request content, or a path to a file where the SOAP request content will be written. [OUT]
docTypeFlag	A flag indicating whether *reqDoc* is an output string that is to hold the request content, or a path to a file where the SOAP request content will be written. n 0 – reqDoc is a file where the request content will be written upon successful completion. n 1 – reqDoc is a string that will hold the request upon successful completion. [IN]

SOAPRequestWrite Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid request handle.
2	Unable to open the file named by reqDoc.
3	Unable to write to the file named by reqDoc.

SOAPRequestWrite Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

SOAPSubmitRequest

Syntax

SOAPSubmitRequest(*Request, timeout, respHeaders, respData, soapStatus*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPSubmitRequest** function submits a request and gets the response.

Internally, SOAPSubmitRequest utilizes CallHTTP's submitRequest() function to send the SOAP message. The *soapStatus* variable holds the status from the underlying CallHTTP function. If an error occurs on the SOAP server while processing the request, *soapStatus* will indicate an HTTP 500 "Internal Server Error", and **respData** will be a SOAP Fault message indicating the server-side processing error.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
Request	Handle to the request created with SOAPCreateRequest. [IN]
timeout	Timeout, in milliseconds, to wait for a response. [IN]
respHeaders	Dynamic array of HTTP response headers and their associated values. [OUT]
respData	The SOAP response message. [OUT]
soapStatus	Dynamic array containing status code and explanatory text. [OUT]

SOAPSubmitRequest Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid request handle.
2	Request timed out.
3	Network error occurred.
4	Other error occurred.

SOAPSubmitRequest Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

Example

The following code sample illustrates the SOAPSubmitRequest function:

```
* Submit the Request
Ret = SoapSubmitRequest(SoapReq, Timeout, RespHeaders, RespData,
SoapStatus)
IF Ret <> 0 THEN
   STOP "Error in SoapSubmitRequest: " : Ret
END

PRINT "Response status : " : SoapStatus
PRINT "Response headers: " : RespHeaders
PRINT "Response data   : " : RespData
.
.
.
```

SOAPGetResponseHeader

Syntax

SOAPGetResponseHeader(*Request, headerName, headerValue*)

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Description

The **SOAPGetResponseHeader** function gets a specific response header after issuing a SOAP request.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
Request	Handle to the request created with SOAPCreateRequest. [IN]
headerName	The header name whose value is being queried. [IN]
headerValue	The header value, if present in the response, or empty string if not (in which case the return status of the function is 2). [OUT]

SOAPGetResponseHeader Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid request handle.
2	Header not found in set of response headers.

SOAPGetResponseHeader Return Codes

You can also use the UniBasic STATUS() function o obtain the return status from the function.

SOAPGetFault

Syntax

SOAPGetFault(*respData, soapFault*)

Description

If the SOAPSubmitRequest function receives a SOAP Fault, the **SOAPGetFault** function parses the response data from SOAPSubmitRequest into a dynamic array of SOAP Fault components.

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
respData	Response data from SOAPSubmitRequest after receiving a SOAP fault. [IN]
soapFault	Dynamic array consisting of Fault Code, Fault String, and optional Fault Detail, for example: <*faultcode*>@AM<*faultstring*>@AM<*faultdetail*>@AM<*faultactor*> Fault code values are XML-qualified names, consisting of: n VersionMismatch n MustUnderstand n DTDNotSupported n DataEncoding Unknown n Sender n Receiver

SOAPGetFault Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	Invalid response data, possibly not a valid XML document.
2	SOAP Fault not found in response data.

SOAPGetFault Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

protocolLogging

Syntax

protocolLogging(*logFile, logAction, logLevel*)

Description

The **protocolLogging** function starts or stops logging. By default, no logging takes place. The function parses the response data from SOAPSubmitRequest, after receiving a SOAP Fault, into a dynamic array of SOAP Fault components.

Note: *This function is case-sensitive. If you want it to be case-insensitive, you must compile your programs using the BASIC command with the -i option.*

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
logFile	The name of the log file [IN]
logAction	Flag (values “ON” or “OFF”) indicating whether logging should be turned on or off. [IN]
logLevel	Controls the level of log detail. n 0 – No logging takes place. n 1 – Only errors are logged. n 3 – Warnings and errors are logged. n 7 – All SOAP actions are logged. [IN]

protocolLogging Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
0	Function completed successfully.
1	An error occurred starting or stopping logging.

protocol Logging Return Codes

You can also use the UniBasic STATUS() function to obtain the return status from the function.

SOAP API for BASIC Example

```
*
* Example of Sending a SOAP Request from UniBasic
*

URL         = "http://u2.ibm.com/webservices/AddressBookService"
SoapAction  = "http://u2.ibm.com/AddressBook#getAddressFromName"
NameSpace   = "http://u2.ibm.com/AddressBook"
Method      = "getAddressFromName"
MethodParms = "name":@VM:"John Doe":@VM:"xsd:string"
Timeout     = 30000

* Create the Request
Ret = SoapCreateRequest(URL, SoapAction, SoapReq)
IF Ret <> 0 THEN
   STOP "Error in SoapCreateRequest: " : Ret
END

* Set up the Request Body
Ret = SoapSetParameters(SoapReq, NameSpace, Method, MethodParms)
IF Ret <> 0 THEN
   STOP "Error in SoapSetParameters: " : Ret
END

* Submit the Request
Ret = SoapSubmitRequest(SoapReq, Timeout, RespHeaders, RespData,
SoapStatus)
IF Ret <> 0 THEN
   STOP "Error in SoapSubmitRequest: " : Ret
END

PRINT "Response status : " : SoapStatus
PRINT "Response headers: " : RespHeaders
PRINT "Response data   : " : RespData
```

Chapter

The Document Object Model

7

The Document Object Model (DOM) provides a standard way for you to manipulate XML documents. You can use the DOM API to delete, remove, and update an XML document, as well as create new XML documents.

The DOM represents a document as a tree of Nodes. Each node has a parent (except for the "root" node), and optional children. The DOM provides functions to traverse and manipulate these nodes. Another technology, XPath, (also supported in the XML for UniVerse BASIC API) provides the ability to locate nodes in the DOM based on search criteria.

The DOM defines different types of nodes, with the Element type being the most commonly used:

- Document
- DocumentFragment
- DocumentType
- EntityReference
- Element
- Attr
- ProcessingInstruction
- Comment
- Text
- CDATASection
- Entity
- Notation

XPath and the Document Object Model

XPath is a language that gives the ability to address specific parts of an XML document. It allows you to execute node searches through expressions such as "find the node whose name is ‘LASTNAME’ and whose value starts with ‘Smith’ and is a child node of ‘Employee.’”

The XML for UniVerse BASIC API provides support for XPath by allowing you to specify XPath search strings in some of its API calls. For example, XDOMLocate takes an Xpath string to locate a particular node in the DOM tree. XDOMRemove also takes an Xpath search string to evaluate which node(s) to remove.

A Sample XML document

The following document, "sample.xml," will be used to help illustrate usage of the XML for UniVerse BASIC API. It is a simple address book with two entries:

```
<?xml version = "1.0"?>

<ADDRBOOK>
   <ENTRY ID="id1">
      <NAME>Name One</NAME>
      <ADDRESS>101 Some Way</ADDRESS>
      <PHONENUM DESC="Work">303-111-1111</PHONENUM>
<     PHONENUM DESC="Fax">303-111-2222</PHONENUM>
      <PHONENUM DESC="Pager">303-111-3333</PHONENUM>
      <EMAIL>name.one@some.com</EMAIL>
   </ENTRY>
   <ENTRY ID="id2">
      <NAME>Name Two</NAME>
      <ADDRESS>202 Some Way</ADDRESS>
      <PHONENUM DESC="Work">303-222-1111</PHONENUM>
      <PHONENUM DESC="Fax">303-222-2222</PHONENUM>
      <PHONENUM DESC="Home">303-222-3333</PHONENUM>
      <EMAIL>name.two@some.com</EMAIL>
   </ENTRY>
</ADDRBOOK>
```

Opening and Closing a DOM Document

Use XDOMOpen to load an XML document and build a DOM tree in memory.

```
XDOMOpen("sample.xml", XML.FROM.FILE, mydom)
```

If the first parameter is the XML document itself, the second parameter is XML.FROM.STRING.

You can reference the DOM handle, *mydom*, later in other XML for UniVerse BASIC API calls.

When finished with an XML document, use XDOMClose to destroy the DOM tree in memory:

```
XDOMClose(mydom)
```

Navigating the DOM Tree

Use XDOMLocate to locate the context node.

```
XDOMLocate(xmlHandle, xpathString, nsMap, nodeHandle)
```

For example,

```
XDOMLocate(mydom, "/ADDRBOOK", "", myctx)
```

puts the element ADDRBOOK in variable *myctx*. You can use the context handle, which is also a node handle and more generically an xml handle, in other API calls later.

Use XDOMLocateNode to navigate the DOM tree without bothering with XPath:

```
XDOMLocateNode(nodeHandle, direction, childIndex, nodeType,
newNodeHandle)
```

For example,

```
XDOMLocateNode(mydom, XDOM.CHILD, XDOM.FIRST.CHILD,
XDOM.ELEMENT.NODE, thefirst)
```

puts the ADDRBOOK element, which is the first child of the root in handle thefirst.

And,

```
XDOMLocateNode(thefirst, XDOM.CHILD, 2, XDOM.ELEMENT.NODE,
entrynode2)
```

puts the second ENTRY element in handle entrynode2.

Then,

```
XDOMLocateNode(entrynode2, XDOM.PREV.SIBLING, 0,
XDOM.ELEMENT.NODE, entrynode1)
```

puts the first ENTRY element in handle entrynode1.

Building DOM Trees from Scratch

There are two API calls available to build a DOM tree from scratch:

```
XDOMCreateRoot(domHandle)

XDOMCreateNode(xmlHandle, nodeName, nodeValue, nodeType,
nodeHandle)
```

XDOMCreateRoot creates a DOM tree with one root, whose type is DOCUMENT. XDOMCreateNode creates a node that bears the name, value and type you specify with the parameters.

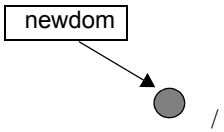
For example,

```
XDOMCreateRoot(newdom)
```

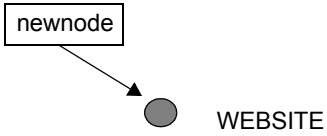
creates this tree in memory:

And

```
XDOMCreateNode(newdom, "Website","", XDOM.ELEMENT.NODE, newnode)
```



creates a new element node with name Website, which you can reference through the handle newnode.

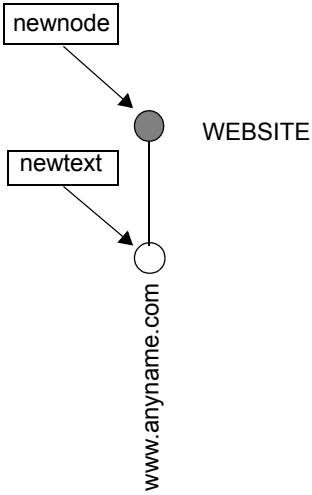


Now we create a text node

```
XDOMCreateNode(newnode, "", "www.anyname.com", XDOM.TEXT.NODE,
newtext)

XDOMAddChild(newnode, "/Website", "", newtext, XDOM.NODUP)
```

The subtree becomes:



Transforming XML documents

Use XDOMTransform to transform an XML document via an XSL document. For example, using the style sheet defined in the following example, "sample.xsl":

```
<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
version="1.0">

  <xsl:output method='html' indent='yes'/>

  <!--    Template 1     -->
  <xsl:template match="/">
    <HTML><HEAD><TITLE>Address Book</TITLE></HEAD>
    <BODY>
    <H1>Address Book</H1>
    <xsl:apply-templates/>
    </BODY>
    </HTML>
  </xsl:template>

  <!--    Template 2     -->
  <xsl:template match="ENTRY">
    <TABLE>
      <TR>
      <TD COLSPAN='2'>
      Contact: <xsl:value-of select='NAME'/> (ID: <xsl:value-of
select='@ID'/>)
      </TD>
      </TR>
      <xsl:apply-templates select='ADDRESS|PHONENUM|EMAIL'/>
    </TABLE>
    <xsl:if test='not(position()=last())'><HR/></xsl:if>
  </xsl:template>

  <!--    Template 3     -->
  <xsl:template match="ADDRESS">
    <TR><TD>Address</TD><TD><xsl:apply-templates/></TD></TR>
  </xsl:template>

  <!--    Template 4     -->
  <xsl:template match="PHONENUM">
    <TR>
    <TD><xsl:value-of select='@DESC'/> Phone Number</TD>
    <TD><xsl:apply-templates/></TD>
    </TR>
  </xsl:template>

  <!--    Template 5     -->
  <xsl:template match="EMAIL">
    <TR><TD>E-mail Address</TD><TD><xsl:apply-
```

```
templates/></TD></TR>
  </xsl:template>

</xsl:stylesheet>
```

The XML for UniVerse BASIC API function XDOMTransform can transform the sample Address Book DOM document (referenced by *mydom*) into a new DOM document using the following command:

```
XDOMTransform(mydom, "sample.xsl", XML.FROM.FILE, newdom)
```

The handle newdom will point to the transformed document, which will be:

```
<HTML>
<HEAD>
<META http-equiv="Content-Type" content="text/html; charset=UTF-
8">
<TITLE>Address Book</TITLE>
</HEAD>
<BODY>
<H1>Address Book</H1>
<TABLE>
<TR>
<TD COLSPAN="2">
      Contact: Name One (ID: id1)
      </TD>
</TR>
<TR>
<TD>Address</TD><TD>101 Some Way</TD>
</TR>
<TR>
<TD>Work Phone Number</TD><TD>303-111-1111</TD>
</TR>
<TR>
<TD>Fax Phone Number</TD><TD>303-111-2222</TD>
</TR>
<TR>
<TD>Pager Phone Number</TD><TD>303-111-3333</TD>
</TR>
<TR>
<TD>E-mail Address</TD><TD>name.one@some.com</TD>
</TR>
</TABLE>
<HR>
<TABLE>
<TR>
<TD COLSPAN="2">
      Contact: Name Two (ID: id2)
      </TD>
</TR>
<TR>
<TD>Address</TD><TD>202 Some Way</TD>
</TR>
<TR>
<TD>Work Phone Number</TD><TD>303-222-1111</TD>
</TR>
<TR>
<TD>Fax Phone Number</TD><TD>303-222-2222</TD>
</TR>
<TR>
<TD>Home Phone Number</TD><TD>303-222-3333</TD>
</TR>
<TR>
<TD>E-mail Address</TD><TD>name.two@some.com</TD>
```

```
</TR>
</TABLE>
<HR>
</BODY>
</HTML>
```

XML for BASIC API Programmatic Interfaces

This section describes the XML for UniVerse BASIC API functions.

XDOMOpen

Syntax

XDOMOpen(*xmlDocument, docLocation, domHandle*)

Description

The XDOMOpen function reads an xmlDocument and creates DOM structure. If the DTD is included in the document, UniVerse validates the document. The *xmlDocument* can be from a string or from a file, depending on the *docLocation* flag.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlDocument	The XML document. [IN]
docLocation	A flag to specify whether *xmlDocument* is a string holding the XML document, or it is a file containing the XML document. Valid values are: ■ XML.FROM.FILE ■ XML.FROM.STRING [IN]
domHandle	Handle to the opened DOM structure. [OUT]

XDOMOpen Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	Invalid DOM handle passed to the function.

XDOMOpen Return Codes

XDOMCreateNode

Syntax

XDOMCreateNode(*xmlhandle*, *nodeName*, *nodeValue*, *nodeType*, *nodeHandle*)

Description

The XDOMCreateNode function creates a new node, whose name and value and *nodeName* and *nodeValue*, respectively. Valid values for *nodeType* are:

- XDOM.ELEMENT.NODE
- XDOM.ATTR.NODE
- XDOM.TEXT.NODE
- XDOM.CDATA.NODE
- XDOM.ENTITY.REF.NODE
- XDOM.PROC.INST.NODE
- XDOM.COMMENT.NODE
- XDOM.DOC.NODE
- XDOM.DOC.TYPE.NODE
- XDOM.DOC.FRAG.NODE
- XDOM.NOTATION.NODE

- XDOM.XML.DECL.NODE

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	Handle to the DOM structure. [IN]
nodeName	The name for the new node. [IN]
nodeValue	The value for the new node. [IN]
nodeType	The type of the new node. [IN]
nodeHandle	The handle to the new node. [OUT]

XDOMCreateNode Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.

XDOMCreateNode Return Codes

XDOMCreateRoot

Syntax

XDOMCreateRoot(*domHandle*)

Description

The XDOMCreateRoot function creates a new DOM structure with root only. You can use the result handle in other functions where a DOM handle or node handle is needed.

Parameters

The following table describes the parameter of the syntax.

Parameter	Description
domHandle	Handle to the opened DOM structure. [OUT]

XDOMCreateRoot Parameter

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.

XDOMCreateRoot Return Codes

XDOMWrite

Syntax

XDOMWrite(*domHandle, xmlDocument, docLocation*)

Description

The XDOMWrite function writes the DOM structure to xmlDocument. xmlDocument can be a string or a file, depending on the value of the *docLocation* flag.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
domHandle	The handle to the opened DOM structure. [IN]
xmlDocument	The XML document [OUT]
docLocation	A flag to specify whether *xmlDocument* is an output string which should hold the XML document, or it is a file where the XML document should be written. Valid values are: ■ XML.TO.FILE ■ XML.TO.STRING [IN]

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	Invalid DOM handle passed to the function.

XDOMWrite Return Codes

XDOMClose

Syntax

XDOMClose(*domHandle*)

Description

The XDOMClose function frees the DOM structure.

Parameters

The following table describes the parameter of the syntax.

Parameter	Description
domHandle	Handle to the DOM structure. [IN]

XDOMClose Parameter

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	Invalid DOM handle passed to the function.

XDOMClose Return Codes

XDOMValidate

Syntax

XDOMValidate(*xmlDocument, docLocation, schFile, schLocation*)

Description

The XDOMValidate function validates the DOM document using the schema specified by *schFile*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlDocument	The name of the XML document. [IN]
docLocation	A flag to specify whether *xmlDocument* is the document itself, or the document file name. Valid values are: ■ XML.FROM.FILE (default) ■ XML.FROM.STRING ■ XML.FROM.DOM [IN]
schFile	The schema file.
schLocation	A flag to specify whether schFile is the schema itself, or the schema file name. Valid values are: ■ XML.FROM.FILE (default) ■ XML.FROM.STRING [IN]

XDOMValidate Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was passed to the function.

XDOMValidate Return Codes

XDOMLocate

Syntax

XDOMLocate(*xmlHandle, xpathString, nsMap, nodeHandle*)

Description

The XDOMLocation function finds a starting point for relative XPath searching in context *xmlHandle* in the DOM structure. The *xpathString* should specify only one node; otherwise, this function returns an error.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	A handle to the DOM structure. [IN]
xpathString	A string to specify the starting point. [IN]
nsMAP	The map of namespaces which resolve the prefixes in the *xpathString*. The format is: “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url For example: “xmlns=”http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com [IN]
nodeHandle	Handle to the found node. [OUT]

XDOMLocate Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	Function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid handle was returned to the function.

XDOMLocate Return Codes

***Note**: In this document, xmlHandle is a generic type, it can be domHandle or nodeHandle. DomHandle stands for a whole document, while nodeHandle stands for a subtree. DomHandle is also a nodeHandle.*

XDOMLocateNode

Syntax

XDOMLocateNode(*nodeHandle, direction, childIndex, nodeType, newNodeHandle*)

Description

The XDOMLocateNode function traverses from *nodeHandle* and gets the next node according to direction and *childIndex*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	The handle to the starting node. [IN]
direction	Direction to traverse. Valid values are: ■ XDOM.PREV.SIBLING ■ XDOM.NEXT.SIBLING ■ XDOM.NEXT.SIBLING.WITH.SAME.NAME ■ XDOM.PREV.SIBLING.WITH.SAME.NAME ■ XDOM.PARENT ■ XDOM.CHILD [IN]

XDOMLocateNode Parameters

Parameter	Description
childIndex	The index in the child array. Valid values are: ■ XDOM.FIRST.CHILD ■ XDOM.LAST.CHILD ■ Positive Integer [IN]

XDOMLocateNode Parameters (Continued)

Parameter	Description
nodeType	The type of node to be located. Valid values are: ■ XDOM.NONE ■ XDOM.ELEMENT.NODE ■ XDOM.ATTR.NODE ■ XDOM.TEXT.NODE ■ XDOM.CDATA.NODE ■ XDOM.ENTITY.REF.NODE ■ XDOM.ENTITY.NODE ■ XDOM.PROC.INST.NODE ■ XDOM.COMMENT.NODE ■ XDOM.DOC.NODE ■ XDOM.DOC.TYPE.NODE ■ XDOM.DOC.FRAG.NODE ■ XDEOM.NOTATION.NODE ■ XDOM.XML.DECL.NODE If *nodeType* is not XDOM.NONE, UniVerse uses this argument, along with *direction* and *childIndex*, to get the right typed node. For example, if *direction* is XDOM.PREV.SIBLING, and *nodeType* is XDOM.ELEMENT.NODE, UniVerse finds the element node which is the first previous sibling of nodeHandle. If *direction* is XDOM.CHILD, *childIndex* is XDOM.FIRST.CHILD, and *nodeType* is XDOM.ELEMENT.NODE, UniVerse finds the element node which is the first element child of nodeHandle. If the *direction* is XDOM.CHILD, *childIndex* is 2, and *nodeType* is XDOM.ELEMENT.NODE, UniVerse finds the element node which is the second element child of *nodeHandle*. When the *direction* is XDOM.NEXT.SIBLING.WITH.SAME.NAME, XDOM.PREV.SIBLING.WITH.SAME.NAME, or XDOM.PARENT, this argument is not used. [IN]
newNodeHandle	Handle to the found node. [OUT]

XDOMLocateNode Parameters (Continued)

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XM.INVALID.HANDLE	An invalid handle was returned to the function.

XDOMLocateNode Return Codes

XDOMEvaluate

Syntax

XDOMEvaluate(*xmlHandle, xpathString, nsMap, aValue*)

Description

The XDOMEvaluate function returns the value of the *xpathString* in the context *xmlHandle* in the DOM structure.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	Handle to the context. [IN]
xpathString	Relative or absolute Xpath string. [IN]
nsMap	The map of namespaces which resolves the prefixes in the *xpathString*. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN]
aValue	The value of *xpathString*. [OUT]

XDOMEvaluate Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMEvaluate Return Codes

XDOMRemove

Syntax

XDOMRemove(*xmlHandle, xpathString, nsMap, attrName, nodeHandle*)

Description

The XDOMRemove function finds the *xpathString* in the context *xmlHandle* in DOM structure, removes the found node or its attribute with name *attrName*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	Handle to the context. [IN]
xpathString	Relative or absolute Xpath string. [IN]
nsMap	The map of namespaces which resolve the prefixes in the *xpathString*. Format is “xmlns=default_url xmlns:prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN]
attrName	The attribute name. [IN]
nodeHandle	The removed node, if nodeHandle is not NULL. [OUT]

XDOMRemove Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMRemove Return Codes

XDOMAppend

Syntax

XDOMAppend(*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

The XDOMAppend function finds the *xpathString* in the context *xmlHandle* in the DOM structure, and inserts *nodeHandle* into the DOM structure as next sibling of found node. If the inserted node type is XDOM.ATTR.NODE, this node is inserted as an attribute.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute XPath string. [IN]
nsMap	The map of namespaces which resolve the prefixes in the *xpathString*. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN]
nodeHandle	Handle to a DOM subtree. If *nodeHandle* points to a DOM document, all of its children are inserted, in the same order. [IN]
dupFlag	XDOM.DUP: Clones *nodeHandle*, and insert the duplicate node. XDOM.NODUP: Inserts the original node. The subtree is also removed from its original location. [IN]

XDOMAppend Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMAppend Return Codes

XDOMInsert

Syntax

XDOMInsert (*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

The XDOMInsert function finds the *xpathString* in the context *xmlHandle* in the DOM structure and inserts *nodeHandle* into the DOM structure as a previous sibling of the found node. If the inserted node type is XDOM.ATTR.NODE, this node is inserted as an attribute.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute xpath string. [IN]
nsMap	The map of namespaces which resolves the prefixes in the *xpathString*. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN]
nodeHandle	The handle to a DOM subtree. If *nodeHandle* points to a DOM document, all of its children are inserted, in the same order. [IN]
dupFlag	XDOM.DUP: Clones *nodeHandle*, and inserts the duplicate node. XDOM.NODUP: Inserts the original node and removes the subtree from its original location.

XDOMInsert Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMInsert Return Codes

XDOMReplace

Syntax

XDOMReplace(*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

The XDOMReplace function finds the *xpathString* in the context *xmlHandle* in the DOM structure, and replaces the found node with *nodeHandle*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute Xpath string. [IN]
nsMap	The map of namespaces which resolve the prefixes in the xpathString. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN]
nodeHandle	Handle to a DOM subtree. If nodeHandle points to a DOM document, the found node is replaced by all of nodeHandle children, which are inserted in the same order. [IN]
dupFlag	XDOM.DUP: Clones nodeHandle, and replaces it with the duplicate node. XDOM.NODUP: Replaces with the original node. The subtree is also removed from its original location. [IN]

XDOMReplace Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMReplace Return Codes

XDOMAddChild

Syntax

XDOMAddChild(*xmlHandle, xpathString, nsMap, nodeHandle, dupFlag*)

Description

The XDOMAddChild function finds the *xpathString* in the context *xmlHandle* in the DOM structure and inserts a node *nodeHandle* as the last child of the found node. If the inserted node type is XDOM.ATTR.NODE, this node is inserted as an attribute.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	The handle to the context. [IN]
xpathString	Relative or absolute Xpath string. [IN]
nsMap	The map of namespaces which resolve the prefixes in the xpath string. Format is “xmlns=default_url xmlns:prefix1=prefix1_url xmlns:prefix2=prefix2_url” For example: “xmlns=http://myproject.mycompany.com xmlns:a_prefix=a.mycompany.com” [IN]
nodeHandle	Handle to a DOM subtree. If *nodeHandle* points to a DOM document, all of its children are inserted, in the same order. [IN]
dupFlag	XDOM.DUP: Clones *nodeHandle*, and inserts the duplicate node. XDOM.NODUP: Inserts the original node. The subtree is also removed from its original location. [IN]

XDOMAddChild Parameters

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMAddChild Return Codes

XDOMClone

Syntax

XDOMClone (*xmlHandle, newXmlHandle, depth*)

Description

The XDOMClone function duplicates the DOM subtree specified by *xmlHandle* to a new subtree newXmlHandle. The duplicate node has no parent (*parentNode* returns null.).

Cloning an element copies all attributes and their values, including those generated by the XML processor, to represent defaulted attributes, but this method does not copy any text it contains unless it is a deep clone, since the text is contained in a child text node. Cloning any other type of node simply returns a copy of this node.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xmlHandle	Handle to the DOM subtree. [IN]
newXmlHandle	Handle to the new DOM subtree. [IN]
depth	XDOM.FALSE: Clone only the node itself. XDOM.TRUE: Recursively clone the subtree under the specified node. [IN]

XDOMClone Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMClone Return Codes

XDOMTransform

Syntax

XDOMTransform(*domHandle, styleSheet, ssLocation, outDomHandle*)

Description

The XDOMTransform function transforms input DOM structure using the style sheet specified by *styleSheet* to output DOM structure.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
domHandle	Handle to the DOM structure. [IN]
styleSheet	Handle to the context [IN]
ssLocation	A flag to specify whether styleSheet contains style sheet itself, or is just the style sheet file name. Value values are: ■ XML.FROM.FILE (default) ■ XML.FROM.STRING [IN]
outDomHandle	Handle to the resulting DOM structure. [OUT]

XDOMTransform Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMTransform Return Codes

XDOMGetNodeName

Syntax

XDOMGetNodeName(*nodeHandle, nodeName*)

Description

The XDOMGetNodeName function returns the node name.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	Handle to the DOM node. [IN]
nodeName	String to store the node name. [OUT]

XDOMGetNodeName Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetNodeName Return Codes

XDOMGetNodeValue

Syntax

XDOMGetNodeValue(*nodeHandle, nodeValue*)

Description

The XDOMGetNodeValue returns the node value.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	The handle to the DOM node. [IN]
nodeValue	The string to hold the node value. [OUT]

XDOMGetNodeValue Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetNodeValue Return Codes

XDOMGetNodeType

Syntax

XDOMGetNodeType(*nodeHandle, nodeType*)

Description

The XDOMGetNodeType function returns the node type.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	The handle to the DOM node. [IN]
nodeType	An integer to store the node type. [OUT]

XDOMGetNodeType Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetNodeType Return Codes

XDOMGetAttribute

Syntax

XDOMGetAttribute(*nodeHandle, attrName, nodeHandle*)

Description

The XDOMGetAttribute function returns the node's attribute node, whose attribute name is *attrName*.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	Handle to the DOM node. [IN]
attrName	Attribute name. [IN]
nodeHandle	Handle to the found attribute node. [OUT]

XDOMGetAttribute Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetAttribute Return Codes

XDOMGetOwnerDocument

Syntax

XDOMGetOwnerDocument(*nodeHandle, domHandle*)

Description

The XDOMGetOwnerDocument function returns the DOM handle to which *nodeHandle* belongs.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	Handle to the DOM node. [IN]
domHandle	Handle to the DOM structure. [OUT]

XDOMGetOwnerDocument Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetOwnerDocument Return Codes

XDOMGetUserData

Syntax

XDOMGetUserData(*nodeHandle, userData*)

Description

The XDOMGetUserData function returns the user data associated with the node.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	The handle to the DOM node. [IN]
userData	String to hold the user data. [OUT]

XDOMGetUserData Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMGetUserData Return Codes

XDOMSetNodeValue

Syntax

XDOMSetNodeValue(*nodeHandle, nodeValue*)

Description

XDOMSetNodeValue sets the node value.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	The handle to the DOM node. [IN]
nodeValue	String to hold the node value. [IN]

XDOMSetNodeValue Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMSetNodeValue Return Codes

XDOMSetUserData

Syntax

XDOMSetUserData(*nodeHandle, userData*)

Description

The XDOMSetUserData function sets the user data associated with the node.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
nodeHandle	Handle to the DOM node. [IN]
userData	String to hold the user data. [IN]

XDOMSetUserData Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.
XML.INVALID.HANDLE	An invalid DOM handle was returned to the function.

XDOMSetUserData Return Codes

XMLGetError

Syntax

XMLGetError(*errorCode, errorMessage*)

Description

The XMLGetError function returns the error code and error message after the previous XML API failed.

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
errorCode	The error code. [OUT]
errorMessage	The error message. [OUT]

XMLGetError Parameters

Return Codes

The return code indicating success or failure. The following table describes the value of each return code.

Return Code	Description
XML.SUCCESS	The function completed successfully.
XML.ERROR	An error occurred.

XDOMGetError Return Codes

Chapter

Data Transfer Between XML Documents and UniVerse Files

8

The new XMLDB data transfer capability extends the existing XML support in UniVerse. It consists of the data transfer utilities and the UniVerse BASIC XMAP API. The data transfer utilities consist of two TCL commands, XML.TODB and DB.TOXML, and two UniVerse BASIC functions, XMLTODB() and DBTOXML(). The UniVerse BASIC XMAP API consists of the following six UniVerse BASIC functions:

- XMAPOpen()
- XMAPClose()
- XMAPCreate()
- XMAPReadNext()
- XMAPAppendRec()
- XMAPToXMLDoc()

These new TCL commands and UniVerse BASIC functions enable data transfer between XML documents and UniVerse files.

Transferring Data From XML to the Database

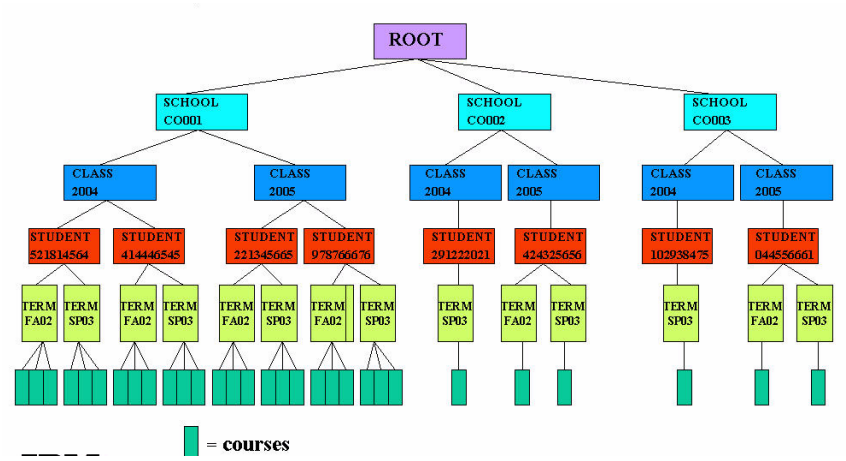
You can store data contained in an XML document in UniVerse files. This process is called shredding. You can also create XML documents from data contained in UniVerse files.

Prior to this release, transferring information from an XML document to UniVerse supported limited levels of nesting. At this release, you can transfer an unlimited levels of XML data to UniVerse files, although one UniVerse file can contain no more than three levels of data. If you are extracting more than three levels of data, you must write the data to more than one UniVerse file.

The following example shows a sample XML document containing information about students in different school districts:

```
<?xml version="1.0" ?>
<ROOT>
 <SCHOOL SCHOOLID="CO001" NAME="Fairview"
     DISTRICT="BVSD">
  <CLASS CLASSOF="2004"
    <STUDENT ID="521814564" NAME="Harry Smith" DOB="1985-02-08">
     <TERM SEMESTER="FA02">
        <COURSE NAME="MA130" GRADE="A" />
        <COURSE NAME="CH100" GRADE="B" />
        <COURSE NAME="PY100" GRADE="B" />
     </TERM>
     <TERM SEMESTER="SP03">
        <COURSE NAME="MA131" GRADE="B" />
        <COURSE NAME="CH101" GRADE="B" />
        <COURSE NAME="PE220" GRADE="A" />
     </TERM>
    </STUDENT>
    <STUDENT ID="414446545" NAME="Karl Offenbach" DOB="1984-12-
26">
                              ...
    </STUDENT>
   </CLASS>
   <CLASS CLASSOF="2005">
                              ...
  </SCHOOL>
 <SCHOOL SCHOOLID="CO002" NAME="Golden" DISTRICT="ACSD"
  <CLASS CLASSOF="2004">
   <STUDENT ID="291222021" NAME="Jojo Smith" DOB="1985-08-06">
    <TERM SEMESTER="SP03">
     <COURSE NAME="FR101" GRADE="B" />
    </TERM>
   </STUDENT>
  </CLASS>
  <CLASS CLASSOF="2005">
   <STUDENT ID="424325656" NAME="Sally Martin" DOB="1985=12-01"
    <TERM SEMESTER="FA02"
     <COURSE NAME="PY100" GRADE="C" />
     <COURSE NAME="PE100" GRADE="C" />
    </TERM>
   </STUDENT>
  </CLASS>
 <SCHOOL SCHOOLID="CO003" NAME="Cherry Creek" DISTRICT="CCSD"
                          ...
 </SCHOOL>
</ROOT>
```

This document can be represented by the following XML document tree:



The following is an overview of the steps required to retrieve data from and XML database and store it in UniVerse files.

Generate Database Schema

First, you must understand the structure of the data in the incoming XML document. You can understand this structure by reviewing the DTD or Schema of the XML document.

Create UniVerse Data Files

After you review the DTD or Schema from the incoming XML document, you must create the corresponding UniVerse data and dictionary files, and create a dictionary record for each element or attribute in the corresponding XML document.

If you want to transfer all the data from this sample XML document to UniVerse, you must deal with five levels of nested elements, SCHOOL, CLASS, STUDENT, TERM and COURSES. Therefore, you have to map this XML document to two UniVerse files. Logically, you would map the bottom three elements, STUDENT, TERM, and COURSES, to one UniVerse file. We will call this file the STUDENT file. We will map the top two elements, SCHOOL and CLASS, to another UniVerse file. We will call this file the SCHOOL file. The ID, NAME, and DOB attributes of the element STUDENT will map to singlevalued fields in the STUDENT file, the attribute SEMESTER of the subelement TERM will map to a multivalued field, and the attributes NAME and GRADE of the third-level nested element COURSES will map to multivalued fields as well. However, we will separate the fields that correspond to the NAME and GRADE attributes with subvalue marks.

Since the STUDENT file fields corresponding to XML attributes SEMESTER, NAME, and GRADE are all related, they will be combined into one association, called CGA.

The element CLASS serves as a link between the two UniVerse files, and therefore the field CLASS_OF appears in both UniVerse files.

The contents of the dictionary for each file follows:

```
DICT STUDENT    01:25:17pm  16 Sep 2003  Page    1

               Type &
Field......... Field. Field........ Conversion.. Column......... Output Depth &
Name.......... Number Definition... Code........ Heading........ Format Assoc..

@ID            D    0                            STUDENT       10L    S
NAME           D    1                            Name          10L    S
DOB            D    2               D2           DOB           10L    S
CLASS_OF       D    3                            Class Of      10L    S
SEMESTER         D     4                                Semester         10L    M CGA
COURSE_NBR       D     5                                Course No        10L    M CGA
COURSE_GRD       D     6                                Grade            10L    M CGA

7 records listed.
>

DICT SCHOOL    01:27:14pm  16 Sep 2003  Page    1

               Type &
Field......... Field. Field........ Conversion.. Column......... Output Depth &
Name.......... Number Definition... Code........ Heading........ Format Assoc..

@ID            D    0                            SCHOOL          10L    S
SCHOOLID       D    0                            SchoolId        10L    S
SCHOOL_NAME    D    1                            Name            10L    S
SCHOOL_DISTRIC D    2                       District        10L    S
T
CLASS_OF       D    3                       Class Of        10L    S

5 records listed.
```

Create the U2XMAP File

The rules for transferring data between an XML document and database files are recorded in a separate file, referred to as the U2XMAP file. This file contains such information as the starting node of the XML document, names and relationships of database files that are being used to exchange data with a specified XML document, the mapping of XML attribute names to database field names, and other optional information, such as the mapping of NULL values and date format conversions.

The following example illustrates a U2XMAP:

```
<?xml version="1.0" ?>
<!--DOCTYPE U2XMAP SYSTEM "U2XMAP.DTD"   -->
<U2XMAP Version="1.0" Name="XMAP1">
  <!-- Table/Class Map   -->
  <TABLECLASSMAP MapName="M1" StartNode="/ROOT/SCHOOL" TableName="SCHOOL">
      <ColumnMap Node="@SCHOOLID" Column="SCHOOLID" />
      <ColumnMap Node="@NAME" Column="SCHOOL_NAME" />
      <ColumnMap Node="@DISTRICT" Column="SCHOOL_DISTRICT" />
      <ColumnMap Node="CLASS, @CLASSOF" Column="CLASS_OF" />
      <TableMap Node="CLASS/STUDENT" MapName="M2" />
   </TABLECLASSMAP>
   <TABLECLASSMAP MapName="M2" StartNode="CLASS/STUDENT" TableName="STUDENT">
      <ColumnMap Node="@ID" Column="@ID" />
      <ColumnMap Node="@NAME" Column="NAME" />
      <ColumnMap Node="@DOB" Column="DOB" />
      <ColumnMap Node="TERM, @SEMESTER" Column="SEMESTER" />
      <ColumnMap Node="TERM, COURSES, @NAME" Column="COURSE_NBR" />
      <ColumnMap Node="TERM, COURSES, @GRADE" Column="COURSE_GRD" />
   </TABLECLASSMAP>
```

Each TABLECLASSMAP element defines where to find the data in the XML document, and where to place it in the UniVerse data file based on the dictionary definition of the field.

Syntax:

TABLECLASSMAP MapName = "*xx*" StartNode = "*startnode*" Table-Name = "*UniVerse file name*"

The following table describes each parameter of the syntax:

Parameter	Description
MapName	The name of the relationship between the portion of the XML document that starts with StartNode and the UniVerse data file.
StartNode	The XPath expression defining the starting position in the XML document.
TableName	The name of the target UniVerse file.

TABLECLASSMAP Parameters

To map a particular XML attribute to a UniVerse field, use the ColumnMap element.

Syntax:

ColumnMap Node=*XPath expression*, Column = *UniVerse record field*

The ColumnMap node defines the location of the node in the XML document. The ColumnMap Column defines the field in the UniVerse file to which you want to map the XML data. The UniVerse file must exist, and the dictionary record for the field must be defined.

Mapping XML Data to Multivalued Fields

If you want to map an XML attribute to a multivalued field in the UniVerse record, specify a comma (",") before the name of the XML attribute, as shown in the following example:

ColumnMap Node = "CLASS, @CLASSOF" Column = "CLASS_OF"

If you want the values of the corresponding UniVerse data files to be separated by subvalue marks, such as COURSE_NBR and COURSE_GRADE in the STUDENT file, specify a comma before the attribute of the next level subelement and another comma before the attribute of the next level subelement, as shown in the following example:

ColumnMap Node="TERM, COURSES, @NAME"
Column="COURSE_NBR"

ColumnMap Node="TERM, COURSES, @GRADE"
Column="COURSE_GRD"

Defining a Map Relationship

If you are mapping the XML attributes to more than one UniVerse data file, you must define a dependent map using the TableMap Node element.

TableMap Node=”CLASS/STUDENT” MapName=”M2”

In this example, MapName M2 is defined within the MapName M1 element as a dependent map to M1.

```
<TABLECLASSMAP MapName=”M1” StartNode=”/ROOT/SCHOOL” TableName=”SCHOOL”>
     <ColumnMap Node=”@SCHOOLID” Column=”SCOOLID” />
     <ColumnMap Node=”@NAME” Column=”SCHOOL_NAME” />
     <ColumnMap Node=”@DISTRICT” Column=”SCHOOL_DISTRICT” />
     <ColumnMap Node=”CLASS, @CLASSOF” Column=”CLASS_OF” />
     <TableMap Node = “CLASS/STUDENT” MapName=”M2” />
   </TABLECLASSMAP>
```

Defining Related Tables

If you are mapping more than three levels of data, you must map the data to more than one UniVerse file, since a UniVerse file can support no more than three levels of data. In the U2XMAP file, you define the files that are related to each other using the RelatedTable element.

Use the MapParentKey element to define the parent file (the file corresponding to the top portion of the XML subtree being transformed). Use the MapChildKey to define each child file of the parent file, as shown in the following example:

```
<RelatedTable>
     <MapParentKey TableName=”SCHOOL” Column=”CLASS_OF” Key
Generate=”No” />
     <MapChildKey TableName=”STUDENT” Column=”CLASS_OF” />
</RelatedTable>
```

In this example, SCHOOL is the parent UniVerse file which contains one child file, STUDENT. You must define a field that appears in both UniVerse files using the Column element. In this case, CLASS_OF appears in both the SCHOOL and STUDENT files.

The KeyGenerate element determines if UniVerse generates the parent/child key or not.

Populating the Database

After you define the U2XMAP file, you can populate the UniVerse database from TCL or UniVerse BASIC.

Populating the Database from TCL

Use the XML.TODB command to populate the UniVerse database from TCL.

Syntax:

XML.TODB <XML Document> <U2XMAP File>

The following example assumes that the XML document STUDENT.XML and the U2XMAP STUDENT.MAP are located in the &XML& file.

```
XML.TODB  STUDENT.XML  STUDENT.MAP
LIST SCHOOL
SCHOOL.....   Name......        District…..        Class Of…

CO001         Fairview          BVSD              2004
                                                    2005
CO002         Golden            ACSD              2004
                                                    2005
CO003         Cherry Creek      CCSD              2004
                                                    2005

LIST STUDENT
STUDENT.....  Name……          DOB…      Class Of   Semester..  Course NO.  Grade

414446545     Karl Offenbach    24 DEC 84 2004       FA02        HY104       D
                                                                 MA101       C
                                                                 FR100       C
                                                       SP03      HY105       B
                                                                 MA102       C
                                                                 FR101       C
4243255656    Sally Martin      01 DEC 85 2005       FA02        PY100       C
                                 ........
```

Populating the Database using the UniVerse BASIC XMLTODB() function

You can also populate the UniVerse database by calling the UniVerse BASIC XMLTODB function. XMLTODB does the same thing as the TCL XML.TODB command. If you want to transform specific data, use the XMAP API.

Syntax:

> XMLTODB(*xml_document, doc_flag, u2xmapping_rules, u2xmap_flag, status*)

The following table describes each parameter of the syntax.

Parameter	Description
xml_document	The name of the XML document.
doc_flag	A flag defining the type of *xml_document*. Valid values are: ■ XML.FROM.DOM - *xml_document* is a DOM handle. ■ XML.FROM.FILE - *xml_document* is a file name. ■ XML.FROM.STRING - *xml_document* is the name of variable containing the XML document
u2xmapping_rules	The mapping rules for the XML document.
u2xmap_flag	A flag indicating if the mapping file is the U2XMAP file itself or a string located within the UniVerse BASIC program. Valid values are: ■ XMAP.FROM.FILE - the mapping rules are contained in a U2XMAP file. ■ XMAP.FROM.STRING - *u2xmap_flag* is the name of the variable containing the mapping rules.
Status	The return status.

XMAPOpen Parameters

Populating the Database Using the UniVerse BASIC XMAP API

While the TCL command XML.TODB and the UniVerse BASIC function XMLTODB() provide easy ways of transferring data from an XML document to a set of related database files, you may want to have greater control over which part of the XML document you want to use for transferring data. For example, neither XML.TODB or XMLTODB() let you start the data transfer from a particular sibling of the start node. An example of such finer control is transferring only the second school data and its dependent subtree to the database from the sample XML document. You can accomplish this using a combination of the DOM API functions and the XMAP API functions.

In order to provide a record-by-record mapping between the XML document and the corresponding UniVerse files, the UniVerse engine generates an internal structure, called U2XMAP dataset. This internal structure contains information about the mapped XML elements and attributes, as well as how they relate to the fields in the corresponding UniVerse files. The U2XMAP dataset is not directly accessible to Basic programs, but instead referenced by its handle, called U2XMAP dataset handle.

The XMAP API

The UniVerse XMAP API consists of the following UniVerse BASIC functions:

- XMAPOpen()
- XMAPClose()
- XMAPCreate()
- XMAPReadNext()
- XMAPAppendRec()
- XMAPToXMLDoc()

XMAPOpen Function

The XMAPOpen function opens an XML document as a U2XMAP data set.

Syntax:

XMAPOpen(*xml_document, doc_flag, u2xmapping_rules, u2xmap_flag, XMAPhandle*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xml_document	The name of the XML document.
doc_flag	A flag defining the type of *xml_document*. Valid values are: ■ XML.FROM.DOM - *xml_document* is a DOM handle. ■ XML.FROM.FILE - *xml_document* is a file name. ■ XML.FROM.STRING -*xml_document* is the name of variable containing the XML document.

XMAPOpen Parameters

Parameter	Description
u2xmapping_rules	The name of the U2XMAP file, or the UniVerse BASIC variable containing the XML to Database mapping rules.
u2xmap_flag	A flag indicating if the mapping file is the U2XMAP file itself or a string located within the UniVerse BASIC program. Valid values are: ■ XMAP.FROM.FILE - the mapping rules are contained in a U2XMAP file. ■ XMAP.FROM.STRING - *u2xmap_flag* is the name of the variable containing the mapping rules.
XMAPhandle	The handle to the XMAP dataset.

XMAPOpen Parameters (Continued)

Return Values

The following table describes the return values for the XMAPOpen function.

Return Value	Description
XML_SUCCESS	The XML document was opened successfully.
XML_ERROR	An error occurred opening the XML document.

XMAPOpen Return Values

XMAPClose Function

The XMAPClose function closes the U2XMAP dataset handle and frees all related structures and memory.

Syntax

XMAPClose(*XMAPhandle*)

where *XMAPhandle* is the handle to the U2XMAP dataset.

Return Values

The following table describes the return values from the XMAPClose function.

Return Value	Description
XML_SUCCESS	The XML document was closed successfully.
XML_ERROR	An error occurred closing the XML document.
XML_INVALID_HANDLE	The XMAP dataset was invalid.

XMAPClose Return Values

XMAPCreate Function

The XMAPCreate function creates an empty XML document for transferring data from the UniVerse database to XML according the mapping rules you define.

Syntax

XMAPCreate(*u2xmapping_rules, mapping_flag, XMAPhandle*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
u2xmapping_rules	The name of the U2XMAP file, or the UniVerse BASIC variable containing the XML to Database mapping rules.
mapping_flag	A flag indicating if the mapping file is the U2XMAP file itself or a string located within the UniVerse BASIC program. Valid values are: ■ XMAP.FROM.FILE - the mapping rules are contained in a U2XMAP file. ■ XMAP.FROM.STRING - *u2xmapping_rules* is the name of the variable containing the mapping rules.
XMAPhandle	The handle to the XMAP dataset.

XMAPCreate Parameters

Return Values

The following table describes the return values for the XMAPCreate function.

Return Value	Description
XML_SUCCESS	The XML document was opened successfully.
XML_ERROR	An error occurred opening the XML document.
XML_INVALID_HANDLE	The XMAP dataset was invalid.

XMAPCreate Return Values

XMAPReadNext Function

The XMAPReadNext function retrieves the next record from the U2XMAP dataset and formats it as a record of the UniVerse file that is being mapped.

Syntax

XMAPReadNext(*XMAPhandle, file_name, record*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
XMAPhandle	The U2XMAP dataset handle.
file_name	The name of the UniVerse file that is being mapped in the U2XMAP dataset.
record	The data record formatted according to the dictionary record of the file.

XMAPReadNext Parameters

Return Values

The following table describes the return values for the XMAPReadNext function.

Return Value	Description
XML_SUCCESS	The XMAPReadNext was executed successfully.
XML_ERROR	Error in executing XMAPReadNext.
XML_INVALID_HANDLE	U2 XMAP dataset handle was invalid.
XML_EOF	The end of the U2XMAP dataset has been reached.

XMAPReadNext Return Values

XMAPAppendRec Function

The XMAPAppendRec function formats the specified record from the UniVerse file as a U2XMAP dataset record and appends it to the U2XMAP dataset.

Syntax

XMAPAppendRec(*XMAPhandle, file_name, record*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
XMAPhandle	The handle to the U2XMAP dataset.
file_name	The name of the UniVerse file that is being mapped in the U2 XMAP dataset
record	The data record formatted according to the dictionary record of the UniVerse file.

XMAPAppendRec Parameters

Return Values

The following table describes the return values of the XMAPAppendRec function.

Return Value	Description
XML_SUCCESS	The XML document was opened successfully.
XML_ERROR	An error occurred opening the XML document.
XML_INVALID_HANDLE	The XMAP dataset was invalid.

XMAPAppendRec Return Values

XMAPToXMLDoc Function

The XMAPToXMLDoc function generates an XML document from the data in the U2XMAP dataset using the mapping rules you define. The XML document can be either an XML DOM handle or an XML document. UniVerse writes the data to a file or a UniVerse BASIC variable.

Syntax

XMAPToXMLDoc(*XMAPhandle, xmlfile, doc_flag*)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
XMAPhandle	The handle to the U2XMAP dataset.
xmlfile	The name of the XML file, or the name of a UniVerse BASIC variable to hold the XML document.
doc_flag	Indicates where to write the XML document. Valid values are: ■ XML.TO.DOM - Writes the XML document to an XML DOM handle. ■ XML.TO.FILE - Writes the XML document to a file. ■ XML.TO.STRING - Writes the XML document to a UniVerse BASIC variable.

XMAPToXMLDoc Parameters

Return Values

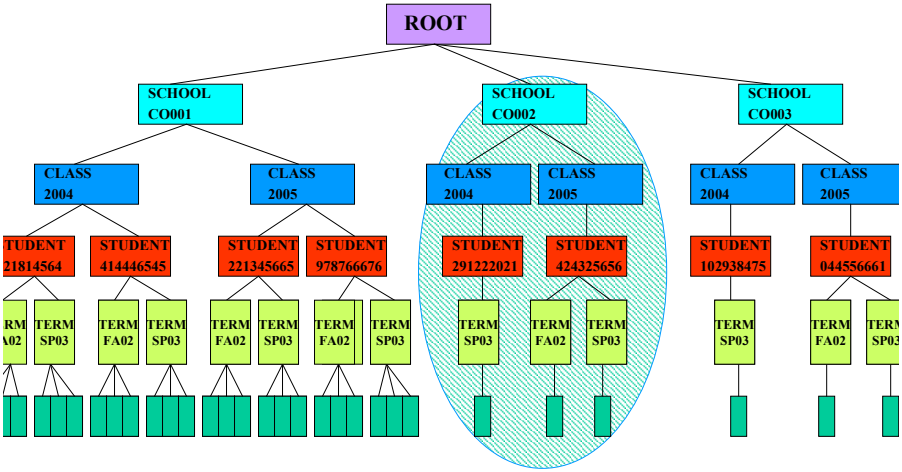
The following table describes the return values of the XMAPToXMLDoc function.

Return Value	Description
XML_SUCCESS	The XML document was opened successfully.
XML_ERROR	An error occurred opening the XML document.
XML_INVALID_HANDLE	The XMAP dataset was invalid.

XMAPToXMLDoc Return Values

Examples

The following example illustrates an XMLDOM tree containing information for three schools:



We will use the following U2XMAP to transfer the data to the UniVerse database:

```
<TABLECLASSMAP MapName="M2" StartNode="CLASS/STUDENT" TableName="STUDENT">
    <ColumnMap Node="@ID" Column="@ID" />
    <ColumnMap Node="@NAME" Column="NAME" />
    <ColumnMap Node="@DOB" Column="DOB" />
    <ColumnMap Node="TERM, @SEMESTER" Column="SEMESTER" />
    <ColumnMap Node="TERM, COURSES, @NAME" Column="COURSE_NBR" />
    <ColumnMap Node="TERM, COURSES, @GRADE" Column="COURSE_GRD" />
  </TABLECLASSMAP>
```

The following UniVerse BASIC program segment illustrates extracting data for only SCHOOL CO002 to the STUDENT file in the UniVerse database:

```
$INCLUDE UNIVERSE.INCLUDE XML.H

*Parse XML document and build DOM tree in memory
STATUS = XDOMOpen("STUDENT.XML",XML.FROM.FILE,domH)

*Position at a specific node
STATUS = XDOMLocate(domH, "/ROOT/SCHOOL[2]", "", domHandle)

*Open XMAP dataset for reading
STATUS = XMAPOpen(domHandle, XML.FROM.DOM, "STUDENT.MAP",
XML.FROM.FILE, Xfile)

OPEN "STUDENT" TO F1 ELSE STOP "Error opening file STUDENT"

*Read records from XMAP dataset, write to STUDENT file
MOREDATA = 1
LOOP
     STATUS = XMAPReadNext(Xfile, "STUDENT", RECORD)
     IF STATUS = XML.EOF THEN
        MOREDATA = 0
     END
WHILE MOREDATA DO
     ID = RECORD<1>
     REC = FIELD(RECORD, @FM, 2, 999)
     WRITE REC TO F1, ID ELSE STOP "Write to file STUDENT failed"
REPEAT
STATUS = XMAPClose(Xfile)
RETURN
END
```

Transferring Data from the Database to XML

There are multiple methods available to transfer data from the UniVerse database to an XML document:

- TCL LIST command
- SQL SELECT statement
- TCL DB.TOXML command and UniVerse BASIC DBTOXML() function
- UniVerse BASIC XMAP API (XMAPCreate Function, XMAPAppendRec Function, and XMAPToXMLDoc Function)

For information about creating an XML document using the TCL LIST command or the SQL SELECT statement, see *Creating XML Documents* in the *UniVerse BASIC Extensions* manual.

Note: *XMLTODB() and DBTOXML() are not part of the XMAP API, they are stand-alone UniVerse BASIC functions completely equivalent to the corresponding TCL commands.*

Creating an XML Document from TCL

To create an XML document from TCL, use the DB.TOXML command.

Syntax

DB.TOXML "*xml_doc_filename*" "*xmap_filename*" "*condition*"

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xml_doc_filename	The name of the XML document to create. If you do not enter a full path, the file is written to the &XML& directory.
xmap_filename	The file name for the U2XMAP file.
condition	A UniVerse RetrieVe condition string, for example, WITH SCHOOL = “CO002”

DB.TOXML Parameters

Example

The following example illustrates using DB.TOXML from TCL to create an XML document.

```
DB.TOXML SCHOOL_STUDENT.XML STUDENT.MAP WITH SCHOOLID = “CO002”
```

Creating an XML Document from UniVerse BASIC

To create an XML document from the UniVerse database using UniVerse BASIC, use the DBTOXML function.

Syntax:

DBTOXML(*xml_document, doc_location, u2xmap_file, u2xmap_location, condition,* status)

Parameters

The following table describes each parameter of the syntax.

Parameter	Description
xml_document	The name of the XML document to create.
doc_flag	A flag defining the type of *xml_document*. Valid values are: ■ XML.FROM.FILE - *xml_document* is a file name. ■ XML.FROM.STRING -*xml_document* is the name of variable containing the XML document.
u2xmap_file	The name of the U2XMAP file to use to produce the XML document.
u2xmap_location	The location of the U2XMAP file. ■ XML.FROM.FILE - *u2xmap_file* is a file name. ■ XML.FROM.STRING - is *u2xmap_file* the name of variable containing the mapping rules.
condition	A query condition for selecting data from the UniVerse file, for example, WHERE SCHOOL = "CO002"
Status	XML.SUCCESS or XML.FAILURE.

DBTOXML Parameters

Chapter

The XML/DB Tool

9

The XML/DB tool enables you to create a mapping file to use when creating XML documents from the UniVerse database, or when extracting data from an XML document and updating the UniVerse database.

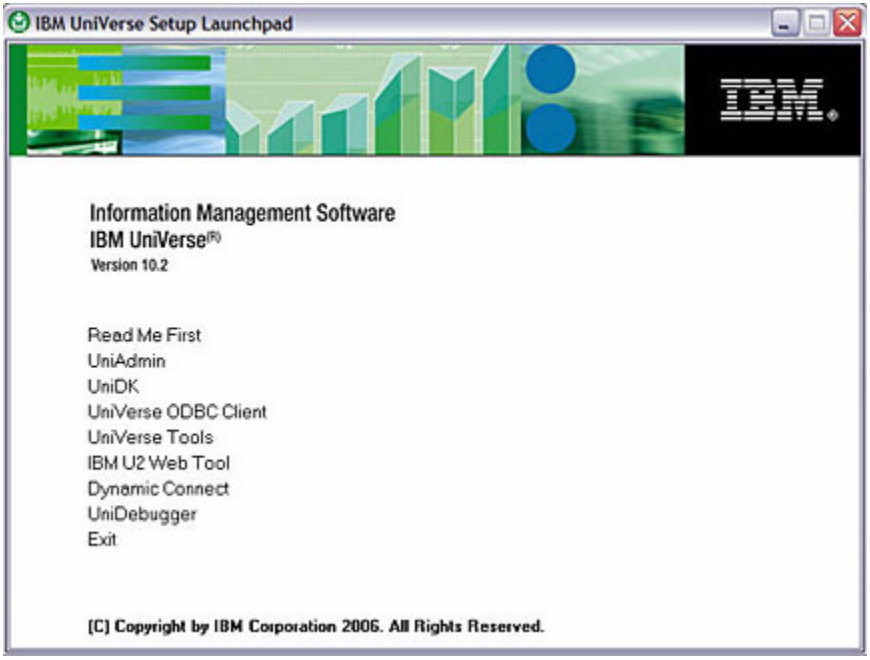
The XML/DB tool loads a DTD or XML Schema, validates the DTD or XML Schema, opens the associated data files, and produces an outline of the file structure. You can then map the DTD or XML Schema tags to the associated fields in the data file, and use this map with RetrieVe, UniVerse SQL, UniVerse BASIC, or the XMAP API.

Installing the XML/DB Tool

Complete the following steps to install the XML/DB tool.

1. Load the UniData Client CD

Place the UniData Client CD in your CD-Rom drive. The following menu appears:



From the menu **Select UniVerse Tools**. From the **Welcome** menu, click Next.

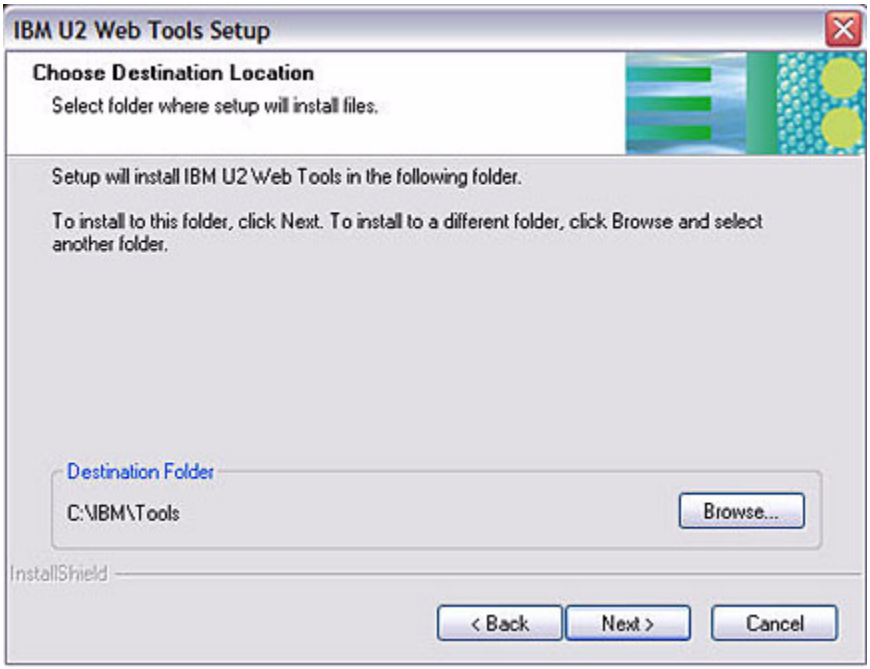
Review License Agreement

Review the license agreement. If you agree with the terms of the license agreement, select **I accept the terms of the license agreement**., and click **Next**.

If you do not accept the terms of the license agreement, select **I do not accept the terms of the license agreement** and exit the installation.

Choose Destination

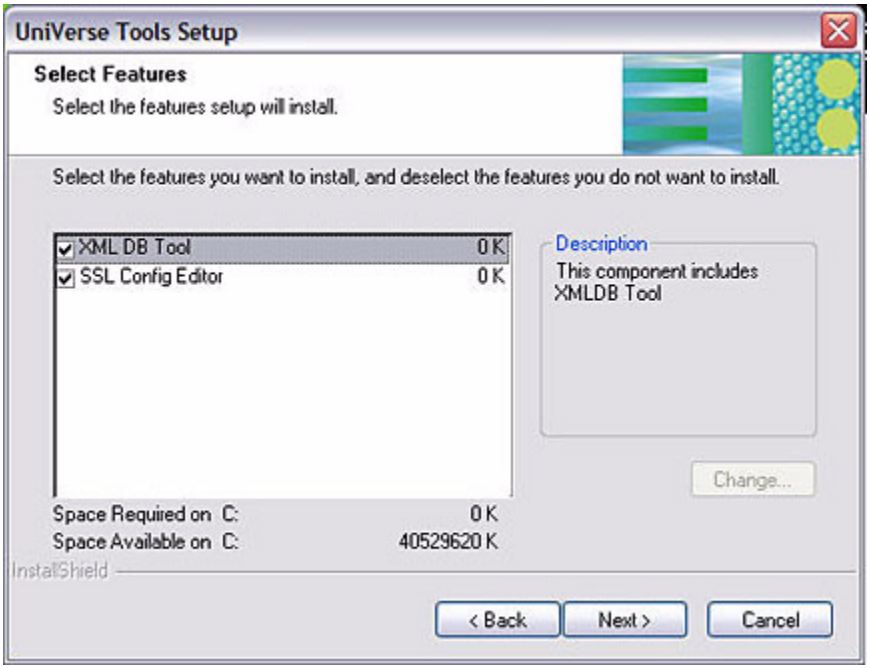
The **Choose Destination Location** dialog box appears, as shown in the following example:



By default, UniVerse installs the Web Tools in the C:\IBM\Tools directory. If you want to choose a different directory, click **Browse** and choose the directory where you want to install the Web Tools. Click **Next** to continue with the installation.

Select Components

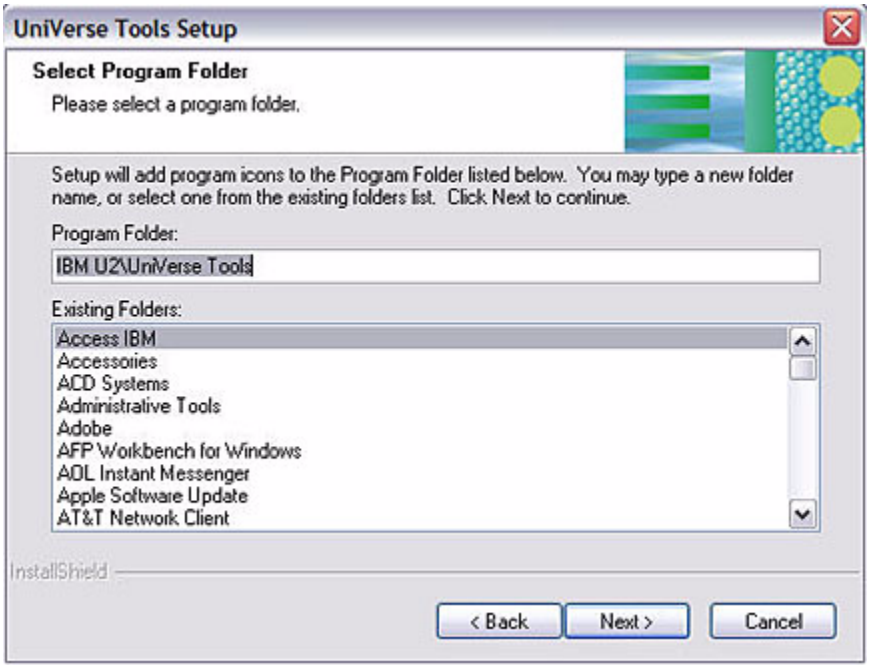
From the **Select Components** dialog box, select the components you want to install. At this release, the only components available are the XML/DB Tool and the SSL Config Editor. Make sure the XMLDBTool check box is selected, as shown in the following example:



Click **Next** to continue with the installation.

Select Program Folder

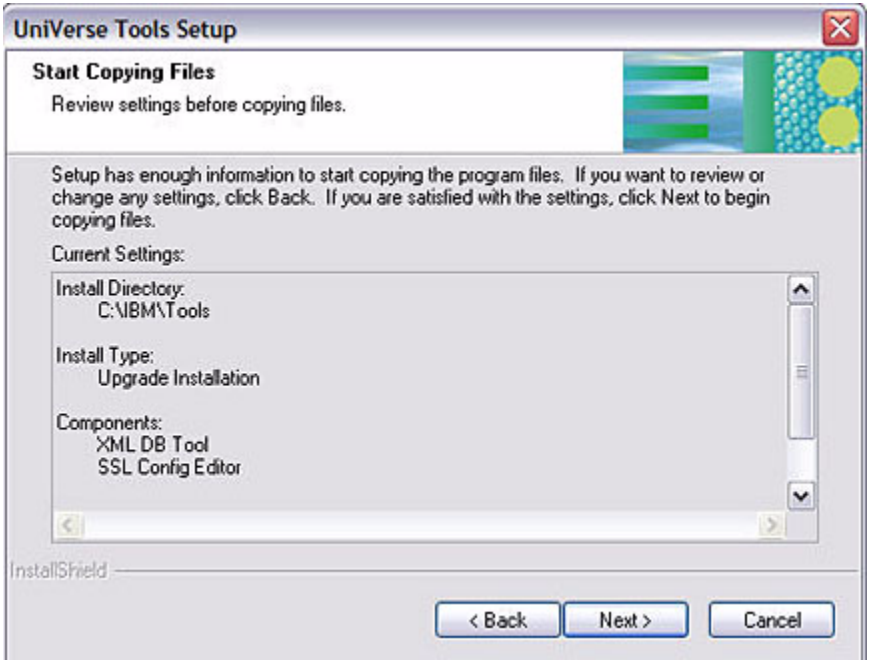
The installation next prompts you for a program folder for UniVerse Tools, as shown in the following example:



Enter the name of the program folder for UniVerse Tools if you do not want to accept the default, then click **Next** to continue the installation process.

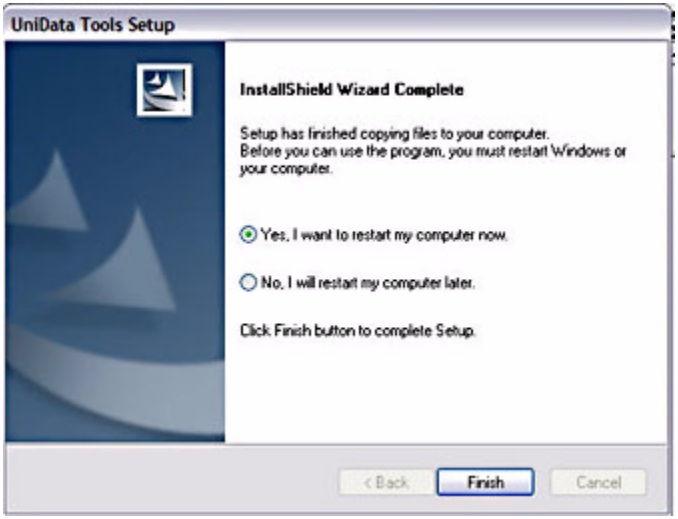
Copy Files

The installation process now has enough information to begin copying files, as shown in the following example. If you want to change any settings, click **Back**. Click **Next** to begin copying files.



Complete the Installation

Click **Finish**. You may want to restart your computer before you use the XML/DB tool. The installation process prompts if you want to restart your computer now or at a later time, as shown in the following example:



Choose when you want to restart your computer, then click **Finish**.

Create the DTD or XML Schema

The XML/DB Tool works with existing DTD or XML Schema files. You must create a DTD or XML Schema file before using the XML/DB mapping tool if one does not already exist. Use UniVerse SQL, UniVerse BASIC, or RetrieVe to create the file.

When you use the RetrieVe LIST statement or the UniVerse SQL SELECT statement, UniVerse creates an XML Schema or DTD if you specify TOXML and the TO keyword in the same statement. UniVerse writes the file to the &XML& directory, with an extension of .xsd for an XML schema file or .dtd for a DTD file.

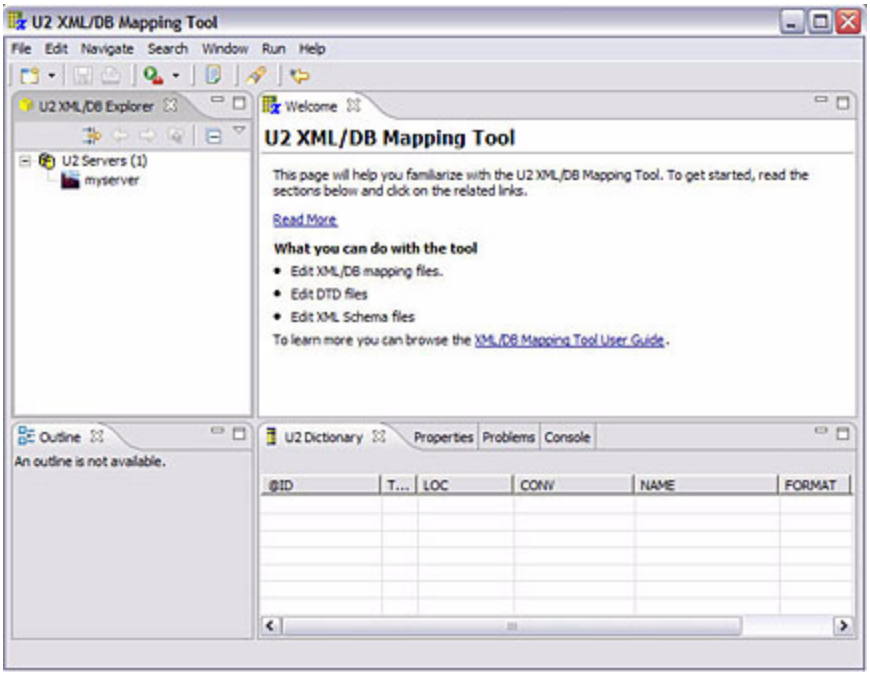
In the following example, UniVerse creates a STUDENT.xsd file in the &XML& directory:

```
:LIST STUDENT FNAME LNAME MAJOR MINOR ADVISOR TOXML WITHSCHEMA TO
STUDENT

:ED &XML& STUDENT.xsd
Top of "STUDENT.xsd" in "&XML&", 26 lines, 812 characters.
*--: p
001: <?xml version="1.0"?>
002: <xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
003:   <xsd:annotation>
004:   <xsd:documentation xml:lang="en">
005:     account: C:\IBM\ud61\Demo
006:     command: LIST STUDENT FNAME LNAME MAJOR MINOR ADVISOR
TOXML WITHSCHEMA
TO STUDENT
007:   </xsd:documentation>
008:   </xsd:annotation>
009:   <xsd:element name="ROOT">
010:     <xsd:complexType>
011:     <xsd:sequence maxOccurs="unbounded">
012:       <xsd:element ref="STUDENT" maxOccurs="unbounded"/>
013:     </xsd:sequence>
014:     </xsd:complexType>
015:   </xsd:element>
016:   <xsd:element name="STUDENT">
017:     <xsd:complexType>
018:     <xsd:attribute name="_ID"/>
019:     <xsd:attribute name="FNAME"/>
020:     <xsd:attribute name="LNAME"/>
021:     <xsd:attribute name="MAJOR"/>
022:     <xsd:attribute name="MINOR"/>
```

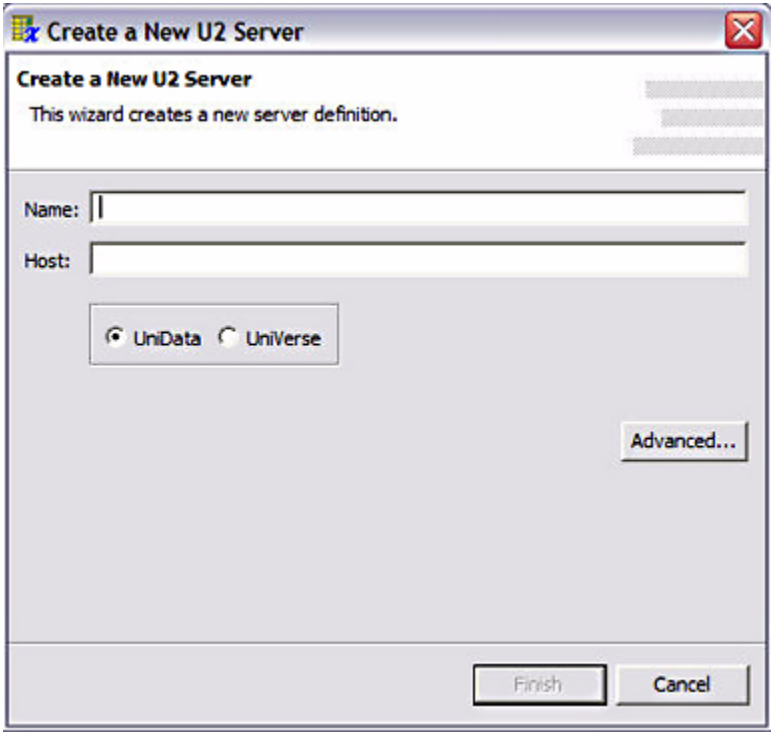
Using the XML/DB Tool

To start the XML/DB Tool, from the **Start** menu, select **Programs**, then select **IBM U2**, then select **UniVerse Tools**, then click **XMLDB Tool**. The following dialog box appears:



Create Server Definition

To establish a connection to a server, right-click **U2 Servers**, then click **New U2 Server**. The **Create New U2 Server** dialog box appears, as shown in the following example:

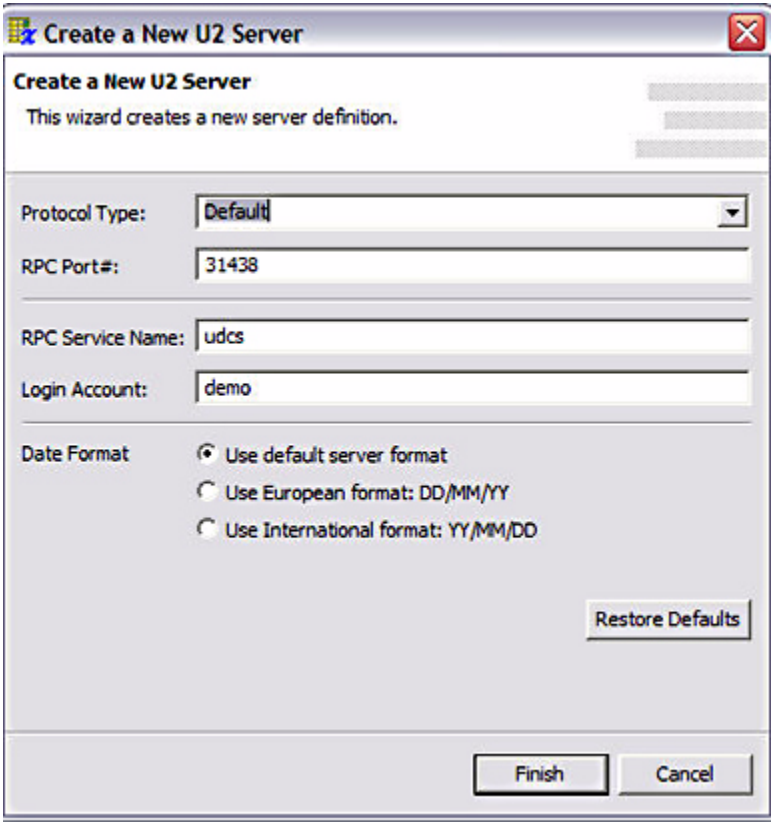


In the **Name** box, enter a unique name to identify the server. The name cannot contain a forward slash ("/") or a back slash ("\").

In the **Host** box, enter the hostname or IP address of the server.

In the **Database** box, select **UniData** or **UniVerse** as the underlying database you are using.

Click **Advanced** if you want to define the type of communication you are using, specify a port number that differs from default, define the RPC Service Name, or specify a login account. A dialog box similar to the following example appears:



In the **Transport Type** box, choose the type of communication you are using to the server. You can choose Default, TCP/IP, or Lan Manager. The default is TCP/IP.

In the **RPC Port#** box, enter the UniRPC port number.

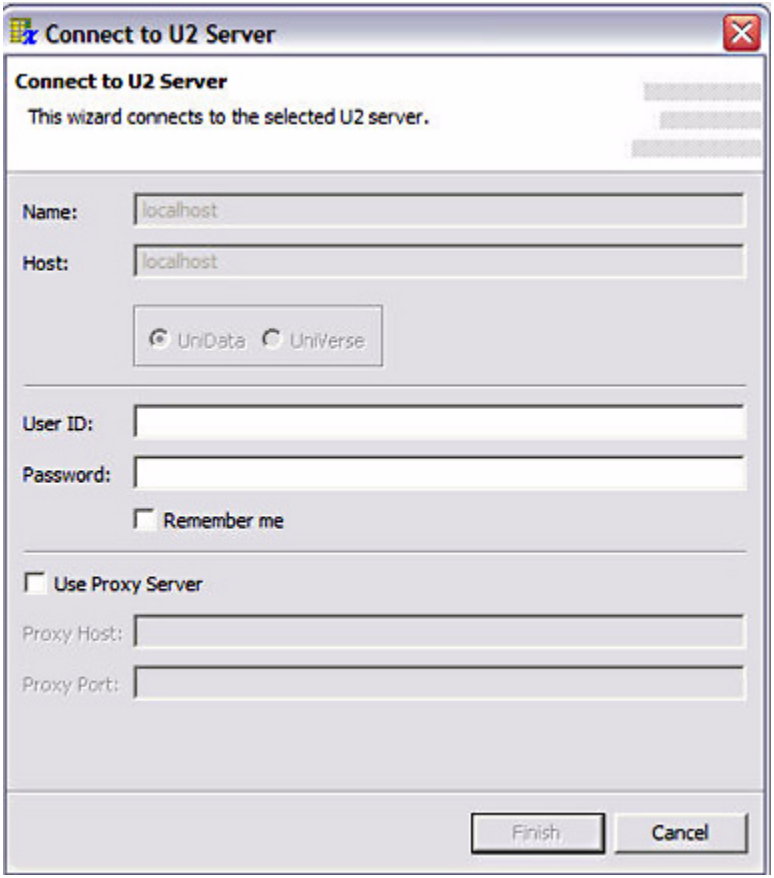
In the **RPC Service Name** box, enter the name of the RPC service you are using. The default service name is udcs for UniData, or uvcs for UniVerse.

Enter the name of the account to which you want to connect in the **Login Account** box.

Click **Finish** to register the server.

Connect to Server

To connect to a server, double-click the server to which you want to connect. A dialog box similar to the following example appears:

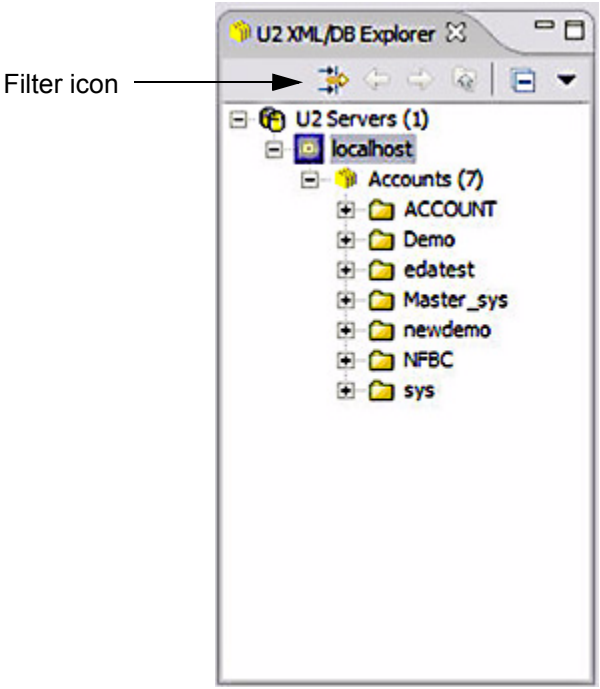


Enter your user ID and password in the appropriate boxes, then click **Finish**.

Once you connect to the server, the XML/DB Tool displays all available accounts, data files, DTD files, XMAP files, and XSD files, as shown in the following example:

Filtering Accounts

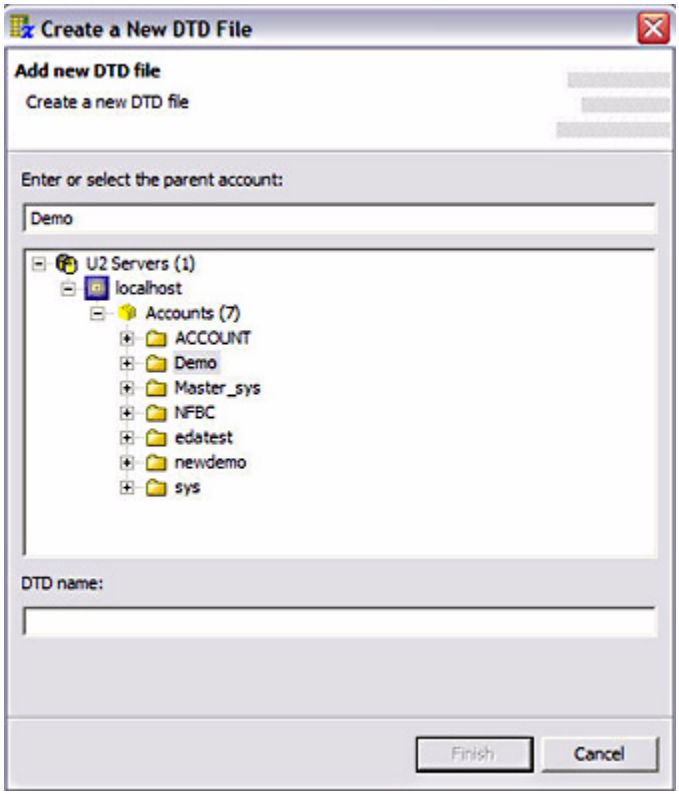
You can filter the accounts that are available in the XML/DB tool. To filter accounts, select the **Filter** icon, as shown in the following example:



Creating a DTD

Use the DTD File wizard to create a new DTD. To display an existing DTD, double-click the file you want to display in the **U2 XML/DB Explorer** area.

To access the file wizard, expand the account where you want to create the DTD, then right-click **DTD Files**. The **Create** a **New DTD File** dialog box appears, as shown in the following example:



In the **DTD name** box, enter the name of the DTD, then click **Finish**.

Enter the DTD in the dialog box. The following example illustrates a DTD.

```
<?xml version="1.0"?>
<!DOCTYPE ROOT[
<!ELEMENT ROOT (CUSTOMER*)>
<!ELEMENT CUSTOMER ( ADDRESS_MV* )>
<!ATTLIST CUSTOMER
        _ID CDATA #REQUIRED
        NAME CDATA #IMPLIED
        STATE CDATA #IMPLIED
>
<!ELEMENT ADDRESS_MV  EMPTY>
<!ATTLIST ADDRESS_MV
        ADDRESS CDATA #IMPLIED
>
]>
```

The XML/DB tool automatically validates the DTD. Click the **Problems** tab to view any problems detected with the DTD, as shown in the following example:

Dictionary | Properties | Problems | Console

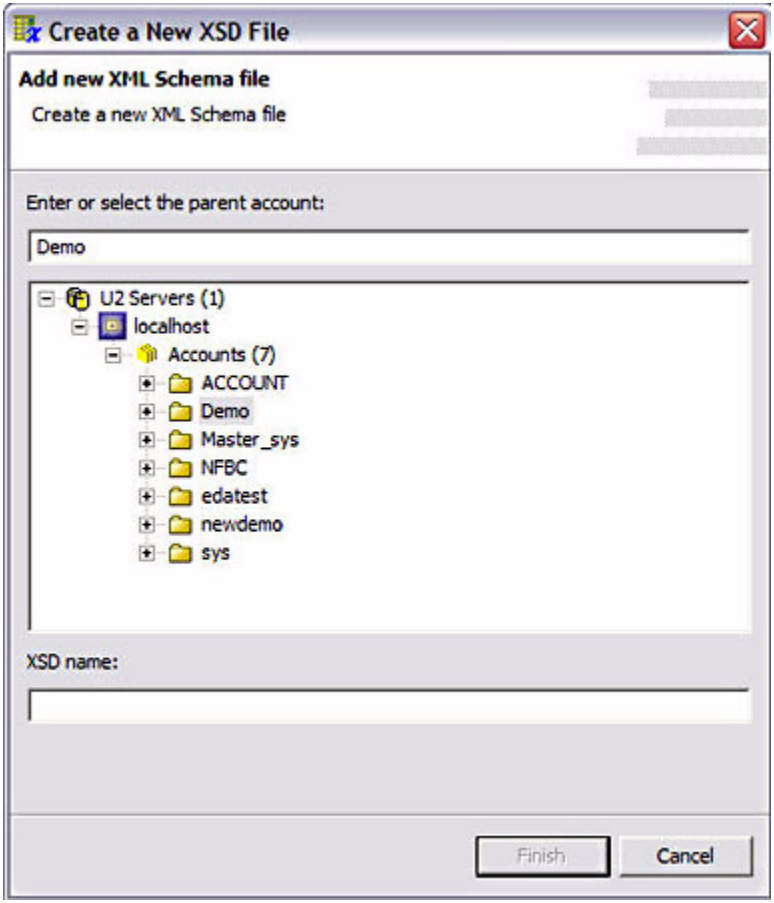
tdtd.dtd (1 problems/infos)

Description	Resource	In Folder	Location
Illegal character in input stream: 91	testdtd.dtd	localhost / Demo / DTD Files	line 1

Creating or Displaying an XML Schema

Use the XSD File wizard to create a new XML Schema or display an existing XML Schema. To display an existing XML Schema, double-click the file you want to display in the Account Explorer area.

To access the file wizard, expand the account where you want to create the XML Schema, then right-click **XSD Files,** then click **New XSD File**. The **Create** a **New XSD File** dialog box appears, as shown in the following example:



In the **XSD name** box, enter the name of the XSD. Enter the XML schema in the dialog box that appears, as shown in the following example:

```
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">


<xsd:element name="ROOT">
  <xsd:complexType>
    <xsd:sequence>
        <xsd:element ref="CLASS" minOccurs='1' maxOccurs='unbounded'/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

<xsd:element name="CLASS">
  <xsd:complexType>
    <xsd:sequence>
        <xsd:element ref="STUDENT" minOccurs='1' maxOccurs='unbounded'/>
    </xsd:sequence>
    <xsd:attribute name="ClassID" type="xsd:string"/>
  </xsd:complexType>
</xsd:element>


<xsd:element name="STUDENT">
```

The XML/DB tool automatically validates the XML Schema. Click the **Problems** tab to view any problems detected with the XML Schema, as shown in the following example:

U2 Dictionary | Properties | Problems | Console

STUDENT.XSD (1 problems/infos)

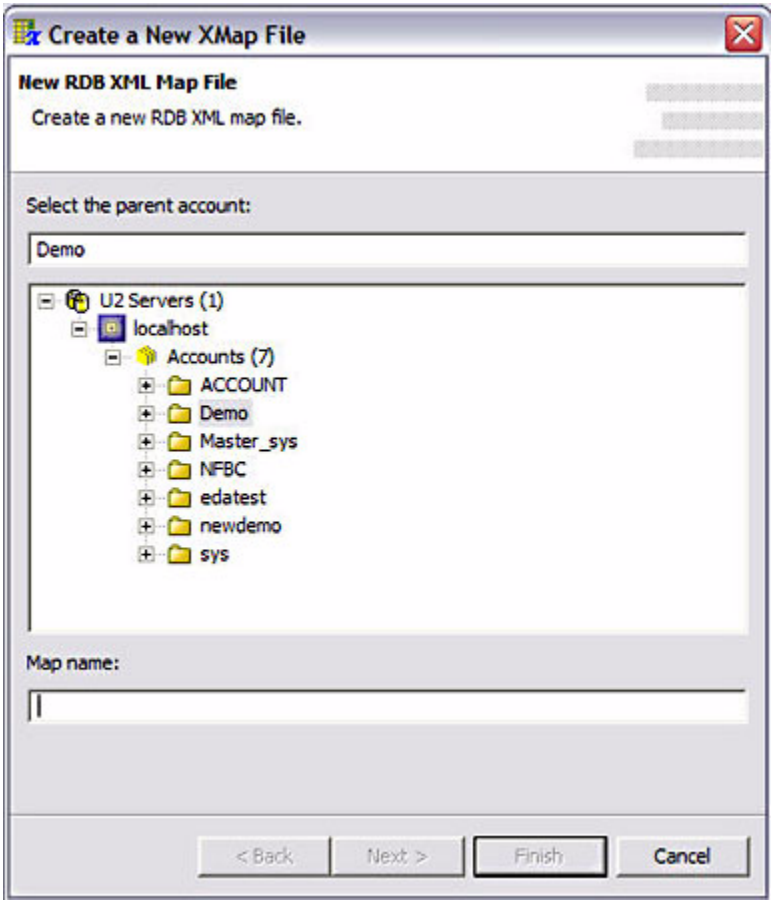
Description	Resource	In Folder	Location
XML document structures must start and end within the same entity.	STUDENT.XSD	localhost / Demo / XSD Files	line 50

Create a Mapping File

The XML/DB Tool enables you to create a new XML mapping file based on an existing DTD or XML Schema file. Creating an XML mapping file includes the following steps:

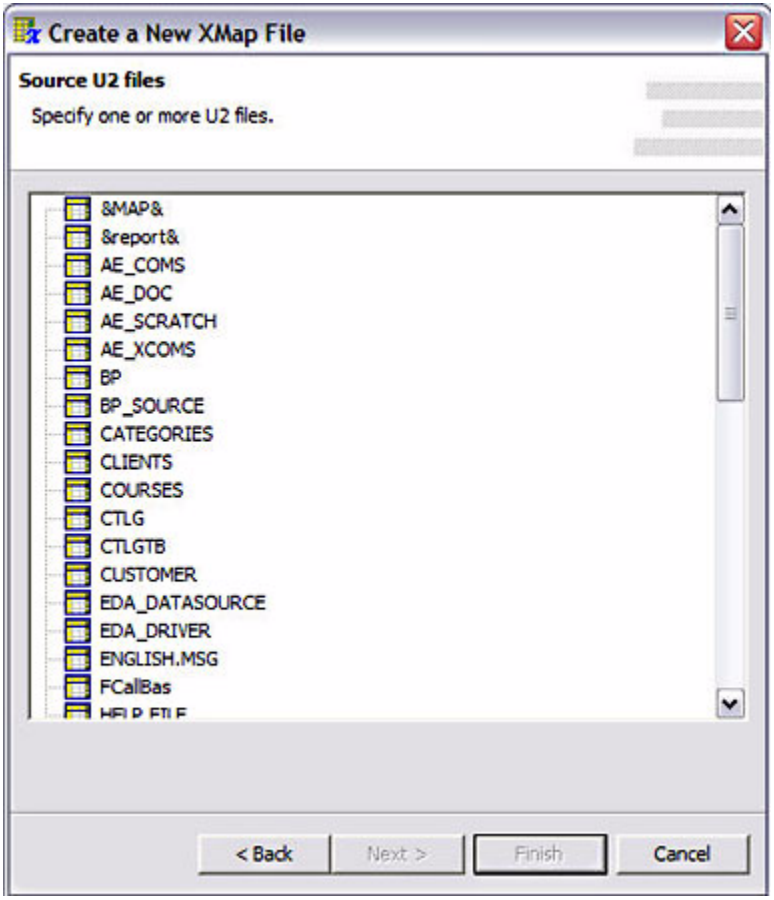
- Select the target account
- Specify the XMap file name
- Select the data files
- Select the DTD or XSD file
- Specify the root element

To create a new mapping file, expand the account where you want to create the XML Schema, then right-click **XMap Files,** then click **New XMap File**. The **Create** a **New XMap File** dialog box appears, as shown in the following example:

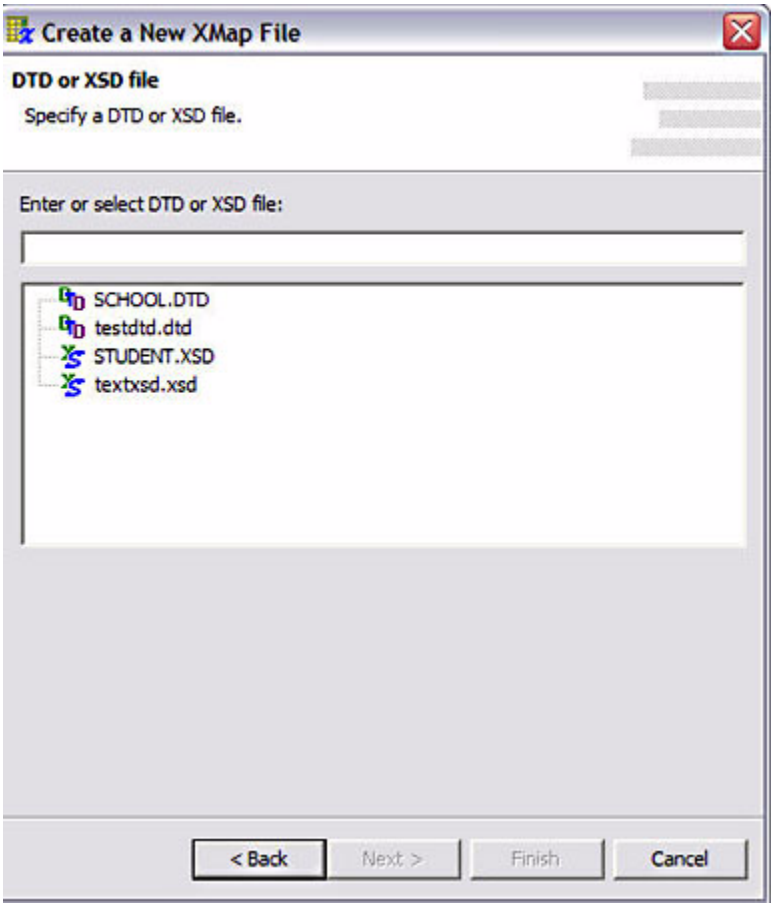


In the **Map name** box, enter the name for the XMap, then click **Next**.

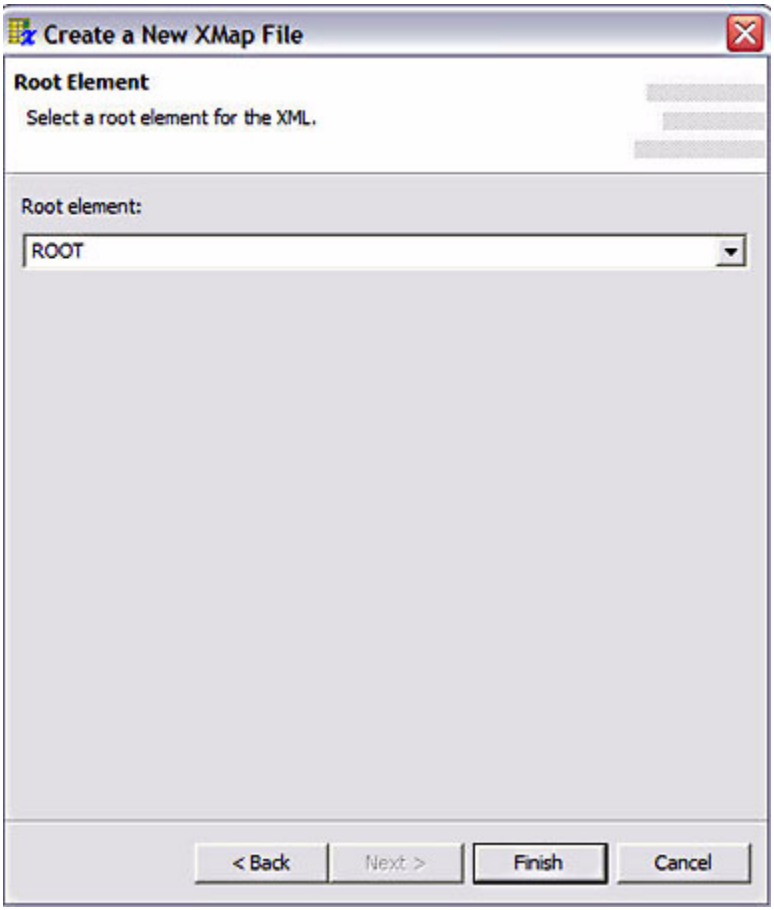
The **Source U2 files** dialog box appears, as shown in the following example:



Select one or more files for which you want to create a map from the DTD or XSD file, then click **Next**. A dialog box similar to the following example appears:

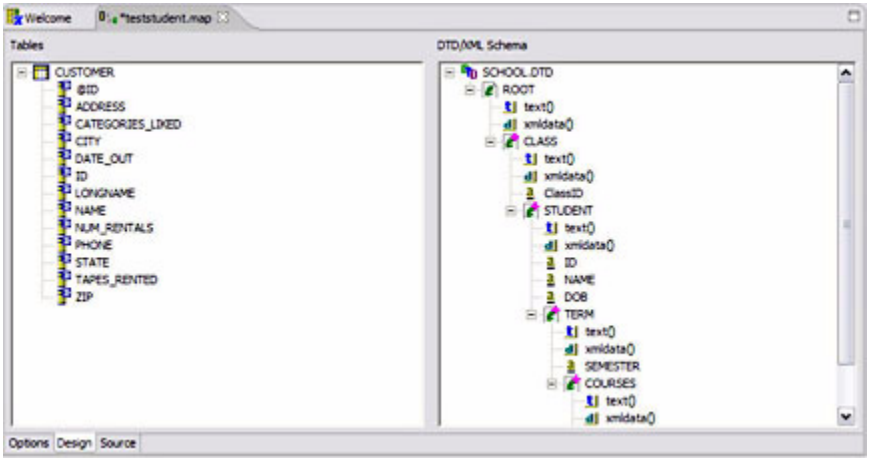


Select the DTD or XSD file for which you want to create a mapping file, then click **Next**. The **Root Element** dialog box appears, as shown in the following example:



In the **Root Element** box, select the name of the root element in the DTD or XSD file, then click **Finish**.

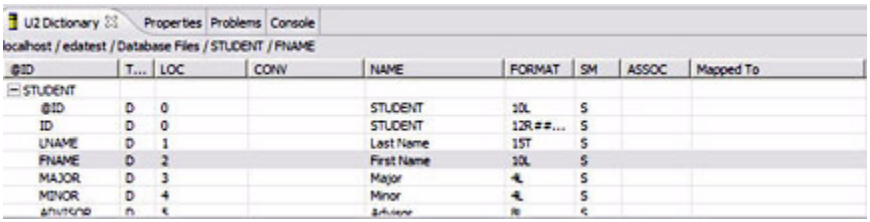
The Mapping Editor appears, as shown in the following example:



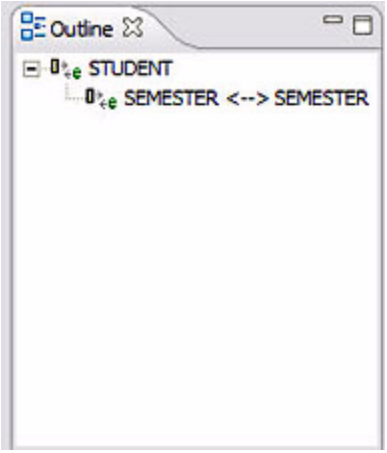
The names of the dictionary records for the file you specified appear in the **Tables** area of the editor. The elements of the DTD or XML Schema file you specified appear in the **DTD/XML Schema** area.

Create Relationship

To create a relationship between a dictionary item and a DTD or XML Schema element, click the dictionary record name. Detailed information about the dictionary records appears in the **U2 Dictionary** area, as shown in the following example:



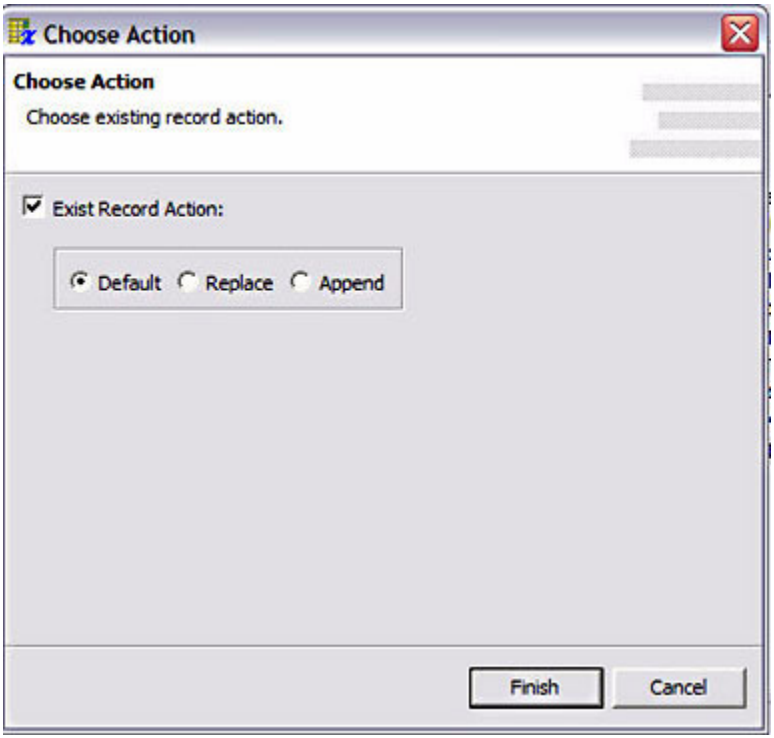
Right-click the element that corresponds to the dictionary item in the **DTD/XML Schema** area, then click **Create Mapping**. Arrows appear next to the items you selected for mapping, and the mapping relationship appears in the **Outline** area of the dialog box, as shown in the following example:



If you want to remove the mapping relationship, right-click the mapping definition in the **DTD/XML Schema** area, then click **Remove Mapping**.

Mapping All Matching Elements

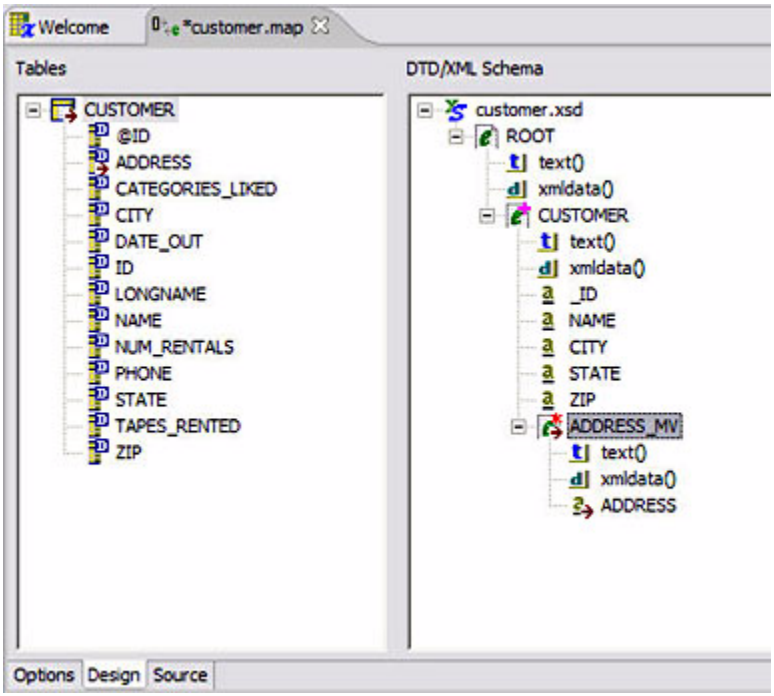
If you want to map all dictionary items that have a matching element name, click the file name in the **Tables** area of the dialog box, right-click the appropriate element in the **DTD/XML Schema** area, then click **Match Mapping**. The XML/DB tool prompts you to select how you want to update the database if a record in the XML document already exists in the database, as shown in the following example:



Following are the choices if a record already exists in the database:

- **Default** – If the record already exists in the database, do not update it.
- **Replace** – Replace the data in the existing record with the data from the XML document.
- **Append** – In the case of a multivalued field, append the new value to the existing multivalued field. If you have duplicate data, do not use the Append option, as the multivalued field may be updated with duplicate data.

Click **Finish**. The XML/DB Tool maps all like elements, as shown in the following example:



Mapping to Multiple UniVerse Files

You can map an XML document to multiple UniVerse files.

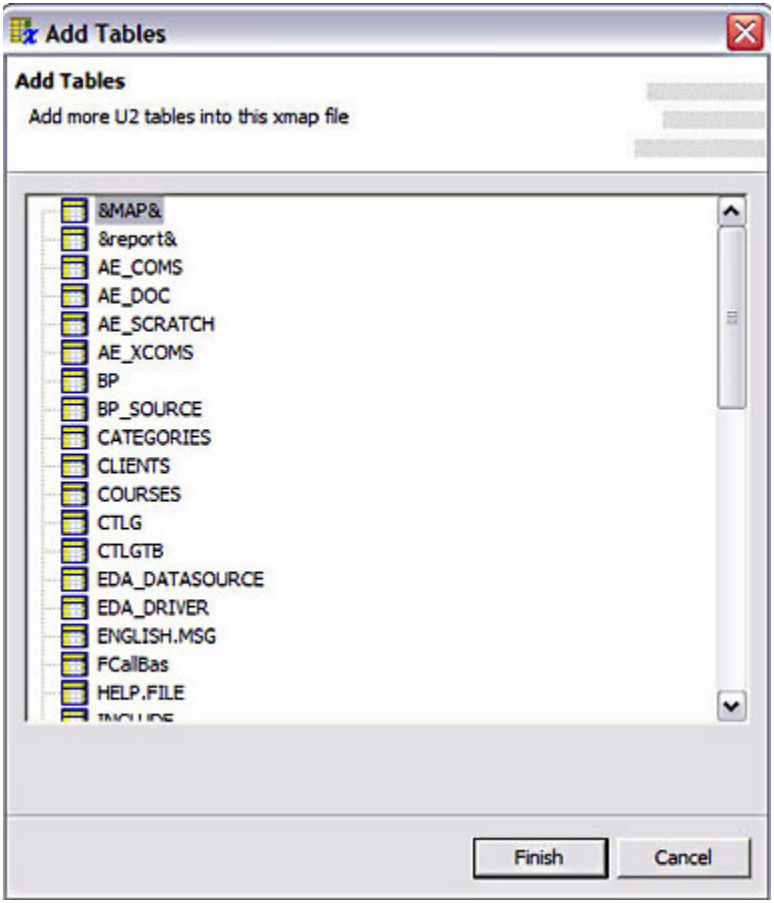
Choose on the following methods to access the **Add Tables** dialog box:

- From the Mapping Editor, from the **XML/DB** menu, click **Add Tables**.
- Click the Add Tables icon from the toolbar, as shown in the following example:

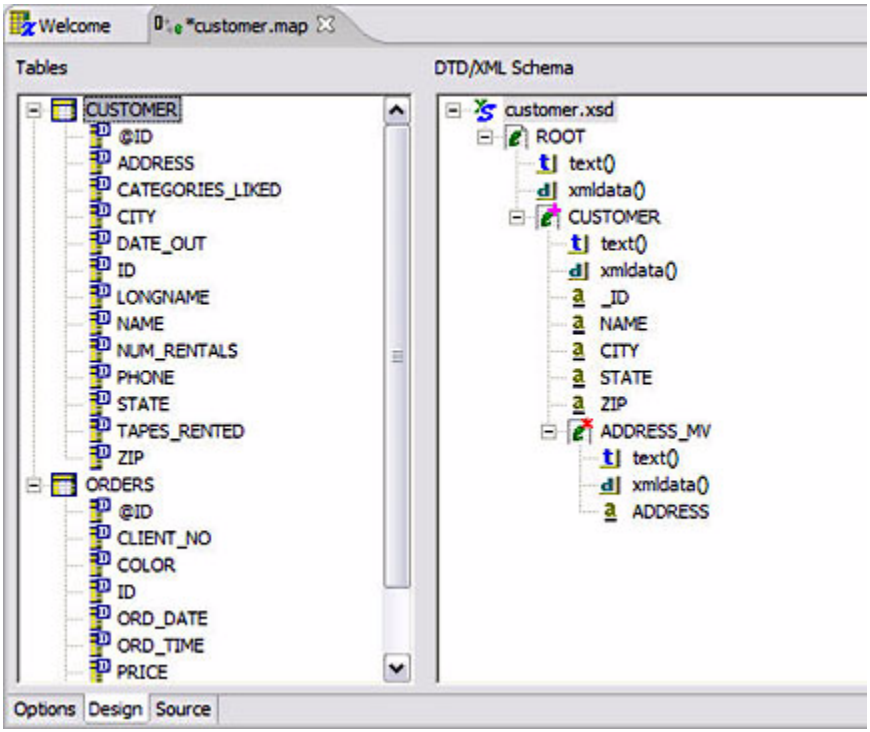
Add Tables Icon

- Right-click an existing table in the **Tables** portion of the XML/DB Mapping Tool, then click **Add Tables**.

The **Source U2 files** dialog box appears, as shown in the following example:



Click the tables you want to add to the mapping file, then click **Finish**. The new table is now added to the mapping editor, as shown in the following example:



Defining Related Tables

If you are mapping more than three levels of data, you must map the data to more than one UniData file, since a UniData file can support no more than three levels of data.

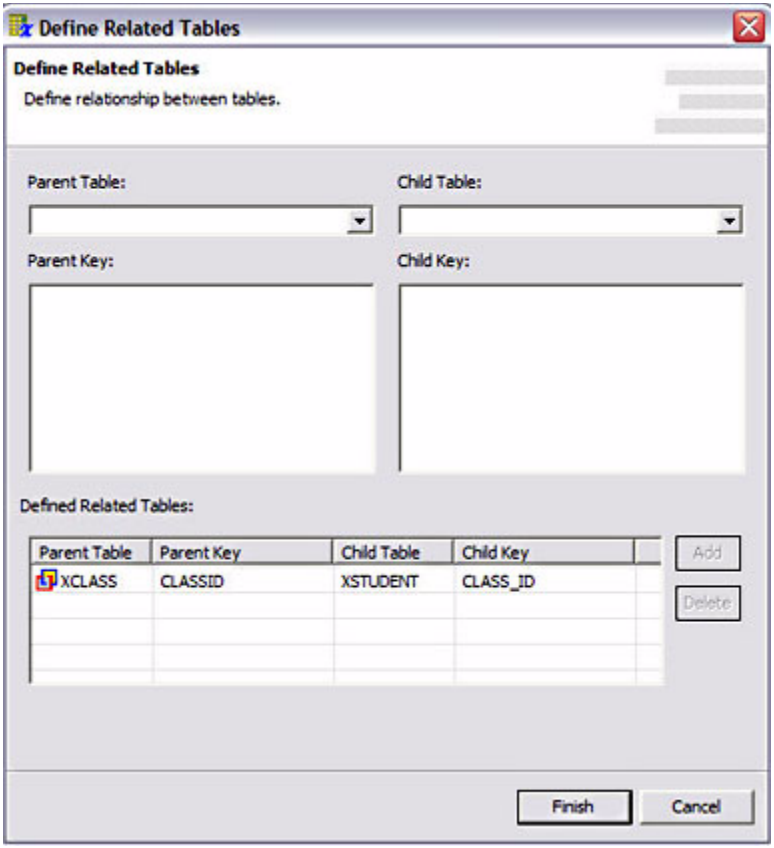
Choose on the following methods to access the **Define Related Tables** dialog box:

- From the Mapping Editor, from the **XML/DB** menu, click **Define Related Tables**.

- Click the **Define Related Tables** icon from the toolbar, as shown in the following example:

- Right-click an existing table in the **Tables** portion of the XML/DB Mapping Tool, then click **Define Related Table**.

The **Define Related Tables** dialog box appears, as shown in the following example:



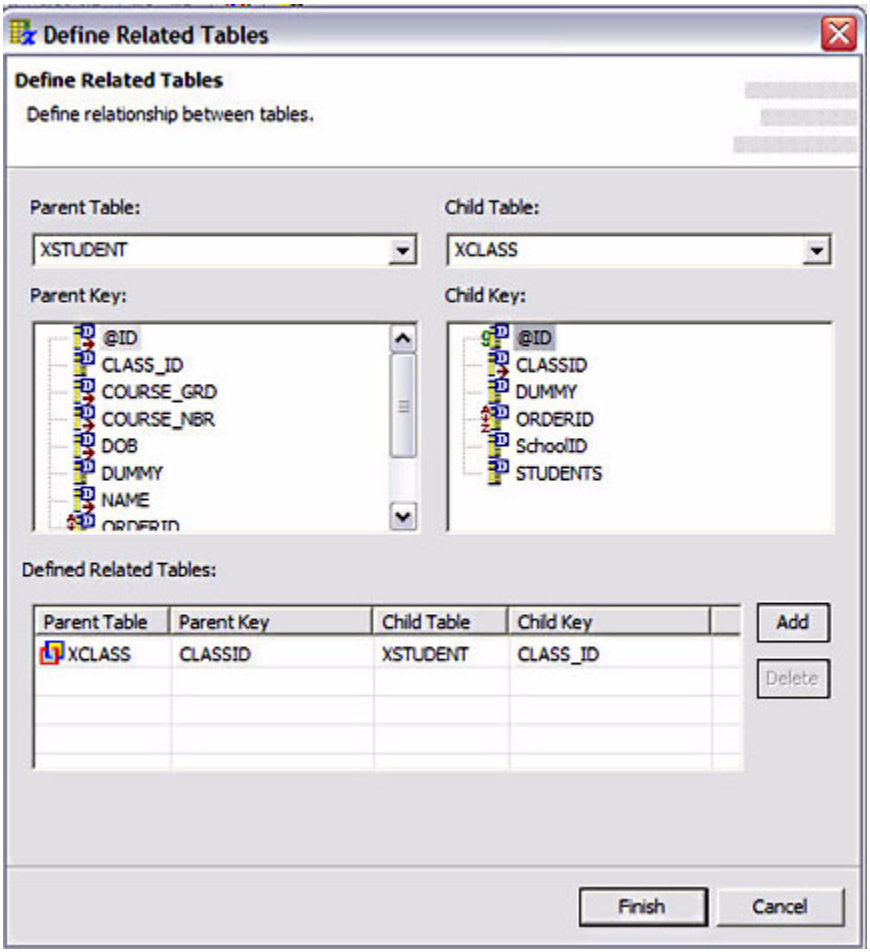
In the **Parent Table** box, select the parent table. The parent table is the file corresponding to the top portion of the XML subtree being transformed.

In the **Parent Key** area, click the dictionary item that represents the primary key for the parent table.

In the **Child Table** box, select the child table of the parent table.

In the **Child Key** box, click the dictionary item that represents the primary key for the child table.

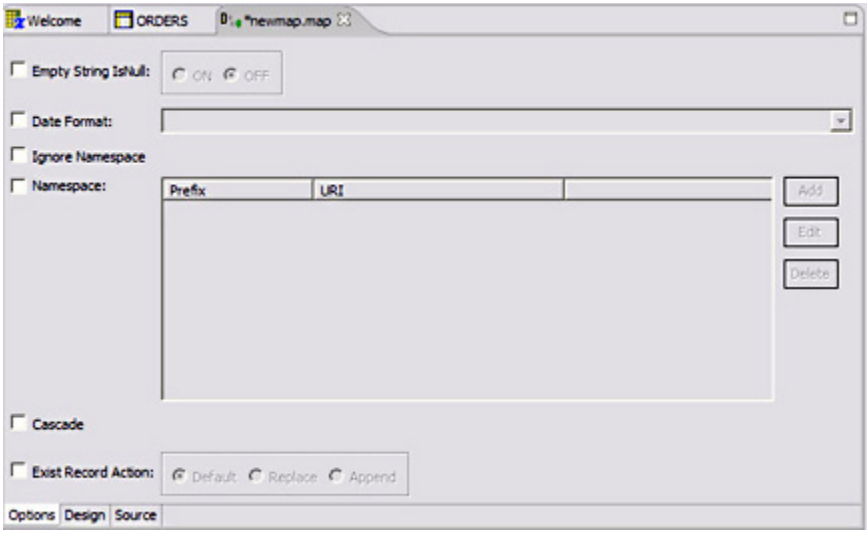
Click **Add**. The **Define Related Tables** area is now populated, as shown in the following example:



Click **Finish** to save the definition, or click **Cancel** to exit without saving changes.

Options

From the Mapping Editor, click the **Options** tab. A dialog box similar to the following example appears:



Define How to Treat Empty Strings

If you select the **Empty String is Null** check box and click ON, when the value of an optional XML element is omitted, the corresponding database field value is set to NULL, otherwise it is considered missing. Similarly, when a database field value is NULL and you select ON, the corresponding value of an optional XML element is omitted, otherwise it is set to an empty string.

Define Date Format

Data Format is a conversion code UniVerse uses to perform the ICONV()/OCONV() function when getting the data from the XML document or creating the XML document. This code can be any conversion code understood by UniVerse. You can also use the value of “XMLFormat” which converts the data into a standard data format for the XML document, or takes the standard XML date format (yyyy-mm-dd).

Specify How to Treat Namespace

If you select the **Ignore Namespace** check box, UniVerse ignores all the Namespace information. This option applies when converting the XML document to the UniVerse database.

Define Namespace

Namespace elements are not required. If they are used, the same URI or prefix cannot be used more than once. Zero-length prefixes ("") are not currently supported.

If you do not define a Prefix, UniVerse uses the Default Name space, used only for generating the XML document. In this case, UniVerse puts a default NameSpace in the output document.

Define Cascade Rules

This option only applies when an XML document is mapped to more than one UniVerse file. By default, the cascade mode is off, which means that the system takes care of the parent-child record relationship according to the ReleatedTable rules described in the U2XMAP file. Setting the cascade mode ON allows you to control the parent-child record relationship. When the cascade mode is ON, once the current parent table record is established, all child table records that are either read from or written to the child table are associated with the current parent table record. This affords you the freedom of associating parent and child table records the way you see fit.

Choose How To Treat Existing Records

Following are the choices if a record already exists in the database:

- **Default** – If the record already exists in the database, do not update it.
- **Replace** – Replace the data in the existing record with the data from the XML document.
- **Append** – In the case of a multivalued field, append the new value to the existing multivalued field. If you have duplicate data, do not use the Append option, as the multivalued field may be updated with duplicate data.

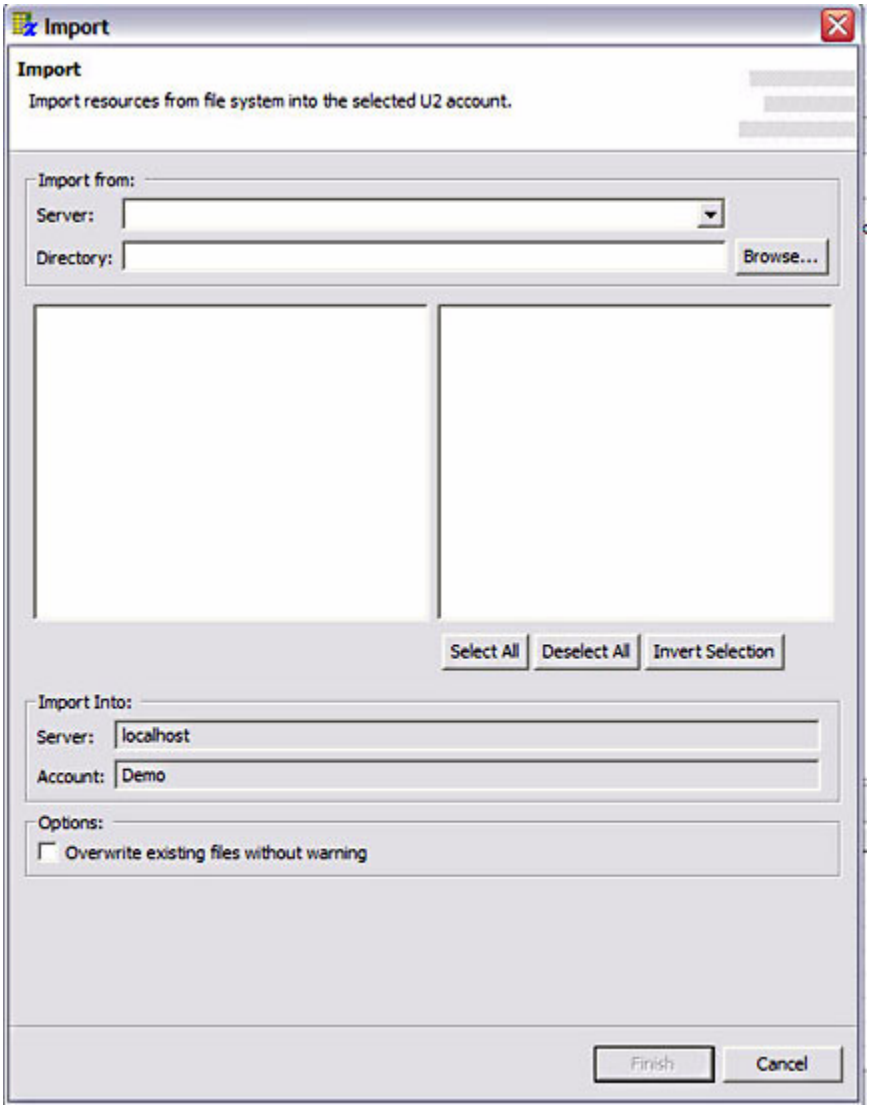
For detailed information about the mapping file, see Appendix B, "The U2XMAP File."

Importing and Exporting Mapping Files

You can import a mapping file, DTD, or XSD from another system-level directory to your account, or export a mapping file to another system-level account.

Importing a Mapping File

To import an operating system-level mapping file, right-click **XMap Files**, then click **Import**. The **Import** dialog box appears, as shown in the following example:



From the **Import From** area, in the **Server** box, enter the name of the server where the mapping file resides.

In the **Directory** box, enter the full path to the location of the mapping file, or click **Browse** to search for the location.

In the **Import Into** area, in the **Server** box, enter the name of the server where you want to write the mapping file.

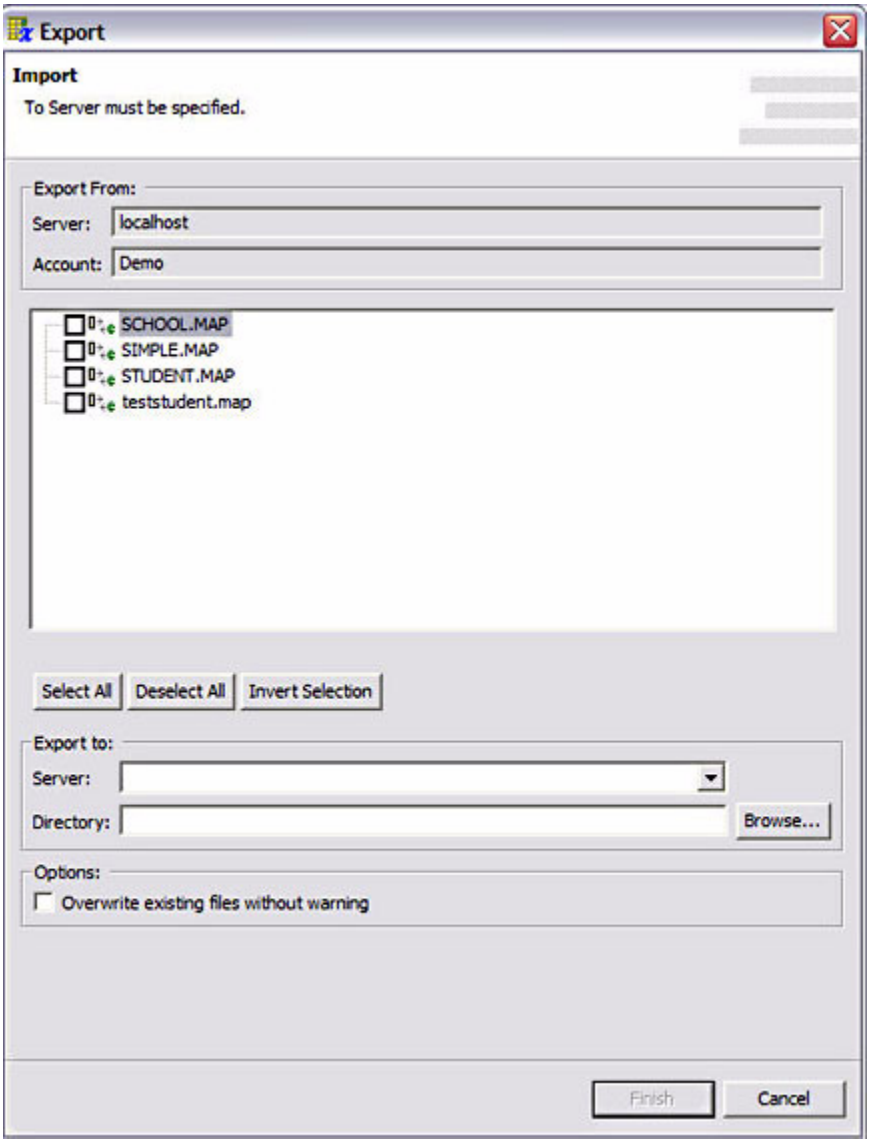
In the **Account** area, enter the name of the account where you want the mapping file to reside, or click **Browse** to search for the account.

Select the **Overwrite existing files without warning** check box if you want to overwrite a mapping file of the same name that may exist in the target account.

Click **Finish** to import the mapping file.

Exporting a Mapping File

To export a mapping file, right-click **XMap Files**, then click **Export**. The **Export** dialog box appears, as shown in the following example:



From the **Export From** area, in the **Server** box, where the mapping file resides.

In the **Account** box, enter the full path to the location of the mapping file, or click **Browse** to search for the location.

In the **Export To** area, in the **Server** box, enter the name of the server where you want to write the mapping file.

In the **Directory** area, enter the name of the account where you want the mapping file to reside at the operating-system level, or click **Browse** to search for the account.

Select the **Overwrite existing files without warning** check box if you want to overwrite a mapping file of the same name that may exist in the target account.

Click **Finish** to import the mapping file.

XML/DB Tool Logging

To enable logging with the XML/DB Tool, create an empty record in the VOC file of the UV account you are using the XML/DB Tool called XTOOLDBG prior to initializing an XML/DB Tool session.

The log file captures output from the XML/DB Tool to the client, and output from the client to the XML/DB Tool, along with the time logging started, and any error codes sent to the client.

The log file, located in the /tmp directory on UNIX platforms and the C:\tmp directory on Windows platforms, has the format XTOOLSUB_*dddd_ttttt*.log, where *dddd* is the internal date stamp and ttttt is the internal time stamp. If the /tmp or C:\tmp directory does not exist, you must create it prior to initializing logging.

Appendix

A

MQSeries API for UniData and UniVerse Reason Codes

This appendix describes the MQSeries Application Program Interface Reason Codes.

Reason Code Number	Reason Code Name	Description
0	AMRC_NONE	The request was successful with no error or warning required.
1	AMRC_UNEXPECTED_ERR	An unexpected error occurred.
2	AMRC_INVALID_Q_NAME	The specified queue name was too long, or contained invalid characters.
3	AMRC_INVALID_SENDER_NAME	The specified sender service name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”
4	AMRC_INVALID_RECEIVER_NAME	The specified receiver service name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”
5	AMRC_INVALID_PUBLISHER_NAME	The specified publisher service name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”
6	AMRC_INVALID_SUBSCRIBER_NAME	The specified subscriber name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”
7	AMRC_INVALID_POLICY_NAME	The specified policy name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”
8	AMRC_INVALID_MSG_NAME	The specified message name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”

MQSeries API Reason Codes

Reason Code Number	Reason Code Name	Description
9	AMRC_INVALID_SESSION_NAME	The specified session name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”
10	AMRC_INVALID_DIST_LIST_NAME	The specified distribution list name was too long, contained invalid characters, or used the reserved prefix “SYSTEM.”
11	AMRC_POLICY_HANDLE_ERR	Reserved for future use.
12	AMRC_SERVICE_HANDLE_ERR	The service handle specified for a sender, receiver, distribution list, publisher, or subscriber was not valid.
13	AMRC_MSG_HANDLE_ERR	The specified message handle was not valid.
14	AMRC_SESSION_HANDLE_ERR	The specified session handle was not valid.
15	AMRC_BROWSE_OPTIONS_ERR	The specified browse options value was not valid or contained an invalid combination of options.
16	AMRC_INSUFFICIENT_MEMORY	There was not enough memory available to complete the requested operation.
17	AMRC_WAIT_TIME_READ_ONLY	An attempt was made to set the wait time in a policy object for which the wait-time was read-only.
18	AMRC_SERVICE_NOT_FOUND	The specified (sender, receiver, distribution list, publisher, or subscriber) service was not found, so the request was not carried out.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
19	AMRC_MSG_NOT_FOUND	The specified message ws not found, so the request was not carried out.
20	AMRC_POLICY_NOT_FOUND	The specified policy was not found, so the request was not carried out.
21	AMRC_SENDER_NOT_UNIQUE	The specified name could not be resolved to a unique sender because more than one sender object with that name exists.
22	AMRC_RECEIVER_NOT_UNIQUE	The specified name could not be resolved to a unique receiver because more than one receiver object with that name exists.
23	AMRC_PUBLISHER_NOT_UNIQUE	The specified name could not be resolved to a unique publisher because more than one publisher object with that name exists.
24	AMRC_SUBSCRIBER_NOT_UNIQUE	The specified name could not be resolved to a unique subscriber because more than one subscriber object with that name exists.
25	AMRC_MSG_NOT_UNIQUE	The specified name could not be resolved to a unique message because more than one message object with that name exists.
26	AMRC_POLICY_NOT_UNIQUE	The specified name could not be resolved to a unique policy because more than one policy with that name exists.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
27	AMRC_DIST_LIST_NOT_UNIQUE	The specified name could not be resolved to a unique distribution list because more than one distribution list with that name exists.
28	AMRC_RECEIVE_BUFF_PTR_ERR	The buffer pointer specified for receiving data was not valid.
29	AMRC_RECEIVE_BUFF_LEN_ERR	The buffer length specified for receiving data was not valid.
30	AMRC_SEND_DATA_PTR_ERR	The buffer pointer specified for sending data was not valid.
31	AMRC_SEND_DATA_LEN_ERR	The data length specified for sending data was not valid.
32	AMRC_INVALID_IF SERVICE_OPEN	The requested operation could not be performed because the specified service (sender, receiver, publisher, or subscriber) was open.
33	AMRC_SERVICE_ALREADY_OPEN	The session was already closed (or terminated).
34	AMRC_DATA_SOURCE_NOT_UNIQUE	Message data for a send operation was passed in an application data buffer or a file, and was also found in the specified message object. Data to be sent can be included in an application buffer or a message object, but not both. Similarly, data can be included in a file or a message object, but not both. If data is sent in an application buffer or file, the message object can be reset first to remove existing data.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
35	AMRC_NO_MSG_AVAILABLE	No message was available for a receive request after the specified wait time.
36	AMRC_SESSION_ALREADY_OPEN	The session was already open (or initialized).
37	AMRC_SESSION_ALREADY_CLOSED	The session was already closed (or terminated).
38	AMRC_ELEM_NOT_FOUND	The specified element was not found.
39	AMRC_ELEM_COUNT_PTR_ERR	The specified element count pointer was not valid.
40	AMRC_ELEM_NAME_PTR_ERR	The specified element name pointer was not valid.
41	AMRC_ELEM_NAME_LEN_ERR	The specified element name length value was not valid.
42	AMRC_ELEM_INDEX_ERR	The specified element index value was not valid.
43	AMRC_ELEM_PTR_ERR	The specified element pointer was not valid.
44	AMRC_ELEM_STRUC_ERR	The specified element structure was not valid. The structure id, version, or a reserved field contained an invalid value.
45	AMRC_ELEM_STRUC_NAME_ERR	At least one of the name (length and pointer) fields in the specified element structure was not valid. Ensure that the name length, pointer, and name string are valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
46	AMRC_ELEM_STRUC_VALUE_ERR	At least one of the value (length and pointer) fields in the specified element structure was not valid. Ensure that the value length, pointer, and value string are valid.
47	AMRC_ELEM_STRUC_NAME_BUFF_ ERR	At least one of the name buffer (length and pointer) fields in the specified element structure was not valid.
48	AMRC_ELEM_STRUC_VALUE_BUFF_ ERR	At least one of the value buffer (length and pointer) fields in the specified structure was not valid.
49	AMRC_TRANSPORT_ERR	An error was reported by the underlying (MQSeries) message transport layer. The message transport reason code can be obtained by the secondary reason code value returned from a “GetLastError” request for the AMI object concerned.
50	AMRC_TRANSPORT_WARNING	A warning was reported by the underlying (MQSeries) message transport layer. The message transport reason code can be obtained by the secondary reason code value returned from a “GetLastError” request for the AMI object concerned.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
51	AMRC_ENCODING_INCOMPLETE	The message contains mixed values for integer, decimal, and floating point encodings, one or more of which are undefined. The encoding value returned to the application reflects only the encoding values that were defined.
52	AMRC_ENCODING_MIXED	The message contains mixed values for integer, decimal, and floating point encodings, one or more of which conflict. An encoding value of undefined was returned to the application.
53	AMRC_ENCODING_ERR	The specified encoding value was not valid.
54	AMRC_BEGIN_INVALID	The begin request was not valid because there were no participating resource managers registered.
55	AMRC_NO_REPLY_TO_INFO	A response sender service specified when attempting to receive a request message was not updated with reply-to information because the request message contained no reply-to information. An attempt to send a reply message using the response send will fail.
56	AMRC_SERVICE_ALREADY_CLOSED	The specified (sender, receiver, distribution list, publisher, or subscriber) service was already closed).
57	AMRC_SESSION_NOT_OPEN	The request failed because the session was not open.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
58	AMRC_DIST_LIST_INDEX_ERR	The specified distribution list index value was not valid.
59	AMRC_WAIT_TIME_ERR	The specified wait-time value was not valid.
60	AMRC_SERVICE_NOT_OPEN	The request failed because the specified (sender, receiver, distribution list, publisher, or subscriber) service was not open.
61	AMRC_HEADER_TRUNCATED	The RFH header of the message was truncated.
62	AMRC_HEADER_INVALID	The RFH header of the message was not valid.
63	AMRC_DATA_LEN_ERR	The specified data length was not valid.
64	AMRC_BACKOUT_REQUEUE_ERR	The backout count of a received message was found to have exceeded its backout limit. The message was returned to the application. It could not be requeued to the backout requeue queue.
65	AMRC_BACKOUT_LIMIT_ERR	The backout count of a received message was found to have exceeded its backout limit. The message was returned to the application. It could not be requeued to the backout requeue queue.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
66	AMRC_COMMAND_ALREADY_ EXISTS	A publish, subscribe, or unsubscribe command could not be added to the message because the message already contained a command element. If this message is generated from the high-level interface, it may mean that you have tried to use the same message name for sending and receiving publish/subscribe messages. It can also occur if the same message object is reused to send a message without being reset.
67	AMRC_UNEXPECTED_RECEIVE_ERR	An unexpected error occurred after a received message was removed from the underlying transport layer. The message was returned to the application.
68	AMRC_UNEXPECTED_SEND_ERR	An unexpected error occurred after a message was successfully sent. Output information updated as a result of the send request should never occur.
70	AMRC_SENDER_USAGE_ERR	The specified sender service definition type was not valid for sending responses. To be valid for sending a response, a sender service must not have a repository definition, must have been specified as a response service when receiving a previous request message, and must not have been used for any purpose other than sending responses.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
71	AMRC_MSG_TRUNCATED	The received message that was returned to the application has been truncated.
72	AMRC_CLOSE_SESSION_ERR	An error occurred while closing the session. The session is closed.
73	AMRC_READ_OFFSET_ERR	The current data offset used for reading bytes from a message is not valid.
74	AMRC_RFH_ALREADY_EXISTS	A publish, subscribe, or unsubscribe command could not be added to the message because the message already contained an RFH header. The message requires a reset first, to remove existing data.
75	AMRC_GROUP_STATUS_ERR	The specified group status value was not valid.
76	AMRC_MSG_ID_LEN_ERR	The specified message id length value was not valid.
77	AMRC_MSG_ID_PTR_ERR	The specified message id pointer was not valid.
78	AMRC_MSG_ID_BUFF_LEN_ERR	The specified message id buffer length value was not valid.
79	AMRC_MSG_ID_BUFF_PTR_ERR	The specified message id buffer pointer was not valid.
80	AMRC_MSG_ID_LEN_PTR_ERR	The specified message id length pointer was not valid.
81	AMRC_CORREL_ID_LEN_ERR	The specified correlation id length value was too long.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
82	AMRC_CORREL_ID_PTR_ERR	The specified correlation id pointer was not valid.
83	AMRC_CORREL_ID_BUFF_LEN_ERR	The specified correlation id buffer length value was not valid.
84	AMRC_CORREL_ID_BUFF_PTR_ERR	The specified correlation id buffer pointer was not valid.
85	AMRC_CORREL_ID_LEN_PTR_ERR	The specified correlation id pointer was not valid.
86	AMRC_FORMAT_LEN_ERR	The specified message format string was too long.
87	AMRC_FORMAT_PTR_ERR	The specified format pointer was not valid.
88	AMRC_FORMAT_BUFF_PTR_ERR	The specified format buffer pointer was not valid.
89	AMRC_FORMAT_LEN_PTR_ERR	The specified format length pointer was not valid.
90	AMRC_FORMAT_BUFF_LEN_ERR	The specified format buffer length value was not valid.
91	AMRC_NAME_BUFF_PTR_ERR	The specified name buffer pointer was not valid.
92	AMRC_NAME_LEN_PTR_ERR	The specified name length pointer was not valid.
93	AMRC_NAME_BUFF_LEN_ERR	The specified name buffer length value was not valid.
94	AMRC_Q_NAME_LEN_ERR	The specified queue name length value was not valid.
95	AMRC_Q_NAME_PTR_ERR	The specified queue name pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
96	AMRC_Q_NAME_BUFF_PTR_ERR	The specified queue name buffer pointer was not valid.
97	AMRC_Q_NAME_LEN_PTR_ERR	The specified queue name length pointer was not valid.
98	AMRC_Q_NAME_BUFF_LEN_ERR	The specified queue name buffer length value was not valid.
99	AMRC_WAIT_TIME_PTR_ERR	The specified wait time pointer was not valid.
100	AMRC_CCSID_PTR_ERR	The specified coded character set id pointer was not valid.
101	AMRC_ENCODING_PTR_ERR	The specified encoding pointer was not valid.
102	AMRC_DEFN_TYPE_PTR_ERR	The specified definition type pointer was not valid.
103	AMRC_CCSID_ERR	The specified coded character value was not valid.
104	AMRC_DATA_LEN_PTR_ERR	The specified data length pointer was not valid.
105	AMRC_GROUP_STATUS_PTR_ERR	The specified group status pointer was not valid.
106	AMRC_DATA_OFFSET_PTR_ERR	The specified data offset pointer was not valid.
107	AMRC_RESP_SENDER_HANDLE_ERR	The response sender service handle specified when receiving a request message was not valid.
108	AMRC_RESP_RECEIVER_HANDLE_ ERR	The response receiver service handle specified when sending a request message was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
109	AMRC_NOT_AUTHORIZED	The user is not authorized by the underlying transport layer to perform the specified request.
110	AMRC_TRANSPORT_NOT_ AVAILABLE	The underlying transport layer is not available.
111	AMRC_BACKED_OUT	The unit of work has been backed out.
112	AMRC_INCOMPLETE_GROUP	The specified request failed because an attempt was made to send a message that was not in a group when the existing message group was incomplete.
113	AMRC_SEND_DISABLED	The specified request could not be performed because the service in the underlying transport layer is not enabled for send requests.
114	AMRC_SERVICE_FULL	The specified (sender, receiver, distribution list, publisher, or subscriber) service was already open.
115	AMRC_NOT_CONVERTED	Data conversion of the received message was unsuccessful. The message was removed from the underlying message transport layer with the message data unconverted.
116	AMRC_RECEIVE_DISABLED	The specified request could not be performed because the service in the underlying transport layer is not enabled for receive requests.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
117	AMRC_GROUP_BACKOUT_LIMIT_ ERR	The backout count of a received message was found to have exceeded its backout limit. The message was returned to the application. It was not requeued to the backout requeue queue because it represented a single message within a group of more than one.
118	AMRC_SENDER_COUNT_PTR_ERR	The specified distribution list sender count pointer was not valid.
119	AMRC_MULTIPLE_REASONS	A distribution list open or send was only partially successful and returned multiple different reason codes in its underlying sender services.
120	AMRC_NO_RESP_SERVICE	The publish request was not successful because a response receiver service is required for registration and was not specified.
121	AMRC_DATA_PTR_ERR	The specified data pointer was not valid.
122	AMRC_DATA_BUFF_LEN_ERR	The specified data buffer length value was not valid.
123	AMRC_DATA_BUFF_PTR_ERR	The specified data buffer pointer was not valid.
124	AMRC_DEFN_TYPE_ERR	The definition type defined for the service point in the repository was inconsistent with the definition type of the underlying message transport queue object when it was opened.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
125	AMRC_BACKOUT_INVALID	The backout request was not valid. On OS/390 under CICS, IMS, or RRS, this can be due to calling the AMI backout functions rather than the transaction managers' own functions.
126	AMRC_COMMIT_INVALID	The commit request was not valid. On OS/390 under CICS, IMS, or RRS, this can be due to calling the AMI commit functions rather than the transaction managers' own functions.
127	AMRC_DATA_OFFSET_ERR	The specified data offset value was not valid.
128	AMRC_FILE_SYSTEM_ERR	A filesystem error occurred during a file transfer call. If this occurs, we recommend that the current unit of work be backed out. This will ensure that messages put to or received from the service are in a consistent state.
129	AMRC_FILE_ALREADY_EXISTS	The AMI was unable to receive the file as the current file disposition is "new," and a file with the same name already exists on your system. The first message of the file transfer is returned to the application. If this occurs, we recommend that the current unit of work is backed out. This will ensure that the messages received from the service are in a consistent state.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
130	AMRC_REPORT_CODE_PTR_ERR	The specified report code pointer was not valid.
131	AMRC_MSG_TYPE_PTR_ERR	The specified message type pointer was not valid.
132	AMRC_FILE_FORMAT_CONVERTED	The AMI received a file successfully, but needed to convert between different file types. An example is from an OS/390 fixed-length data set to a UNIX file or between OS/390 datasets with different geometries.
133	AMRC_FILE_TRUNCATED	On a file send or receive operation, the entire file was not processed. We recommend that the current unit of work is backed out. This will ensure that the messages put to or received from the service are in a consistent state.
134	AMRC_FILE_NOT_FOUND	The file supplied on a file send call could not be opened. Check that the file exists and that the application has read access to it.
135	AMRC_NOT_A_FILE	A message was received from the service, but it does not appear to have been sent as part of a (physical mode) file transfer operation. The message is returned to the application.
136	AMRC_FILE_NAME_LEN_ERR	The file name length passed in to a file transfer call was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
137	AMRC_FILE_NAME_PTR_ERR	The file name pointer passed in to a file transfer call was not valid.
138	AMRC_RFH2_FORMAT_ERR	The format of an MQRFH2 rules and formatting header of a received message was not valid.
139	AMRC_CCSID_NOT_SUPPORTED	**Warning**: OS/390 V2 R9 (or later) is required to enable AMI publish subscribe or message element support under CICS. Ensure that your Language Environment installation is set up to use Unicode character conversion. See the *OS/390 C/C++ Programming Guide* for a list of the coded character sets supported under OS/390. **Failure**: The coded character set of name/value elements in the rules and formatting header of a received message, or that specified for passing elements between the application and the AMI, is not supported.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
140	AMRC_FILE_MSG_FORMAT_ERR	When using physical mode file transfer, only two message formats are allowed: AMFMT_STRING (for text mode transfer), and AMFMT_NONE (for binary mode transfer). When using logical mode file transfer, any message format may be used for messages generated from OS/390 datasets. On other platforms, and for HFS files on OS/390, only AMFMT_STRING and AMFMT_NONE can be used.
141	AMRC_MSG_TYPE_NOT_REPORT	The message is not a report message.
142	AMRC_ELEM_STRUC_TYPE_ERR	At least one of the type (length and pointer) fields in the specified element structure was not valid.
143	AMRC_ELEM_STRUC_TYPE_BUFF_ ERR	At least one of the type buffer (length and pointer) fields in the specified element structure was not valid. Ensure that the type length, pointer, and type string are valid.
144	AMRC_FILE_TRANSFER_INVALID	An application running under CICS on OS/390 tried to perform a file transfer operation, which is invalid in this environment.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
145	AMRC_FILE_NOT_WRITTEN	The file used for a receive could not be opened. The first message of the file is returned to the application. If this occurs, we recommend that the current unit of work is backed out. This will ensure that the messages held on the service are in a consistent state.
146	AMRC_FILE_FORMAT_NOT_SUPPORTED	An attempt was made to send a file type that is not supported. Unsupported file types include OS/390 VSAM datasets, and OS/390 partitioned datasets (though an individual member of a PDS may be sent).
147	AMRC_NEGATIVE_RECEIVE_BUFF_LEN	The value of the buffer length parameter that is specified on a receive message request was negative.
148	AMRC_LIBRARY_NOT_FOUND	A policy handler library file name specified in the repository was not found in the handler's directory.
149	AMRC_LIBRARY_FUNCTION_PTR_ERR	A policy handler library that is specified by the repository attempted to register a function with an invalid function pointer value (for example, NULL).
150	AMRC_LIBRARY_INV_POINT_ERR	A policy handler library that is specified by the repository attempted to register a function with an invocation point value that was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
151	AMRC_LIBRARY_DUP_FUNCTION	A policy handler library that is specified by the repository attempted to register a function with an invocation point value that is already registered.
152	AMRC_POLICY_HANDLER_ERR	An error was returned from a policy handler library invocation that occurred while processing the application function call. The policy handler reason code can be obtained by the secondary reason code value returned from a getlastError request for the AMI object concerned.
153	AMRC_POLICY_HANDLER_ WARNING	A warning was returned from a policy handler library invocation that occurred while processing the application function call. The policy handler reason code can be obtained by the secondary reason code value returned from a getlastError request for the AMI object concerned.
154	AMRC_REPORT_CODE_ERR	The specified report (or feedback) code value was not valid.
201	AMRC_ACCEPT_DIRECT_ERR	The specified accept direct requests value was not valid.
202	AMRC_ACCEPT_DIRECT_PTR_ERR	The specified accept direct requsts pointer was not valid.
203	AMRC_ACCEPT_TRUNCATED_ERR	The specified accept truncated value was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
204	AMRC_ACCEPT_TRUNCATED_PTR_ ERR	The specified accept truncated pointer was not valid.
205	AMRC_ANON_ERR	The specified anonymous value was not valid.
206	AMRC_ANON_PTR_ERR	The specified anonymous pointer was not valid.
207	AMRC_APPL_GROUP_BUFF_LEN_ERR	The specified application group buffer length value was not valid.
208	AMRC_APPL_GROUP_BUFF_PTR_ERR	The specified application group buffer pointer was not valid.
209	AMRC_APPL_GROUP_LEN_ERR	The specified application group length value was not valid.
210	AMRC_APPL_GROUP_LEN_PTR_ERR	The specified application group length pointer was not valid.
211	AMRC_APPL_GROUP_PTR_ERR	The specified application group pointer was not valid.
212	AMRC_BIND_ON_OPEN_ERR	The specified bind on open value was not valid.
213	AMRC_BIND_ON_OPEN_PTR_ERR	The specified bind on open pointer was not valid.
214	AMRC_CHL_NAME_BUFF_LEN_ERR	The specified channel name buffer length value was not valid.
215	AMRC_CHL_NAME_BUFF_PTR_ERR	The specified channel name buffer pointer was not valid.
216	AMRC_CHL_NAME_LEN_ERR	The specified channel name length value was not valid.
217	AMRC_CHL_NAME_LEN_PTR_ERR	The specified channel name length pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
218	AMRC_CHL_NAME_PTR_ERR	The specified channel name pointer was not valid.
219	AMRC_CLOSE_DELETE_ERR	The specified close delete value was not valid.
220	AMRC_CLOSE_DELETE_PTR_ERR	The specified close delete pointer was not valid.
221	AMRC_CONTEXT_ERR	The specified message context value was not valid.
222	AMRC_CONTEXT_PTR_ERR	The specified message context pointer was not valid.
223	AMRC_CONVERT_ERR	The specified convert message value was not valid.
224	AMRC_CONVERT_PTR_ERR	The specified convert message pointer was not valid.
225	AMRC_COUNT_ERR	The specified backout or retry count value was not valid.
226	AMRC_COUNT_PTR_ERR	The specified backout or retry count pointer was not valid.
227	AMRC_CUST_PARM_BUFF_LEN_ERR	The specified custom parameter buffer length value was not valid.
228	AMRC_CUST_PARM_BUFF_PTR_ERR	The specified customer parameter buffer pointer was not valid.
229	AMRC_CUST_PARM_LEN_ERR	The specified custom parameter length value was not valid.
230	AMRC_CUST_PARM_LEN_PTR_ERR	The specified custom parameter length pointer was not valid.
231	AMRC_CUST_PARM_PTR_ERR	The specified custom parameter pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
232	AMRC_DLY_PERSISTENCE_ERR	The specified delivery persistence value was not valid.
233	AMRC_DLY_PERSISTENCE_PTR_ERR	The specified delivery persistence pointer was not valid.
234	AMRC_DST_SUPPORT_ERR	The specified distribution list support value was not valid.
235	AMRC_DST_SUPPORT_PTR_ERR	The specified distribution list support pointer was not valid.
236	AMRC_EXPIRY_ERR	The specified message expiry value was not valid.
237	AMRC_EXPIRY_PTR_ERR	The specified message expiry pointer was not valid.
238	AMRC_FILE_DISP_ERR	The specified file disposition value was not valid.
239	AMRC_FILE_DISP_PTR_ERR	The specified file disposition pointer was not valid.
240	AMRC_FILE_RCD_LEN_ERR	The specified file record length value was not valid.
241	AMRC_FILE_RCD_LEN_PTR_ERR	The specified file record length pointer was not valid.
242	AMRC_GROUP_ID_BUFF_LEN_ERR	The specified group id group buffer length value was not valid.
243	AMRC_GROUP_ID_BUFF_PTR_ERR	The specified group id buffer pointer was not valid.
244	AMRC_GROUP_ID_LEN_ERR	The specified group id length value was not valid.
245	AMRC_GROUP_ID_LEN_PTR_ERR	The specified group id length pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
246	AMRC_GROUP_ID_PTR_ERR	The specified group id pointer was not valid.
247	AMRC_HANDLE_POISON_MSG_ERR	The specified handle poison message value was not valid.
248	AMRC_HANDLE_POISON_MSG_PTR_ERR	The specified handle poison message pointer was not valid.
249	AMRC_HANDLE_PTR_ERR	The specified handle pointer was not valid.
250	AMRC_IMPL_OPEN_ERR	The specified implicit open value was not valid.
251	AMRC_IMPL_OPEN_PTR_ERR	The specified implicit open pointer was not valid.
252	AMRC_INFORM_IF_RET_ERR	The specified inform if retained value was not valid.
253	AMRC_INFORM_IF_RET_PTR_ERR	The specified inform if retained pointer was not valid.
254	AMRC_INTERVAL_ERR	The specified retry interval value was not valid.
255	AMRC_INTERVAL_PTR_ERR	The specified retry interval pointer was not valid.
256	AMRC_LEAVE_OPEN_ERR	The specified leave open value was not valid.
257	AMRC_LEAVE_OPEN_PTR_ERR	The specified leave open pointer was not valid.
258	AMRC_LOCAL_ERR	The specified publish or subscribe locally value was not valid.
259	AMRC_LOCAL_PTR_ERR	The specified publish or subscribe locally pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
260	AMRC_MCD_PARM_BUFF_LEN_ERR	The specified MCD parameter buffer length value was not valid.
261	AMRC_MCD_PARM_BUFF_PTR_ERR	The specified MCD parameter buffer pointer was not valid.
262	AMRC_MCD_PARM_LEN_ERR	The specified MCD parameter length value was not valid.
263	AMRC_MCD_PARM_LEN_PTR_ERR	The specified MCD parameter length pointer was not valid.
264	AMRC_MCD_PARM_PTR_ERR	The specified MCD parameter pointer was not valid.
265	AMRC_MGR_NAME_BUFF_LEN_ERR	The specified queue manager name buffer length value was not valid.
266	AMRC_MGR_NAME_BUFF_PTR_ERR	The specified queue manager name buffer pointer was not valid.
267	AMRC_MGR_NAME_LEN_ERR	The specified queue manager name length value was not valid.
268	AMRC_MGR_NAME_LEN_PTR_ERR	The specified queue manager name length pointer was not valid.
269	AMRC_MGR_NAME_PTR_ERR	The specified queue manager name pointer was not valid.
270	AMRC_MSG_LEN_ERR	The specified message length value was not valid.
271	AMRC_MSG_LEN_PTR_ERR	The specified message length pointer was not valid.
272	AMRC_MSG_TYPE_ERR	The specified message type value was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
273	AMRC_NEW_CORREL_ID_ERR	The specified new correlation id value was not valid.
274	AMRC_NEW_CORREL_ID_PTR_ERR	The specified new correlation id pointer was not valid.
275	AMRC_NEW_PUBS_ONLY_ERR	The specified new publications only value was not valid.
276	AMRC_NEW_PUBS_ONLY_PTR_ERR	The specified new publications only pointer was not valid.
277	AMRC_PERSISTENCE_ERR	The specified persistence value was not valid.
278	AMRC_PERSISTENCE_PTR_ERR	The specified persistence pointer was not valid.
279	AMRC_PRIORITY_ERR	The specified priority value was not valid.
280	AMRC_PRIORITY_PTR_ERR	The specified priority pointer was not valid.
281	AMRC_PUB_ON_REQ_ERR	The specified publish on request value was not valid.
282	AMRC_PUB_ON_REQ_PTR_ERR	The specified publish on request pointer was not valid.
283	AMRC_PUB_OTHERS_ONLY_ERR	The specified publish to others only value was not valid.
284	AMRC_PUB_OTHERS_ONLY_PTR_ERR	The specified publish to others only pointer was not valid.
285	AMRC_READ_ONLY_ERR	The specified wait time read only value was not valid.
286	AMRC_READ_ONLY_PTR_ERR	The specified wait time read only pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
287	AMRC_REMOVE_ALL_ERR	The specified remove all subscriptions value was not valid.
288	AMRC_REMOVE_ALL_PTR_ERR	The specified remove all subscriptions pointer was not valid.
289	AMRC_REPORT_OPTION_ERR	The specified report option value was not valid.
290	AMRC_REPORT_OPTION_PTR_ERR	The specified report option pointer was not valid.
291	AMRC_RETAIN_ERR	The specified retain publications value was not valid.
292	AMRC_RETAIN_PTR_ERR	The specified retain publications pointer was not valid.
293	AMRC_SEGMENT_ERR	The specified segment message value was not valid.
294	AMRC_SEGMENT_PTR_ERR	The specified segment message pointer was not valid.
295	AMRC_SEQ_NO_ERR	The specified sequence number value was not valid.
296	AMRC_SEQ_NO_PTR_ERR	The specified sequence number pointer was not valid.
297	AMRC_SET_NAME_INVALID	The specified name cannot be changed.
298	AMRC_SHARED_ERR	The specified open shared value was not valid.
299	AMRC_SHARED_PTR_ERR	The specified open shared pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
300	AMRC_SND_TYPE_ERR	The specified sender type value was not valid.
301	AMRC_SND_TYPE_PTR_ERR	The specified sender type pointer was not valid.
302	AMRC_SRV_TYPE_ERR	The specified service type value was not valid.
303	AMRC_SRV_TYPE_PTR_ERR	The specified service type pointer was not valid.
304	AMRC_SPLIT_LOGICAL_ERR	The specified split logical value was not valid.
305	AMRC_SPLIT_LOGICAL_PTR_ERR	The specified split logical pointer was not valid.
306	AMRC_SUBS_POINT_BUFF_LEN_ERR	The specified subscription point buffer length value was not valid.
307	AMRC_SUBS_POINT_BUFF_PTR_ERR	The specified subscription point buffer pointer was not valid.
308	AMRC_SUBS_POINT_LEN_ERR	The specified subscription point length value was not valid.
309	AMRC_SUBS_POINT_LEN_PTR_ERR	The specified subscription point length pointer was not valid.
310	AMRC_SUBS_POINT_PTR_ERR	The specified subscription point pointer was not valid.
311	AMRC_SUPPRESS_REG_ERR	The specified suppress registration value was not valid.
312	AMRC_SUPPRESS_REG_PTR_ERR	The specified suppress registration pointer was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
313	AMRC_SYNCPOINT_ERR	The specified sync point value was not valid.
314	AMRC_SYNCPOINT_PTR_ERR	The specified sync point pointer was not valid.
315	AMRC_TCP_ADDR_BUFF_LEN_ERR	The specified TCP/IP address buffer length value was not valid.
316	AMRC_TCP_ADDR_BUFF_PTR_ERR	The specified TCP/IP address buffer pointer was not valid.
317	AMRC_TCP_ADDR_LEN_ERR	The specified TCP/IP address length value was not valid.
318	AMRC_TCP_ADDR_LEN_PTR_ERR	The specified TCP/IP address length pointer was not valid.
319	AMRC_TCP_ADDR_PTR_ERR	The specified TCP/IP address pointer was not valid.
320	AMRC_TRP_TYPE_ERR	The specified transport type value was not valid.
321	AMRC_TRP_TYPE_PTR_ERR	The specified transport type pointer was not valid.
322	AMRC_TRUSTED_ERR	The specified trusted value was not valid.
323	AMRC_TRUSTED_PTR_ERR	The specified trusted pointer was not valid.
324	AMRC_USE_CORREL_ID_ERR	The specified use correlation id value was not valid.
325	AMRC_USE_CORREL_ID_PTR_ERR	The specified use correlation id pointer was not valid.
326	AMRC_WAIT_WHOLE_GROUP_ERR	The specified wait for whole group value was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
327	AMRC_WAIT_WHOLE_GROUP_PTR_ ERR	The specified wait for whole group pointer was not valid.
328	AMRC_CON_INT_PROP_ID_ERR	The specified connection integer property identifier was not valid.
329	AMRC_CON_STR_PROP_ID_ERR	The specified connection string property identifier was not valid.
330	AMRC_MSG_INT_PROP_ID_ERR	The specified message integer property identifier was not valid.
331	AMRC_MSG_STR_PROP_ID_ERR	The specified message string property identifier was not valid.
332	AMRC_POLICY_INT_PROP_ID_ERR	The specified policy integer property identifier was not valid.
333	AMRC_POLICY_STR_PROP_ID_ERR	The specified policy string property identifier was not valid.
334	AMRC_SRV_INT_PROP_ID_ERR	The specified service integer property identifier was not valid.
335	AMRC_SRV_STR_PROP_ID_ERR	The specified service string property identifier was not valid.
336	AMRC_INVALID_IF_CON_OPEN	The requested operation could not be performed because the specified connection was open.
337	AMRC_CON_HANDLE_ERR	The specified connection handle was not valid.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
400	AMRC_INVALID_TRACE_LEVEL	A specified trace level was not valid.
401	AMRC_CONN_NAME_NOT_FOUND	The connection name obtained from the repository was not found in the local host file.
402	AMRC_HOST_FILE_NOT_FOUND	The local host file with the specified name was not found.
403	AMRC_HOST_FILENAME_ERR	The local host file name was not valid. The value of the appropriate environment variable should be corrected.
404	AMRC_HOST_FILE_ERR	The contents of the local host file are not valid.
405	AMRC_POLICY_NOT_IN_REPOS	The definition name that was specified when creating a policy was not found in the repository. The policy was created using default values.
406	AMRC_SENDER_NOT_IN_REPOS	The definition name that was specified when creating a sender was not found in the repository. The sender was created using default values.
407	AMRC_RECEIVER_NOT_IN_REPOS	The definition name that was specified when creating a receiver was not found in the repository. The receiver was created using default values.
408	AMRC_DIST_LIST_NOT_IN_REPOS	The definition name specified for creating a distribution list was not found in the repository. The object was not created.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
409	AMRC_PUBLISHER_NOT_IN_REPOS	The definition name that was specified when creating a publisher was not found in the specified repository. The publisher was created using default values.
410	AMRC_SUBSCRIBER_NOT_IN_REPOS	The definition name that was specified when creating a subscriber was not found in the repository. The subscriber was created using default values.
411	AMRC_RESERVED_NAME_IN_REPOS	The name specified for creating an object was not found in the repository and is a reserved name that is not valid in a repository. The specified object was not created.
414	AMRC_REPOS_FILENAME_ERR	The repository file name was not valid. The value of the appropriate environment variable should be corrected.
415	AMRC_REPOS_WARNING	A warning associated with the underlying repository data was reported.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
416	AMRC_REPOS_ERR	An error was returned when initializing or accessing the respository. This can occur for any of the following reasons: ■ The repository XML file (for instance, amt.xml) contains data that is not valid. ■ The DTD file (amt.dtd) was not found or contains data that is not valid. ■ The files needed to initialize the repository (located in directories intlFiles and locales) could not be located. Check that the DTD and XML files are valid and correctly located, and that the path settings for the local host and repository files are correct.
418	AMRC_REPOS_NOT_FOUND	The repository file was not found. The value of the appropriate environment variable should be corrected.
419	AMRC_TRANSPORT_LIBRARY_ERR	An error occurred loading the transport library.
420	AMRC_HOST_CACHE_ERR	A module was loaded for use as a repository file cache, but the module does not appear to be a valid repository cache.
421	AMRC_REPOS_CACHE_ERR	A module was loaded for use as a host file cache, but the module does not appear to be a valid host cache.

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
422	AMRC_PRIMARY_HANDLE_ERR	The primary handle (that is, the first parameter) passed on the API call was not valid. The most probable reason for failure is that the handle passed is a synonym handle, which is not valid as the *primary* handle on any call to the AMI.
423	AMRC_SESSION_EXPIRED	Under the IMS environment, the current session has been marked as expired. Delete the current session and create a new one for the duration of this transaction.
424	AMRC_DTD_NOT_FOUND	An AMI dtd file (amt.dtd) was not found with the xml repository file in the same directory.
425	AMRC_LDAP_ERR	An error was encountered accessing the AMI repository information in the LDAP directory, or communicating with the LDAP server. The LDAP error code can be obtained from the secondary reason code value that is returned from a GetLastError request for the AMI object concerned.
500	AMRC_JAVA_FIELD_ERR	A field referenced in AMI Java code cannot be found in the AMI Java native library. This is probably due to an incompatibility between the AMI class files and the AMI Java library. (Not applicable to the C and C++ programming languages).

MQSeries API Reason Codes (Continued)

Reason Code Number	Reason Code Name	Description
501	AMRC_JAVA_METHOD_ERR	A method referenced in AMI Java code cannot be found in the AMI Java native library. This is probably due to an incompatibility between the AMI class files and the AMI Java library. (Not applicable to the C and C++ programming languages).
502	AMRC_JAVA_CLASS_ERR	A class referenced in AMI Java code cannot be found in the AMI Java native library. This is probably due to an incompatibility between the AMI class files and the AMI Java library. (Not applicable to the C and C++ programming languages).
503	AMRC_JAVA_JNI_ERR	An unexpected error occurred when calling the AMI Java native library. This is probably due to an incompatibility between the AMI class files and the AMI Java library. (Not applicable to the C and C++ programming languages).
504	AMRC_JAVA_CREATE_ERR	An unexpected error occurred when creating an AMI Java object. This is probably due to an incompatibility between the AMI class files and the AMI Java library. (Not applicable to the C and C++ pogramming languages).
505	AMRC_JAVA_NULL_PARM_ERR	The AMI Java code detected a null parameter that is not valid. (Not applicable to the C and C++ programming languages).

MQSeries API Reason Codes (Continued)

Appendix

The U2XMAP File

B

This Appendix describes the DTD for the U2XMAP file.

```
<!-- U2 XMAP version 1.0 -->
<!ELEMENT U2XMAP (OPTIONS?, DATASOURCE*,
                                        TABLECLASSMAP+,
RelatedTable*) >
<!ATTLIST U2XMAP Version CDATA #FIXED "1.0">

<!ELEMENT OPTIONS (EmptyString?, DateFormat?, Cascade?,
                                          ExistRecord?,
(IgnoreNameSpace | NameSpace*))

<!ELEMENT EmptyString EMPTY>
<!ATTLIST EmptyString isNULL (ON|OFF) #REQUIRED>

<!ELEMENT DateFormat EMPTY>
<!ATTLIST DateFormat Format CDATA #REQUIRED>

<!ELEMENT Cascade EMPTY>

<!ELEMENT ExistRecord EMPTY>
<!ATTLIST ExistRecord Action (Ignore | Replace | Append)
#REQUIRED>

<!ELEMENT IgnoreNameSpace EMPTY>

<!ELEMENT NameSpace EMPTY>
 <!ATTLIST  NameSpace
                      Prefix  NMTOKEN #IMPLIED
                      URI CDATA #REQUIRED>

 <!ELEMENT DATASOURCE EMPTY>
 <!ATTLIST DATASOURCE
                     Name CDATA #REQUIRED
                     ODBCDataSource CDATA #REQUIRED
                     Username CDATA #REQUIRED
                     Password CDATA #REQUIRED>

<!ELEMENT TABLECLASSMAP (GenerateID?, (CloumnMap | TableMap)*,
OrderColumn*)
<!ATTLIST TABLECLASSMAP
                     MapName CDATA #REQUIRED
                     StartNode CDATA #REQUIRED
                     Action (Ignore | Replace | Append)
#IMPLIED
                     DataSource CDATA #IMPLIED
```

```
                        TableName CDATA #REQUIRED>

<!ELEMENT GenerateID EMPTY>
<!ATTLIST GenerateID
                       Column CDATA #REQUIRED
         Xfield CDATA #IMPLIED
         SUBR CDATA #IMPLIED>

<!ELEMENT ColumnMap EMPTY>
<!ATTLIST ColumnMap
                        Node CDATA #REQUIRED
                        Column CDATA #REQUIRED
                       Action (Ignore | Replace | Append) #IMPLIED>

<!ELEMENT TableMap EMPTY>
<!ATTLIST TableMap
                        Node CDATA #REQUIRED
                        MapName CDATA #IMPLIED>

<!ELEMENT OrderColumn EMPTY>
<!ATTLIST OrderColumn
                     Column CDATA #REQUIRED
                     Generate (Yes | No) #REQUIRED>


<!ELEMENT RelatedTable (MapParentKey, ForeignKey)>

<!ELEMENT MapParentKey EMPTY>
<!ATTLIST MapParentKey
          Table CDATA #REQUIRED
       Column CDATA #REQUIRED
       Generate (Yes | No) #REQUIRED>

<!ELEMENT MapChildKey EMPTY>
<!ATTLIST MAPForeignKey
                  Table CDATA #REQUIRED
       Column CDATA #REQUIRED>
```

Mapping Root

The U2XMAP element is the root element type of the mapping file document.

```
<!ELEMENT U2XMAP (OPTIONS?, TABLECLASSMAP+>
<!ATTLIST U2XMAP Version CDATA #FIXED "1.0">
```

The element has three child elements:

- OPTIONS
- TABLECLASSMAP
- RelatedTable

Options

```
<!ELEMENT OPTIONS (EmptyString?, DateFormat?, Cascade?, ExistRecord?,
(IgnoreNameSpace | NameSpace*))
```

Options are a container to hold the various options you can set.

Option EmptyString

```
<!ELEMENT EmptyString EMPTY>
<!ATTLIST EmptyString isNULL (ON|OFF) #REQUIRED>
```

If the attribute isNull in EmptyString is ON, when the value of an optional XML element is omitted, the corresponding database field value is set to NULL, otherwise it is considered missing. Similarly, when a database field value is NULL and the attribute isNULL in EmptyString is ON, the corresponding value of an optional XML element is omitted, otherwise it is set to an empty string.

Option DateFormat

```
<!ELEMENT DateFormat EMPTY>
<!ATTLIST DateFormat Format CDATA #REQUIRED>
```

Format is a conversion code UniVerse uses to perform the ICONV()/OCONV() function when getting the data from the XML document or creating the XML document. This code can be any conversion code understood by UniVerse. You can also use the value of “XMLFormat” which converts the data into a standard data format for the XML document, or takes the standard XML data format (yyyy-mm-dd).

Option Cascade

```
<!ELEMENT Cascade EMPTY>
```

The U2XMAP dataset can define whether to use the cascade mode or not.

This option only applies when an XML document is mapped to more than one UniVerse table. By default, the cascade mode is off, which means that the system takes care of the parent-child record relationship according to the ReleatedTable rules described in the U2XMAP file. Setting the cascade mode ON allows a user to control the parent-child record relationship. When the cascade mode is ON, once the current parent table record is established, all child table records that are either read from or written to the child table are associated with the current parent table record. This affords a user the freedom of associating parent and child table records the way he or she sees fit.

Option ExistRecord

```
<!ELEMENT ExistReocrd EMPTY>
<!ATTLIST ExistRecord Action (Ignore | Replace | Append) #REQUIRED>
```

Use the ExistRecord option to specify the action when a record ID from the XML document already exists in the UniVerse file. When you specify “Ignore” the XML.TODB command will not change the record with the same record ID. If you specify “Replace” XML.TODB replaces the existing record ID. If you specify “Append” XML.TODB appends the value from the XML document to the multi-valued or multi-subvalued filed in the UniVerse file if the record already exists in the database.

For example, assume STUDENT (ID=12345) exists in the UniVerse file with COURSES C1, C2, and C3. Further assume that the same STUDENT ID exists in the XML document with COURSES C4 and C5. If ExistRecord is Ignore, the existing student record remains unchanged. In ExistRecord is Replace, XML.TODB replaces the existing record with the record from the XML document, so the COURSES field becomes C4 and C5. If ExistRecord is Append, XML.TODB appends course C4 and C5 to the COURSES field, so the COURSES field contains COURSES C1, C2, C3, C4, and C5.

Note: *Append is only valid with multivalued fields. If specified with a singlevalued field, it is ignored.*

Option Namespace

```
<!ELEMENT NameSpace EMPTY>
<!ATTLIST  NameSpace
           Prefix  NMTOKEN #IMPLIED
           URI CDATA #REQUIRED>
<!ELEMENT IgnoreNameSpace EMPTY>
```

<IgnoreNameSpace> means UniVerse ignores all the Namespace information This option applies when converting the XML document to the UniVerse database.

Namespace elements give URIs and their associated prefixes. These are used as follows:

- In the mapping document, prefixes identify to which namespace an element or attribute belongs. They can be used in the Name attribute of the ElementType and Attribute element types.

- When transferring data from an XML document to the UniVerse database, UniVerse uses namespace URIs to identify elements and attributes in that document. The XML document can use different prefixes than are used in the mapping document.
- When transferring data from the UniVerse database to an XML document, namespace URIs and prefixes are used to prefix element and attribute names in that document.

Namespace elements are not required. If they are used, the same URI or prefix cannot be used more than once. Zero-length prefixes ("") are not currently supported.

If you do not define a Prefix, UniVerse uses the Default Name space, used only for generating the XML document. In this case, UniVerse puts a default NameSpace in the output document.

Table Class Maps

```
<!ELEMENT TABLECLASSMAP (GenerateID?, (CloumnMap | TableMap)*,
OrderColumn*)
<!ATTLIST TABLECLASSMAP
            MapName CDATA #REQUIRED
            StartNode CDATA #REQUIRED
            Action  (Ignore | Replace | Append) #IMPLIED
            DataSource CDATA #IMPLIED
            TableName CDATA #REQUIRED>
```

<TABLECLASSMAP> elements instruct the data transfer system to map an XML element to a database file. So, if you have more than one such element, the data transfer system puts records into more than one database file. Basically, the properties in this element map to the column in the database file. You cannot pull the properties in other elements to map to this database table.

<MapName> is the given name for this <TABLECLASSMAP>. It can be referenced when you define the relationship of the tables. <StartNode> is the start element in the XML document tree. If this map is under other <TABLECLASSMAP>, this will be a related path. <TableName> is the database file name.

<Action> can overwrite the global action for an existing record. You can specify own action for this table only.

Element <GenerateID>

```
<!ELEMENT GenerateID EMPTY>
<!ATTLIST GenerateID
             Column CDATA #REQUIRED
         Xfield CDATA #IMPLIED
         SUBR CDATA #IMPLIED>
```

The <GenerateID> elements instruct the data transfer system to create an ID for the record if a unique ID cannot be found. If you specify Xfield, UniVerse uses the value from the field in the dictionary for the file as the ID, adds 1, and writes the record back to the dictionary.

If you specify SUBR, UniVerse calls this subroutine to obtain an ID for the current record. The subroutine must be cataloged, and have one parameter defining the return value for the ID.

If you do not specify Xfield or SUBR, XML.TODB automatically generates a unique ID for the record.

Element <ColumnMap>

```
<!ELEMENT ColumnMap EMPTY>
<!ATTLIST ColumnMap
             Node CDATA #REQUIRED
        Action  (Ignore | Replace | Append) #IMPLIED
             Column CDATA #REQUIRED>
```

<ColumnMap> elements instruct the data transfer system to transfer the data between a certain XML document node and the database file field. The value of <Node> is a U2 xpath (subset of the 'xpath' with some extension). The value of <Column> is the field name in the database file.

<Action> can overwrite the global action for Existed Record". You can specify your own action for this field only.

Element <TableMap>

```
<!ELEMENT ColumnMap EMPTY>
<!ATTLIST TableMap
            Node CDATA #REQUIRED
            MapName CDATA #IMPLIED>
```

<TableMap> elements instruct the data transfer system where to put this subset of data in the XML document. It also instructs the system that this map is the child map of the current map. The value of <Node> is a U2 xpath (subset of the 'xpath' with some extension). The value of <MapName> is the MAP name in this map file.

Element <OrderColumn>

```
<!ELEMENT OrderColumn EMPTY>
<!ATTLIST OrderColumn
          Column CDATA #REQUIRED
          Generate (Yes | No) #REQUIRED>
```

UniVerse uses <OrderColumn> elements to store information about the order in which elements and PCDATA occur in their parent element.

Storing order information is optional. If you do not store it, there is no guarantee that the order will be preserved in a round trip from an XML document to the database and back again.

The Generate attribute of the OrderColumn element tells the system whether to generate order information or not. The presence or absence of the OrderColumn element tells the system whether to use order information. If you do not generate order information, you must map another column to the order column.

Related Table Maps

```
<!ELEMENT RelatedTable MapParentKey, MapChildKey>
<!ATTLIS RelatedTable
        MapName CDATA #REQUIRED
        Generate (Yes | No) #REQUIRED>

<!ELEMENT MapParentKey EMPTY>
<!ATTLIST Column CDATA #REQUIRED>

<!ELEMENT MapChildKey EMPTY>
<!ATTLIST Column CDATA #REQUIRED>
```

<RelatedTable> elements state the relationship between 2 maps or files. In class terms, think of this as a property added to the class being defined that points to the related class. In XML terms, this means that the element type for the related class is a child of the element type for the class being defined.

This element tells the data transfer system the relationship of these two tables. The keys are used to join these two tables.

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