The GNU libmicrohttpd Reference Manual

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This manual documents GNU libmicrohttpd version 0.4.4, last updated 14 October 2009. It is built upon the documentation in the header file '`microhttpd.h`'.

Short Contents

Table of Contents

GNU libmicrohttpd is a GNU package.

1 Introduction

All symbols defined in the public API start with `MHD_`. MHD is a small HTTP daemon library. As such, it does not have any API for logging errors (you can only enable or disable logging to stderr). Also, it may not support all of the HTTP features directly, where applicable, portions of HTTP may have to be handled by clients of the library.

The library is supposed to handle everything that it must handle (because the API would not allow clients to do this), such as basic connection management; however, detailed interpretations of headers — such as range requests — and HTTP methods are left to clients. The library does understand `HEAD` and will only send the headers of the response and not the body, even if the client supplied a body. The library also understands headers that control connection management (specifically, `Connection: close` and `Expect: 100 continue` are understood and handled automatically).

MHD understands `POST` data and is able to decode certain formats (at the moment only `application/x-www-form-urlencoded` and `multipart/form-data`) using the post processor API. The data stream of a POST is also provided directly to the main application, so unsupported encodings could still be processed, just not conveniently by MHD.

The header file defines various constants used by the HTTP protocol. This does not mean that MHD actually interprets all of these values. The provided constants are exported as a convenience for users of the library. MHD does not verify that transmitted HTTP headers are part of the standard specification; users of the library are free to define their own extensions of the HTTP standard and use those with MHD.

All functions are guaranteed to be completely reentrant and thread-safe. MHD checks for allocation failures and tries to recover gracefully (for example, by closing the connection). Additionally, clients can specify resource limits on the overall number of connections, number of connections per IP address and memory used per connection to avoid resource exhaustion.

2 Constants

`MHD_FLAG` [Enumeration]

Options for the MHD daemon.

Note that if neither `MHD_USER_THREAD_PER_CONNECTION` nor `MHD_USE_SELECT_INTERNALLY` are used, the client wants control over the process and will call the appropriate microhttpd callbacks.

Starting the daemon may also fail if a particular option is not implemented or not supported on the target platform (i.e. no support for SSL, threads or IPv6). SSL support generally depends on options given during MHD compilation. Threaded operations (including `MHD_USE_SELECT_INTERNALLY`) are not supported on Symbian.

`MHD_NO_FLAG`
: No options selected.

`MHD_USE_DEBUG`
: Run in debug mode. If this flag is used, the library should print error messages and warnings to stderr. Note that MHD also needs to be compiled with the configure option `--enable-messages` for this run-time option to have any effect.

`MHD_USE_SSL`
: Run in https mode (this option may not work with all threading modes yet).

`MHD_USE_THREAD_PER_CONNECTION`
: Run using one thread per connection.

`MHD_USE_SELECT_INTERNALLY`
: Run using an internal thread doing `SELECT`.

`MHD_USE_IPv6`
: Run using the IPv6 protocol (otherwise, MHD will just support IPv4).

`MHD_USE_PEDANTIC_CHECKS`
: Be pedantic about the protocol (as opposed to as tolerant as possible). Specifically, at the moment, this flag causes MHD to reject HTTP 1.1 connections without a `Host` header. This is required by the standard, but of course in violation of the "be as liberal as possible in what you accept" norm. It is recommended to turn this **ON** if you are testing clients against MHD, and **OFF** in production.

`MHD_OPTION` [Enumeration]

MHD options. Passed in the varargs portion of `MHD_start_daemon()`.

`MHD_OPTION_END`
: No more options / last option. This is used to terminate the VARARGs list.

`MHD_OPTION_CONNECTION_MEMORY_LIMIT`
: Maximum memory size per connection (followed by a `size_t`). The default is 32 kB (32*1024 bytes) as defined by the internal constant `MHD_POOL_SIZE_DEFAULT`.

`MHD_OPTION_CONNECTION_LIMIT`
: Maximum number of concurrenct connections to accept (followed by an `unsigned int`). The default is `FD_SETSIZE - 4` (the maximum number of file descriptors supported by `select` minus four for `stdin`, `stdout`, `stderr` and the server socket). In other words, the default is as large as possible.

`MHD_OPTION_CONNECTION_TIMEOUT`
: After how many seconds of inactivity should a connection automatically be timed out? (followed by an `unsigned int`; use zero for no timeout). The default is zero (no timeout).

`MHD_OPTION_NOTIFY_COMPLETED`
: Register a function that should be called whenever a request has been completed (this can be used for application-specific clean up). Requests that have never been presented to the application (via `MHD_AccessHandlerCallback()`) will not result in notifications.

  This option should be followed by **TWO** pointers. First a pointer to a function of type `MHD_RequestCompletedCallback()` and second a pointer to a closure to pass to the request completed callback. The second pointer maybe `NULL`.

`MHD_OPTION_PER_IP_CONNECTION_LIMIT`
: Limit on the number of (concurrent) connections made to the server from the same IP address. Can be used to prevent one IP from taking over all of the allowed connections. If the same IP tries to establish more than the specified number of connections, they will be immediately rejected. The option should be followed by an `unsigned int`. The default is zero, which means no limit on the number of connections from the same IP address.

`MHD_OPTION_SOCK_ADDR`
: Bind daemon to the supplied socket address. This option should be followed by a `struct sockaddr *`. If `MHD_USE_IPv6` is specified, the `struct sockaddr*` should point to a `struct sockaddr_in6`, otherwise to a `struct sockaddr_in`. If this option is not specified, the daemon will listen to incomming connections from anywhere.

`MHD_OPTION_URI_LOG_CALLBACK`
: Specify a function that should be called before parsing the URI from the client. The specified callback function can be used for processing the URI (including the options) before it is parsed. The URI after parsing will no longer contain the options, which maybe inconvenient for logging. This option should be followed by two arguments, the first one must be of the form

  ```
  void * my_logger(void * cls, const char * uri)
  ```

  where the return value will be passed as `*con_cls` in calls to the `MHD_AccessHandlerCallback` when this request is processed later; returning a value of NULL has no special significance; (however, note that if you

return non-NULL, you can no longer rely on the first call to the access handler having `NULL == *con_cls on entry` on entry) `cls` will be set to the second argument following MHD_OPTION_URI_LOG_CALLBACK. Finally, `uri` will be the 0-terminated URI of the request.

`MHD_OPTION_HTTPS_MEM_KEY`
: Memory pointer to the private key to be used by the HTTPS daemon. This option should be followed by an "const char*" argument. This should be used in conjunction with 'MHD_OPTION_HTTPS_MEM_CERT'.

`MHD_OPTION_HTTPS_MEM_CERT`
: Memory pointer to the certificate to be used by the HTTPS daemon. This option should be followed by an "const char*" argument. This should be used in conjunction with 'MHD_OPTION_HTTPS_MEM_KEY'.

`MHD_OPTION_CRED_TYPE`
: Daemon credentials type. Either certificate or anonymous, this option should be followed by one of the values listed in "enum MHD_GNUTLS_CredentialsType".

`MHD_OPTION_PROTOCOL_VERSION`
: SSL/TLS protocol version. Memory pointer to a zero (MHD_GNUTLS_PROTOCOL_END) terminated (const) array of 'enum MHD_GNUTLS_Protocol' values representing the protocol versions to this server should support. Unsupported requests will be dropped by the server.

`MHD_OPTION_CIPHER_ALGORITHM`
: Memory pointer to a zero (MHD_GNUTLS_CIPHER_UNKNOWN) terminated (const) array of 'enum MHD_GNUTLS_CipherAlgorithm' representing the cipher priority order to which the HTTPS daemon should adhere.

`MHD_OPTION_EXTERNAL_LOGGER`
: Use the given function for logging error messages. This option must be followed by two arguments; the first must be a pointer to a function of type 'void fun(void * arg, const char * fmt, va_list ap)' and the second a pointer of type 'void*' which will be passed as the "arg" argument to "fun".

  Note that MHD will not generate any log messages if it was compiled without the "–enable-messages" flag being set and the MHD_USE_DEBUG flag being set, even if this argument is used.

`MHD_ValueKind` [Enumeration]

The `MHD_ValueKind` specifies the source of the key-value pairs in the HTTP protocol.

`MHD_RESPONSE_HEADER_KIND`
: Response header.

`MHD_HEADER_KIND`
: HTTP header.

`MHD_COOKIE_KIND`
: Cookies. Note that the original HTTP header containing the cookie(s) will still be available and intact.

`MHD_POSTDATA_KIND`
: `POST` data. This is available only if a content encoding supported by MHD is used (currently only URL encoding), and only if the posted content fits within the available memory pool. Note that in that case, the upload data given to the `MHD_AccessHandlerCallback()` will be empty (since it has already been processed).

`MHD_GET_ARGUMENT_KIND`
: `GET` (URI) arguments.

`MHD_HEADER_KIND`
: HTTP footer (only for http 1.1 chunked encodings).

`MHD_RequestTerminationCode` [Enumeration]

The `MHD_RequestTerminationCode` specifies reasons why a request has been terminated (or completed).

`MHD_REQUEST_TERMINATED_COMPLETED_OK`
: We finished sending the response.

`MHD_REQUEST_TERMINATED_WITH_ERROR`
: Error handling the connection (resources exhausted, other side closed connection, application error accepting request, etc.)

`MHD_REQUEST_TERMINATED_TIMEOUT_REACHED`
: No activity on the connection for the number of seconds specified using `MHD_OPTION_CONNECTION_TIMEOUT`.

`MHD_REQUEST_TERMINATED_DAEMON_SHUTDOWN`
: We had to close the session since MHD was being shut down.

`MHD_GNUTLS_Protocol` [Enumeration]

SSL/TLS Protocol types. Note that not all listed algorithms are necessarily supported by all builds of MHD.

`MHD_GNUTLS_PROTOCOL_END`
`MHD_GNUTLS_PROTOCOL_SSL3`
`MHD_GNUTLS_PROTOCOL_TLS1_0`
`MHD_GNUTLS_PROTOCOL_TLS1_1`
`MHD_GNUTLS_PROTOCOL_TLS1_2`
`MHD_GNUTLS_PROTOCOL_UNKNOWN`

`MHD_GNUTLS_CipherAlgorithm` [Enumeration]

List of symmetric ciphers. Note that not all listed algorithms are necessarily supported by all builds of MHD.

MHD_GNUTLS_CIPHER_UNKNOWN
MHD_GNUTLS_CIPHER_NULL
MHD_GNUTLS_CIPHER_ARCFOUR_128
MHD_GNUTLS_CIPHER_3DES_CBC
MHD_GNUTLS_CIPHER_AES_128_CBC
MHD_GNUTLS_CIPHER_AES_256_CBC

MHD_ConnectionInfoType [Enumeration]

Values of this enum are used to specify what information about a connection is desired.

MHD_CONNECTION_INFO_CIPHER_ALGO
: What cipher algorithm is being used. Takes no extra arguments.

MHD_CONNECTION_INFO_PROTOCOL,
: Takes no extra arguments.

MHD_DaemonInfoType [Enumeration]

Values of this enum are used to specify what information about a deamon is desired.

MHD_DAEMON_INFO_KEY_SIZE
: Request information about the key size for a particular cipher algorithm. The cipher algorithm should be passed as an extra argument (of type 'enum MHD_GNUTLS_CipherAlgorithm').

MHD_DAEMON_INFO_MAC_KEY_SIZE
: Request information about the key size for a particular cipher algorithm. The cipher algorithm should be passed as an extra argument (of type 'enum MHD_GNUTLS_HashAlgorithm').

MHD_DAEMON_INFO_LISTEN_FD
: Request the file-descriptor number that MHD is using to listen to the server socket. This can be useful if no port was specified and a client needs to learn what port is actually being used by MHD. No extra arguments should be passed.

3 Structures type definition

`MHD_Daemon` [C Struct]
: Handle for the daemon (listening on a socket for HTTP traffic).

`MHD_Connection` [C Struct]
: Handle for a connection / HTTP request. With HTTP/1.1, multiple requests can be run over the same connection. However, MHD will only show one request per TCP connection to the client at any given time.

`MHD_Response` [C Struct]
: Handle for a response.

`MHD_PostProcessor` [C Struct]
: Handle for `POST` processing.

`MHD_ConnectionInfo` [C Union]
: Information about a connection.

`MHD_DaemonInfo` [C Union]
: Information about an MHD daemon.

4 Callback functions definition

`int *MHD_AcceptPolicyCallback` (*void *cls, const struct sockaddr * addr, socklen_t addrlen*) [Function Pointer]

Invoked in the context of a connection to allow or deny a client to connect. This callback return `MHD_YES` if connection is allowed, `MHD_NO` if not.

cls custom value selected at callback registration time;

addr address information from the client;

addrlen length of the address information.

`int *MHD_AccessHandlerCallback` (*void *cls, struct MHD_Connection * connection, const char *url, const char *method, const char *version, const char *upload_data, size_t *upload_data_size, void **con_cls*) [Function Pointer]

Invoked in the context of a connection to answer a request from the client. This callback must call MHD functions (example: the `MHD_Response` ones) to provide content to give back to the client and return an HTTP status code (i.e. `200` for OK, `404`, etc.).

Chapter 9 [microhttpd-post], page 27, for details on how to code this callback.

Must return `MHD_YES` if the connection was handled successfully, `MHD_NO` if the socket must be closed due to a serious error while handling the request

cls custom value selected at callback registration time;

url the URL requested by the client;

method the HTTP method used by the client (`GET`, `PUT`, `DELETE`, `POST`, etc.);

version the HTTP version string (i.e. `HTTP/1.1`);

upload_data
the data being uploaded (excluding headers):

- for a `POST` that fits into memory and that is encoded with a supported encoding, the `POST` data will **NOT** be given in *upload_data* and is instead available as part of `MHD_get_connection_values()`;
- very large `POST` data **will** be made available incrementally in *upload_data*;

upload_data_size
set initially to the size of the *upload_data* provided; this callback must update this value to the number of bytes **NOT** processed; unless external select is used, the callback maybe required to process at least some data. If the callback fails to process data in multi-threaded or internal-select mode and if the read-buffer is already at the maximum size that MHD is willing to use for reading (about half of the maximum amount of memory allowed for the connection), then MHD will abort handling the connection and return an internal server error to the client. In order to avoid this, clients must be able to process upload data incrementally and reduce the value of `upload_data_size`.

con_cls reference to a pointer, initially set to `NULL`, that this callback can set to some address and that will be preserved by MHD for future calls for this request;

since the access handler may be called many times (i.e., for a `PUT/POST` operation with plenty of upload data) this allows the application to easily associate some request-specific state;

if necessary, this state can be cleaned up in the global `MHD_RequestCompletedCallback` (which can be set with the `MHD_OPTION_NOTIFY_COMPLETED`).

`void *MHD_RequestCompletedCallback` (*void *cls, struct MHD_Connectionconnection, void **con_cls, enum MHD_RequestTerminationCode toe*) [Function Pointer]

Signature of the callback used by MHD to notify the application about completed requests.

cls custom value selected at callback registration time;

connection connection handle;

con_cls value as set by the last call to the `MHD_AccessHandlerCallback`;

toe reason for request termination see `MHD_OPTION_NOTIFY_COMPLETED`.

`int *MHD_KeyValueIterator` (*void *cls, enum MHD_ValueKind kind, const char *key, const char *value*) [Function Pointer]

Iterator over key-value pairs. This iterator can be used to iterate over all of the cookies, headers, or `POST`-data fields of a request, and also to iterate over the headers that have been added to a response.

Return `MHD_YES` to continue iterating, `MHD_NO` to abort the iteration.

`int *MHD_ContentReaderCallback` (*void *cls, uint64_t pos, char *buf, int max*) [Function Pointer]

Callback used by MHD in order to obtain content. The callback has to copy at most *max* bytes of content into *buf*. The total number of bytes that has been placed into *buf* should be returned.

Note that returning zero will cause MHD to try again, either "immediately" if in multi-threaded mode (in which case the callback may want to do blocking operations to avoid busy waiting) or in the next round if `MHD_run` is used. Returning zero for a daemon that runs in internal `select()` mode is an error (since it would result in busy waiting) and cause the program to be aborted (`abort()`).

cls custom value selected at callback registration time;

pos position in the datastream to access; note that if an `MHD_Response` object is re-used, it is possible for the same content reader to be queried multiple times for the same data; however, if an `MHD_Response` is not re-used, MHD guarantees that *pos* will be the sum of all non-negative return values obtained from the content reader so far.

Return `-1` on error (MHD will no longer try to read content and instead close the connection with the client).

`void *MHD_ContentReaderFreeCallback` (*void *cls*) [Function Pointer]
This method is called by MHD if we are done with a content reader. It should be used to free resources associated with the content reader.

`int *MHD_PostDataIterator` (*void *cls, enum MHD_ValueKind kind, const char *key, const char *filename, const char *content_type, const char *transfer_encoding, const char *data, uint64_t off, size_t size*) [Function Pointer]
Iterator over key-value pairs where the value maybe made available in increments and/or may not be zero-terminated. Used for processing `POST` data.

cls custom value selected at callback registration time;

kind type of the value;

key zero-terminated key for the value;

filename name of the uploaded file, `NULL` if not known;

content_type
mime-type of the data, `NULL` if not known;

transfer_encoding
encoding of the data, `NULL` if not known;

data pointer to size bytes of data at the specified offset;

off offset of data in the overall value;

size number of bytes in data available.

Return `MHD_YES` to continue iterating, `MHD_NO` to abort the iteration.

5 Starting and stopping the server

`struct MHD_Daemon * MHD_start_daemon` (*unsigned int flags, unsigned short port, MHD_AcceptPolicyCallback apc, void *apc_cls, MHD_AccessHandlerCallback dh, void *dh_cls, ...*) [Function]

Start a webserver on the given port.

flags OR-ed combination of `MHD_FLAG` values;

port port to bind to;

apc callback to call to check which clients will be allowed to connect; you can pass `NULL` in which case connections from any IP will be accepted;

apc_cls extra argument to *apc*;

dh default handler for all URIs;

dh_cls extra argument to *dh*.

Additional arguments are a list of options (type-value pairs, terminated with `MHD_OPTION_END`). It is mandatory to use `MHD_OPTION_END` as last argument, even when there are no additional arguments.

Return `NULL` on error, handle to daemon on success.

`void MHD_stop_daemon` (*struct MHD_Daemon *daemon*) [Function]

Shutdown an HTTP daemon.

`int MHD_run` (*struct MHD_Daemon *daemon*) [Function]

Run webserver operations (without blocking unless in client callbacks). This method should be called by clients in combination with `MHD_get_fdset()` if the client-controlled `select()` method is used.

Return `MHD_YES` on success, `MHD_NO` if this daemon was not started with the right options for this call.

6 Implementing external `select`

`int MHD_get_fdset` (*struct MHD_Daemon *daemon, fd_set * read_fd_set, fd_set * write_fd_set, fd_set * except_fd_set, int *max_fd*) [Function]

Obtain the `select()` sets for this daemon. The daemon's socket is added to *read_fd_set*. The list of currently existent connections is scanned and their file descriptors added to the correct set.

see ⟨undefined⟩ [], page ⟨undefined⟩ for details on file descriptor sets.

After the call completed successfully: the variable referenced by *max_fd* references the file descriptor with highest integer identifier. The variable must be set to zero before invoking this function.

Return `MHD_YES` on success, `MHD_NO` if: the arguments are invalid (example: `NULL` pointers); this daemon was not started with the right options for this call.

`int MHD_get_timeout` (*struct MHD_Daemon *daemon, unsigned long long *timeout*) [Function]

Obtain timeout value for select for this daemon (only needed if connection timeout is used). The returned value is how long `select()` should at most block, not the timeout value set for connections.

set to the timeout (in milliseconds).

Return `MHD_YES` on success, `MHD_NO` if timeouts are not used (or no connections exist that would necessiate the use of a timeout right now).

7 Handling requests

`int MHD_get_connection_values` (*struct MHD_Connection *connection, enum MHD_ValueKind kind, MHD_KeyValueIterator iterator, void *iterator_cls*) [Function]

Get all the headers matching *kind* from the request.

The *iterator* callback is invoked once for each header, with *iterator_cls* as first argument. Return the number of entries iterated over; this can be less than the number of headers if, while iterating, *iterator* returns `MHD_NO`.

iterator can be `NULL`: in this case this function just counts and returns the number of headers.

`int MHD_set_connection_value` (*struct MHD_Connection *connection, enum MHD_ValueKind kind, const char * key, const char * value*) [Function]

This function can be used to add an entry to the HTTP headers of a connection (so that the MHD_get_connection_values function will return them – and the MHD PostProcessor will also see them). This maybe required in certain situations (see Mantis #1399) where (broken) HTTP implementations fail to supply values needed by the post processor (or other parts of the application).

This function MUST only be called from within the MHD_AccessHandlerCallback (otherwise, access maybe improperly synchronized). Furthermore, the client must guarantee that the key and value arguments are 0-terminated strings that are NOT freed until the connection is closed. (The easiest way to do this is by passing only arguments to permanently allocated strings.).

connection is the connection for which the entry for *key* of the given *kind* should be set to the given *value*.

The function returns `MHD_NO` if the operation could not be performed due to insufficient memory and `MHD_YES` on success.

`const char * MHD_lookup_connection_value` (*struct MHD_Connection *connection, enum MHD_ValueKind kind, const char *key*) [Function]

Get a particular header value. If multiple values match the *kind*, return one of them (the "first", whatever that means). *key* must reference a zero-terminated ASCII-coded string representing the header to look for: it is compared against the headers using `strcasecmp()`, so case is ignored. Return `NULL` if no such item was found.

8 Building answers to responses

Response objects handling by MHD is asynchronous with respect to the application execution flow. Instances of the `MHD_Response` structure are not associated to a daemon and neither to a client connection: they are managed with reference counting.

In the simplest case: we allocate a new `MHD_Response` structure for each response, we use it once and finally we destroy it.

MHD allows more efficient resources usages.

Example: we allocate a new `MHD_Response` structure for each response **kind**, we use it every time we have to give that responce and we finally destroy it only when the daemon shuts down.

8.1 Enqueuing a response

`int MHD_queue_response` (*struct MHD_Connection *connection, unsigned int status_code, struct MHD_Response *response*) [Function]

Queue a response to be transmitted to the client as soon as possible but only after MHD_AccessHandlerCallback returns. This function checks that it is legal to queue a response at this time for the given connection. It also increments the internal reference counter for the response object (the counter will be decremented automatically once the response has been transmitted).

connection the connection identifying the client;

status_code HTTP status code (i.e. `200` for OK);

response response to transmit.

Return `MHD_YES` on success or if message has been queued. Return `MHD_NO`: if arguments are invalid (example: `NULL` pointer); on error (i.e. reply already sent).

`void MHD_destroy_response` (*struct MHD_Response *response*) [Function]

Destroy a response object and associated resources (decrement the reference counter). Note that MHD may keep some of the resources around if the response is still in the queue for some clients, so the memory may not necessarily be freed immediatley.

An explanation of reference counting[1]:

1. a `MHD_Response` object is allocated:

```
struct MHD_Response * response = MHD_create_response_from_data(...);
/* here: reference counter = 1 */
```

2. the `MHD_Response` object is enqueued in a `MHD_Connection`:

```
MHD_queue_response(connection, , response);
/* here: reference counter = 2 */
```

[1] Note to readers acquainted to the Tcl API: reference counting on `MHD_Connection` structures is handled in the same way as Tcl handles `Tcl_Obj` structures through `Tcl_IncrRefCount()` and `Tcl_DecrRefCount()`.

3. the creator of the response object discharges responsibility for it:

```
MHD_destroy_response(response);
/* here: reference counter = 1 */
```

4. the daemon handles the connection sending the response's data to the client then decrements the reference counter by calling `MHD_destroy_response()`: the counter's value drops to zero and the `MHD_Response` object is released.

8.2 Creating response objects

`struct MHD_Response * MHD_create_response_from_callback` [Function]
(*uint64_t size, size_t block_size, MHD_ContentReaderCallback crc, void *crc_cls, MHD_ContentReaderFreeCallback crfc*)

Create a response object. The response object can be extended with header information and then it can be used any number of times.

size size of the data portion of the response, `-1` for unknown;

block_size preferred block size for querying *crc* (advisory only, MHD may still call *crc* using smaller chunks); this is essentially the buffer size used for IO, clients should pick a value that is appropriate for IO and memory performance requirements;

crc callback to use to obtain response data;

crc_cls extra argument to *crc*;

crfc callback to call to free *crc_cls* resources.

Return `NULL` on error (i.e. invalid arguments, out of memory).

`struct MHD_Response * MHD_create_response_from_data` (*size_t size, void *data, int must_free, int must_copy*) [Function]

Create a response object. The response object can be extended with header information and then it can be used any number of times.

size size of the data portion of the response;

data the data itself;

must_free if true: MHD should free data when done;

must_copy if true: MHD allocates a block of memory and use it to make a copy of *data* embedded in the returned `MHD_Response` structure; handling of the embedded memory is responsibility of MHD; *data* can be released anytime after this call returns.

Return `NULL` on error (i.e. invalid arguments, out of memory).

Example: create a response from a statically allocated string:

```
const char * data = "<html><body><p>Error!</p></body></html>";

struct MHD_Connection * connection = ...;
```

```
struct MHD_Response *   response;

response = MHD_create_response_from_data(strlen(data), data,
                                         MHD_NO, MHD_NO);
MHD_queue_response(connection, 404, response);
MHD_destroy_response(response);
```

8.3 Adding headers to a response

`int MHD_add_response_header` (*struct MHD_Response *response, const char *header, const char *content*) [Function]

Add a header line to the response. The strings referenced by *header* and *content* must be zero-terminated and they are duplicated into memory blocks embedded in *response*.

Notice that the strings must not hold newlines, carriage returns or tab chars.

Return `MHD_NO` on error (i.e. invalid header or content format or memory allocation error).

`int MHD_del_response_header` (*struct MHD_Response *response, const char *header, const char *content*) [Function]

Delete a header line from the response. Return `MHD_NO` on error (arguments are invalid or no such header known).

8.4 Inspecting a response object

`int MHD_get_response_headers` (*struct MHD_Response *response, MHD_KeyValueIterator iterator, void *iterator_cls*) [Function]

Get all of the headers added to a response.

Invoke the *iterator* callback for each header in the response, using *iterator_cls* as first argument. Return number of entries iterated over. *iterator* can be `NULL`: in this case the function just counts headers.

iterator should not modify the its key and value arguments, unless we know what we are doing.

`const char * MHD_get_response_header` (*struct MHD_Response *response, const char *key*) [Function]

Find and return a pointer to the value of a particular header from the response. *key* must reference a zero-terminated string representing the header to look for. The search is case sensitive. Return `NULL` if header does not exist or *key* is `NULL`.

We should not modify the value, unless we know what we are doing.

9 Adding a POST processor

MHD provides the post procesor API to make it easier for applications to parse the data of a client's POST request: the MHD_AccessHandlerCallback will be invoked multiple times to process data as it arrives; at each invocation a new chunk of data must be processed. The arguments *upload_data* and *upload_data_size* are used to reference the chunk of data.

When MHD_AccessHandlerCallback is invoked for a new connection: its **con_cls* argument is set to NULL. When POST data comes in the upload buffer it is **mandatory** to use the *con_cls* to store a reference to per-connection data. The fact that the pointer was initially NULL can be used to detect that this is a new request.

One method to detect that a new connection was established is to set *con_cls to anunused integer:

```
int
access_handler (void *cls,
                struct MHD_Connection * connection,
                const char *url,
                const char *method, const char *version,
                const char *upload_data, size_t *upload_data_size,
                void **con_cls)
{
  static int old_connection_marker;
  int new_connection = (MYNULL == *con_cls);

  if (new_connection)
    {
      /* new connection with POST */
      *con_cls = &old_connection_marker;
    }

  ...
}
```

In contrast to the previous example, for POST requests in particular, it is more common to use the value of *con_cls to keep track of actual state used during processing, such as the post processor (or a struct containing a post processor):

```
int
access_handler (void *cls,
                struct MHD_Connection * connection,
                const char *url,
                const char *method, const char *version,
                const char *upload_data, size_t *upload_data_size,
                void **con_cls)
{
  struct MHD_PostProcessor * pp = *con_cls;

  if (pp == NULL)
    {
```

```
      pp = MHD_create_post_processor(connection, ...);
      *con_cls = pp;
      return MHD_YES;
    }
  if (*upload_data_size)
    {
      MHD_post_process(pp, upload_data, *upload_data_size);
      *upload_data_size = 0;
      return MHD_YES;
    }
  else
    {
      MHD_destroy_post_processor(pp);
      return MHD_queue_response(...);
    }
}
```

Note that the callback from `MHD_OPTION_NOTIFY_COMPLETED` should be used to destroy the post processor. This cannot be done inside of the access handler since the connection may not always terminate normally.

9.1 Programming interface for the `POST` processor

`struct MHD_PostProcessor * MHD_create_post_processor` (*struct MHD_Connection *connection, size_t buffer_size, MHD_PostDataIterator iterator, void *iterator_cls*) [Function]

Create a PostProcessor. A PostProcessor can be used to (incrementally) parse the data portion of a `POST` request.

connection the connection on which the `POST` is happening (used to determine the `POST` format);

buffer_size maximum number of bytes to use for internal buffering (used only for the parsing, specifically the parsing of the keys). A tiny value (256-1024) should be sufficient; do **NOT** use a value smaller than 256;

iterator iterator to be called with the parsed data; must **NOT** be `NULL`;

iterator_cls custom value to be used as first argument to *iterator*.

Return `NULL` on error (out of memory, unsupported encoding), otherwise a PP handle.

`int MHD_post_process` (*struct MHD_PostProcessor *pp, const char *post_data, size_t post_data_len*) [Function]

Parse and process `POST` data. Call this function when `POST` data is available (usually during an `MHD_AccessHandlerCallback`) with the *upload_data* and *upload_data_size*. Whenever possible, this will then cause calls to the `MHD_IncrementalKeyValueIterator`.

pp the post processor;

post_data *post_data_len* bytes of POST data;

post_data_len
length of *post_data*.

Return MHD_YES on success, MHD_NO on error (out-of-memory, iterator aborted, parse error).

`int MHD_destroy_post_processor` (*struct MHD_PostProcessor *pp*) [Function]
Release PostProcessor resources. After this function is being called, the PostProcessor is guaranteed to no longer call its iterator. There is no special call to the iterator to indicate the end of the post processing stream. After destroying the PostProcessor, the programmer should perform any necessary work to complete the processing of the iterator.

Return MHD_YES if processing completed nicely, MHD_NO if there were spurious characters or formatting problems with the post request. It is common to ignore the return value of this function.

10 Obtaining status information.

10.1 Obtaining state information about an MHD daemon

`const union MHD_DaemonInfo * MHD_get_daemon_info` (*struct MHD_Daemon *daemon, enum MHD_DaemonInfoType infoType, ...*) [Function]

Obtain information about the given daemon. This function is currently not fully implemented.

daemon the daemon about which information is desired;

infoType type of information that is desired

... additional arguments about the desired information (depending on infoType)

Returns a union with the respective member (depending on infoType) set to the desired information), or NULL in case the desired information is not available or applicable.

10.2 Obtaining state information about a connection

`const union MHD_ConnectionInfo * MHD_get_connection_info` (*struct MHD_Connection *daemon, enum MHD_ConnectionInfoType infoType, ...*) [Function]

Obtain information about the given connection.

connection the connection about which information is desired;

infoType type of information that is desired

... additional arguments about the desired information (depending on infoType)

Returns a union with the respective member (depending on infoType) set to the desired information), or NULL in case the desired information is not available or applicable.

GNU-LGPL

Version 2.1, February 1999

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