

Mini-XML Programmers Manual, Version 2.0

Michael Sweet
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Introduction

This programmers manual describes Mini-XML version 2.0, a small XML parsing library that you can use to read and write XML and XML-like data files in your application without requiring large non-standard libraries. Mini-XML only requires an ANSI C compatible compiler (GCC works, as do most vendors' ANSI C compilers) and a "make" program.

Mini-XML provides the following functionality:

- Reading of UTF-8 and UTF-16 encoded XML files and strings.
- Writing of UTF-8 encoded XML files and strings.
- Data is stored in a linked-list tree structure, preserving the XML data hierarchy.
- Supports arbitrary element names, attributes, and attribute values with no preset limits, just available memory.
- Supports integer, real, opaque ("cdata"), and text data types in "leaf" nodes.
- Functions for creating and managing trees of data.
- "Find" and "walk" functions for easily locating and navigating trees of data.

Mini-XML doesn't do validation or other types of processing on the data based upon schema files or other sources of definition information, nor does it support character entities other than those required by the XML specification.

Legal Stuff

The Mini-XML library is copyright 2003–2004 by Michael Sweet.

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History

Mini-XML was initially developed for the [Gimp-Print](#) project to replace the rather large and unwieldy `libxml2` library with something substantially smaller and easier-to-use. It all began one morning in June of 2003 when Robert posted the following sentence to the developer's list:

It's bad enough that we require libxml2, but rolling our own XML parser is a bit more than we can handle.

I then replied with:

Given the limited scope of what you use in XML, it should be trivial to code a mini-XML API in a few hundred lines of code.

I took my own challenge and coded furiously for two days to produced the initial public release of Mini-XML, total lines of code: 696. Robert promptly integrated Mini-XML into Gimp-Print and removed libxml2.

Thanks to lots of feedback and support from various developers, Mini-XML has evolved since then to provide a more complete XML implementation and now stands at a whopping 2,240 lines of code, compared to 96,335 lines of code for libxml2 version 2.6.9. Aside from Gimp-Print, Mini-XML is used for the following projects/software applications:

- [Common UNIX Printing System](#)
- [CUPS Driver Development Kit](#)
- [ESP Print Pro](#)
- [ZynAddSubFX](#)

Please email me (mxml @ easysw . com) if you would like your project added or removed from this list, or if you have any comments/quotes you would like me to publish about your experiences with Mini-XML.

Organization of This Document

This manual is organized into the following chapters and appendices:

- Chapter 1, "[Building, Installing, and Packaging Mini-XML](#)", provides compilation, installation, and packaging instructions for Mini-XML.
- Chapter 2, "[Getting Started with Mini-XML](#)", shows how to use the Mini-XML library in your programs.
- Chapter 3, "[More Mini-XML Programming Techniques](#)", shows additional ways to use the Mini-XML library.
- Chapter 4, "[Using the mxmldoc Utility](#)", describes how to use the `mxmldoc(1)` program to generate software documentation.
- Appendix A, "[GNU Library General Public License](#)", provides the terms and conditions for using and distributing Mini-XML.
- Appendix B, "[Release Notes](#)", lists the changes in each release of Mini-XML.
- Appendix C, "[Library Reference](#)", contains a complete reference for Mini-XML, generated by `mxmldoc`.

Notation Conventions

Various font and syntax conventions are used in this guide. Examples and their meanings and uses are explained below:

Example	Description
<code>lpstat</code> <code>lpstat (1)</code>	The names of commands; the first mention of a command or function in a chapter is followed by a manual page section number.
<code>/var</code> <code>/usr/share/cups/data/testprint.ps</code>	File and directory names.
Request ID is Printer-123	Screen output.
<code>lp -d printer filename ENTER</code>	Literal user input; special keys like ENTER are in ALL CAPS.
12.3	Numbers in the text are written using the period (.) to indicate the decimal point.

Abbreviations

The following abbreviations are used throughout this manual:

Gb

Gigabytes, or 1073741824 bytes

kb

Kilobytes, or 1024 bytes

Mb

Megabytes, or 1048576 bytes

UTF-8, UTF-16

Unicode Transformation Format, 8-bit or 16-bit

W3C

World Wide Web Consortium

XML

Extensible Markup Language

Other References

The Unicode Standard, Version 4.0, Addison-Wesley, ISBN 0-321-18578-1

The definition of the Unicode character set which is used for XML.

Extensible Markup Language (XML) 1.0 (Third Edition)

The XML specification from the World Wide Web Consortium (W3C)

1 – Building, Installing, and Packaging Mini-XML

This chapter describes how to build, install, and package Mini-XML on your system.

Compiling Mini-XML

Mini-XML comes with an autoconf-based configure script; just type the following command to get things going:

```
./configure ENTER
```

The default install prefix is */usr/local*, which can be overridden using the **--prefix** option:

```
./configure --prefix=/foo ENTER
```

Other configure options can be found using the **--help** option:

```
./configure --help ENTER
```

Once you have configured the software, use the `make (1)` program to do the build and run the test program to verify that things are working, as follows:

```
make ENTER
```

Installing Mini-XML

Use the `make` command with the **`install`** target to install Mini-XML in the configured directories:

```
make install ENTER
```

Creating Mini-XML Packages

Mini-XML includes two files that can be used to create binary packages. The first file is *mxml.spec* which is used by the `rpmbuild(8)` software to create Red Hat Package Manager ("RPM") packages which are commonly used on Linux. Since `rpmbuild` wants to compile the software on its own, you can provide it with the Mini-XML tar file to build the package:

```
rpmbuild -ta mxml-version.tar.gz ENTER
```

The second file is *mxml.list* which is used by the `epm(1)` program to create software packages in a variety of formats. The `epm` program is available from the following URL:

<http://www.easysw.com/epm/>

Use the `make` command with the **`epm`** target to create portable and native packages for your system:

```
make epm ENTER
```

The packages are stored in a subdirectory named *dist* for your convenience. The portable packages utilize scripts and tar files to install the software on the target system; this is especially useful when installing on systems with different Linux distributions. Use the *mxml.install* script to install the software and *mxml.remove* script to remove the software.

The native packages will be in the local OS's native format: RPM for Red Hat Linux, DPKG for Debian Linux, PKG for Solaris, and so forth. Use the corresponding commands to install the native packages.

2 – Getting Started with Mini-XML

This chapter describes how to write programs that use Mini-XML to access data in an XML file.

The Basics

Mini-XML provides a single header file which you include:

```
#include <mxml.h>
```

The Mini-XML library is included with your program using the **-lmxml** option:

```
gcc -o myprogram myprogram.c -lmxml ENTER
```

If you have the `pkg-config(1)` software installed, you can use it to determine the proper compiler and linker options for your installation:

```
pkg-config --cflags mxml ENTER  
pkg-config --libs mxml ENTER
```

Nodes

Every piece of information in an XML file (elements, text, numbers) is stored in memory in "nodes". Nodes are defined by the `mxml_node_t` structure. The `type` member defines the node type (element, integer, opaque, real, or text) which determines which value you want to look at in the `value` union.

New nodes can be created using the `mxm1NewElement()`, `mxm1NewInteger()`, `mxm1NewOpaque()`, `mxm1NewReal()`, and `mxm1NewText()` functions. Only elements can have child nodes, and the top node must be an element, usually "?xml".

Each node has pointers for the node above (parent), below (child), to the left (prev), and to the right (next) of the current node. If you have an XML file like the following:

```
<?xml version="1.0"?>
<data>
  <node>val1</node>
  <node>val2</node>
  <node>val3</node>
  <group>
    <node>val4</node>
    <node>val5</node>
    <node>val6</node>
  </group>
  <node>val7</node>
  <node>val8</node>
  <node>val9</node>
</data>
```

the node tree returned by `mxm1LoadFile()` would look like the following in memory:

```
?xml
|
data
|
node - node - node - group - node - node - node
|   |   |   |   |   |   |
val1 val2 val3   |   val7 val8 val9
                |
                node - node - node
                |   |   |
                val4 val5 val6
```

where "-" is a pointer to the next node and "|" is a pointer to the first child node.

Once you are done with the XML data, use the `mxm1Delete()` function to recursively free the memory that is used for a particular node or the entire tree:

```
mxm1Delete(tree);
```

Loading and Saving XML Files

You load an XML file using the `mxm1LoadFile()` function:

```
FILE *fp;
mxm1_node_t *tree;

fp = fopen("filename.xml", "r");
tree = mxm1LoadFile(NULL, fp, MXML_NO_CALLBACK);
fclose(fp);
```

The third argument specifies a callback function which returns the value type of the immediate children for a new element node: `MXML_INTEGER`, `MXML_OPAQUE`, `MXML_REAL`, or `MXML_TEXT`. This function is

called *after* the element and its attributes have been read, so you can look at the element name, attributes, and attribute values to determine the proper value type to return. The default value type is `MXML_TEXT` if no callback is used.

Similarly, you save an XML file using the `mxm1SaveFile()` function:

```
FILE *fp;
mxm1_node_t *tree;

fp = fopen("filename.xml", "w");
mxm1SaveFile(tree, fp, MXML_NO_CALLBACK);
fclose(fp);
```

Callback functions for saving are used to optionally insert whitespace before and after elements in the node tree. Your function will be called up to four times for each element node with a pointer to the node and a "where" value of `MXML_WS_BEFORE_OPEN`, `MXML_WS_AFTER_OPEN`, `MXML_WS_BEFORE_CLOSE`, or `MXML_WS_AFTER_CLOSE`. The callback function should return `NULL` if no whitespace should be added and the string to insert (spaces, tabs, carriage returns, and newlines) otherwise.

The `mxm1LoadString()`, `mxm1SaveAllocString()`, and `mxm1SaveString()` functions load XML node trees from and save XML node trees to strings:

```
char buffer[8192];
char *ptr;
mxm1_node_t *tree;

...
tree = mxm1LoadString(NULL, buffer, MXML_NO_CALLBACK);

...
mxm1SaveString(tree, buffer, sizeof(buffer), MXML_NO_CALLBACK);

...
ptr = mxm1SaveAllocString(tree, MXML_NO_CALLBACK);
```

Finding and Iterating Nodes

The `mxm1WalkPrev()` and `mxm1WalkNext()` functions can be used to iterate through the XML node tree:

```
mxm1_node_t *node = mxm1WalkPrev(current, tree, MXML_DESCEND);

mxm1_node_t *node = mxm1WalkNext(current, tree, MXML_DESCEND);
```

In addition, you can find a named element/node using the `mxm1FindElement()` function:

```
mxm1_node_t *node = mxm1FindElement(tree, tree, "name", "attr",
                                     "value", MXML_DESCEND);
```

The name, attr, and value arguments can be passed as `NULL` to act as wildcards, e.g.:

```
/* Find the first "a" element */
node = mxm1FindElement(tree, tree, "a", NULL, NULL, MXML_DESCEND);

/* Find the first "a" element with "href" attribute */
```

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```
node = mxmlFindElement(tree, tree, "a", "href", NULL, MXML_DESCEND);

/* Find the first "a" element with "href" to a URL */
node = mxmlFindElement(tree, tree, "a", "href",
                        "http://www.easysw.com/~mike/mxml/", MXML_DESCEND);

/* Find the first element with a "src" attribute*/
node = mxmlFindElement(tree, tree, NULL, "src", NULL, MXML_DESCEND);

/* Find the first element with a "src" = "foo.jpg" */
node = mxmlFindElement(tree, tree, NULL, "src", "foo.jpg", MXML_DESCEND);
```

You can also iterate with the same function:

```
mxml_node_t *node;

for (node = mxmlFindElement(tree, tree, "name", NULL, NULL, MXML_DESCEND);
     node != NULL;
     node = mxmlFindElement(node, tree, "name", NULL, NULL, MXML_DESCEND))
{
    ... do something ...
}
```

The MXML_DESCEND argument can actually be one of three constants:

- MXML_NO_DESCEND means to not to look at any child nodes in the element hierarchy, just look at siblings at the same level or parent nodes until the top node or top-of-tree is reached. The previous node from "group" would be the "node" element to the left, while the next node from "group" would be the "node" element to the right.
- MXML_DESCEND_FIRST means that it is OK to descend to the first child of a node, but not to descend further when searching. You'll normally use this when iterating through direct children of a parent node, e.g. all of the "node" elements under the "?xml" parent node in the example above. This mode is only applicable to the search function; the walk functions treat this as MXML_DESCEND since every call is a first time.
- MXML_DESCEND means to keep descending until you hit the bottom of the tree. The previous node from "group" would be the "val3" node and the next node would be the first node element under "group". If you were to walk from the root node "?xml" to the end of the tree with `mxmlWalkNext()`, the order would be:

```
?xml
data
node
val1
node
val2
node
val3
group
node
val4
node
val5
node
val6
node
val7
node
```

```
val8  
node  
val9
```

If you started at "val9" and walked using `mxmlWalkPrev()`, the order would be reversed, ending at "?xml".

3 – More Mini–XML Programming Techniques

This chapter shows additional ways to use the Mini–XML library in your programs.

Load Callbacks

Save Callbacks

Changing Node Values

Formatted Text

Indexing

4 – Using the mxmldoc Utility

This chapter describes how to use the `mxmldoc(1)` utility that comes with Mini-XML to automatically generate documentation for your programs.

The Basics

The `mxmldoc` utility scans C and C++ source and header files and produces an XML file describing the library interface and an XHTML file providing a human-readable reference to the code.

XML Schema

The following poor-man's schema describes the format of the XML files produced by `mxmldoc`:

```
<?xml version="1.0"?>
<namespace name="">                                [optional...]
  <constant name="">
    <description>descriptive text</description>
  </constant>

  <enumeration name="">
    <constant name="">...</constant>
  </enumeration>

  <typedef name="">
    <description>descriptive text</description>
    <type>type string</type>
  </typedef>
```

```

<function name="" scope="">
  <description>descriptive text</description>
  <argument name="" direction="I|O|IO" default="">
    <description>descriptive text</description>
    <type>type string</type>
  </argument>
  <returnvalue>
    <description>descriptive text</description>
    <type>type string</type>
  </returnvalue>
  <seealso>function names separated by spaces</seealso>
</function>

<variable name="" scope="">
  <description>descriptive text</description>
  <type>type string</type>
</variable>

<struct name="">
  <description>descriptive text</description>
  <variable name="">...</variable>
  <function name="">...</function>
</struct>

<union name="">
  <description>descriptive text</description>
  <variable name="">...</variable>
</union>

<class name="" parent="">
  <description>descriptive text</description>
  <class name="">...</class>
  <enumeration name="">...</enumeration>
  <function name="">...</function>
  <struct name="">...</struct>
  <variable name="">...</variable>
</class>
</namespace>

```

A – GNU Library General Public License

Version 2, June 1991

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59 Temple Place – Suite 330, Boston, MA 02111–1307, USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the library GPL. It is numbered 2 because it goes with version 2 of the ordinary GPL.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software—to make sure the software is free for all its users.

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Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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- b)** You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c)** You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d)** If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs

whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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Changes in Mini-XML 2.0

- New programmers manual.
- Changed the whitespace callback interface to return strings instead of a single character, allowing for greater control over the formatting of XML files written using Mini-XML. **THIS CHANGE WILL REQUIRE CHANGES TO YOUR 1.x CODE IF YOU USE WHITESPACE CALLBACKS.**
- The mxmldoc utility is now capable of documenting C++ classes, functions, and structures, and correctly handles C++ comments.
- Added new modular tests for mxmldoc.
- Updated the mxmldoc output to be more compatible with embedding in manuals produced with HTMLDOC.
- The makefile incorrectly included a "/" separator between the destination path and install path. This caused problems when building and installing with MingW.

Changes in Mini-XML 1.3

- Fixes for mxmldoc.
- Added support for reading standard HTML entity names.
- mxmloadString/File() did not decode character entities in element names, attribute names, or attribute values.
- mxmloadString/File() would crash when loading non-conformant XML data under an existing parent (top) node.
- Fixed several bugs in the mxmldoc utility.

- Added new error callback function to catch a variety of errors and log them to someplace other than stderr.
- The `mxmlelementsetattr()` function now allows for NULL attribute values.
- The load and save functions now properly handle quoted element and attribute name strings properly, e.g. for !DOCTYPE declarations.

Changes in Mini-XML 1.2

- Added new "set" methods to set the value of a node.
- Added new formatted text methods `mxmlelementnewtextf()` and `mxmlelementsettextf()` to create/set a text node value using printf-style formats.
- Added new standard callbacks for use with the `mxmlelementload` functions.
- Updated the HTML documentation to include examples of the walk and load function output.
- Added `--with/without-ansi` configure option to control the `strdup()` function check.
- Added `--with/without-sprintf` configure option to control the `sprintf()` and `vsprintf()` function checks.

Changes in Mini-XML 1.1.2

- The `mxmlelement(3)` man page wasn't updated for the string functions.
- `mxmlelementsavestring()` returned the wrong number of characters.
- `mxmlelementaddchar()` updated the buffer pointer in the wrong place.

Changes in Mini-XML 1.1.1

- The private `mxmlelementaddch()` function did not update the start-of-buffer pointer which could cause a crash when using `mxmlelementsavestring()`.
- The private `mxmlelementwrite_ws()` function called `putc()` instead of using the proper callback which could cause a crash when using `mxmlelementsavestring()`.
- Added a `mxmlelementsaveallocstring()` convenience function for saving an XML node tree to an allocated string.

Changes in Mini-XML 1.1

- The `mxmlelementloadfile()` function now uses dynamically allocated string buffers for element names, attribute names, and attribute values. Previously they were capped at 16383, 255, and 255 bytes, respectively.
- Added a new `mxmlelementloadstring()` function for loading an XML node tree from a string.
- Added a new `mxmlelementsavestring()` function for saving an XML node tree to a string.
- Add emulation of `strdup()` if the local platform does not provide the function.

Changes in Mini-XML 1.0

- The `mxmldoc` program now handles function arguments, structures, unions, enumerations, classes, and typedefs properly.
- Documentation provided via `mxmldoc` and more in-line comments in the code.
- Added man pages and packaging files.

Changes in Mini-XML 0.93

- New mxmldoc example program that is also used to create and update code documentation using XML and produce HTML reference pages.
- Added mxxmlAdd() and mxxmlRemove() functions to add and remove nodes from a tree. This provides more flexibility over where the nodes are inserted and allows nodes to be moved within the tree as needed.
- mxxmlLoadFile() now correctly handles comments.
- mxxmlLoadFile() now supports the required "gt", "quot", and "nbsp" character entities.
- mxxmlSaveFile() now uses newlines as whitespace when valid to do so.
- mxxmlFindElement() now also takes attribute name and attribute value string arguments to limit the search to specific elements with attributes and/or values.

NULL pointers can be used as "wildcards".

- Added uninstall target to makefile, and auto-reconfig if Makefile.in or configure.in are changed.
- mxxmlFindElement(), mxxmlWalkNext(), and mxxmlWalkPrev() now all provide "descend" arguments to control whether they descend into child nodes in the tree.
- Fixed some whitespace issues in mxxmlLoadFile().
- Fixed Unicode output and whitespace issues in mxxmlSaveFile().
- mxxmlSaveFile() now supports a whitespace callback to provide more human-readable XML output under program control.

Changes in Mini-XML 0.92

- mxxmlSaveFile() didn't return a value on success.

Changes in Mini-XML 0.91

- mxxmlWalkNext() would go into an infinite loop.

Changes in Mini-XML 0.9

- Initial public release.

C – Library Reference

Contents

- Enumerations
- Functions
- Structures
- Types
- Unions

Enumerations

- mxml_type_e

mxml_type_e

Description

The XML node type.

Values

Name	Description
MXML_ELEMENT	XML element with attributes
MXML_INTEGER	Integer value
MXML_OPAQUE	Opaque string
MXML_REAL	Real value
MXML_TEXT	Text fragment

Functions

- [mxmlAdd\(\)](#)
- [mxmlDelete\(\)](#)
- [mxmlElementGetAttr\(\)](#)
- [mxmlElementSetAttr\(\)](#)
- [mxmlEntityGetName\(\)](#)
- [mxmlEntityGetValue\(\)](#)
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- [mxmlSetTextf\(\)](#)
- [mxmlWalkNext\(\)](#)
- [mxmlWalkPrev\(\)](#)

mxmlAdd()

Description

Add a node to a tree. Adds the specified node to the parent. If the child argument is not NULL, puts the new node before or after the specified child depending on the value of the where argument. If the child argument is NULL, puts the new node at the beginning of the child list (MXML_ADD_BEFORE) or at the end of the child list (MXML_ADD_AFTER). The constant MXML_ADD_TO_PARENT can be used to specify a NULL child pointer.

Syntax

```
void
mxmlAdd(
    mxml_node_t * parent,
    int where,
    mxml_node_t * child,
    mxml_node_t * node);
```

Arguments

Name	Description
parent	Parent node
where	Where to add, MXML_ADD_BEFORE or MXML_ADD_AFTER
child	Child node for where or MXML_ADD_TO_PARENT
node	Node to add

Returns

Nothing.

mxmDelete()

Description

Delete a node and all of its children. If the specified node has a parent, this function first removes the node from its parent using the `mxmRemove()` function.

Syntax

```
void  
mxmDelete(  
    mxm_node_t * node);
```

Arguments

Name	Description
node	Node to delete

Returns

Nothing.

mxmElementGetAttr()

Description

Get an attribute. This function returns NULL if the node is not an element or the named attribute does not exist.

Syntax

```
const char *  
mxmElementGetAttr(  
    mxm_node_t * node,  
    const char * name);
```

Arguments

Name	Description
node	Element node
name	Name of attribute

Returns

Attribute value or NULL

mxmlElementSetAttr()

Description

Set an attribute. If the named attribute already exists, the value of the attribute is replaced by the new string value. The string value is copied into the element node. This function does nothing if the node is not an element.

Syntax

```
void  
mxmlElementSetAttr(  
    mxml_node_t * node,  
    const char * name,  
    const char * value);
```

Arguments

Name	Description
node	Element node
name	Name of attribute
value	Attribute value

Returns

Nothing.

mxmlEntityGetName()

Description

Get the name that corresponds to the character value. If val does not need to be represented by a named entity, NULL is returned.

Syntax

```
const char *  
mxmlEntityGetName(  
    int val);
```

Arguments

Name	Description
val	Character value

Returns

Entity name or NULL

mxmlEntityGetValue()

Description

Get the character corresponding to a named entity. The entity name can also be a numeric constant. -1 is returned if the name is not known.

Syntax

```
int  
mxmlEntityGetValue(  
    const char * name);
```

Arguments

Name	Description
name	Entity name

Returns

Character value or -1 on error

mxmIFindElement()

Description

Find the named element. The search is constrained by the name, attribute name, and value; any NULL names or values are treated as wildcards, so different kinds of searches can be implemented by looking for all elements of a given name or all elements with a specific attribute. The descend argument determines whether the search descends into child nodes; normally you will use MXML_DESCEND_FIRST for the initial search and MXML_NO_DESCEND to find additional direct descendents of the node. The top node argument constrains the search to a particular node's children.

Syntax

```
mxmI_node_t *
mxmIFindElement (
    mxmI_node_t * node,
    mxmI_node_t * top,
    const char * name,
    const char * attr,
    const char * value,
    int descend);
```

Arguments

Name	Description
node	Current node
top	Top node
name	Element name or NULL for any
attr	Attribute name, or NULL for none
value	Attribute value, or NULL for any
descend	Descend into tree – MXML_DESCEND, MXML_NO_DESCEND, or MXML_DESCEND_FIRST

Returns

Element node or NULL

mxmLoadFile()

Description

Load a file into an XML node tree. The nodes in the specified file are added to the specified top node. If no top node is provided, the XML file MUST be well-formed with a single parent node like <?xml> for the entire file. The callback function returns the value type that should be used for child nodes. If MXML_NO_CALLBACK is specified then all child nodes will be either MXML_ELEMENT or MXML_TEXT nodes. The constants MXML_INTEGER_CALLBACK, MXML_OPAQUE_CALLBACK, MXML_REAL_CALLBACK, and MXML_TEXT_CALLBACK are defined for loading child nodes of the specified type.

Syntax

```
mxm_node_t *
mxmLoadFile(
    mxm_node_t * top,
    FILE * fp,
    mxm_type_t (*cb) (mxm_node_t *node));
```

Arguments

Name	Description
top	Top node
fp	File to read from
(*cb) (mxm_node_t *node)	Callback function or MXML_NO_CALLBACK

Returns

First node or NULL if the file could not be read.

mxmlloadString()

Description

Load a string into an XML node tree. The nodes in the specified string are added to the specified top node. If no top node is provided, the XML string MUST be well-formed with a single parent node like <?xml> for the entire string. The callback function returns the value type that should be used for child nodes. If MXML_NO_CALLBACK is specified then all child nodes will be either MXML_ELEMENT or MXML_TEXT nodes. The constants MXML_INTEGER_CALLBACK, MXML_OPAQUE_CALLBACK, MXML_REAL_CALLBACK, and MXML_TEXT_CALLBACK are defined for loading child nodes of the specified type.

Syntax

```
mxmlloadString(  
    mxmlloadString(  
        mxmlloadString(  
            const char * s,  
            mxmlloadString_t (*cb) (mxmlloadString_t *node));
```

Arguments

Name	Description
top	Top node
s	String to load
(*cb) (mxmlloadString_t *node)	Callback function or MXML_NO_CALLBACK

Returns

First node or NULL if the string has errors.

mxmINewElement()

Description

Create a new element node. The new element node is added to the end of the specified parent's child list. The constant MXML_NO_PARENT can be used to specify that the new element node has no parent.

Syntax

```
mxml_node_t *  
mxmINewElement(  
    mxml_node_t * parent,  
    const char * name);
```

Arguments

Name	Description
parent	Parent node or MXML_NO_PARENT
name	Name of element

Returns

New node

mxmINewInteger()

Description

Create a new integer node. The new integer node is added to the end of the specified parent's child list. The constant MXML_NO_PARENT can be used to specify that the new integer node has no parent.

Syntax

```
mxmI_node_t *  
mxmINewInteger(  
    mxmI_node_t * parent,  
    int integer);
```

Arguments

Name	Description
parent	Parent node or MXML_NO_PARENT
integer	Integer value

Returns

New node

mxm1NewOpaque()

Description

Create a new opaque string. The new opaque node is added to the end of the specified parent's child list. The constant MXML_NO_PARENT can be used to specify that the new opaque node has no parent. The opaque string must be nul-terminated and is copied into the new node.

Syntax

```
mxm1_node_t *  
mxm1NewOpaque(  
    mxm1_node_t * parent,  
    const char * opaque);
```

Arguments

Name	Description
parent	Parent node or MXML_NO_PARENT
opaque	Opaque string

Returns

New node

mxmINewReal()

Description

Create a new real number node. The new real number node is added to the end of the specified parent's child list. The constant MXML_NO_PARENT can be used to specify that the new real number node has no parent.

Syntax

```
mxml_node_t *  
mxmINewReal(  
    mxml_node_t * parent,  
    double real);
```

Arguments

Name	Description
parent	Parent node or MXML_NO_PARENT
real	Real number value

Returns

New node

mxmINewText()

Description

Create a new text fragment node. The new text node is added to the end of the specified parent's child list. The constant MXML_NO_PARENT can be used to specify that the new text node has no parent. The whitespace parameter is used to specify whether leading whitespace is present before the node. The text string must be nul-terminated and is copied into the new node.

Syntax

```
mxml_node_t *
mxmINewText (
    mxml_node_t * parent,
    int whitespace,
    const char * string);
```

Arguments

Name	Description
parent	Parent node or MXML_NO_PARENT
whitespace	1 = leading whitespace, 0 = no whitespace
string	String

Returns

New node

mxmINewTextf()

Description

Create a new formatted text fragment node. The new text node is added to the end of the specified parent's child list. The constant MXML_NO_PARENT can be used to specify that the new text node has no parent. The whitespace parameter is used to specify whether leading whitespace is present before the node. The format string must be nul-terminated and is formatted into the new node.

Syntax

```
mxmI_node_t *
mxmINewTextf(
    mxmI_node_t * parent,
    int whitespace,
    const char * format,
    ...);
```

Arguments

Name	Description
parent	Parent node or MXML_NO_PARENT
whitespace	1 = leading whitespace, 0 = no whitespace
format	Printf-style format string
...	Additional args as needed

Returns

New node

mxmlRemove()

Description

Remove a node from its parent. Does not free memory used by the node – use `mxmlDelete()` for that. This function does nothing if the node has no parent.

Syntax

```
void  
mxmlRemove(  
    mxml_node_t * node);
```

Arguments

Name	Description
node	Node to remove

Returns

Nothing.

mxmISaveAllocString()

Description

Save an XML node tree to an allocated string. This function returns a pointer to a string containing the textual representation of the XML node tree. The string should be freed using the free() function when you are done with it. NULL is returned if the node would produce an empty string or if the string cannot be allocated.

Syntax

```
char *
mxmISaveAllocString(
    mxmI_node_t * node,
    const char * (*cb)(mxmI_node_t *node, int ws));
```

Arguments

Name	Description
node	Node to write
(*cb)(mxmI_node_t *node, int ws)	Whitespace callback or MXML_NO_CALLBACK

Returns

Allocated string or NULL

mxm1SaveFile()

Description

Save an XML tree to a file. The callback argument specifies a function that returns a whitespace character or nul (0) before and after each element. If MXML_NO_CALLBACK is specified, whitespace will only be added before MXML_TEXT nodes with leading whitespace and before attribute names inside opening element tags.

Syntax

```
int
mxm1SaveFile(
    mxm1_node_t * node,
    FILE * fp,
    const char * (*cb)(mxm1_node_t *node, int ws));
```

Arguments

Name	Description
node	Node to write
fp	File to write to
(*cb)(mxm1_node_t *node, int ws)	Whitespace callback or MXML_NO_CALLBACK

Returns

0 on success, -1 on error.

mxm1SaveString()

Description

Save an XML node tree to a string. This function returns the total number of bytes that would be required for the string but only copies (bufsize – 1) characters into the specified buffer.

Syntax

```
int
mxm1SaveString(
    mxm1_node_t * node,
    char * buffer,
    int bufsize,
    const char * (*cb)(mxm1_node_t *node, int ws));
```

Arguments

Name	Description
node	Node to write
buffer	String buffer
bufsize	Size of string buffer
(*cb) (mxm1_node_t *node, int ws)	Whitespace callback or MXML_NO_CALLBACK

Returns

Size of string

mxm1SetElement()

Description

Set the name of an element node. The node is not changed if it is not an element node.

Syntax

```
int  
mxm1SetElement(  
    mxm1_node_t * node,  
    const char * name);
```

Arguments

Name	Description
node	Node to set
name	New name string

Returns

0 on success, -1 on failure

mxmlSetErrorCallback()

Description

Set the error message callback.

Syntax

```
void  
mxmlSetErrorCallback(  
    void (*cb)(const char *));
```

Arguments

Name	Description
(*cb)(const char *)	Error callback function

Returns

Nothing.

mxmlSetInteger()

Description

Set the value of an integer node. The node is not changed if it is not an integer node.

Syntax

```
int  
mxmlSetInteger(  
    mxml_node_t * node,  
    int integer);
```

Arguments

Name	Description
node	Node to set
integer	Integer value

Returns

0 on success, -1 on failure

mxm1SetOpaque()

Description

Set the value of an opaque node. The node is not changed if it is not an opaque node.

Syntax

```
int  
mxm1SetOpaque(  
    mxm1_node_t * node,  
    const char * opaque);
```

Arguments

Name	Description
node	Node to set
opaque	Opaque string

Returns

0 on success, -1 on failure

mxmlSetReal()

Description

Set the value of a real number node. The node is not changed if it is not a real number node.

Syntax

```
int  
mxmlSetReal(  
    mxml_node_t * node,  
    double real);
```

Arguments

Name	Description
node	Node to set
real	Real number value

Returns

0 on success, -1 on failure

mxmlSetText()

Description

Set the value of a text node. The node is not changed if it is not a text node.

Syntax

```
int  
mxmlSetText(  
    mxml_node_t * node,  
    int whitespace,  
    const char * string);
```

Arguments

Name	Description
node	Node to set
whitespace	1 = leading whitespace, 0 = no whitespace
string	String

Returns

0 on success, -1 on failure

mxmISetTextf()

Description

Set the value of a text node to a formatted string. The node is not changed if it is not a text node.

Syntax

```
int  
mxmISetTextf(  
    mxmI_node_t * node,  
    int whitespace,  
    const char * format,  
    ...);
```

Arguments

Name	Description
node	Node to set
whitespace	1 = leading whitespace, 0 = no whitespace
format	Printf-style format string
...	Additional arguments as needed

Returns

0 on success, -1 on failure

mxmIWalkNext()

Description

Walk to the next logical node in the tree. The descend argument controls whether the first child is considered to be the next node. The top node argument constrains the walk to the node's children.

Syntax

```
mxml_node_t *  
mxmIWalkNext (  
    mxml_node_t * node,  
    mxml_node_t * top,  
    int descend);
```

Arguments

Name	Description
node	Current node
top	Top node
descend	Descend into tree – MXML_DESCEND, MXML_NO_DESCEND, or MXML_DESCEND_FIRST

Returns

Next node or NULL

mxmIWalkPrev()

Description

Walk to the previous logical node in the tree. The descend argument controls whether the previous node's last child is considered to be the previous node. The top node argument constrains the walk to the node's children.

Syntax

```
mxml_node_t *  
mxmIWalkPrev(  
    mxml_node_t * node,  
    mxml_node_t * top,  
    int descend);
```

Arguments

Name	Description
node	Current node
top	Top node
descend	Descend into tree – MXML_DESCEND, MXML_NO_DESCEND, or MXML_DESCEND_FIRST

Returns

Previous node or NULL

Structures

- mxm1_attr_s
- mxm1_node_s
- mxm1_text_s
- mxm1_value_s

mxml_attr_s

Description

An XML element attribute value.

Definition

```
struct mxml_attr_s
{
    char * name;
    char * value;
};
```

Members

Name	Description
name	Attribute name
value	Attribute value

mxml_node_s

Description

An XML node.

Definition

```
struct mxml_node_s
{
    struct mxml_node_s * child;
    struct mxml_node_s * last_child;
    struct mxml_node_s * next;
    struct mxml_node_s * parent;
    struct mxml_node_s * prev;
    mxml_type_t type;
    mxml_value_t value;
};
```

Members

Name	Description
child	First child node
last_child	Last child node
next	Next node under same parent
parent	Parent node
prev	Previous node under same parent
type	Node type
value	Node value

mxml_text_s

Description

An XML text value.

Definition

```
struct mxml_text_s
{
    char * string;
    int whitespace;
};
```

Members

Name	Description
string	Fragment string
whitespace	Leading whitespace?

mxml_value_s

Description

An XML element value.

Definition

```
struct mxml_value_s
{
    mxml_attr_t * attrs;
    char * name;
    int num_attrs;
};
```

Members

Name	Description
attrs	Attributes
name	Name of element
num_attrs	Number of attributes

Types

- mxml_attr_t
- mxml_element_t
- mxml_node_t
- mxml_text_t
- mxml_type_t
- mxml_value_t

mxml_attr_t

Description

An XML element attribute value.

Definition

```
typedef struct mxml_attr_s mxml_attr_t;
```

mxml_element_t

Description

An XML element value.

Definition

```
typedef struct mxml_value_s mxml_element_t;
```


mxml_node_t

Description

An XML node.

Definition

```
typedef struct mxml_node_s mxml_node_t;
```

mxml_text_t

Description

An XML text value.

Definition

```
typedef struct mxml_text_s mxml_text_t;
```

mxml_type_t

Description

The XML node type.

Definition

```
typedef enum mxml_type_e mxml_type_t;
```

mxml_value_t

Description

An XML node value.

Definition

```
typedef union mxml_value_u mxml_value_t;
```

Unions

- mxml_value u

mxml_value_u

Description

An XML node value.

Definition

```
union mxml_value_u
{
    mxml_element_t element;
    int integer;
    char * opaque;
    double real;
    mxml_text_t text;
};
```

Members

Name	Description
element	Element
integer	Integer number
opaque	Opaque string
real	Real number
text	Text fragment