



Welcome to libjson 7. libjson is the fastest and more customizable json library for C and C++. It has a special interface for C++, to allow C++ programmers to embed libjson within their program, and because many of libjson's functions are inlined, they will get a major optimization boost from the compiler.

It also has a C-style interface for other programming languages and for sharing libraries. This document will explain building and optimizing libjson to fit your needs, the C interface, and the C++ specialized interface. Each has their own part in this document.

If you are upgrading from libJSON 5 or earlier, this new library has a different interface, so your programs will break if you try and plug and play, but it should not be difficult to convert them, as all of the functions are still there, they just have more standardized names.

If you are upgrading from libjson 6, the only difference in the interface is `json_validate`.

libjson's interface will not change during minor or bug fix releases. Only major upgrades will (ie, libjson 6 to libjson 7.)

You should look at the changelog at the end of the document each time you upgrade, as things may have been added or fixed that you are using.

## About libjson

libjson is a high speed complete JSON library, including parsers, writers, builders, formatters, validators... It is also highly customizable. It may seem strange that libjson is considered a very lightweight library, but the documentation is 200 pages long and there are dozens of source files, but the fact is that very little of the library gets compiled at any given time. The `JSONOptions.h` file sets options for which parts are compiled and how they are. This document will tell you if function behave differently or are unavailable under certain options.

libjson was written with performance in mind. It is fast, and uses very little memory. Low level memory manipulation allows libjson to do some speed tricks that less fine-tuned libraries don't do. The loads of preprocessor options means that there are few conditions at run-time, allowing it to focus as much energy on the task at hand. The options allow you to optimize libjson for your program. See the Optimizing libjson section.

I also gave it more customizability than any other library, including mutex managers, garbage collection, memory control, and unicode support, all optional of course, and not on by default. There is a clean C interface, with all methods using C - style names and all prefixed with `json_`. There is also a very intuitive C++ interface complete with iterators, and a very STL - style interface. These two libraries share some code, but also have version specific code.

Please report any bugs or feature requests here: [http://sourceforge.net/tracker/?group\\_id=314112](http://sourceforge.net/tracker/?group_id=314112)

If you email from your sourceforge account, be sure that you're able to receive replies. It seems that the default behavior of sourceforge turns this off, I've gotten lots of requests for help that I've been unable to respond to, I try my best to find another way to answer you, but I can't always.

## Supported platforms 8

## Building libjson 9

<i>JSONOptions.h</i>	9
<i>JSON_LIBRARY</i>	10
<i>JSON_STRICT</i>	11
<i>JSON_DEBUG</i>	12
<i>JSON_ISO_STRICT</i>	13
<i>JSON_SAFE</i>	14
<i>JSON_STDERROR</i>	15
<i>JSON_PREPARSE</i>	16
<i>JSON_LESS_MEMORY</i>	17
<i>JSON_UNICODE</i>	18
<i>JSON_REF_COUNT</i>	19
<i>JSON_BINARY</i>	20
<i>JSON_EXPOSE_BASE64</i>	21
<i>JSON_ITERATORS</i>	22
<i>JSON_STREAM</i>	23
<i>JSON_MEMORY_CALLBACKS</i>	24
<i>JSON_MEMORY_MANAGE</i>	25
<i>JSON_MUTEX_CALLBACKS</i>	26
<i>JSON_MUTEX_MANAGE</i>	27
<i>JSON_NO_C_CONSTS</i>	28
<i>JSON_OCTAL</i>	29
<i>JSON_READ_PRIORITY</i>	30
<i>JSON_WRITE_PRIORITY</i>	31
<i>JSON_NEWLINE</i>	32
<i>JSON_INDENT</i>	33
<i>JSON_ESCAPE_WRITES</i>	34
<i>JSON_COMMENTS</i>	35
<i>JSON_WRITE_BASH_COMMENTS</i>	36
<i>JSON_WRITE_SINGLE_LINE_COMMENTS</i>	37
<i>JSON_VALIDATE</i>	38
<i>JSON_CASE_INSENSITIVE_FUNCTIONS</i>	39
<i>JSON_INDEX_TYPE</i>	40
<i>JSON_BOOL_TYPE</i>	41
<i>JSON_STRING_HEADER</i>	42
<i>JSON_NO_EXCEPTIONS</i>	43
<i>JSON_DEPRECATED_FUNCTIONS</i>	44
<i>JSON_UNIT_TEST</i>	45

## C interface

46

<i>JSONNODE types</i>	46
<i>libjson types</i>	46
<i>JSONNODE functions</i>	47
<i>Inspector functions</i>	47
<i>Modifier Functions</i>	48
<i>Streaming Functions</i>	48
<i>json_new</i>	51
<i>json_new_a</i>	52
<i>json_new_i</i>	53
<i>json_new_f</i>	54
<i>json_new_b</i>	55
<i>json_copy</i>	56
<i>json_duplicate</i>	57
<i>json_delete</i>	58
<i>json_delete_all</i>	59
<i>json_new_stream</i>	60
<i>json_stream_push</i>	61
<i>json_delete_stream</i>	62
<i>json_type</i>	63
<i>json_size</i>	64
<i>json_empty</i>	65
<i>json_name</i>	66
<i>json_get_comment</i>	67
<i>json_as_string</i>	68
<i>json_as_int</i>	69
<i>json_as_float</i>	70
<i>json_as_bool</i>	71
<i>json_as_node</i>	72
<i>json_as_array</i>	73
<i>json_as_binary</i>	74
<i>json_write</i>	75
<i>json_write_formatted</i>	76
<i>json_equal</i>	77
<i>json_set_a</i>	78
<i>json_set_i</i>	79
<i>json_set_f</i>	80
<i>json_set_b</i>	81
<i>json_set_n</i>	82
<i>json_set_name</i>	83

<i>json_set_comment</i>	84
<i>json_clear</i>	85
<i>json_swap</i>	86
<i>json_merge</i>	87
<i>json_preparse</i>	88
<i>json_set_binary</i>	89
<i>json_cast</i>	90
<i>json_at</i>	91
<i>json_get</i>	92
<i>json_get_nocase</i>	93
<i>json_reserve</i>	94
<i>json_push_back</i>	95
<i>json_pop_back_at</i>	96
<i>json_pop_back</i>	97
<i>json_pop_back_nocase</i>	98
<i>json_find</i>	99
<i>json_find_nocase</i>	100
<i>json_erase</i>	101
<i>json_erase_multi</i>	102
<i>json_insert</i>	103
<i>json_insert_multi</i>	104
<i>json_begin</i>	105
<i>json_end</i>	106
<i>json_lock</i>	107
<i>json_unlock</i>	108
<i>json_set_mutex</i>	109
<i>json_set_global_mutex</i>	110
<i>json_parse</i>	111
<i>json_parse_unformatted</i>	112
<i>json_strip_white_space</i>	113
<i>json_is_valid</i>	114
<i>json_is_valid_unformatted</i>	115
<i>json_validate (deprecated)</i>	116
<i>json_register_debug_callback</i>	117
<i>json_register_mutex_callbacks</i>	118
<i>json_register_memory_callbacks</i>	119
<i>json_free</i>	120
<i>json_free_all</i>	121
<i>json_encode64</i>	122
<i>json_decode64</i>	123
<i>JSON_TEXT</i>	124

## C++ interface

125

<i>JSONNode</i>	126
<i>JSONNode types</i>	126
<i>Member types</i>	126
<i>Class functions</i>	127
<i>Inspector functions</i>	127
<i>Modifier Functions</i>	128
<i>JSONNode::JSONNode</i>	130
<i>JSONNode::~~JSONNode</i>	132
<i>JSONNode::duplicate</i>	133
<i>JSONNode::operator =</i>	134
<i>JSONNode::operator ==</i>	136
<i>JSONNode::operator !=</i>	137
<i>JSONNode::type</i>	138
<i>JSONNode::size</i>	139
<i>JSONNode::empty</i>	140
<i>JSONNode::name</i>	141
<i>JSONNode::get_comment</i>	142
<i>JSONNode::as_string</i>	143
<i>JSONNode::as_int</i>	144
<i>JSONNode::as_float</i>	145
<i>JSONNode::as_bool</i>	146
<i>JSONNode::as_node</i>	147
<i>JSONNode::as_array</i>	148
<i>JSONNode::as_binary</i>	149
<i>JSONNode::dump</i>	150
<i>JSONNode::write</i>	151
<i>JSONNode::write_formatted</i>	152
<i>JSONNode::set_name</i>	153
<i>JSONNode::set_comment</i>	154
<i>JSONNode::clear</i>	155
<i>JSONNode::swap</i>	156
<i>JSONNode::merge</i>	157
<i>JSONNode::preparse</i>	158
<i>JSONNode::set_binary</i>	159
<i>JSONNode::cast</i>	160
<i>JSONNode::at</i>	161
<i>JSONNode::at_nocase</i>	162
<i>JSONNode::operator []</i>	163
<i>JSONNode::reserve</i>	164

<i>JSONNode::push_back</i>	165
<i>JSONNode::pop_back</i>	166
<i>JSONNode::pop_back_nocase</i>	167
<i>JSONNode::find</i>	168
<i>JSONNode::find_nocase</i>	169
<i>JSONNode::erase</i>	170
<i>JSONNode::insert</i>	171
<i>JSONNode::begin</i>	173
<i>JSONNode::end</i>	174
<i>JSONNode::rbegin</i>	175
<i>JSONNode::rend</i>	176
<i>JSONNode::set_mutex</i>	177
<i>JSONNode::lock</i>	178
<i>JSONNode::unlock</i>	179
<b>JSONStream</b>	<b>180</b>
<i>JSONStream::JSONStream</i>	181
<i>JSONStream::~JSONStream</i>	182
<i>JSONStream::operator =</i>	183
<i>JSONStream::operator &lt;&lt;</i>	184
<b>libjson</b>	<b>185</b>
<i>libjson::parse</i>	187
<i>libjson::parse_unformatted</i>	188
<i>libjson::strip_white_space</i>	189
<i>libjson::is_valid</i>	190
<i>libjson::is_valid_unformatted</i>	191
<i>libjson::validate (deprecated)</i>	192
<i>libjson::register_debug_callback</i>	193
<i>libjson::register_mutex_callbacks</i>	194
<i>libjson::set_global_mutex</i>	195
<i>libjson::register_memory_callbacks</i>	196
<i>libjson::encode64</i>	197
<i>libjson::decode64</i>	198
<i>JSON_TEXT</i>	199
<b>Optimizing libjson</b>	<b>200</b>
<i>Compiler Options</i>	200
<i>C++ Optimizations</i>	200
<i>JSONOptions.h Optimizations</i>	200
<b>Changelog</b>	<b>202</b>



## Supported platforms

libjson officially supports and has been tested on the following platforms

- gcc (OSX)
- gcc (Linux)
- MinGW (Windows)
- Visual C++ (Windows)

More compilers are being added as I get word that it is working on them. If you are using a different compiler than one on this list, it *should* work. The code is meant to be platform and compiler independent. If there are minor incompatibilities, please open a ticket on sourceforge and I will get it fixed as soon as I can.



## Building libjson

libjson is designed for customizability by experts, but also ease of use by novices. Most users simply need to make the library. If you are planning on embedding it in your C++ program, then all you have to do is add libjson's source to your project and comment `JSON_LIBRARY` in `JSONOptions.h`. libjson does not use anything other than built-in C++ and any compiler should compile it.

### JSONOptions.h

In the source code you will find a file called `JSONOptions.h`, which is used for configuring libjson's build. All of the options are in there and it's recommended that you leave them, just comment out what you don't need. There is a brief description of each option in the file, as well as a more extensive explanation further down in this document.

I chose to use a file for the options in libjson instead of forcing the user to know compile options and change them in the project and make files. I think this is easier.

It is recommended that you build and run the Unit Test before compiling for the library or using it in C++. As there are billions of combinations of options, not all of them have been tested together. If the build failed, please take out a ticket on sourceforge: [http://sourceforge.net/tracker/?group\\_id=314112](http://sourceforge.net/tracker/?group_id=314112) or email the author at [ninja9578@yahoo.com](mailto:ninja9578@yahoo.com). Your issue will be quickly fixed and your options added to the quarter of a million unit tests that are already run, that way regression of the bug is impossible.

### Make Options

Thanks to Bernhard Fluehmann, libjson now has a proper makefile. The options of how libjson behaves are all in `JSONOptions`, but the way it compiles depends on the options you give the make file. The most common options for the makefile are `BUILD_TYPE`, `SHARED`, and `install`.

Running make by itself will cause the library to be built as a static library, exactly where the source is. Doing make install will install it in the `exec_prefix`. By default, `exec_prefix` is `/usr/local`, but you can set this as an option too.

To build libjson for specific purposes, you can set the `BUILD_TYPE` parameter. This is set to the same values as libjson 6's target: `small` or `debug`;

	<b>BUILD_TYPE=debug</b>	<b>BUILD_TYPE=small</b>
Output	libjson_dbg.a	libjson.a
Library Options	JSONOptions.h, JSON_SAFE, and JSON_DEBUG	JSONOptions.h and JSON_LESS_MEMORY
Compile Options	-g -Wall	-Os, -ffast-math -DNDEBUG

libjson now also has an option to compile as a shared or static library. Shared libraries are quite useful if you have multiple programs that all require json functionality. To use a shared library make `SHARED=1`. By default, `SHARED` is 0, so it will output a static library. The extension for a shared library is hard coded as `.so` in the makefile. To use `.dll` or `.dylib`, you will have to edit the make file. There are a few more options, all documented in the makefile itself.

## **JSON\_LIBRARY**

This option exposes only the C-style interface, which is used for static and dynamic library compilation so that it can be shared by multiple programs, or used by non-C++ programming languages. This C interface is a little simpler so that it is compatible with most programming languages primitives, but the overall functionality remains the same.

### **Recommended for**

Sharing the library among multiple programs, dynamically loading the library, or using it in a programming language other than C++.

### **On by default**

Yes

## **JSON\_STRICT**

This option makes libjson strictly adhere to the specs laid out for JSON. This eliminates all support for comments, hexadecimal and octal values, and various other things that libjson supports that isn't standard.

### **Recommended for**

Programmers who want a bare-bones strict JSON library and nothing more.

### **Requirements**

JSON\_UNICODE is required for this option

JSON\_COMMENTS is required to be off for this option

JSON\_OCTAL is required to be off for this option

### **On by default**

No

## **JSON\_DEBUG**

This option is used to create a debugging version of the library. It does a lot of checks not only of the json, but also of the library itself. This is recommended only while writing your software, but not for release, as it is a little bit slower.

This option exposes `libjson::registerDebugCallback` in C++ and `json_register_debug_callback` in C, which allows you to get feedback from libjson if something goes wrong. This will not protect against errors, only let you know about them before it crashes. If you want to catch errors and handle them gracefully, then turn on `JSON_SAFE` as well. You can also turn on `JSON_STDERROR`, which hides the callbacks and prints problems to `stderr`.

This option also exposes the `JSONNode::dump` function in C++, which allows you inspect the internal workings of libjson, which can be useful for debugging. I chose to omit this from the C interface because it is mostly used by the author and maintainers.

### **Recommended for**

Writing and debugging software, not for release software

### **On by default**

No

## **JSON\_ISO\_STRICT**

This option makes libjson use iso strict settings. This includes doing things like removing any non-standard C++ functionality like long longs and wchar\_t.

### **Recommended for**

Those who have compiler or company restrictions

### **On by default**

Depends, usually it is off, but if you compile on GCC with -ansi, this option will turn itself on and warn you that you left it off

## **JSON\_SAFE**

This option is also used for debugging, but can also be useful if you think that your program might receive json that is not properly formatted. If libjson encounters something it considers an error, then it will tell you through the callback or stderr, depending on the other options. then handle it gracefully. This option is required for validation.

### **Recommended for**

Programs that might receive incorrect json, or if you need to validate json. If your sure that your json will be correct, then there is no need for this option.

### **On by default**

Yes

## **JSON\_STDERROR**

This option will route all error messages to cerr instead of the callback. It hides libjson::registerDebugCallback and json\_register\_debug\_callback as they are not needed. You can see the errors in the console.

### **Recommended for**

Debugging for those who do not want to handle error messages in a special way.

### **On by default**

No

## **JSON\_PREPARSE**

This option forces libjson to parse the entire json string at once. By default, libjson does on-the-fly parsing for speed reasons. This makes initial parsing much faster and use much less memory, but subsequent reads of it slightly slower. This options switches those.

### **Recommended for**

Programs that use all or most of the json that it receives. Because json is largely used for communication from client to server, often the server will send more information that needed, so parsing all of it wastes time for no reason. However, json can also be used for configuration files as well as other things, so in cases like that, it might be preferable to use this option.

### **On by default**

No



## **JSON\_LESS\_MEMORY**

This option makes libjson use about 20% less memory on average. When libjson is done using memory, it doesn't always release all of it, it keeps it allocated so that any future requests to push memory back is much faster. This option doesn't allow that to happen, it instantly releases all extra memory.

This also turns off hot spot optimizations under GCC, but turns on the better packing.

### **Recommended for**

Programs that need as much memory as possible. Possibly for embedded programming, or programs that might end up using billions of nodes and need as much memory as possible.

### **On by default**

No

## **JSON\_UNICODE**

This option makes libjson use wide strings both internally and for the interface. Because the JSON standard specifies that it must support full UTF8, libjson can not meet this standard without wide characters. However, because these multi-byte characters are rarely used, this is optional, and off by default.

### **Recommended for**

Programs that need the full range of UTF-8.

### **Requirements**

Must not be compiled using ansi strict.

### **On by default**

No

## **JSON\_REF\_COUNT**

This option makes libjson's nodes reference count and copy-on-write it's internal structure. This makes passing by value and copying nodes very fast, but less thread-safe.

### **Recommended for**

Programmers that want to copy and pass by value often. Also by programmers who take JSONNodes just to read them. It is recommended if you are interacting with your json with multiple threads, that you turn this option off, or use the JSON\_MUTEX\_CALLBACKS options and use critical sections.

### **On by default**

Yes

## **JSON\_BINARY**

This option turns on the `set_binary` and `get_binary` functions. Because the JSON standard offers no way to encode true binary data, libjson (like most json libraries) uses Base64 to encode and decode binary data into text. This allows you to transport binary data between server and client, such as images or files. If you already have a base64 library, then you don't need this, however, this one is highly optimized and will probably be faster than most others.

### **Recommended for**

Programs that have to encode and decode binary data such as images. It can also be used to obfuscate data.

### **On by default**

No

## **JSON\_EXPOSE\_BASE64**

This option exposes an interface to libjson's base64 encoding functions. Normally, these are hidden behind the scenes (and off unless JSON\_BINARY is turned on,) but sometimes you may want a high-speed base64 encoder to accompany libjson. It is inefficient to have a base64 encoder/decoder AND libjson in your project. libjson's encoder and decoder is by far the fastest I've come across, and already therefor you. JSON is often used in networking, and base64 is often also required in networking.

### **Recommended for**

Programs that have to encode and decode binary data such as images. It can also be used to obfuscate data.

### **On by default**

No

## **JSON\_ITERATORS**

This option turns on iterator functions for libjson. erase, find, insert are exposed when this option is on. In C++ mode you'll find iterator functions to be very STL-like, and there is even support for iterators in the library, but more restrictive.

### **Recommended for**

Programmers familiar and comfortable with STL iterators or need advanced manipulation methods.

### **On by default**

No

## **JSON\_STREAM**

This option turns on streaming functions for libjson. This allows you buffer json, and send it to the stream a little bit at a time.

### **Recommended for**

Programs that want to buffer json, or need to stream from the internet.

### **On by default**

No

## **JSON\_MEMORY\_CALLBACKS**

This option exposes functions to register callbacks for allocating, resizing, and freeing memory. Because libjson is designed for speed, it is feasible that some users would like to further add speed by having the library utilize a memory pool. With this option turned on, the default behavior is still done internally unless a callback is registered

### **Recommended for**

Programs that want to use custom memory handling functionality, such as memory pools and garbage collection.

### **On by default**

No



## **JSON\_MEMORY\_MANAGE**

This option exposes functions to bulk delete all memory that libjson has allocated for you. This includes strings and nodes. Usually, you are required to keep track of all of the nodes and strings that libjson creates, but with this option you don't have to.

### **Recommended for**

Programs that use lots of strings and nodes and want to do bulk cleanups or memory managers.

### **On by default**

No

## **JSON\_MUTEX\_CALLBACKS**

This option exposes functions to register callbacks to lock and unlock mutexs and functions to lock and unlock JSONNodes and all of it's children. This does not prevent other threads from accessing the node, but will prevent them from locking it. Because of libjson's extremely complex internal working and reference counting, it is much easier for the end programmer to allow libjson to manage your mutexs because of reference counting and manipulating trees, libjson automatically tracks mutex controls for you, so you only ever lock what you need to.

### **Recommended for**

Programs that require libjson be used in critical sections.

### **On by default**

No

## **JSON\_MUTEX\_MANAGE**

This option lets you set mutexes and forget them, libjson will not only keep track of the mutex, but also keep a count of how many nodes are using it, and delete it when there are no more references. This changes the registerMutexCallbacks and json\_register\_mutex\_callbacks to require a third deleter callback as well.

### **Recommended for**

Programs that require libjson be used in critical sections and handle it's own mutexes.

### **Requirements**

JSON\_MUTEX\_CALLBACKS is required to also be defined, if it is not, the build will fail.

### **On by default**

No

## **JSON\_NO\_C\_CONSTS**

This option removes the const qualifier for the function declarations. The functions do not behave any differently, they simply have a slightly different interface.

### **Recommended for**

Programmers who are using legacy C compilers or coding guidelines

### **On by default**

No

## **JSON\_OCTAL**

This option turns on features for supporting octal values in strings and numbers. Normally, octal numbers are treated as decimal

### **Recommended for**

People who need octal support

### **On by default**

No

## **JSON\_READ\_PRIORITY**

This option exposes libjson's parsing functionality, and sets it's priority. By default reading is high priority, but if the majority of your time is spent writing, you can lower the priority to produce a better writing engine.

### **Recommended for**

Programs that need to read json, this is almost everyone.

### **On by default**

Yes (HIGH)

## **JSON\_WRITE\_PRIORITY**

This option exposes the `write` and `write_formatted` functionality. Without this option, `libjson` is read-only, this allows you to write json as well. This also sets the priority of the writing, some compilers will generate different code depending on the priority that you give.

### **Recommended for**

Programs that need to write json, such as two way communication or recording a config file after it has changed.

### **On by default**

Yes (MED)

## **JSON\_NEWLINE**

This option is used for writing formatted json using specialized newlines. By default, libjson will use the UNIX newline character. Simply defining this option is not adequate, you must define it to something. Whatever it's defined to will be used. The JSONOptions.h file included with libjson shows you how, as it defined is as a carriage return followed by a newline character, this is standard on Windows or MS-DOS. You may also want to set it to `<br>` (the new line tag for HTML.)

Even if you are using unicode, write the value of the newline in regular quotes, libjson will automatically make it unicode for you (in preprocessor.)

### **Recommended for**

Programs that write formatted JSON that require special newline characters.

### **On by default**

No



## **JSON\_INDENT**

This option is used for writing formatted json using specialized indents. By default, libjson will use the ASCII tab character. Simply defining this option is not adequate, you must define it to something. Whatever it's defined to will be used. The JSONOptions.h file included with libjson shows you how, you will most commonly change it to spaces, but HTML might also be common.

Even if you are using unicode, write the value of the newline in regular quotes, libjson will automatically make it unicode for you (in preprocessor.)

### **Recommended for**

Programs that write formatted JSON that spaces to indent instead of tabs.

### **On by default**

No

## **JSON\_ESCAPE\_WRITES**

This option is used for writing json where the special characters have been escaped. This is on by default, because without it, the json no longer meets the standards. If it's off special characters like newlines, tabs, and special unicode characters are simply place in the json as they appear. This may cause problems with other JSON engines, and it will not pass validation, so it is recommended that you leave it on.

### **Recommended for**

Programs that write JSON and want to adhere to the JSON standard, or communicate between other json engines.

### **On by default**

Yes

## **JSON\_COMMENTS**

This option tells libjson to store and write comments. libjson always supports parsing json that has comments in it as it simply ignores them, but with this option it keeps the comments and allows you to insert further comments.

libjson will automatically determine if comments are multiline or single line and write them accordingly.

### **Recommended for**

Programs that write complex JSON that might be read by human eyes. Comments make JSON easier to understand and alter.

### **On by default**

No

## **JSON\_WRITE\_BASH\_COMMENTS**

This option tells libjson to use bash comments to output json with comments. Bash comments are the # character. This also disables multi-line comments in the C-style (*/\* \*/*). Instead it will simply put multiple lines, all with leading # characters.

### **Recommended for**

Programs that require bash comments, perhaps for DOxygen documentation.

### **On by default**

No

## **JSON\_WRITE\_SINGLE\_LINE\_COMMENTS**

This option tells libjson to not use the C-style multi-line comment, as some JSON libraries don't support them. This will write multi-line comments as a series of // comments instead.

### **Recommended for**

Programs that need to output JSON that libraries that don't support multiline comments need to read.

### **On by default**

No

## **JSON\_VALIDATE**

This option exposes validation functions. For programs that might get invalid json, validation might be required before anything is done.

### **Recommended for**

Programs that might receive invalid json.

### **Requirements**

JSON\_READ\_PRIORITY is required to also be defined, if it is not, the build will fail.

### **On by default**

No

## **JSON\_CASE\_INSENSITIVE\_FUNCTIONS**

This option exposes case-insensitive functions. This includes at, get, find...

### **Recommended for**

Programs that don't know the cases of the node names

### **On by default**

No

## **JSON\_INDEX\_TYPE**

This option changes the type that is used to track the number of children. Usually unsigned int is used because it's fast and efficient, but there are cases where it's not desired. For instance, on embedded systems where there is little memory, one might choose to use a short or even a char. Or on huge 64-bit systems where the number of nodes may go outside the range of an unsigned int.

### **Recommended for**

Either very large or very small systems

### **On by default**

No



## **JSON\_BOOL\_TYPE**

This option changes the bool type in the C interface. This allows you to change the interface to fit the language that you are working with. If this option is not on, then the bool type is an int, but you can make it anything.

### **Recommended for**

Programming languages other than C-based ones

### **On by default**

No

## **JSON\_STRING\_HEADER**

This option changes the string type that libjson uses for both its interface and internals. This can be very useful for working with other libraries. For instance, developers using Qt or wxWidgets. Both are very common and have their own string class. Both should be able to be dropped right in without much problem. The class must be named or typedefed json\_string.

If you change this option and are using the C++ interface, then you must recompile the entire library because this makes a dynamic dependency that your IDE or compiler will not pick up on.

### **Recommended for**

Making interface between libjson and other libraries easier.

### **On by default**

No

## **JSON\_NO\_EXCEPTIONS**

This option shuts off all exceptions at the interface level. The engine may still use exceptions internally (it doesn't in the current version.) For the functions that throw exceptions, their differences are documented in the method documentation.

### **Recommended for**

Companies that do not allow exception-style error handling.

### **On by default**

No

## **JSON\_DEPRECATED\_FUNCTIONS**

This option leaves functions that are not supposed to be used anymore. You will get compiler warnings if you try to use these functions, but they will behave just as they did before they were deprecated.

### **Recommended for**

Backwards compatibility and ease of transition between major versions

### **On by default**

Yes

## **JSON\_UNIT\_TEST**

This option is used to maintain and debug the libjson. It makes all private members and functions public so that tests can do checks of the inner workings of libjson. This should not be turned on by end users.

### **Recommended for**

libjson maintainers only.

### **On by default**

No

## C interface

libjson has an interface that uses standard C types and a standard C interface. This interface doesn't have to be used in just C, it can be used in Basic, C, C++ and any other language that supports the C interface (most do.) All methods in libjson begin with "json\_" to make sure that the names don't collide with other libraries or any of your methods.

### JSONNODE types

Function	Description
JSON_NULL	Blank node or "null" (case-less)
JSON_STRING	A string
JSON_NUMBER	A floating point number
JSON_BOOL	A boolean "true" or "false" (case-less)
JSON_ARRAY	An array of JSONNodes
JSON_NODE	A complex JSONNode structure

### libjson types

Function	Description
JSONNODE *	Opaque pointer to a node within libjson
JSONNODE_ITERATOR	Random access iterator
JSONSTREAM	Opaque pointer to a stream
json_char	Either char or wchar_t, depending on options
json_number	Either float or double, depending on options
json_index_t	Child node indexing type
json_bool_t	Boolean type
json_error_callback_t	typedef void (* json_error_callback_t)(const json_char *)
json_stream_callback_t	typedef void (* json_stream_callback_t)(JSONNODE *)
json_mutex_callback_t	typedef void (* json_mutex_callback_t)(void *)
json_malloc_t	typedef void * (* json_malloc_t)(unsigned long)
json_realloc_t	typedef void * (* json_realloc_t)(void *, unsigned long)
json_free_t	typedef void (* json_free_t)(void *)

## JSONNODE functions

Function	Description
json_new	Construct JSONNode
json_new_a	Constructs a string node
json_new_i	Constructs a integer node
json_new_f	Constructs a floating point node
json_new_b	Constructs a boolean node
json_copy	Copy JSONNode content, usually reference counting
json_duplicate	Copy JSONNode content, forcing a copy
json_delete	Deletes the node
json_delete_all	Deletes all allocated nodes

## Inspector functions

Function	Description
json_type	The type of JSONNode it is
json_size	The number of child nodes
json_empty	Tests if the node has children
json_name	The name of the node
json_get_comment	The comment attached to the node
json_as_string	The string value of the node
json_as_int	The integer value of the string
json_as_float	The floating point value of the string
json_as_bool	The boolean value of the string
json_as_node	The node, cast to a JSON_NODE
json_as_array	The node, cast to a JSON_ARRAY
json_as_binary	The node with it's value converted to binary
json_write	Writes the node as JSON text
json_write_formatted	Writes the node as readable JSON text
json_equal	Compare JSONNode contents

## Modifier Functions

Function	Description
json_set_a	Sets the contents of the node to a string
json_set_i	Sets the contents of the node to an int
json_set_f	Sets the contents of the node to a float
json_set_b	Sets the contents of the node to a bool
json_set_n	Sets the contents of the node to another node
json_set_name	Sets the name of the node
json_set_comment	Sets the comment attached to the node
json_clear	Removes all children
json_nullify	Nulls out the node
json_swap	Swap the contents of two nodes
json_merge	Merges the contents of two or more nodes
json_preparse	Completely parses the JSON
json_set_binary	Sets the binary value of the node
json_cast	Change the node's type

## Streaming Functions

Function	Description
json_new_stream	Creates a stream
json_stream_push	Pushes data onto the stream
json_delete_stream	Deletes the stream



## Children Access Functions

Function	Description
json_at	Access item by index
json_get	Access item by name or index
json_get_nocase	Assess item by name, case-insensitive
json_reserve	Reserve enough space
json_push_back	Adds a child
json_pop_back_at	Removes and returns an item by index
json_pop_back	Removes and returns an item by name
json_pop_back_nocase	Removes and returns an item by name, case-insensitive
json_find	Finds a node by name
json_find_nocase	Finds a node by name, case-insensitive
json_erase	Removes an item
json_erase_multi	Remove a set of children
json_insert	Adds a child
json_insert_multi	Insert a set of children

## Iterator Functions

Function	Description
json_begin	Return iterator to beginning
json_end	Return iterator to end

## Thread Safety Functions

Function	Description
json_lock	Return iterator to end
json_unlock	Return reverse iterator to reverse beginning
json_set_mutex	Attaches a mutex to the node
json_set_global_mutex	Sets the global mutex

## JSON Functions

Function	Description
json_parse	Parses json
json_parse_unformatted	Parses son that has no white spaces
json_strip_white_space	Removes all white space and comment
json_is_valid	Validates json
json_is_valid_unformatted	Validates json that has no white spaces
json_validate (deprecated)	Validates json and if it's valid, return an object

## Callback Registration

Function	Description
json_register_debug_callback	Registers error callback
json_register_mutex_callbacks	Register mutex callbacks
json_register_memory_callbacks	Registers the memory callbacks

## Cleanup Functions

Function	Description
json_free	Frees memory of a string
json_free_all	Frees memory of all strings that libjson had allocated

## Base64 Functions

Function	Description
json_encode64	Base64 encodes data
json_decode64	Decodes Base64 data

## Text Functions

Function	Description
JSON_TEXT	Creates a text string in the right format

## json\_new

```
JSONNODE * json_new (char mytype);
```

### New Node

This function creates an empty node of the specified type. This would normally be used to start serializing something or writing a configuration file. You must json\_delete the resulting node or attach it to something as a child.

### Option Differences

JSON\_MEMORY\_MANAGER - Will keep a reference to the resulting node, so it doesn't have to be explicitly json\_deleted.

### Parameters

mytype  
The enumerated type of the JSONNODE.

### Return Value

Empty node

### Complexity

Constant

## json\_new\_a

```
JSONNODE * json_new_a (const json_char * name, const json_char * value);
```

### New Node

This function creates a string node with the name and value specified. You must json\_delete the resulting node or attach it to something as a child.

### Option Differences

JSON\_MEMORY\_MANAGER - Will keep a reference to the resulting node, so it doesn't have to be explicitly json\_deleted.

JSON\_SAFE - Allows value to be NULL

### Parameters

name

The node's name, this may be NULL

value

The node's value, this should not be NULL

### Return Value

A new node

### Complexity

Constant

## json\_new\_i

```
JSONNODE * json_new_i(const json_char * name, long value);
```

### New Node

This function creates a integer node with the name and value specified. You must json\_delete the resulting node or attach it to something as a child.

### Option Differences

JSON\_MEMORY\_MANAGER - Will keep a reference to the resulting node, so it doesn't have to be explicitly json\_deleted.

### Parameters

name	The node's name, may be NULL
value	The node's value

### Return Value

A new node

### Complexity

Constant

## json\_new\_f

```
JSONNODE * json_new_f(const json_char * name, json_number value);
```

### New Node

This function creates a floating point node with the name and value specified. You must `json_delete` the resulting node or attach it to something as a child.

### Option Differences

`JSON_MEMORY_MANAGER` - Will keep a reference to the resulting node, so it doesn't have to be explicitly `json_deleted`.

### Parameters

name	The node's name, may be NULL
value	The node's value

### Return Value

A new node

### Complexity

Constant

## json\_new\_b

```
JSONNODE * json_new_b(const json_char * name, int value);
```

### New Node

This function creates a boolean node with the name and value specified. You must json\_delete the resulting node or attach it to something as a child.

It's important to note that this function takes an int as the value, Some languages do not have a bool type (including C89.)

### Option Differences

JSON\_MEMORY\_MANAGER - Will keep a reference to the resulting node, so it doesn't have to be explicitly json\_deleted.

### Parameters

name

The node's name, may be NULL

value

The node's value

### Return Value

A new node

### Complexity

Constant

## json\_copy

```
JSONNODE * json_copy(const JSONNODE * node);
```

### Copy Node

This function copies a JSONNODE and returns the new copy. With reference counting, this operation is extremely fast. If you want a literal copy and not a reference count, use json\_duplicate.

### Option Differences

JSON\_MEMORY\_MANAGER - Will keep a reference to the resulting node, so it doesn't have to be explicitly json\_deleted.

JSON\_REF\_COUNT - if this is turned off, the copy constructor will fully duplicate the node

### Parameters

node

The node to be copied

### Return Value

An exact copy of the node parameter

### Complexity

Constant, unless JSON\_REF\_COUNT is on, in which case it's the same as json\_duplicate.



## json\_duplicate

```
JSONNODE * json_duplicate(const JSONNODE * node);
```

### Duplicating JSONNODE

Constructs a JSONNODE object, by copying the contents of JSONNODE. This is different from the json\_copy because it makes a literal copy, not reference counting.

### Option Differences

None

### Parameters

node  
The node to be copied

### Return Value

A JSONNode that is a new copy of the original node.

### Complexity

Linear on json\_size, however, because JSON is a tree structure it's worse case scenario is linear on json\_size + json\_size of each child recursively.

## json\_delete

```
void json_delete(JSONNODE * node);
```

### Destruct JSONNODE

Destructs the JSONNode object and cleans itself up.

### Option Differences

None

### Parameters

node  
The node to be deleted

### Return Value

None

### Complexity

Depends on circumstances. If it's reference count is not one, then it's complexity is constant, if it's the sole owner of it's value, then it becomes linear on JSONNode::size, however, because JSON is a tree structure it's worse case scenario is linear on JSONNode::size + JSONNode::size of each child recursively.

## **json\_delete\_all**

```
void json_delete_all(void);
```

### **Destruct All JSONNODEs**

Deletes all nodes that have been allocated by libjson. This is for bulk delete when you are done with libjson for the time.

### **Option Differences**

JSON\_MEMORY\_MANAGER - Is required to use this function

### **Parameters**

None

### **Return Value**

None

### **Complexity**

Complexity of json\_delete for each node.

## json\_new\_stream

```
JSONSTREAM * json_new_stream(json_stream_callback_t callback);
```

### New Stream

This function creates a stream. Streams are used for pushing small amounts of json at a time, it may be incomplete json, or even multiple json nodes, and the callback you give it will be called whenever a complete node is recognized.

Your callback must assume that the node given to it will be immediately deleted once the callback is finished, so if you need to keep it, you must copy it.

### Option Differences

JSON\_STREAM must be turned on to use this function

### Parameters

callback

The method that gets called whenever nodes are completed

### Return Value

A new stream

### Complexity

Constant

## json\_stream\_push

```
void json_stream_push(JSONSTREAM * stream, json_char * text);
```

### Push to stream

Pushes more text to the stream. If the stream sees that you have completed a node, it will call the callback.

### Option Differences

JSON\_STREAM must be turned on to use this function

### Parameters

stream

The stream to push onto

text

The text to add to the stream

### Return Value

None

### Complexity

Constant

## **json\_delete\_stream**

```
void json_delete_stream(JSONSTREAM * stream);
```

### **Deletes a stream**

Deletes a stream object

### **Option Differences**

JSON\_STREAM must be turned on to use this function

### **Parameters**

stream

The stream to push onto

### **Return Value**

None

### **Complexity**

Constant

## json\_type

```
char json_type(JSONNODE * node);
```

### Return type

Returns the type of the JSONNODE.

### Option Differences

None

### Parameters

none

### Return Value

The type of the node.

### Complexity

Constant

## **json\_size**

```
json_index_t json_size(JSONNODE * node);
```

### **Return size**

Returns the number of children that the node has. This should be zero for anything other than JSON\_ARRAY or JSON\_NODE, but this is only guaranteed with the JSON\_SAFE option turned on. This is because casting may or may not purge the children.

### **Option Differences**

JSON\_SAFE - will guarantee that anything other than JSON\_NODE and JSON\_ARRAY will return 0.

### **Parameters**

None

### **Return Value**

The number of children that the node has.

### **Complexity**

Constant.



## json\_empty

```
int json_empty(JSONNODE * node);
```

### Return empty

Returns whether or not the node has any children. If the node is not of JSON\_NODE or JSON\_ARRAY it will invariably return true. Note that it returns an int, because some languages do not have a bool type.

### Option Differences

None

### Parameters

node  
The node to perform this function on

### Return Value

Whether or not the node is empty

### Complexity

Constant.

## **json\_name**

```
json_char * json_name(JSONNODE * node);
```

### **Return name**

Returns the name of the node. If there is no name, then it returns a blank string.

### **Option Differences**

None

### **Parameters**

node  
The node to perform this function on

### **Return Value**

The name of the string.

### **Complexity**

Constant.

## **json\_get\_comment**

```
json_char * json_get_comment(JSONNODE * node);
```

### **Return comment**

Returns the comment attached to the node

### **Option Differences**

JSON\_COMMENTS - If this option is turned off, this function is not exposed

### **Parameters**

node  
The node to perform this function on

### **Return Value**

The comment of the node

### **Complexity**

Constant.

## json\_as\_string

```
json_char * json_as_string(JSONNODE * node);
```

### Return string value

Returns the string representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	"" or "null" depending on how it was created
JSON_STRING	The unescaped string value
JSON_NUMBER	The number in string form (may be in scientific notation)
JSON_BOOL	"true" or "false"
JSON_ARRAY	""
JSON_NODE	""

Notice that both JSON\_NODE and JSON\_ARRAY return empty strings. Use json\_write and json\_write\_formatted to output JSON.

### Option Differences

None

### Parameters

node  
The node to perform this function on

### Return Value

The string representation of the node.

### Complexity

Constant.

## json\_as\_int

```
long json_as_int(JSONNODE * node);
```

### Return int value

Returns the integer representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	0
JSON_STRING	Truncated atof(as_string)
JSON_NUMBER	Truncated Value
JSON_BOOL	1 if true, 0 if false
JSON_ARRAY	Undefined
JSON_NODE	Undefined

If the value is actually a floating point value, then libjson will record an error via it's callback, but will continue on ahead and simply truncate the value. So 15.9 will be returned as 15. If JSON\_DEBUG is turned on, it will also error if the value of the node is outside the range of the long datatype.

### Option Differences

None

### Parameters

node  
The node to perform this function on

### Return Value

The integer representation of the node.

### Complexity

Constant.

## json\_as\_float

```
json_number json_as_float(JSONNODE * node);
```

### Return floating point value

Returns the floating point representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	0.0
JSON_STRING	atof(as_string)
JSON_NUMBER	Value
JSON_BOOL	1.0 if true, 0.0 if false
JSON_ARRAY	Undefined
JSON_NODE	Undefined

### Option Differences

None

### Parameters

node

The node to perform this function on

### Return Value

The floating point representation of the node.

### Complexity

Constant.

## json\_as\_bool

```
int json_as_bool(JSONNODE * node);
```

### Return bool value

Returns the boolean representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	FALSE
JSON_STRING	Undefined
JSON_NUMBER	Value == 0.0
JSON_BOOL	Value
JSON_ARRAY	Undefined
JSON_NODE	Undefined

### Option Differences

None

### Parameters

node  
The node to perform this function on

### Return Value

The boolean representation of the node.

### Complexity

Constant.

## json\_as\_node

```
JSONNODE * json_as_node(JSONNODE * node);
```

### Return node value

Returns the node representation of the node. For anything other than node and array, it simply returns an empty node. If the caller is an array, it will convert it to a node.

Function	Description
JSON_NULL	Empty node
JSON_STRING	Empty node
JSON_NUMBER	Empty node
JSON_BOOL	Empty node
JSON_ARRAY	Array converted to a node
JSON_NODE	A copy of the node

This command creates a new JSONNODE that has to be deleted or attached to a parent.

### Option Differences

None

### Parameters

node  
The node to perform this function on

### Return Value

The node representation of the node.

### Complexity

Constant for all except JSON\_ARRAYs and JSON\_NODEs which are the same as the json\_copy function.



## json\_as\_array

```
JSONNODE * json_as_array(JSONNODE * node);
```

### Return array value

Returns the array representation of the node. For anything other than node and array, it simply returns an empty array. If the caller is an node, it will convert it to an array by stripping all of the names of each child.

Function	Description
JSON_NULL	Empty node
JSON_STRING	Empty node
JSON_NUMBER	Empty node
JSON_BOOL	Empty node
JSON_ARRAY	A copy of the array
JSON_NODE	An array of the children

This command creates a new JSONNODE that has to be deleted or attached to a parent.

### Option Differences

None

### Parameters

node  
The node to perform this function on

### Return Value

The node representation of the node.

### Complexity

Constant for anything other than a node. For a JSON\_NODE, it is linear with respect to json\_size, and JSON\_ARRAY which is the same as the json\_copy function.

## json\_as\_binary

```
void * json_as_binary(JSONNODE * node, unsigned long * size);
```

### Return binary value

Returns the binary value that was part of this node. It returns a byte array which is the original binary data. It gives you how large the array is by the pass by pointer size parameter.

Function	Description
JSON_NULL	Undefined
JSON_STRING	The binary data from the decoded Base64
JSON_NUMBER	Undefined
JSON_BOOL	Undefined
JSON_ARRAY	Undefined
JSON_NODE	Undefined

### Option Differences

JSON\_BINARY - If this option is not on, then this function is not accessible.

### Parameters

node

The node to perform this function on

size

A pointer to an unsigned long, which will tell you how many bytes the data is

### Return Value

The Base64 decoded binary data

### Complexity

Linear with respect to the length of the binary data

## json\_write

```
json_char * json_write(JSONNODE * node);
```

### Write JSON

Returns JSON text, with no white space or comments. Designed to create JSON that is very small, and therefore, faster to send between servers or write to a disk. The flipside is that it's nearly impossible to read by human eyes.

Only root nodes (JSON\_NODE and JSON\_ARRAYs) are meant to be written, all others will return a blank string.

### Option Differences

JSON\_WRITER - If this option is not on, then this function is not accessible.

JSON\_ESCAPE\_WRITES - Escapes special characters

### Parameters

node

The node to perform this function on

### Return Value

JSON text of the node being written

### Complexity

Linear with respect to the size of the tree underneath the node.

## json\_write\_formatted

```
json_char * json_write_formatted(JSONNODE * node);
```

### Write JSON

Returns JSON text that has been indented and prettied up so that it can be easily read and modified by humans.

Only root nodes (JSON\_NODE and JSON\_ARRAYs) are meant to be written, all others will return a blank string.

### Option Differences

JSON\_WRITER - If this option is not on, then this function is not accessible.

JSON\_COMMENTS - If this option is not turned on, then no comments are written

JSON\_WRITE\_BASH\_COMMENTS - This option will make libjson write only bash style # comments

JSON\_WRITE\_SINGLE\_LINE\_COMMENTS - This option will make libjson not write C-style /\* \*/ comments

JSON\_ESCAPE\_WRITES - Escapes special characters

### Parameters

node

The node to perform this function on

### Return Value

JSON text of the node being written

### Complexity

Linear with respect to the size of the tree underneath the node.

## json\_equal

```
int json_equal(JSONNODE * node1, JSONNODE * node2);
```

### Comparing JSONNODE

Checks if the value held within the nodes are equal. This ignores things like comments, but for JSON\_NODE and JSON\_ARRAYs, this is a deep comparison, checking each child too.

### Option Differences

None

### Parameters

node1

The value to compare to

node2

Another node to compare to

### Complexity

Constant except for JSON\_NODES and JSON\_ARRAYs in which case it's linear with respect to size() and size() of each child recursively.

## json\_set\_a

```
void json_set_a(JSONNODE * node, json_char * value);
```

### Setting the node's value

Sets the string value of the JSONNODE.

### Option Differences

JSON\_SAFE - Allows value to be NULL

### Parameters

node

The node to perform this function on

value

The new value of the node, shouldn't be NULL unless JSON\_SAFE is on

### Return Value

None

### Complexity

Constant

## json\_set\_i

```
void json_set_i(JSONNODE * node, long value);
```

### Setting the node's value

Sets the integer value of the JSONNODE.

### Option Differences

None

### Parameters

node	The node to perform this function on
value	The new value of the node

### Return Value

None

### Complexity

Constant

## json\_set\_f

```
void json_set_f(JSONNODE * node, json_number value);
```

### Setting the node's value

Sets the floating point value of the JSONNODE.

### Option Differences

None

### Parameters

node	The node to perform this function on
value	The new value of the node

### Return Value

None

### Complexity

Constant



## json\_set\_b

```
void json_set_b(JSONNODE * node, int value);
```

### Setting the node's value

Sets the boolean value of the JSONNODE. The value is an int because of the missing bool datatype in C.

### Option Differences

None

### Parameters

node	The node to perform this function on
value	The new value of the node

### Return Value

None

### Complexity

Constant

## json\_set\_n

```
void json_set_n(JSONNODE * node, JSONNODE * value);
```

### Setting the node's value

Sets the value of the JSONNODE to the value of the other, usually through fast and simple reference counting.

### Option Differences

None

### Parameters

node	The node to perform this function on
value	The new value of the node

### Return Value

None

### Complexity

Constant

## json\_set\_name

```
void json_set_name(JSONNODE * node, json_char * name_t);
```

### Setting the node's name

Sets the name of the JSONNode.

### Option Differences

JSON\_SAFE - name\_t can be NULL

### Parameters

node	
	The node to perform this function on
name_t	
	The name of the node

### Return Value

None

### Complexity

Constant

## json\_set\_comment

```
void json_set_comment(JSONNODE * node, json_char * comment_t);
```

### Setting the node's comment

Sets the comment that will be associated with the JSONNode.

### Option Differences

JSON\_COMMENTS - this option is required to expose this function

JSON\_SAFE - comment\_t can be NULL

### Parameters

node

The node to perform this function on

comment\_t

The comment attached to the node

### Return Value

None

### Complexity

Constant

## json\_clear

```
void json_clear(JSONNODE * node);
```

### Clearing a node

Clears all children from the node.

### Option Differences

None

### Parameters

node  
The node to perform this function on

### Return Value

None

### Complexity

Linear with respect to the size of the tree underneath it

## json\_swap

```
void json_swap(JSONNODE * node1, JSONNODE * node2);
```

### Swaps the contents of nodes

Swaps the contents of two nodes. This is very fast because JSONNODE is just a wrapper around an internal structure, so it simply swaps pointers to those structures.

### Option Differences

None

### Parameters

node1      The node to perform this function on  
node2      The node to swap values with

### Return Value

None

### Complexity

Constant

## json\_merge

```
void json_merge(JSONNODE * node1, JSONNODE * node2);
```

### Merge the contents of nodes

It's possible that you may end up with multiple copies of the same node, through duplication and such. To save space, you might want to merge the internal reference counted structure. Obviously, this only makes a difference if reference counting is turned on.

libjson will try and do this efficiently, merging with the internal structure that has the highest reference count.

### Option Differences

JSON\_REF\_COUNT - this option is required for this to do anything

### Parameters

node

The node to perform this function on

node2

One of the other nodes to merge with.

### Return Value

None

### Complexity

Constant

## json\_preparse

```
void json_preparse(JSONNODE * node);
```

### Preparse the json

libjson's lazy parsing makes parsing JSON that is not entirely used very fast, but sometimes you want to parse it all at once, making the next reads a little faster

### Option Differences

JSON\_PREPARSE - this option does this automatically, so it hides this function

### Parameters

node

The node to perform this function on

### Return Value

None

### Complexity

Linear with respect to the total number of nodes in the JSON



## json\_set\_binary

```
void json_set_binary(JSONNODE * node, const void * bin, unsigned long bytes);
```

### Set binary data

libjson's built in Base64 encoder will create a JSON\_NODE with Base64 encoded binary data, which allows you to send images and files around. libjson's Base64 encoder is faster than most others, so it's recommended that you use this method rather than other libraries.

### Option Differences

JSON\_BINARY - this option is required to use this method and the Base64 method

### Parameters

node	
	The node to perform this function on
bin	
	binary data
bytes	
	the number of bytes that the binary data is

### Return Value

None

### Complexity

Linear with respect to the number of bytes

## json\_cast

```
void json_cast(JSONNODE * node, char type);
```

### Cast to a different type

Will change the node to a different type and do any conversions necessary.

### Option Differences

None

### Parameters

node	The node to perform this function on
type	New type of node

### Return Value

None

### Complexity

Constant except for casting a node to array which is linear with respect to json\_size.

## json\_at

```
JSONNODE * json_at(JSONNODE * node, json_index_t pos);
```

### Getting a child

This will give you a reference to a child node at a specific location. This is a safe function and will return zero if you go out of bounds. The returned value is still a child, so do not try and delete the results.

### Option Differences

None

### Parameters

node	The node to perform this function on
pos	The index of the child node

### Return Value

The child at the desired location.

### Complexity

Constant

## json\_get

```
JSONNODE * json_get(JSONNODE * node, json_char * name);
```

### Getting a child

This will give you a reference to a child node by its name. This is a safe function and will return zero if that child does not exist. The returned value is still a child, so do not try and delete the results.

### Option Differences

None

### Parameters

node	The node to perform this function on
name	The name of the child node

### Return Value

The child at the desired location.

### Complexity

Linear with respect to json\_size

## json\_get\_nocase

```
JSONNODE * json_get_nocase(JSONNODE * node, json_char * name);
```

### Getting a child

This will give you a reference to a child node by its name. This is a safe function and will return zero if that child does not exist. The returned value is still a child, so do not try and delete the results.

### Option Differences

JSON\_CASE\_INSENSITIVE\_FUNCTIONS is required to use this function

### Parameters

node	The node to perform this function on
name	The name of the child node

### Return Value

The child at the desired location.

### Complexity

Linear with respect to json\_size.

## json\_reserve

```
void json_reserve(JSONNODE * node, json_index_t size);
```

### Reserving space

This function reserves children space, this makes the program faster and use less memory as it doesn't have to keep allocating new memory when it runs out.

### Option Differences

JSON\_LESS\_MEMORY - Causes this method to do nothing

### Parameters

node	
	The node to perform this function on
size	
	The size to reserve

### Return Value

None

### Complexity

If there is already some children it's linear with respect to json\_size unless the reserved amount is less than the current capacity, in which case it's constant. If there are no children, then it's constant.

## json\_push\_back

```
void json_push_back(JSONNODE * node, JSONNODE * child);
```

### Adding a child

This function pushes a new child node on the back of the child list. The child is then managed, so do not try and delete it later.

### Option Differences

None

### Parameters

node	The node to perform this function on
child	The node to be added as a child

### Return Value

None

### Complexity

Constant

## json\_pop\_back\_at

```
JSONNODE * json_pop_back_at(JSONNODE * node, json_index_t pos);
```

### Getting a child

This will give remove a JSONNODE from it's parent and return it to you. Because it's removed from the parent, you must delete it yourself.

### Option Differences

None

### Parameters

node

The node to perform this function on

pos

The index of the child node

### Return Value

The child at the desired location by value.

### Complexity

Linear based on json\_size minus pos. This is because the references of the other children have to be shifted.



## json\_pop\_back

```
JSONNODE * json_pop_back(JSONNODE * node, json_char * name);
```

### Getting a child

This will give remove a JSONNODE from it's parent and return it to you. Because it's removed from the parent, you must delete it yourself.

### Option Differences

None

### Parameters

node	The node to perform this function on
pos	The index of the child node
name	The name of the child node

### Return Value

The child at the desired location by value.

### Complexity

Linear based on json\_size.

## json\_pop\_back\_nocase

```
JSONNODE * json_pop_back_nocase(JSONNODE * node, json_char * name);
```

### Getting a child

This will give remove a JSONNODE from it's parent and return it to you. Because it's removed from the parent, you must delete it yourself.

### Option Differences

JSON\_CASE\_INSENSITIVE\_FUNCTIONS is required to use this function

### Parameters

node	The node to perform this function on
name	The name of the child node

### Return Value

The child at the desired location.

### Complexity

Linear with respect to json\_size.

## json\_find

```
JSONNODE_ITERATOR json_find(JSONNODE * node, json_char * name);
```

### Getting a child

Searches through the children and finds an iterator to it. This function returns json\_end if the child does not exist.

### Option Differences

JSON\_ITERATORS must be on to use this function

### Parameters

node

The node to perform this function on

name

The name of the child node

### Return Value

An iterator that points to the child requested, or json\_end if it wasn't found.

### Complexity

Linear based on json\_size.

## json\_find\_nocase

JSONNODE\_ITERATOR json\_find\_nocase(JSONNODE \* node, json\_char \* name);

### Getting a child

Searches through the children and finds an iterator to it. This function returns json\_end if the child does not exist.

### Option Differences

JSON\_ITERATORS and JSON\_CASE\_INSENSITIVE\_FUNCTIONS must be on to use this function

### Parameters

node                      The node to perform this function on  
name                      The name of the child node

### Return Value

An iterator that points to the child requested, or json\_end if it wasn't found.

### Complexity

Linear based on json\_size.

## **json\_erase**

```
JSONNODE_ITERATOR json_erase(JSONNODE * node, JSONNODE_ITERATOR pos);
```

### **Removing a child**

Erases a single child and returns the iterator to the next one.

### **Option Differences**

JSON\_ITERATORS must be on to use this function

### **Parameters**

node

The node to perform this function on

pos

The position of the node that is to be deleted

### **Return Value**

An iterator that points to the child after the deleted one, or json\_end

### **Complexity**

Linear based on json\_size minus where it starts from due to memory shifting.

## **json\_erase\_multi**

```
JSONNODE_ITERATOR json_erase_multi(JSONNODE * node, JSONNODE_ITERATOR start,  
JSONNODE_ITERATOR end);
```

### **Removing a child**

Erases a single child and returns the iterator to the next one.

### **Option Differences**

JSON\_ITERATORS must be on to use this function

### **Parameters**

node	The node to perform this function on
start	The position of starting node to be deleted (inclusively)
end	The position of ending node to be deleted (inclusively)

### **Return Value**

An iterator that points to the child after the deleted one, or json\_end

### **Complexity**

Linear based on json\_size minus where it starts from due to memory shifting.

## json\_insert

```
JSONNODE_ITERATOR json_insert(JSONNODE * node, JSONNODE_ITERATOR pos, JSONNODE * child);
```

### Adding a child

These functions place a new child into your node before the node pointed to by the iterator. This functions copy the nodes, they remain where they are as well, so you must delete it.

### Option Differences

JSON\_ITERATORS must be on to use this function

### Parameters

node	The node to perform this function on
pos	The position to insert before
child	The node to be inserted

### Return Value

An iterator that points to the first inserted node

## json\_insert\_multi

```
JSONNODE_ITERATOR json_insert_multi(JSONNODE * node, JSONNODE_ITERATOR start,  
JSONNODE_ITERATOR end);
```

### Adding a child

These functions place a new child into your node before the node pointed to by the iterator. This functions copy the nodes, they remain where they are as well, so you must delete it.

### Option Differences

JSON\_ITERATORS must be on to use this function

### Parameters

node	The node to perform this function on
pos	The position to insert before
start	Position to start copying (inclusively)
end	Position to stop copying (inclusively)

### Return Value

An iterator that points to the first inserted node

### Complexity

Linear based on json\_size minus where it starts from due to memory shifting plus end minus start for the ranged variety.



## **json\_begin**

`JSONNODE_ITERATOR json_begin(JSONNODE * node);`

### **Getting start of children**

This function gets you an iterator pointing to the beginning of the children.

### **Option Differences**

JSON\_ITERATORS must be on to use this function

### **Parameters**

node

The node to perform this function on

### **Return Value**

An iterator that points to the first child

### **Complexity**

Constant

## **json\_end**

```
JSONNODE_ITERATOR json_end(JSONNODE * node);
```

### **Getting end of children**

This function gets you an iterator pointing past the end of the children.

### **Option Differences**

JSON\_ITERATORS must be on to use this function

### **Parameters**

node

The node to perform this function on

### **Return Value**

An iterator that points past the last child

### **Complexity**

Constant

## json\_lock

```
void json_lock(JSONNODE * node, int threadID);
```

### Lock a mutex

This function locks the mutex attached to a node, and locks anything sharing the lock in a different thread. The reason for the threadID parameter is that because libjson passes around structures behind the scenes it might be possible to try and lock the same lock in multiple places in the same critical section. Counting locks per thread eliminates this problem.

### Option Differences

JSON\_MUTEX\_CALLBACKS must be on to use this function

### Parameters

node

The node to perform this function on

threadID

A unique id for this thread

### Return Value

None

### Complexity

Constant

## json\_unlock

```
void json_unlock(JSONNODE * node, int threadID);
```

### Unlock a mutex

This function unlocks the mutex attached to a node. If the mutex has been locked multiple times by the same thread, then it will wait until all locks have been released before actually doing the unlock.

### Option Differences

JSON\_MUTEX\_CALLBACKS must be on to use this function

### Parameters

node

The node to perform this function on

threadID

A unique id for this thread

### Return Value

None

### Complexity

Constant

## json\_set\_mutex

```
void json_set_mutex(JSONNODE * node, void * mutex);
```

### Set a lock

This function attaches a mutual exclusion lock for the node. It can be locked and unlocked by using the lock and unlock functions. The reason for this is that because libjson's complex reference counting and internal magic, it is difficult to be sure that you track data correctly, so libjson will pass this mutex around its internal system and track it for you.

You can pass NULL to this function to unset a mutex.

This method will filter the mutex down to all children as well, and anything that you add to it later.

### Option Differences

JSON\_MUTEX\_CALLBACKS must be on to use this function

JSON\_MUTEX\_MANAGER - if this option is on, then libjson will automatically delete this mutex when it runs out of references to it

### Parameters

node

The node to perform this function on

mutex

A pointer to a mutex of any type (POSIX, Windows...)

### Return Value

None

### Complexity

Linear with json\_size and json\_size of each child recursively.

## json\_set\_global\_mutex

```
void json_set_global_mutex(void * mutex);
```

### Register library-wide mutex

This function sets a global mutex for libjson. This is not the same as the manager mutex that you are required to register in `register_mutex_callbacks`. This mutex is a fallback mutex that gets locked when you attempt to lock a node that has no mutex attached to it. You may wish to omit assigning mutexes for each node and just let them all use the global one.

### Option Differences

JSON\_MUTEX\_CALLBACKS must be on to use this feature

### Parameters

mutex

A mutex that libjson will use when it doesn't have any to use

### Return Value

None

### Complexity

Constant

## **json\_parse**

```
JSONNODE * json_parse(const json_char * json);
```

### **Parse JSON text**

This function parses JSON text and returns you a JSONNode which is the root node of the text that you just passed it. If bad JSON is sent to this method it may return NULL.

### **Option Differences**

JSON\_SAFE - a node of type JSON\_NULL will be returned if the json was invalid

### **Parameters**

json  
JSON text

### **Return Value**

The root node of the text

### **Complexity**

Linear depending on strlen(json)

## **json\_parse\_unformatted**

```
JSONNODE * json_parse_unformatted(const json_char * json);
```

### **Parse JSON text**

This function parses JSON text and returns you a JSONNode which is the root node of the text that you just passed it. If bad JSON is sent to this method it may return NULL. This method assumes that the JSON has no whitespace, or comments.

### **Option Differences**

JSON\_SAFE - a node of type JSON\_NULL will be returned if the json was invalid

### **Parameters**

json  
JSON text

### **Return Value**

The root node of the text

### **Complexity**

Linear depending on strlen(json)



## **json\_strip\_white\_space**

```
json_char * json_strip_white_space(const json_char * json);
```

### **Parse JSON text**

This function removes anything that the JSON standard defines as white space, including extra tabs, spaces, formatting, and comments. This makes this function useful for compressing json that needs to be stored or sent over a network.

### **Option Differences**

None

### **Parameters**

json  
JSON text

### **Return Value**

Valid JSON that is free of all white space

### **Complexity**

Linear depending on strlen(json)

## **json\_is\_valid**

```
json_bool_t json_is_valid(const json_char * json);
```

### **Validate JSON text**

This function validates the text by parsing it completely and looking for anything that is malformed.

### **Option Differences**

JSON\_VALIDATE must be on to use this feature

### **Parameters**

json  
JSON text

### **Return Value**

whether or not the json is valid

### **Complexity**

Linear depending on strlen(json) and the number of nodes within the text.

## **json\_is\_valid\_unformatted**

```
json_bool_t json_is_valid_unformatted(const json_char * json);
```

### **Validate JSON text**

This function validates the text by parsing it completely and looking for anything that is malformed. This is the version to use if your json doesn't have any white space or comments.

### **Option Differences**

JSON\_VALIDATE must be on to use this feature

### **Parameters**

json  
JSON text

### **Return Value**

whether or not the json is valid

### **Complexity**

Linear depending on strlen(json) and the number of nodes within the text.

## **json\_validate (deprecated)**

**JSONNODE** \* json\_validate(const json\_char \* json);

### **Validate JSON text**

This function validates the text by parsing it completely and looking for anything that is malformed. If bad JSON is sent to this method it will return NULL, otherwise it will return the parsed object.

This function will be removed shortly, you are advised to replace all validate calls to json\_is\_valid and json\_parse functions.

### **Option Differences**

JSON\_VALIDATE, and JSON\_DEPRECATED\_FUNCTIONS must be on to use this feature

### **Parameters**

json  
JSON text

### **Return Value**

The root node of the text

### **Complexity**

Linear depending on strlen(json) and the number of nodes within the text.

## **json\_register\_debug\_callback**

```
void json_register_debug_callback(json_error_callback_t callback);
```

### **Register error callback**

This callback allows libjson to tell you exactly what is going wrong in your software, making debugging and fixing the problem much easier.

### **Option Differences**

JSON\_DEBUG must be on to use this feature

### **Parameters**

callback

A method that must have this prototype: `static void callback (const json_char * message)`

### **Return Value**

None

### **Complexity**

Constant

## json\_register\_mutex\_callbacks

```
void json_register_mutex_callbacks(json_mutex_callback_t lock, json_mutex_callback_t unlock, void * manager_mutex);
```

```
void json_register_mutex_callbacks(json_mutex_callback_t lock, json_mutex_callback_t unlock, json_mutex_callback_t destroy, void * manager_mutex);
```

### Register mutex callbacks

This callback allows libjson to lock mutexes that you assign to JSONNode structures. Because libjson has no idea what kind of mutex you gave it, it can't lock it without the help of a callback. This method is required to run before any locking can take place.

### Option Differences

JSON\_MUTEX\_CALLBACKS must be on to use this feature

JSON\_MUTEX\_MANAGER must be on to use the second variant

### Parameters

lock

A method that locks a mutex and must have this prototype: `static void callback (void * mutex).`

unlock

A method that unlocks a mutex and must have this prototype: `static void callback (void * mutex).`

destroy

A method that deletes a mutex and must have this prototype: `static void callback (void * mutex).`  
This parameter is only allowed if JSON\_MUTEX\_MANAGER is defined, otherwise, you are responsible for cleaning up your mutexes.

manager\_mutex

A mutex that libjson will need to use to handle all of the mutexes, as even without JSON\_MUTEX\_MANAGER, some management takes place and libjson has a few critical sections when threading. May not be the same as the global mutex.

### Return Value

None

### Complexity

Constant

## json\_register\_memory\_callbacks

```
void json_register_memory_callbacks(json_malloc_t allocator, json_realloc_t reallocer, json_free_t freer);
```

### Register memory handling

This function sets callbacks that libjson will use to allocate memory. This allows you to keep a tight control of memory allocation, or use things like memory pool and such. These methods are currently not allowed to return null or less than it asked for, as it will cause instability in libjson.

### Option Differences

JSON\_MEMORY\_CALLBACKS must be on to use this feature

### Parameters

allocator

A method that must have this prototype: `static void * alloc(unsigned long bytes)`

reallocer

A method that must have this prototype: `static void * realloc(void * buffer, unsigned long bytes)`

freer

A method that must have this prototype: `static void dealloc(void * buffer)`

### Return Value

None

### Complexity

Constant

## **json\_free**

```
void json_free(void * str);
```

### **Frees text**

This function removes the memory allocated by various functions that return strings, such as `json_as_string`, `json_as_binary`, `json_write...`

### **Option Differences**

None

### **Parameters**

str

Memory that libjson allocated

### **Return Value**

None

### **Complexity**

Constant unless `JSON_MEMORY_MANAGE` is defined in which case it's logarithmic depending on the number of strings currently allocated.



## **json\_free\_all**

```
void json_free_all(void);
```

### **Frees text**

This function removes all of the memory that libjson has allocated for strings and binary. This allows for bulk frees and garbage collection.

### **Option Differences**

JSON\_MEMORY\_MANAGE is required to use this function

### **Parameters**

None

### **Return Value**

None

### **Complexity**

Constant

## **json\_encode64**

```
json_char * json_encode64(const void * binary, json_index_t bytes);
```

### **Encodes data**

This function takes binary data and does a base64 encoding so that you can send it through a text only protocol,

### **Option Differences**

JSON\_EXPOSE\_BASE64 is required to use this function

### **Parameters**

binary

binary data

bytes

the number of bytes in the binary buffer

### **Return Value**

Base 64 encoded string

### **Complexity**

Linear

## json\_decode64

```
void * json_decode64(const json_char * text, unsigned long * bytes);
```

### Encodes data

This function takes base64 encoded data and decodes it for you

### Option Differences

JSON\_EXPOSE\_BASE64 is required to use this function

### Parameters

text

base64 encoded text

bytes

the number of bytes in the returned binary buffer

### Return Value

Decoded string

### Complexity

Linear

## **JSON\_TEXT**

### **Converts text**

This is a marco that you can use to wrap around text that you pass into libjson. It automatically prepends an L in unicode mode and does nothing when not in unicode mode. This allows you to use the same code for unicode and non unicode software.

## C++ interface

libjson has an interface specifically designed for C++. It's designed for the following things: speed, heavy internal optimization, and ease of use. The interface should be very intuitive to those familiar with STL and uses standard overloaded operators.

Because so many of the functions in JSONNode are inline, the merge between your program and the library at the optimization level allows more optimization than if the library was external. Your program will run faster and use less memory because of this.

There are two main interfaces here: libjson and JSONNode. libjson is for parsing and registering callbacks and JSONNode is the worker and the structure that stores and manipulates JSON once it's been loaded.

This part of the document is set up to look like [cplusplus.com](http://cplusplus.com)'s reference manual, so that it should be easy to navigate and find everything that you're looking for.

## JSONNode

JSONNode is the basic class for holding JSON values. It is a reference-counted, copy-on-write class that adheres to standard C++ practices. It has a very small footprint, both in memory and on the processor. Its interface is similar to anything in STL, and should be very intuitive.

There are several types of JSONNodes, but they all share the same class.

### JSONNode types

Function	Description
JSON_NULL	Blank node or “null” (case-less)
JSON_STRING	A string
JSON_NUMBER	A floating point number
JSON_BOOL	A boolean “true” or “false” (case-less)
JSON_ARRAY	An array of JSONNodes
JSON_NODE	A complex JSONNode structure

### Member types

Function	Description
iterator	Random access iterator
const_iterator	Constant random access iterator
reverse_iterator	A reverse random access iterator
reverse_const_iterator	A constant reverse random access iterator
json_string	Either std::string or std::wstring, depending on options
json_char	Either char or wchar_t, depending on options
json_number	Either float or double, depending on options
json_index_t	Child node indexing type
auto_lock	A scoped locking mechanism for JSONNodes

## Class functions

Function	Description
(constructor)	Construct JSONNode
(destructor)	JSONNode destructor
duplicate	Copy JSONNode content, forcing a copy
operator =	Copy JSONNode content, usually reference counting

## Inspector functions

Function	Description
type	The type of JSONNode it is
size	The number of child nodes
empty	Tests if the node has children
name	The name of the node
get_comment	The comment attached to the node
as_string	The string value of the node
as_int	The integer value of the string
as_float	The floating point value of the string
as_bool	The boolean value of the string
as_node	The node, cast to a JSON_NODE
as_array	The node, cast to a JSON_ARRAY
as_binary	The node with it's value converted to binary
dump	Dumps the inner working of the node into JSON
write	Writes the node as JSON text
write_formatted	Writes the node as readable JSON text

## Comparison Functions

Function	Description
operator ==	Compare JSONNode contents
operator !=	Compare JSONNode contents

## Modifier Functions

Function	Description
set_name	Sets the name of the node
set_comment	Sets the comment attached to the node
clear	Removes all children
nullify	Nulls out the node
swap	Swap the contents of two nodes
merge	Merges the contents of two or more nodes
preparse	Completely parses the JSON
set_binary	Sets the binary value of the node
cast	Change the node's type

## Children Access Functions

Function	Description
at	Access item by name or index
at_nocase	Assess item by name, case-insensitive
operator []	Assess item by name or index
reserve	Reserve enough space
push_back	Adds a child
pop_back	Removes and returns an item by name or index
pop_back_nocase	Removes and returns an item by name, case-insensitive
find	Finds a node by name
find_nocase	Finds a node by name, case-insensitive
erase	Removes an item
insert	Adds a child



### Iterator Functions

Function	Description
begin	Return iterator to beginning
end	Return iterator to end
rbegin	Return reverse iterator to reverse beginning
rend	Return reverse iterator to reverse end

### Thread Safety Functions

Function	Description
set_mutex	Attaches a mutex to the node
lock	Return iterator to end
unlock	Return reverse iterator to reverse beginning

### Text Functions

Function	Description
JSON_TEXT	Creates a text string in the right format

## JSONNode::JSONNode

```
explicit JSONNode(char mytype = JSON_NODE);
JSONNode(const json_string & name_t, char value_t);
JSONNode(const json_string & name_t, unsigned char value_t);
JSONNode(const json_string & name_t, short value_t);
JSONNode(const json_string & name_t, unsigned short value_t);
JSONNode(const json_string & name_t, int value_t);
JSONNode(const json_string & name_t, unsigned int value_t);
JSONNode(const json_string & name_t, long long value_t);
JSONNode(const json_string & name_t, unsigned long long value_t);
JSONNode(const json_string & name_t, long value_t);
JSONNode(const json_string & name_t, unsigned long value_t);
JSONNode(const json_string & name_t, float value_t);
JSONNode(const json_string & name_t, double value_t);
JSONNode(const json_string & name_t, bool value_t);
JSONNode(const json_string & name_t, const json_string & value_t);
JSONNode(const json_string & name_t, const json_char * value_t);
JSONNode(const JSONNode & orig);
```

### Construct JSONNode

Constructs a JSONNode object, initializing it's contents depending on which constructor is used:

```
explicit JSONNode(char mytype = JSON_NODE);
```

Default constructor: creates an empty JSONNode of the specified type.

```
JSONNode(const json_string & name_t, char value_t);
JSONNode(const json_string & name_t, unsigned char value_t);
JSONNode(const json_string & name_t, short value_t);
JSONNode(const json_string & name_t, unsigned short value_t);
JSONNode(const json_string & name_t, int value_t);
JSONNode(const json_string & name_t, unsigned int value_t);
JSONNode(const json_string & name_t, long value_t);
JSONNode(const json_string & name_t, unsigned long value_t);
JSONNode(const json_string & name_t, long long value_t);
JSONNode(const json_string & name_t, unsigned long long value_t);
JSONNode(const json_string & name_t, float value_t);
JSONNode(const json_string & name_t, double value_t);
```

Constructs a numeric JSONNode.

```
JSONNode(const json_string & name_t, bool value_t);
```

Constructs a boolean JSONNode.

```
JSONNode(const json_string & name_t, const json_string & value_t);
JSONNode(const json_string & name_t, const json_char * value_t);
```

Constructs a string JSONNode.

```
JSONNode(const JSONNode & orig);
```

Copy constructor, increments the reference counter, will only copy if one of them changes. To make a literal copy, use the duplicate method.

### Option differences

JSON\_REF\_COUNT - if this is turned off, the copy constructor will fully duplicate the node

### Parameters

mytype      The enumerated type of the JSONNode.  
name\_t      The name of the object  
value\_t      The value of the object  
orig      The original JSONNode that gets copied

### **Complexity**

Constant with the exception of copying a JSON\_NODE or JSON\_ARRAY, in which case it is equivalent to JSONNode::duplicate.

## JSONNode::~~JSONNode

```
~JSONNode(void);
```

### Destruct JSONNode

Destructs the JSONNode object and cleans itself up.

### Option Differences

None

### Parameters

None

### Complexity

Depends on circumstances. If it's reference count is not one, then it's complexity is constant, if it's the sole owner of it's value, then it becomes linear on JSONNode::size, however, because JSON is a tree structure it's worse case scenario is linear on JSONNode::size + JSONNode::size of each child recursively.

## JSONNode::duplicate

```
JSONNode duplicate(void);
```

### Duplicating JSONNode

Constructs a JSONNode object, by copying the contents of JSONNode. This is different from the copy constructor or assignment operator because it makes a literal copy, not reference counting.

### Option Differences

None

### Parameters

None

### Return Value

A JSONNode that is a new copy of the original node.

### Complexity

Linear on JSONNode::size, however, because JSON is a tree structure it's worse case scenario is linear on JSONNode::size + JSONNode::size of each child recursively.

## JSONNode::operator =

```
void operator = (char value_t);  
void operator = (unsigned char value_t);  
void operator = (short value_t);  
void operator = (unsigned short value_t);  
void operator = (int value_t);  
void operator = (unsigned int value_t);  
void operator = (long long value_t);  
void operator = (unsigned long long value_t);  
void operator = (long value_t);  
void operator = (unsigned long value_t);  
void operator = (float value_t);  
void operator = (double value_t);  
void operator = (bool value_t);  
void operator = (const json_string value_t);  
void operator = (const json_char * value_t);  
void operator = (const JSONNode & orig);
```

### Assign JSONNode

Assigns JSONNode to a specific value and sets the type according to which version is used:

```
void operator = (char value_t);  
void operator = (unsigned char value_t);  
void operator = (short value_t);  
void operator = (unsigned short value_t);  
void operator = (int value_t);  
void operator = (unsigned int value_t);  
void operator = (long value_t);  
void operator = (unsigned long value_t);  
void operator = (long long value_t);  
void operator = (unsigned long long value_t);  
void operator = (float value_t);  
void operator = (double value_t);
```

Constructs a numeric JSONNode.

```
void operator = (bool value_t);
```

Constructs a boolean JSONNode.

```
void operator = (const json_string value_t);
```

```
void operator = (const json_char * value_t);
```

Constructs a string JSONNode.

```
void operator = (const JSONNode & orig);
```

Copy assignment, increments the reference counter, will only copy if one of them changes. To make a literal copy, use the duplicate method.

### Option Differences

JSON\_REF\_COUNT - if this is off, then the copy assignment will fully duplicate the node

### Parameters

value\_t

orig      The value of the object  
          The original JSONNode that gets copied

### **Complexity**

All assignments run in constant time due to reference counting, if reference counting is not turned on, then the copy assignment is the same as duplicate.

## JSONNode::operator ==

```
bool operator == (char value_t);
bool operator == (unsigned char value_t);
bool operator == (short value_t);
bool operator == (unsigned short value_t);
bool operator == (int value_t);
bool operator == (unsigned int value_t);
bool operator == (long long value_t);
bool operator == (unsigned long long value_t);
bool operator == (long value_t);
bool operator == (unsigned long value_t);
bool operator == (float value_t);
bool operator == (double value_t);
bool operator == (bool value_t);
bool operator == (const json_string value_t);
bool operator == (const json_char * value_t);
bool operator == (const JSONNode & node);
```

## Comparing JSONNode

Checks if the value held within the nodes are equal. This ignores things like comments, but for JSON\_NODE and JSON\_ARRAYS, this is a deep comparison, checking each child too.

## Option Differences

none

## Parameters

value\_t

The value to compare to

node

Another node to compare to

## Complexity

Constant except for JSON\_NODES and JSON\_ARRAYS in which case it's linear with respect to size() and size() of each child recursively.



## JSONNode::operator !=

```
bool operator != (char value_t);  
bool operator != (unsigned char value_t);  
bool operator != (short value_t);  
bool operator != (unsigned short value_t);  
bool operator != (int value_t);  
bool operator != (unsigned int value_t);  
bool operator != (long long value_t);  
bool operator != (unsigned long long value_t);  
bool operator != (long value_t);  
bool operator != (unsigned long value_t);  
bool operator != (float value_t);  
bool operator != (double value_t);  
bool operator != (bool value_t);  
bool operator != (const json_string value_t);  
bool operator != (const json_char * value_t);  
bool operator != (const JSONNode & node);
```

## Comparing JSONNode

Checks if the value held within the nodes are not equal. This ignores things like comments, but for JSON\_NODE and JSON\_ARRAYs, this is a deep comparison, checking each child too.

### Option Differences

none

### Parameters

value\_t

The value to compare to

node

Another node to compare to

### Complexity

Constant except for JSON\_NODES and JSON\_ARRAYs in which case it's linear with respect to size() and size() of each child recursively.

## **JSONNode::type**

`char` type(`void`);

### **Return type**

Returns the type of the JSONNode.

### **Option Differences**

None

### **Parameters**

none

### **Return Value**

The type of the node.

### **Complexity**

Constant

## **JSONNode::size**

`size_t` size(`void`);

### **Return size**

Returns the number of children that the node has. This should be zero for anything other than JSON\_ARRAY or JSON\_NODE, but this is only guaranteed with the JSON\_SAFE option turned on. This is because casting may or may not purge the children.

### **Option Differences**

None

### **Parameters**

None

### **Return Value**

The number of children that the node has.

### **Complexity**

Constant.

## **JSONNode::empty**

`bool empty(void);`

### **Return empty**

Returns whether or not the node has any children. If the node is not of JSON\_NODE or JSON\_ARRAY it will invariably return true.

### **Option Differences**

None

### **Parameters**

None

### **Return Value**

Whether or not the node is empty

### **Complexity**

Constant.

## **JSONNode::name**

```
json_string name(void);
```

### **Return name**

Returns the name of the node. If there is no name, then it returns a blank string.

### **Option Differences**

None

### **Parameters**

None

### **Return Value**

The name of the string.

### **Complexity**

Constant.

## **JSONNode::get\_comment**

`json_string` get\_comment(`void`);

### **Return comment**

Returns the comment attached to the node

### **Option Differences**

JSON\_COMMENTS - If this option is turned off, this function is not exposed

### **Parameters**

None

### **Return Value**

The comment of the node

### **Complexity**

Constant.

## JSONNode::as\_string

`json_string` as\_string(`void`);

### Return string value

Returns the string representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	"" or "null" depending on how it was created
JSON_STRING	The unescaped string value
JSON_NUMBER	The number in string form (may be in scientific notation)
JSON_BOOL	"true" or "false"
JSON_ARRAY	""
JSON_NODE	""

Notice that both JSON\_NODE and JSON\_ARRAY return empty strings. Use JSONNode::write and JSONNode::write\_formatted to output JSON.

### Option Differences

None

### Parameters

None

### Return Value

The string representation of the node.

### Complexity

Constant.

## JSONNode::as\_int

`long as_int(void);`

### Return int value

Returns the boolean representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	0
JSON_STRING	Undefined
JSON_NUMBER	Truncated Value
JSON_BOOL	1 if true, 0 if false
JSON_ARRAY	Undefined
JSON_NODE	Undefined

If the value is actually a floating point value, then libjson will record an error via it's callback, but will continue on ahead and simply truncate the value. So 15.9 will be returned as 15. If JSON\_DEBUG is turned on, it will also error if the value of the node is outside the range of the long datatype.

### Option Differences

None

### Parameters

None

### Return Value

The integer representation of the node.

### Complexity

Constant.



## JSONNode::as\_float

`json_number` as\_float(`void`);

### Return floating point value

Returns the boolean representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	0.0
JSON_STRING	Undefined
JSON_NUMBER	Value
JSON_BOOL	1.0 if true, 0.0 if false
JSON_ARRAY	Undefined
JSON_NODE	Undefined

### Option Differences

None

### Parameters

None

### Return Value

The floating point representation of the node.

### Complexity

Constant.

## JSONNode::as\_bool

`bool as_bool(void);`

### Return bool value

Returns the boolean representation of the node. This may be different depending on the type of the node

Function	Description
JSON_NULL	FALSE
JSON_STRING	Undefined
JSON_NUMBER	Value == 0.0
JSON_BOOL	Value
JSON_ARRAY	Undefined
JSON_NODE	Undefined

### Option Differences

None

### Parameters

None

### Return Value

The boolean representation of the node.

### Complexity

Constant.

## JSONNode::as\_node

JSONNode as\_node(void);

### Return node value

Returns the node representation of the node. For anything other than node and array, it simply returns an empty node. If the caller is an array, it will convert it to a node.

Function	Description
JSON_NULL	Empty node
JSON_STRING	Empty node
JSON_NUMBER	Empty node
JSON_BOOL	Empty node
JSON_ARRAY	Array converted to a node
JSON_NODE	A copy of the node

### Option Differences

None

### Parameters

None

### Return Value

The node representation of the node.

### Complexity

Constant for all except JSON\_ARRAYs and JSON\_NODEs which are the same as the copy constructor.

## JSONNode::as\_array

JSONNode as\_array(void);

### Return array value

Returns the array representation of the node. For anything other than node and array, it simply returns an empty array. If the caller is an node, it will convert it to an array by stripping all of the names of each child.

Function	Description
JSON_NULL	Empty node
JSON_STRING	Empty node
JSON_NUMBER	Empty node
JSON_BOOL	Empty node
JSON_ARRAY	A copy of the array
JSON_NODE	An array of the children

### Option Differences

None

### Parameters

None

### Return Value

The node representation of the node.

### Complexity

Constant for anything other than a node. For a JSON\_NODE, it is linear with respect to JSONNode::size, and JSON\_ARRAY which is the same as the copy constructor

## JSONNode::as\_binary

`std::string as_binary(void);`

### Return binary value

Returns the binary value that was part of this node. It returns it as a `std::string`, you can use the `data()` function to retrieve it in binary form. This allows you to use `size()` to know how large the binary data is.

Function	Description
JSON_NULL	Undefined
JSON_STRING	The binary data from the decoded Base64
JSON_NUMBER	Undefined
JSON_BOOL	Undefined
JSON_ARRAY	Undefined
JSON_NODE	Undefined

### Option Differences

JSON\_BINARY - If this option is not on, then this function is not accessible.

### Parameters

None

### Return Value

The Base64 decoded binary data

### Complexity

Linear with respect to the length of the binary data

## JSONNode::dump

JSONNode dump(void);

### Dump JSONNode's internal structure

Returns a JSONNode that exposes all of the inner members of JSONNode. This is useful for debugging purposes of libjson, but not much else. It is mostly used to maintain and upgrade libjson.

### Option Differences

JSON\_DEBUG - If this option is not on, then this function is not accessible.

### Parameters

None

### Return Value

A JSONNode representation of the inner workers of the JSONNode, showing all of the members and their current state.

### Complexity

Linear with respect to the size of the tree underneath the node.

## **JSONNode::write**

`json_string` write(`void`);

### **Write JSON**

Returns JSON text, with no white space or comments. Designed to create JSON that is very small, and therefore, faster to send between servers or write to a disk. The flipside is that it's nearly impossible to read by human eyes.

Only root nodes (JSON\_NODE and JSON\_ARRAYs) are meant to be written, all others will return a blank string.

### **Option Differences**

JSON\_WRITER - If this option is not on, then this function is not accessible.

### **Parameters**

None

### **Return Value**

JSON text of the node being written

### **Complexity**

Linear with respect to the size of the tree underneath the node.

## **JSONNode::write\_formatted**

`json_string` write\_formatted(`void`);

### **Write JSON**

Returns JSON text that has been indented and prettied up so that it can be easily read and modified by humans.

Only root nodes (JSON\_NODE and JSON\_ARRAYs) are meant to be written, all others will return a blank string.

### **Option Differences**

JSON\_WRITER - If this option is not on, then this function is not accessible.

JSON\_COMMENTS - If this option is not turned on, then no comments are written

JSON\_WRITE\_BASH\_COMMENTS - This option will make libjson write only bash style # comments

JSON\_WRITE\_SINGLE\_LINE\_COMMENTS - This option will make libjson not write C-style /\* \*/ comments

### **Parameters**

None

### **Return Value**

JSON text of the node being written

### **Complexity**

Linear with respect to the size of the tree underneath the node.



## **JSONNode::set\_name**

```
void set_name(json_string name_t);
```

### **Setting the node's name**

Sets the name of the JSONNode.

### **Option Differences**

None

### **Parameters**

name\_t  
The name of the node

### **Return Value**

None

### **Complexity**

Constant

## **JSONNode::set\_comment**

```
void set_comment(json_string comment_t);
```

### **Setting the node's comment**

Sets the comment that will be associated with the JSONNode.

### **Option Differences**

JSON\_COMMENTS - this option is required to expose this function

### **Parameters**

comment\_t

The comment attached to the node

### **Return Value**

None

### **Complexity**

Constant

## **JSONNode::clear**

```
void clear(void);
```

### **Clearing a node**

Clears all children from the node.

### **Option Differences**

None

### **Parameters**

None

### **Return Value**

None

### **Complexity**

Linear with respect to the size of the tree underneath it

## **JSONNode::swap**

**void** swap(**JSONNode** & other);

### **Swaps the contents of nodes**

Swaps the contents of two nodes. This is very fast because JSONNode is just a wrapper around an internal structure, so it simply swaps pointers to those structures.

### **Option Differences**

None

### **Parameters**

other

The node to swap values with

### **Return Value**

None

### **Complexity**

Constant

## JSONNode::merge

```
void merge(JSONNode & other);  
void merge(unsigned int num, . . .);
```

### Merge the contents of nodes

It's possible that you may end up with multiple copies of the same node, through duplication and such. To save space, you might want to merge the internal reference counted structure. Obviously, this only makes a difference if reference counting is turned on.

libjson will try and do this efficiently, merging with the internal structure that has the highest reference count.

### Option Differences

JSON\_REF\_COUNT - this option is required for this to do anything

### Parameters

other	One of the other nodes to merge with.
num	The number of JSONNodes to merge together
. . .	A list of JSONNode *

### Return Value

None

### Complexity

Constant or linear with respect to num.

## **JSONNode::preparse**

```
void preparse(void);
```

### **Preparse the json**

libjson's lazy parsing makes parsing JSON that is not entirely used very fast, but sometimes you want to parse it all at once, making the next reads a little faster

### **Option Differences**

JSON\_PREPARSE - this option does this automatically, so it hides this function

### **Parameters**

None

### **Return Value**

None

### **Complexity**

Linear with respect to the total number of nodes in the JSON

## JSONNode::set\_binary

```
void set_binary(const unsigned char * bin, size_t bytes);
```

### Set binary data

libjson's built in Base64 encoder will create a JSON\_NODE with Base64 encoded binary data, which allows you to send images and files around. libjson's Base64 encoder is faster than most others, so it's recommended that you use this method rather than other libraries.

### Option Differences

JSON\_BINARY - this option is required to use this method and the Base64 method

### Parameters

bin

binary data

bytes

the number of bytes that the binary data is

### Return Value

None

### Complexity

Linear with respect to the number of bytes

## **JSONNode::cast**

`void cast(char type);`

### **Cast to a different type**

Will change the node to a different type and do any conversions necessary.

### **Option Differences**

None

### **Parameters**

type

New type of node

### **Return Value**

None

### **Complexity**

Constant except for casting a node to array which is linear with respect to size().



## JSONNode::at

```
JSONNode & at(json_index_t pos) throw(std::out_of_range);  
JSONNode & at(const json_string & name) throw(std::out_of_range);  
const JSONNode & at(json_index_t pos) const throw(std::out_of_range);  
const JSONNode & at(const json_string & name) const throw(std::out_of_range);
```

### Getting a child

This will give you a reference to a child node either at a specific location or by it's name. This differs from the [] operator because at will throw an std::out\_of\_bounds exception.

### Option Differences

None

### Parameters

pos	The index of the child node
name	The name of the child node

### Return Value

The child at the desired location.

### Complexity

Constant for the indexed variety, linear for the named variety.

## JSONNode::at\_nocase

```
JSONNode & at_nocase(const json_string & name) throw(std::out_of_range);  
const JSONNode & at_nocase(const json_string & name) const throw(std::out_of_range);
```

### Getting a child case insensitive

This will give you a reference to a child node by it's name in a case-insensitive way.

### Option Differences

JSON\_CASE\_INSENSITIVE\_FUNCTIONS is required to use this function

### Parameters

name

The name of the child node

### Return Value

The child at the desired location.

### Complexity

Linear with respect to size().

## JSONNode::operator []

```
JSONNode & operator [] (json_index_t pos);  
const JSONNode & operator [] (json_index_t pos) const;  
JSONNode & operator [] (const json_string & name);  
const JSONNode & operator [] (const json_string & name) const;
```

### Getting a child

This will give you a reference to a child node either at a specific location or by it's name. Asking for a node that is not there will result in undefined behavior.

### Option Differences

None

### Parameters

pos

The index of the child node

name

The name of the child node

### Return Value

The child at the desired location.

### Complexity

Constant for the indexed variety, linear for the named variety.

## JSONNode::reserve

```
void reserve(json_index_t size);
```

### Reserving space

This function reserves children space, this makes the program faster and use less memory as it doesn't have to keep allocating new memory when it runs out.

### Option Differences

None

### Parameters

size  
The size to reserve

### Return Value

None

### Complexity

If there is already some children it's linear with respect to size() unless the reserved amount is less than the current capacity, in which case it's constant. If there are no children, then it's constant.

## JSONNode::push\_back

```
void push_back(const JSONNode & node);
```

### Adding a child

This function pushes a new child node on the back of the child list. This method copies the child, so altering the parameter later will not affect the one in the children.

### Option Differences

None

### Parameters

node

The node to be added as a child

### Return Value

None

### Complexity

Depends on if new memory is needed to be allocated. This function would have the same complexity as push\_back for a vector plus the copy constructor. If JSON\_LESS\_MEMORY is defined, then this operation is always linear with respect to size(), unless reserve had been used, in which case it's constant while smaller than that reserved amount. Otherwise it is linear if the node is currently full, otherwise it's constant.

## JSONNode::pop\_back

```
JSONNode pop_back(json_index_t pos) throw(std::out_of_range);  
JSONNode pop_back(const json_string & name) throw(std::out_of_range);
```

### Getting a child

This will give remove a JSONNode from it's parent and return it to you.

### Option Differences

None

### Parameters

pos	The index of the child node
name	The name of the child node

### Return Value

The child at the desired location by value.

### Complexity

Linear based on size() for the variety using the name, but linear based on size() minus pos. This is because the references of the other children have to be shifted.

## JSONNode::pop\_back\_nocase

```
JSONNode pop_back_nocase(const json_string & name) throw(std::out_of_range);
```

### Getting a child

This will give remove a JSONNode from it's parent and return it to you.

### Option Differences

JSON\_CASE\_INSENSITIVE\_FUNCTIONS is required to use this function

### Parameters

name

The name of the child node

### Return Value

The child at the desired location by value.

### Complexity

Linear based on size().

## JSONNode::find

iterator find(const json\_string & name);

### Getting a child

Searches through the children and finds an iterator to it. This function returns JSONNode::end() if the child does not exist.

### Option Differences

JSON\_ITERATORS must be on to use this function

### Parameters

name

The name of the child node

### Return Value

An iterator that points to the child requested, or end() if it wasn't found.

### Complexity

Linear based on size().



## JSONNode::find\_nocase

iterator find\_nocase(const json\_string & name);

### Getting a child

Searches through the children and finds an iterator to it. This function returns JSONNode::end() if the child does not exist.

### Option Differences

JSON\_ITERATORS and JSON\_CASE\_INSENSITIVE\_FUNCTIONS must be on to use this function

### Parameters

name

The name of the child node

### Return Value

An iterator that points to the child requested, or end() if it wasn't found.

### Complexity

Linear based on size().

## JSONNode::erase

```
iterator erase(iterator pos);  
iterator erase(iterator start, const iterator & end);  
reverse_iterator erase(reverse_iterator pos);  
reverse_iterator erase(reverse_iterator start, const reverse_iterator & end);
```

### Removing child(ren)

```
iterator erase(iterator pos);  
reverse_iterator erase(reverse_iterator pos);  
    Erases a single child and returns the iterator to the next one.  
iterator erase(iterator start, const iterator & end);  
reverse_iterator erase(reverse_iterator start, const reverse_iterator & end);  
    Erases a set of children, allowing for quick dumps of unneeded children.
```

### Option Differences

JSON\_ITERATORS must be on to use this function

### Parameters

pos	The position of the node that is to be deleted
start	The position of starting node to be deleted (inclusively)
end	The position of ending node to be deleted (inclusively)

### Return Value

An iterator that points to the child after the deleted one, or end()/rend()

### Complexity

Linear based on size() minus where it starts from due to memory shifting.

## JSONNode::insert

```
iterator insert(iterator pos, const JSONNode & node);
iterator insert(iterator pos, const iterator & start, const iterator & end);
iterator insert(iterator pos, const reverse_iterator & start, const reverse_iterator & end);
iterator insert(iterator pos, const const_iterator & start, const const_iterator & end);
iterator insert(iterator pos, const const_reverse_iterator & start, const const_reverse_iterator & end);
reverse_iterator insert(reverse_iterator pos, const JSONNode & node);
reverse_iterator insert(reverse_iterator pos, const reverse_iterator & start, const reverse_iterator & end);
reverse_iterator insert(iterator pos, const iterator & start, const iterator & end);
reverse_iterator insert(reverse_iterator pos, const const_iterator & start, const const_iterator & end);
reverse_iterator insert(reverse_iterator pos, const const_reverse_iterator & start, const
const_reverse_iterator & end);
```

## Adding child(ren)

```
iterator insert(iterator pos, const JSONNode & node);
reverse_iterator insert(reverse_iterator pos, const JSONNode & node);
    These functions place a new child into your node before the node pointed to by the iterator.
iterator insert(iterator pos, const iterator & start, const iterator & end);
iterator insert(iterator pos, const reverse_iterator & start, const reverse_iterator & end);
iterator insert(iterator pos, const const_iterator & start, const const_iterator & end);
iterator insert(iterator pos, const const_reverse_iterator & start, const const_reverse_iterator & end);
reverse_iterator insert(reverse_iterator pos, const reverse_iterator & start, const reverse_iterator & end);
reverse_iterator insert(iterator pos, const iterator & start, const iterator & end);
reverse_iterator insert(reverse_iterator pos, const const_iterator & start, const const_iterator & end);
reverse_iterator insert(reverse_iterator pos, const const_reverse_iterator & start, const
const_reverse_iterator & end);
```

These functions will copy a set of children from one node to another. These all start inserting at start and increment it until it's end, so if you are reverse iterating, you can insert them in reverse order.

All of these functions copy the nodes, they remain where they are as well.

## Option Differences

JSON\_ITERATORS must be on to use this function

## Parameters

pos	The position to insert before
node	The node to be inserted
start	Position to start copying (inclusively)
end	Position to stop copying (inclusively)

## Return Value

An iterator that points to the first inserted node

## **Complexity**

Linear based on `size()` minus where it starts from due to memory shifting plus end minus start for the ranged variety.

## JSONNode::begin

```
iterator begin(void);  
const_iterator begin(void) const;
```

### Getting start of children

This function gets you an iterator pointing to the beginning of the children.

### Option Differences

JSON\_ITERATORS must be on to use this function

### Parameters

None

### Return Value

An iterator that points to the first child

### Complexity

Constant

## **JSONNode::end**

```
iterator end(void);  
const_iterator end(void) const;
```

### **Getting end of children**

This function gets you an iterator pointing past the end of the children.

### **Option Differences**

JSON\_ITERATORS must be on to use this function

### **Parameters**

None

### **Return Value**

An iterator that points past the last child

### **Complexity**

Constant

## JSONNode::rbegin

```
reverse_iterator rbegin(void);  
reverse_const_iterator rbegin(void) const;
```

### Getting start of children

This function gets you an iterator pointing to the beginning of the children in reverse order.

### Option Differences

JSON\_ITERATORS must be on to use this function

### Parameters

None

### Return Value

An iterator that points to the first child in reverse order (actually the last child.)

### Complexity

Constant

## **JSONNode::rend**

```
reverse_iterator rend(void);  
reverse_const_iterator rend(void) const;
```

### **Getting start of children**

This function gets you an iterator pointing past the end of the children in reverse order

### **Option Differences**

JSON\_ITERATORS must be on to use this function

### **Parameters**

None

### **Return Value**

An iterator that points past the last child in reverse order

### **Complexity**

Constant



## **JSONNode::set\_mutex**

```
void set_mutex(void * mutex);
```

### **Set a lock**

This function attaches a mutual exclusion lock for the node. It can be locked and unlocked by using the lock and unlock functions. The reason for this is that because libjson's complex reference counting and internal magic, it is difficult to be sure that you track data correctly, so libjson will pass this mutex around its internal system and track it for you.

You can pass NULL to this function to unset a mutex.

This method will filter the mutex down to all children as well, and anything that you add to it later.

### **Option Differences**

JSON\_MUTEX\_CALLBACKS must be on to use this function

JSON\_MUTEX\_MANAGER - if this option is on, then libjson will automatically delete this mutex when it runs out of references to it

### **Parameters**

mutex

A pointer to a mutex of any type (POSIX, Windows...)

### **Return Value**

None

### **Complexity**

Linear with size() and size() of each child recursively.

## **JSONNode::lock**

**void** lock(**int** threadID);

### **Lock a mutex**

This function locks the mutex attached to a node, and locks anything sharing the lock in a different thread. The reason for the threadID parameter is that because libjson passes around structures behind the scenes it might be possible to try and lock the same lock in multiple places in the same critical section. Counting locks per thread eliminates this problem.

### **Option Differences**

JSON\_MUTEX\_CALLBACKS must be on to use this function

### **Parameters**

threadID

A unique id for this thread

### **Return Value**

None

### **Complexity**

Constant

## **JSONNode::unlock**

**void** unlock(**int** threadID);

### **Unlock a mutex**

This function unlocks the mutex attached to a node. If the mutex has been locked multiple times by the same thread, then it will wait until all locks have been released before actually doing the unlock.

### **Option Differences**

JSON\_MUTEX\_CALLBACKS must be on to use this function

### **Parameters**

threadID

A unique id for this thread

### **Return Value**

None

### **Complexity**

Constant

## JSONStream

JSONStreams allow you to have partial json or multiple json objects and alert you when the nodes are completed.

### Class Functions

Function	Description
(constructor)	Construct JSONStream
(destructor)	JSONStream destructor
operator <<	Pushes data into the stream
operator =	Copy JSONStream

## JSONStream::JSONStream

```
JSONStream(json_stream_callback_t call_p);  
JSONStream(const JSONStream & orig);
```

### New Stream

This function creates a stream. Streams are used for pushing small amounts of json at a time, it may be incomplete json, or even multiple json nodes, and the callback you give it will be called whenever a complete node is recognized.

### Option Differences

JSON\_STREAM must be turned on to use this function

### Parameters

callback

The method that gets called whenever nodes are completed

orig

The stream to copy

### Return Value

A new stream

### Complexity

Constant

## **JSONStream::~~JSONStream**

`~JSONStream(void);`

### **Deletes stream**

Deletes the stream

### **Option Differences**

JSON\_STREAM must be turned on to use this function

### **Parameters**

None

### **Return Value**

None

### **Complexity**

Constant

## **JSONStream::operator =**

```
JSONStream & operator = (const JSONStream & orig);
```

### **Copies a stream**

Copies a stream

### **Option Differences**

JSON\_STREAM must be turned on to use this function

### **Parameters**

orig  
The node to copy

### **Return Value**

A reference to itself

### **Complexity**

Constant

## JSONStream::operator <<

```
JSONStream & operator << (const json_string & str);
```

### Push to a stream

This pushes a string on the stream, and if a node gets completed, the callback gets called.

### Option Differences

JSON\_STREAM must be turned on to use this function

### Parameters

str  
Partial json

### Return Value

A reference to itself

### Complexity

Constant



## libjson

libjson is a namespace that holds a few functions that are part of libjson, but separate from JSONNode. These methods include json text functions and callback registration.

### JSON Functions

Function	Description
parse	Parses json
parse_unformatted	Parse json that has no white space
strip_white_space	Removes all white space and comment
is_valid	Validates json
is_valid_unformatted	Validates json that has no whitespace
validate (deprecated)	Validate json and return the parsed node

### Callback Registration

Function	Description
register_debug_callback	Registers error callback
register_mutex_callbacks	Register mutex callbacks
set_global_mutex	Set the global mutex
register_memory_callbacks	Registers the memory callbacks

### Base64 Functions

Function	Description
encode64	Base64 encodes data
decode64	Decodes Base64 data

### Callback Types

Function	Description
json_error_callback_t	typedef void (* json_error_callback_t)(const json_string &)
json_mutex_callback_t	typedef void (* json_mutex_callback_t)(void *)
json_malloc_t	typedef void * (* json_malloc_t)(size_t)
json_realloc_t	typedef void * (* json_realloc_t)(void *, size_t)

Function	Description
json_free_t	typedef <b>void</b> (* json_free_t)( <b>void</b> *)

## **libjson::parse**

```
JSONNode parse(const json_string & json) throw(std::invalid_argument);
```

### **Parse JSON text**

This function parses JSON text and returns you a JSONNode which is the root node of the text that you just passed it. If bad JSON is sent to this method it will throw a std::invalid\_argument exception.

### **Option Differences**

JSON\_SAFE - a node of type JSON\_NULL will be returned if the json was invalid

### **Parameters**

json  
JSON text

### **Return Value**

The root node of the text

### **Complexity**

Linear depending on json.length()

## **libjson::parse\_unformatted**

`JSONNode parse_unformatted(const json_string & json) throw(std::invalid_argument);`

### **Parse JSON text**

This function parses JSON text and returns you a JSONNode which is the root node of the text that you just passed it. If bad JSON is sent to this method it will throw a `std::invalid_argument` exception.

### **Option Differences**

JSON\_SAFE - a node of type JSON\_NULL will be returned if the json was invalid

### **Parameters**

json  
JSON text

### **Return Value**

The root node of the text

### **Complexity**

Linear depending on `json.length()`

## **libjson::strip\_white\_space**

`json_string strip_white_space(const json_string & json);`

### **Parse JSON text**

This function removes anything that the JSON standard defines as white space, including extra tabs, spaces, formatting, and comments. This makes this function useful for compressing json that needs to be stored or sent over a network.

### **Option Differences**

None

### **Parameters**

json  
JSON text

### **Return Value**

Valid JSON that is free of all white space

### **Complexity**

Linear depending on `json.length()`

## **libjson::is\_valid**

```
bool is_valid(const json_string & json);
```

### **Validate JSON text**

This function validates the text by parsing it completely and looking for anything that is malformed.

### **Option Differences**

JSON\_VALIDATE must be on to use this feature

### **Parameters**

json  
JSON text

### **Return Value**

true or false

### **Complexity**

Linear depending on json.length() and the number of nodes within the text.

## **libjson::is\_valid\_unformatted**

`bool is_valid_unformatted(const json_string & json);`

### **Validate JSON text**

This function validates the text by parsing it completely and looking for anything that is malformed. This is the version for json that doesn't have any white space or comments.

### **Option Differences**

JSON\_VALIDATE must be on to use this feature

### **Parameters**

json  
JSON text

### **Return Value**

true or false

### **Complexity**

Linear depending on json.length() and the number of nodes within the text.

## **libjson::validate (deprecated)**

`JSONNode` validate(`const json_string` & json);

### **Validate JSON text**

This function validates the text by parsing it completely and looking for anything that is malformed. If bad JSON is sent to this method it will throw a `std::invalid_argument` exception, otherwise it returns the root node of the text.

This function will be removed shortly, you are advised to replace all `validate` calls to `is_valid` and `parse` functions.

### **Option Differences**

`JSON_VALIDATE`, and `JSON_DEPRECATED_FUNCTIONS` must be on to use this feature

### **Parameters**

json  
JSON text

### **Return Value**

The root node of the text

### **Complexity**

Linear depending on `json.length()` and the number of nodes within the text.



## **libjson::register\_debug\_callback**

```
void register_debug_callback(json_error_callback_t callback);
```

### **Register error callback**

This callback allows libjson to tell you exactly what is going wrong in your software, making debugging and fixing the problem much easier.

### **Option Differences**

JSON\_DEBUG must be on to use this feature

### **Parameters**

callback

A method that must have this prototype: `static void callback (const json_string & message)`

### **Return Value**

None

### **Complexity**

Constant

## libjson::register\_mutex\_callbacks

```
void register_mutex_callbacks(json_mutex_callback_t lock, json_mutex_callback_t unlock, void *  
manager_mutex);
```

```
void register_mutex_callbacks(json_mutex_callback_t lock, json_mutex_callback_t unlock,  
json_mutex_callback_t destroy, void * manager_mutex);
```

### Register mutex callbacks

This callback allows libjson to lock mutexes that you assign to JSONNode structures. Because libjson has no idea what kind of mutex you gave it, it can't lock it without the help of a callback. This method is required to run before any locking can take place.

### Option Differences

JSON\_MUTEX\_CALLBACKS must be on to use this feature

JSON\_MUTEX\_MANAGER must be on to use the second variant

### Parameters

lock

A method that locks a mutex and must have this prototype: `static void callback (void * mutex).`

unlock

A method that unlocks a mutex and must have this prototype: `static void callback (void * mutex).`

destroy

A method that deletes a mutex and must have this prototype: `static void callback (void * mutex).`

This parameter is only allowed if JSON\_MUTEX\_MANAGER is defined, otherwise, you are responsible for cleaning up your mutexes.

manager\_mutex

A mutex that libjson will need to use to handle all of the mutexes, as even without JSON\_MUTEX\_MANAGER, some management takes place and libjson has a few critical sections when threading. May not be the same as the global mutex.

### Return Value

None

### Complexity

Constant

## **libjson::set\_global\_mutex**

`void set_global_mutex(void * mutex);`

### **Register library-wide mutex**

This function sets a global mutex for libjson. This is not the same as the manager mutex that you are required to register in `register_mutex_callbacks`. This mutex is a fallback mutex that gets locked when you attempt to lock a node that has no mutex attached to it. You may wish to omit assigning mutexes for each node and just let them all use the global one.

### **Option Differences**

JSON\_MUTEX\_CALLBACKS must be on to use this feature

### **Parameters**

mutex

A mutex that libjson will use when it doesn't have any to use

### **Return Value**

None

### **Complexity**

Constant

## libjson::register\_memory\_callbacks

`void register_memory_callbacks(json_malloc_t allocator, json_realloc_t reallocer, json_free_t freer);`

### Register memory handling

This function sets callbacks that libjson will use to allocate memory. This allows you to keep a tight control of memory allocation, or use things like memory pool and such. These methods are currently not allowed to return null or less than it asked for, as it will cause instability in libjson.

### Option Differences

JSON\_MEMORY\_CALLBACKS must be on to use this feature

### Parameters

allocator

A method that must have this prototype: `static void * alloc(size_t bytes)`

reallocer

A method that must have this prototype: `static void * realloc(void * buffer, size_t bytes)`

freer

A method that must have this prototype: `static void dealloc(void * buffer)`

### Return Value

None

### Complexity

Constant

## **libjson::encode64**

`json_string` encode64(const unsigned char \* binary, json\_index\_t bytes);

### **Encodes data**

This function takes binary data and does a base64 encoding so that you can send it through a text only protocol,

### **Option Differences**

JSON\_EXPOSE\_BASE64 is required to use this function

### **Parameters**

binary

binary data

bytes

the number of bytes in the binary buffer

### **Return Value**

Base 64 encoded string

### **Complexity**

Linear

## **libjson::decode64**

`unsigned char * decode64(const json_string & text, unsigned long * bytes);`

### **Encodes data**

This function takes base64 encoded data and decodes it for you

### **Option Differences**

JSON\_EXPOSE\_BASE64 is required to use this function

### **Parameters**

text

base64 encoded text

bytes

the number of bytes in the returned binary buffer

### **Return Value**

Decoded string

### **Complexity**

Linear

## **JSON\_TEXT**

### **Converts text**

This is a marco that you can use to wrap around text that you pass into libjson. It automatically prepends an L in unicode mode and does nothing when not in unicode mode. This allows you to use the same code for unicode and non unicode software.

## Optimizing libjson

Once your program is written and functioning with libjson, it is time to optimize it. libjson's options are the best way to do this, however if you are using a library, then you can also edit the make file and change the compiler options. Obviously you should never try to optimize with a debug build, it's doing a lot of extra checks that help debugging, but are unneeded in release.

## Compiler Options

You can see the default compiler options in the building libjson section of this document. -O3 isn't always optimal, because it's such a small library, caching may actually make -Os the fastest, it depends on how much cache you have, what kind of computer, and what libjson options are turned on.

There are also many optimizations that you can do that are compiler specific. libjson does a decent amount of string functions internally, so turning on reference counted or copy on write strings may result in a performance increase, both faster due to less copying and less memory.

## C++ Optimizations

If using C++, you can embed libjson and compile it into your program. This saves any time at the interface. The C interface is fairly rigid, and everything has to pass through the library interface, creating a choke-point. But in C++, many of the functions get inlined, so that little extra overhead is gone. The compiler is also free to do things like return by reference and other little tricks that you can't get with the json\_ interface.

## JSONOptions.h Optimizations

You can also optimize libjson by changing the options. Here are some common optimizations.

### Speed

If you know that you will always be receiving proper json, or json written by your libjson engine (like if you are using it to store and read a configuration file), then JSON\_SAFE is probably not needed. That option does a lot of checks to make sure that the json isn't corrupt and guards if it is. If there is no need for these guards, don't bother with them.

If you are not always sure that the json is valid, but need more parsing speed. turn JSON\_SAFE off and validate the json before sending it to the parser.

The JSON\_MEMORY\_CALLBACKS option can help you dramatically speed up your program. libjson allocates a lot of memory using malloc, but those calls can be rerouted to callbacks, allowing you to utilize your own memory management system. A memory pool can speed up a program.

Starting with libjson 6.3.0, you can have libjson compile some parts of itself differently than other parts. If your program is mostly using libjson for reading, you should set JSON\_READ\_PRIORITY to HIGH. If you are mostly writing set JSON\_WRITE\_PRIORITY to HIGH. If you almost never write, turn it to LOW. This can create some dramatically different code on certain compilers.

### Memory

If JSON\_STDERROR is on, libjson prints out any errors to std::cerr, which requires iostream. iostream adds considerable size to the library. Removing the JSON\_STDERROR option will compile the library without iostream in it.



If you are parsing huge amounts of JSON, or are working with very limited memory and need libjson to use less of it, turn on the `JSON_LESS_MEMORY` option. This will cause libjson to be far more stringent with its memory and clean it up faster. It also makes it slightly slower though because it allocates and deallocates memory more often.

Manage your own memory. Turn `JSON_MEMORY_MANAGE` off if you turned it on and delete your memory when you are done using it instead of just letting it sit around. libjson utilizes a map to keep track of memory, this can grow quite a bit if not flushed often enough. Managed memory is in libjson for ease of use, not performance.

If you can bring down the size of the indexes, it may save some bytes. By turning on and changing the `JSON_INDEX_TYPE` option, you can choose a different type of all of the indexing. This cuts down on the size of the internal structure, but be careful, you have to give enough space to hold all of your nodes. If you are sure that no node will ever hold more than 255 subitems, you can even use an unsigned char.

You might be able to further decrease the memory required and the size of the library if you use your own string class. `JSON_STRING_HEADER` lets you drop in your own string class which you can heavily optimize for your needs.

## **Overall**

If your program almost always uses most or all of the json that it receives, then doing parsing as needed might not make sense, and you might want all parsing done at once. `JSON_PREPARSE` will force libjson to do this. This makes the initial parse command a little slower, but every subsequent request is faster. It also drops the amount of memory libjson uses slightly.

If you turned `JSON_REF_COUNT` off, and can find a way to turn it back on, do it. This cuts down on both the amount of memory used when copying objects, but also saves copy time, which sometimes can be quite expensive. The common reason to turn this option off is for thread safety. It is recommended that you use the mutex callback system instead.

Write your own string class, or find a better one. There are many string classes out there that perform better than STL in some cases and are drop in and forget. Define `JSON_STRING_HEADER` to point to a header where you typedef your replacement string as `json_string`. libjson has no control over how the strings work, so you can often specialize a string type for this case. The majority of both time and memory used by libjson is spent doing string manipulation.

# Changelog

## 7.0.1

Bernhard Fluehmann fixed a bug in the makefile

## 7.0.0

Added JSON\_STRICT option

Made checking of numeric values more precise

Expanded some test macros

Replaced some implicit initializations with explicit ones

Replaced FromOctal with one big conversion

Made number converters more explicit

Removed // comments from C interface

Added exception specification

Added various GCC-specific optimizations

- Made a few methods `__attribute__((pure))`

- Made a few fields `__attribute__((packed))` with JSON\_LESS\_MEMORY

- Packed data even tighter in JSON\_LESS\_MEMORY mode

- Added hot and cold spots depending on options

- Added compile-time branch prediction

Added various VC++-specific optimizations

- Packed data even tighter in JSON\_LESS\_MEMORY mode

Made `_ftoa` not a template function

Changed JSON\_WRITER option to JSON\_WRITE\_PRIORITY

Added JSON\_READ\_PRIORITY

Added `__LIBJSON_MAJOR__`

Added `__LIBJSON_MINOR__`

Added `__LIBJSON_PATCH__`

Added `__LIBJSON_VERSION__`

With JSON\_LESS\_MEMORY on, number conversion buffers are on the heap

Number to string conversions much faster now

String to number in JSON\_STRICT mode really fast

Sped up string manipulation

Allowed reserve with JSON\_LESS\_MEMORY again

Added NDEBUG to release build options

Rewrote how validation is done

Made entire reading engine much faster in most cases

Constants can now be case-insensitive

Added JSON\_OCTAL option

Added JSONStreams

Added JSON\_EXPOSE\_BASE64 option

Nodes that aren't containers use considerably less memory

Fixed a bug where mutexes wouldn't propagate during a copy

Added JSON\_NO\_EXCEPTIONS option

Added JSON\_DEPRECATED\_FUNCTIONS option

- Replaced makefile with one written by Bernhard Fluehmann
- 6.2.3 (12/10/10)
  - Any unsupported escape character is put in as-is
  - Removed escaping of vertical tabs when writing
- 6.2.2 (12/9/10)
  - Fix bug where single quotes got escaped
- 6.2.1 (11/23/10)
  - Fix a few documentation slips
  - Fixed bug in All Test Suite options
  - Defined `as_int` and `as_float` for strings
  - reserve now is a noop when `JSON_LESS_MEMORY` is on
  - Added `JSON_BOOL_TYPE` option for the C interface
- 6.2.0 (11/18/10)
  - Fix problem with escaping names sometimes
  - Added `JSON_ESCAPE_WRITES` option to make escaping special chars optional
  - Added `JSON_STRING_HEADER` option to drop in custom string classes
  - Added `JSON_NO_C_CONSTS` option
  - Memory enhancements throughout
  - Added Salvor Hardin's fix for missing `snprintf` in VC++
  - Added C++ example in the Getting Started folder
- 6.1.2 (11/11/10)
  - Fixed bug where unicode wasn't writing escaped UTF correctly
  - Added `JSON_TEXT` macro to the documentation
- 6.1.1 (11/10/10)
  - Fixed bug with consecutive surrogate pairs not being read correctly
  - Changed license to FreeBSD
- 6.1.0 (10/16/10)
  - Made buffers for converting numbers to strings solved at compile time
  - Minor performance tweaks throughout
  - Better examples thanks to Chris Larsen
  - Fixed a few mistakes in documentation
- 6.0.0 (9/11/10)
  - Complete rewrite of library
  - More STL-like C++ interface
  - More standard C interface
  - Must faster
  - Less Memory
  - Must more customizable
  - Huge Test Suite
  - Complete `cplusplus.com`-like documentation
- 5.2.4 (8/24/10)
  - Added memory cleanup in `example.cpp`
- 5.2.3 (8/24/10)
  - Fixed safety catch in mismatched quotes
- 5.2.2 (8/20/10)
  - Added safety catch for mismatched quotes

#### 5.2.1 (8/6/10)

Fixed bug 3040432 (not mallocing enough memory in white space stripper)

#### 5.2 (7/7/10)

Changed some size\_t to unsigned ints for uniformity

Made some functions faster

Fixed problem with key/value pairs being accepted in arrays

Fixed problem where DEBUG mode would give false Children errors

Fixed compiling error under Linux

#### 5.1 (7/6/10)

Fixed bug where duplication arrays or nodes wouldn't work

Added JSON\_LESS\_MEMORY compiling option

Replaced std::vector with custom container

#### 5.0 (6/27/10)

Added a JSON\_SAFE compiling option

Added JSON\_PREPARSE compiling option

Fixed bug with name\_encoded flag not dumping correctly

Nodes now use 5% - 20% less memory

#### 4.5 (6/18/10)

Made unicode slightly more efficient

Fixed some documentation

Added GetMemoryUsage method to debugger

Nodes now use 8% less memory

#### 4.4 (6/17/10)

Fixed bug where false values were not always flagged as Fetched

Fixed typecast when converting double to int

Used a union for boolean and double values for smaller memory footprint

#### 4.3 (6/16/10)

new makefiles for each platform

Removed unused declarations

#### 4.2 (4/7/10)

Fixed makefile

Removed unused declarations

#### 4.1 (4/5/10)

Full support for surrogate pairs

makefile for linux

Better documentation

#### 4.0 (4/21/10)

Numbers not get fetched lazily too

Added full unicode support by adding a JSON\_UNICODE compile option

Added unicode targets in Code::Blocks projects

Prebuilt libraries / suites now not included to make downloads faster

#### 3.0 (4/20/10)

Fixed bug with Root Arrays printing an extra comma

Root arrays now also lazily fetched

Unified array parsing routine

Decent speed and memory optimizations

- NodeAsFloat now returns a double, not a single
- Replaced profiler with Dump method
- Dump now uses allocated string space instead of length
- Added Preparse function
- Made header safeties more obscure to not interfere with other headers

#### 2.2 (4/18/10)

- More technical documentation
- More speed in initial parsing
- Added profiler and raw memory dumps to Debug version

#### 2.1 (4/15/10)

- Added support for escaping object names
- Added support for bash-style comments
- Made writing strings without escaping faster
- Made initial parse faster and uses less memory

#### 2.0 (4/7/10)

- Added support for Octal string escaping
- Added support for both single and multiline C-style comments

#### 1.0 (4/1/10)

- Initial release
- Renamed LiveJSON to libjson and added Test Suites

# License

This license is also available in `license.txt`

Copyright 2010 Jonathan Wallace. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY JONATHAN WALLACE ``AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL JONATHAN WALLACE OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The views and conclusions contained in the software and documentation are those of the authors and should not be interpreted as representing official policies, either expressed or implied, of Jonathan Wallace.