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# **LOOT API Documentation**

*Release latest*

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# Introduction

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LOOT is a utility that helps users avoid serious conflicts between their mods by setting their plugins in an optimal load order. It also provides tens of thousands of plugin-specific messages, including usage notes, requirements, incompatibilities, bug warnings and installation mistake notifications, and thousands of Bash Tag suggestions.

This metadata that LOOT supplies is stored in its masterlist, which is maintained by the LOOT team using information provided by mod authors and users. Users can also add to and modify the metadata used by LOOT through the use of userlist files. The LOOT API provides a way for third-party developers to access this metadata for use in their own programs.



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## Miscellaneous Details

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### String Encoding

- All output strings are encoded in UTF-8.
- Metadata files are written encoded in UTF-8.
- Input strings are expected to be encoded in UTF-8.
- Metadata files read are expected to be encoded in UTF-8.
- File paths are case-sensitive if and only if the underlying file system is case-sensitive.

### Language Codes

All language strings in the API are codes of the form `ll` or `ll_CC`, where `ll` is an ISO 639-1 language code and `CC` is an ISO 3166 country code. For example, the default language for metadata message content is English, identified by the code `en`, and Brazilian Portuguese is `pt_BR`.

### Errors

All errors encountered are thrown as exceptions that inherit from `std::exception`.

### Metadata Files

LOOT stores plugin metadata in YAML files. It distinguishes between *masterlist* and *userlist* files: each game has a single masterlist, which is a public, curated metadata store, and each LOOT user has a private userlist, which can contain metadata added by the user. The two files use the same syntax, but metadata in the userlist extends or replaces metadata sourced from the masterlist.

LOOT's plugin metadata can be conditional, eg. a plugin may require a patch only if another plugin is also present. The API's `LoadLists()` method parses metadata files into memory, but does not evaluate these conditions, so the loaded metadata may contain metadata that is invalid for the installed game that the `loot::DatabaseInterface` object being operated on was created for.

## Caching

All unevaluated metadata is cached between calls to *LoadLists()*.

Plugin content is cached between calls to *LoadPlugins()* and *SortPlugins()*.

Load order is cached between calls to *LoadPlugins()*, *SortPlugins()* and *LoadCurrentLoadOrderState()*.

## Performance

Loading metadata lists is a relatively costly operation, as is updating the masterlist (which involves loading it).

Sorting plugins is expensive, as it involves loading all the FormIDs for all the plugins, apart from the game's main master file, which is skipped as an optimisation (it doesn't depend on anything else and is much bigger than any other plugin, so is unnecessary and slow to load).

Getting plugin metadata once loaded is cheap, as is getting a masterlist's revision.

Loading the current load order state is relatively cheap and can take < 1 ms depending on hardware and the size of the load order, but involves filesystem access and should not be done more often than necessary to avoid a performance impact.



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## LOOT's Sorting Algorithm

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LOOT's sorting algorithm consists of four stages:

- *Load plugin data*
- *Create plugin graph vertices*
- *Create plugin graph edges*
- *Topologically sort the plugin graph*

### Load plugin data

In this first stage, the plugins to be sorted are parsed and their FormIDs stored. Parsing is multithreaded by dividing the plugins into buckets with roughly equal total file sizes, and loading each bucket's plugins in a separate thread. The number of buckets created is equal to the number of concurrent threads that are hardware-supported (e.g. a dual-core CPU without hyperthreading may report that it supports two threads).

When parsing plugins, all subrecords are skipped over for efficiency, apart from the subrecords of the TES4 header record.

### Create plugin graph vertices

Once loaded, a directed graph is created and the plugins are added to it in lexicographical order as vertices. Any metadata a plugin has in the masterlist and userlist are then merged into its vertex's data store.

### Create plugin graph edges

In this section, the terms *vertex* and *plugin* are used interchangeably, and the iteration order 'for each plugin' is the order in which the vertices were added to the graph.

For each plugin:

1. If the plugin is a master file, add edges going to all non-master files. If the plugin is a non-master file, add edges coming from all master files.
2. Add edges coming from all the plugin's masters. Missing masters have no edges added.

3. Add edges coming from all the plugin's requirements. Missing requirements have no edges added.
4. Add edges coming from all the plugin's load after files that are installed plugins.

At this point, all explicit interdependencies have been graphed. Plugin priority metadata values must now be propagated down the dependency trees to ensure that priority edges are added correctly later in the process. To do this:

1. Create a list of all vertices with a global or non-global priority value greater than zero.
2. Sort the list in order of decreasing priority value.
3. For each vertex, perform a depth-first search, setting priorities at each vertex visited until equal or larger values are encountered.

Now that the priorities have been propagated, the priority edges can be added. For each plugin, if it has a global priority value of zero, overrides no records and loads no archive, skip it, otherwise iterate over all other plugins and:

- If the other plugin's global and non-global priority values equal the plugin's own values, or if both plugins have a global priority of zero and have no FormIDs in common, skip the other plugin.
- Otherwise, add an edge from the plugin with lower global priority to the plugin with higher global priority, if that edge does not cause a cycle. A cycle is caused if a circular dependency is introduced, for example for two vertices A and B, A -> B -> A is a cycle.

If the global priorities are equal, compare the non-global priorities instead.

Plugin overlap edges are then added. Two plugins overlap if they contain the same FormID, i.e. if they both edit the same record or if one edits a record the other plugin adds.

For each plugin, skip it if it overrides no records, otherwise iterate over all other plugins.

- If the plugin and other plugin override the same number of records, or do not overlap, skip the other plugin.
- Otherwise, add an edge from the plugin which overrides more records to the plugin that overrides fewer records, unless that edge would cause a cycle.

Finally, tie-break edges are added to ensure that sorting is consistent. For each plugin, iterate over all other plugins and add an edge between each pair of plugins in the direction given by the tie-break comparison function, unless that edge would cause a cycle.

The tie-break comparison function compares current plugin load order positions, falling back to plugin names.

- If both plugins have positions in the current load order, the function preserves their existing relative order.
- If one plugin has a position and the other does not, the edge added goes from the plugin with a position to the plugin without a position.
- If neither plugin has a load order position, a case-insensitive lexicographical comparison of their filenames without file extensions is used to decide their order.

## Topologically sort the plugin graph

Note that edges for explicit interdependencies are the only edges allowed to create cycles: this is because the first step of this stage is to check the plugin graph for cycles, and throw an error if any are encountered, so that metadata (or indeed plugin data) that cause them can be corrected.

Once the graph is confirmed to be cycle-free, a topological sort is performed on the graph, outputting a list of plugins in their newly-sorted load order.

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## API Reference

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- *API Reference*
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  - *Classes*
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## Enumerations

**enum** `loot` : **GameType**

Codes used to create database handles for specific games.

*Values:*

**tes4**

The Elder Scrolls IV: Oblivion

**tes5**

The Elder Scrolls V: Skyrim

**fo3**

Fallout 3

**fonv**

Fallout: New Vegas

**fo4**

Fallout 4

**tes5se**

The Elder Scrolls V: Skyrim Special Edition

**enum** `loot::LogLevel`

Codes used to specify different levels of API logging.

*Values:*

**trace**

**debug**

**info**

**warning**

**error**

**fatal**

**enum** `loot::MessageType`

Codes used to indicate the type of a message.

*Values:*

**say**

A notification message that is of no significant severity.

**warn**

A warning message, used to indicate that an issue may be present that the user may wish to act on.

**error**

An error message, used to indicate that an issue that requires user action is present.

## Public-Field Data Structures

**struct** `loot::MasterlistInfo`

A structure that holds data about a masterlist's source control revision.

### Public Members

`std::string` **revision\_id**

The revision hash for the masterlist. If the masterlist doesn't exist, or there is no Git repository at its location, this will be empty.

`std::string` **revision\_date**

A pointer to a string containing the ISO 8601 formatted revision date, ie. YYYY-MM-DD. If the masterlist doesn't exist, or there is no Git repository at its location, this will be empty.

`bool` **is\_modified**

`true` if the masterlist has been edited since the outputted revision, or `false` if it is at exactly the revision given.

**struct** `loot::SimpleMessage`

A structure that holds the type of a message and the message string itself.

### Public Members

`MessageType` **type**

The type of the message.

std::string **language**

The language the message string is written in.

std::string **text**

The message string, which may be formatted using [GitHub Flavored Markdown](#).

std::string **condition**

The message's condition string.

## Functions

void loot::SetLoggingCallback (std::function<void> *LogLevel*, const char \*  
> *callback*) Set the callback function that is called when logging.

If this function is not called, the default behaviour is to print messages to the console.

### Parameters

- *callback*: The function called when logging. The first parameter is the level of the message being logged, and the second is the message.

bool loot::IsCompatible (const unsigned int *major*, const unsigned int *minor*, const unsigned int *patch*)  
Checks for API compatibility.

Checks whether the loaded API is compatible with the given version of the API, abstracting API stability policy away from clients. The version numbering used is major.minor.patch.

**Return** True if the API versions are compatible, false otherwise.

### Parameters

- *major*: The major version number to check.
- *minor*: The minor version number to check.
- *patch*: The patch version number to check.

void loot::InitialiseLocale (const std::string &*id*)  
Initialise the current global locale using the given ID.

This sets the global locale up so that the library's UTF-8 support can function.

### Parameters

- *id*: A locale ID.

std::shared\_ptr<*GameInterface*> loot::CreateGameHandle (const *GameType* *game*, const std::string  
&*game\_path* = "", const std::string  
&*game\_local\_path* = "")

Initialise a new game handle.

Creates a handle for a game, which is then used by all game-specific functions.

**Return** The new game handle.

### Parameters

- *game*: A game code for which to create the handle.
- *game\_path*: The relative or absolute path to the game folder, or an empty string. If an empty string, the API will attempt to detect the data path of the specified game by searching for the game's main master file in a sibling Data folder and by searching for the game's Registry entry.

- `game_local_path`: The relative or absolute path to the game's folder in `%LOCALAPPDATA%` or an empty string. If an empty string, the API will attempt to look up the path that `%LOCALAPPDATA%` corresponds to. This parameter is provided so that systems lacking that environmental variable (eg. Linux) can still use the API.

## Interfaces

**class** `loot::DatabaseInterface`

The interface provided by API's database handle.

### Data Reading & Writing

**virtual** void **LoadLists** (**const** std::string &*masterlist\_path*, **const** std::string &*userlist\_path* = "") = 0  
 Loads the masterlist and userlist from the paths specified.

Can be called multiple times, each time replacing the previously-loaded data.

#### Parameters

- `masterlist_path`: A string containing the relative or absolute path to the masterlist file that should be loaded.
- `userlist_path`: A string containing the relative or absolute path to the userlist file that should be loaded, or an empty string. If an empty string, no userlist will be loaded.

**virtual** void **WriteUserMetadata** (**const** std::string &*outputFile*, **const** bool *overwrite*) **const** = 0  
 Writes a metadata file containing all loaded user-added metadata.

#### Parameters

- `outputFile`: The path to which the file shall be written.
- `overwrite`: If `false` and `outputFile` already exists, no data will be written. Otherwise, data will be written.

**virtual** void **WriteMinimalList** (**const** std::string &*outputFile*, **const** bool *overwrite*) **const** = 0  
 Writes a minimal metadata file that only contains plugins with Bash *Tag* suggestions and/or dirty info, plus the suggestions and info themselves.

#### Parameters

- `outputFile`: The path to which the file shall be written.
- `overwrite`: If `false` and `outputFile` already exists, no data will be written. Otherwise, data will be written.

### Masterlist Update

**virtual** bool **UpdateMasterlist** (**const** std::string &*masterlist\_path*, **const** std::string &*remote\_url*,  
**const** std::string &*remote\_branch*) = 0

Update the given masterlist.

Uses Git to update the given masterlist to a given remote. If the masterlist doesn't exist, this will create it. This function also initialises a Git repository in the given masterlist's parent folder. If the masterlist was not already up-to-date, it will be re-loaded, but not re-evaluated.

If a Git repository is already present, it will be used to perform a diff-only update, but if for any reason a fast-forward merge update is not possible, the existing repository will be deleted and a new repository cloned from the given remote.

**Return** `true` if the masterlist was updated. `false` if no update was necessary, ie. it was already up-to-date. If `true`, the masterlist will have been re-loaded, but will need to be re-evaluated separately.

**Parameters**

- `masterlist_path`: A string containing the relative or absolute path to the masterlist file that should be updated. The filename must match the filename of the masterlist file in the given remote repository, otherwise it will not be updated correctly. Although LOOT itself expects this filename to be “masterlist.yaml”, the API does not check for any specific filename.
- `remote_url`: The URL of the remote from which to fetch updates. This can also be a relative or absolute path to a local repository.
- `remote_branch`: The branch of the remote from which to apply updates. LOOT’s official masterlists are versioned using separate branches for each new version of the masterlist syntax, so if you’re using them, check their repositories to see which is the latest release branch.

**virtual** MasterlistInfo **GetMasterlistRevision** (`const` std::string &*masterlist\_path*, `const` bool *get\_short\_id* `const` = 0

Get the given masterlist’s revision.

Getting a masterlist’s revision is only possible if it is found inside a local Git repository.

**Return** The revision data.

**Parameters**

- `masterlist_path`: A string containing the relative or absolute path to the masterlist file that should be queried.
- `get_short_id`: If `true`, the shortest unique hexadecimal revision hash that is at least 7 characters long will be outputted. Otherwise, the full 40 character hash will be outputted.

**virtual** bool **IsLatestMasterlist** (`const` std::string &*masterlist\_path*, `const` std::string &*branch*) `const` = 0

Check if the given masterlist is the latest available for a given branch.

**Return** True if the masterlist revision matches the latest masterlist revision for the given branch, and false otherwise.

**Parameters**

- `masterlist_path`: A string containing the relative or absolute path to the masterlist file for which the latest revision should be obtained. It needs to be in a local Git repository.
- `branch`: The branch to check against.

**Non-plugin Data Access**

**virtual** std::set<std::string> **GetKnownBashTags** () `const` = 0

Gets the Bash Tags that are listed in the loaded metadata lists.

Bash *Tag* suggestions can include plugins not in this list.

**Return** A set of Bash *Tag* names.

**virtual** std::vector<Message> **GetGeneralMessages** (bool *evaluateConditions* = false) `const` = 0

Get all general messages listen in the loaded metadata lists.

**Return** A vector of messages supplied in the metadata lists but not attached to any particular plugin.

**Parameters**

- `evaluateConditions`: If true, any metadata conditions are evaluated before the metadata is returned, otherwise unevaluated metadata is returned. Evaluating general message conditions also clears the condition cache before evaluating conditions.

**Plugin Data Access**

**virtual *PluginMetadata* GetPluginMetadata** (`const std::string &plugin`, `bool includeUserMetadata = true`, `bool evaluateConditions = false`) `const = 0`

Get all a plugin's loaded metadata.

**Return** A *PluginMetadata* object containing all the plugin's metadata. If the plugin has no metadata, `PluginMetadata.IsNameOnly()` will return true.

**Parameters**

- `plugin`: The filename of the plugin to look up metadata for.
- `includeUserMetadata`: If true, any user metadata the plugin has is included in the returned metadata, otherwise the metadata returned only includes metadata from the masterlist.
- `evaluateConditions`: If true, any metadata conditions are evaluated before the metadata is returned, otherwise unevaluated metadata is returned. Evaluating plugin metadata conditions does not clear the condition cache.

**virtual *PluginMetadata* GetPluginUserMetadata** (`const std::string &plugin`, `bool evaluateConditions = false`) `const = 0`

Get a plugin's metadata loaded from the given userlist.

**Return** A *PluginMetadata* object containing the plugin's user-added metadata. If the plugin has no metadata, `PluginMetadata.IsNameOnly()` will return true.

**Parameters**

- `plugin`: The filename of the plugin to look up user-added metadata for.
- `evaluateConditions`: If true, any metadata conditions are evaluated before the metadata is returned, otherwise unevaluated metadata is returned. Evaluating plugin metadata conditions does not clear the condition cache.

**virtual void SetPluginUserMetadata** (`const PluginMetadata &pluginMetadata`) `= 0`

Sets a plugin's user metadata, overwriting any existing user metadata.

**Parameters**

- `pluginMetadata`: The user metadata you want to set, with `plugin.Name()` being the filename of the plugin the metadata is for.

**virtual void DiscardPluginUserMetadata** (`const std::string &plugin`) `= 0`

Discards all loaded user metadata for the plugin with the given filename.

**Parameters**

- `plugin`: The filename of the plugin for which all user-added metadata should be deleted.



**virtual** void **DiscardAllUserMetadata** () = 0

Discards all loaded user metadata for all plugins, and any user-added general messages and known bash tags.

**class** `loot::GameInterface`

The interface provided for accessing game-specific functionality.

### Metadata Access

**virtual** std::shared\_ptr<DatabaseInterface> **GetDatabase** () = 0

Get the database interface used for accessing metadata-related functionality.

**Return** A shared pointer to the game's *DatabaseInterface*

### Plugin Data Access

**virtual** bool **IsValidPlugin** (const std::string &plugin) const = 0

Check if a file is a valid plugin.

The validity check is not exhaustive: it checks that the file extension is `.esm` or `.esp` (after trimming any `.ghost` extension), and that the TES4 header can be parsed.

**Return** True if the file is a valid plugin, false otherwise.

#### Parameters

- `plugin`: The filename of the file to check.

**virtual** void **LoadPlugins** (const std::vector<std::string> &plugins, bool loadHeadersOnly) = 0

Parses plugins and loads their data.

Any previously-loaded plugin data is discarded when this function is called. This function also loads the current load order state.

#### Parameters

- `plugins`: The filenames of the plugins to load.
- `loadHeadersOnly`: If true, only the plugins' TES4 headers are loaded. If false, all records in the plugins are parsed, apart from the main master file if it has been identified by a previous call to *IdentifyMainMasterFile* ().

**virtual** std::shared\_ptr<const PluginInterface> **GetPlugin** (const std::string &pluginName) const = 0

Get data for a loaded plugin.

Throws an exception if the given plugin has not been loaded.

**Return** A const *PluginInterface* reference. The reference remains valid until the *LoadPlugins* () or *SortPlugins* () functions are next called or this *GameInterface* is destroyed.

#### Parameters

- `pluginName`: The filename of the plugin to get data for.

**virtual** std::set<std::shared\_ptr<const PluginInterface>> **GetLoadedPlugins** () const = 0

Get a set of const references to all loaded plugins' *PluginInterface* objects.

**Return** A set of const *PluginInterface* references. The references remain valid until the *LoadPlugins* () or *SortPlugins* () functions are next called or this *GameInterface* is destroyed.

## Sorting

**virtual void IdentifyMainMasterFile** (const std::string &masterFile) = 0

Identify the game's main master file.

When sorting, LOOT always only loads the headers of the game's main master file as a performance optimisation.

**virtual std::vector<std::string> SortPlugins** (const std::vector<std::string> &plugins) = 0

Calculates a new load order for the game's installed plugins (including inactive plugins) and outputs the sorted order.

Pulls metadata from the masterlist and userlist if they are loaded, and reads the contents of each plugin. No changes are applied to the load order used by the game. This function does not load or evaluate the masterlist or userlist.

**Return** A vector of the given plugin filenames in their sorted load order.

### Parameters

- `plugins`: A vector of filenames of the plugins to sort.

## Load Order Interaction

**virtual void LoadCurrentLoadOrderState** () = 0

Load the current load order state, discarding any previously held state.

This function should be called whenever the load order or active state of plugins "on disk" changes, so that the cached state is updated to reflect the changes.

**virtual bool IsPluginActive** (const std::string &plugin) const = 0

Check if a plugin is active.

**Return** True if the plugin is active, false otherwise.

### Parameters

- `plugin`: The filename of the plugin for which to check the active state.

**virtual std::vector<std::string> GetLoadOrder** () const = 0

Get the current load order.

**Return** A vector of plugin filenames in their load order.

**virtual void SetLoadOrder** (const std::vector<std::string> &loadOrder) = 0

Set the game's load order.

### Parameters

- `loadOrder`: A vector of plugin filenames sorted in the load order to set.

**class loot::PluginInterface**

Represents a plugin file that has been parsed by LOOT.

## Public Functions

**virtual** std::string **GetName** () **const** = 0

Get the plugin's filename.

**Return** The plugin filename.

**virtual** std::string **GetLowercasedName** () **const** = 0

Get the plugin's filename in lowercase characters.

**Return** The lowercased plugin filename.

**virtual** std::string **GetVersion** () **const** = 0

Get the plugin's version number from its description field.

If no version number is found in the description field, an empty string is returned. The description field parsing may fail to extract the version number correctly, though it functions correctly in all known cases.

**Return** A string containing a version number, or an empty string.

**virtual** std::vector<std::string> **GetMasters** () **const** = 0

Get the plugin's masters.

**Return** The plugin's masters in the same order they are listed in the file.

**virtual** std::set<Tag> **GetBashTags** () **const** = 0

Get any Bash Tags found in the plugin's description field.

**Return** A set of Bash Tags. The order of elements in the set holds no semantics.

**virtual** uint32\_t **GetCRC** () **const** = 0

Get the plugin's CRC-32 checksum.

**Return** The plugin's CRC-32 checksum if it has been fully read. If only the plugin's header has been read, 0 will be returned.

**virtual** bool **IsMaster** () **const** = 0

Check if the plugin's master flag is set.

**Return** True if the master flag is set, false otherwise.

**virtual** bool **IsLightMaster** () **const** = 0

Check if the plugin is a light master.

**Return** True if plugin is a light master, false otherwise.

**virtual** bool **IsEmpty** () **const** = 0

Check if the plugin contains any records other than its TES4 header.

**Return** True if the plugin only contains a TES4 header, false otherwise.

**virtual** bool **LoadsArchive** () **const** = 0

Check if the plugin loads an archive (BSA/BA2 depending on the game).

**Return** True if the plugin loads an archive, false otherwise.

**virtual** bool **DoFormIDsOverlap** (const PluginInterface &plugin) **const** = 0

Check if two plugins contain records for the same FormIDs.

**Return** True if the plugins both contain at least one record with the same FormID, false otherwise.

### Parameters

- `plugin`: The other plugin to check for FormID overlap with.

## Classes

**class** `loot::ConditionalMetadata`

A base class for metadata that can be conditional based on the result of evaluating a condition string.

Subclassed by *File*, *Message*, *Tag*

### Public Functions

**ConditionalMetadata** ()

Construct a *ConditionalMetadata* object with an empty condition string.

**Return** A *ConditionalMetadata* object.

**ConditionalMetadata** (const std::string &condition)

Construct a *ConditionalMetadata* object with a given condition string.

**Return** A *ConditionalMetadata* object.

#### Parameters

- `condition`: A condition string, as defined in the LOOT metadata syntax documentation.

bool **IsConditional** () const

Check if the condition string is non-empty.

**Return** True if the condition string is not empty, false otherwise.

void **ParseCondition** () const

Check if the condition string is syntactically valid.

Throws a *ConditionSyntaxError* if the condition string's syntax is not valid.

std::string **GetCondition** () const

Get the condition string.

**Return** The object's condition string.

**class** `loot::File`

Represents a file in a game's Data folder, including files in subdirectories.

Inherits from *ConditionalMetadata*

### Public Functions

**File** ()

Construct a *File* with blank name, display and condition strings.

**Return** A *File* object.

**File** (const std::string &name, const std::string &display = "", const std::string &condition = "")

Construct a *File* with the given name, display name and condition strings.

**Return** A *File* object.

#### Parameters

- `name`: The filename of the file.
- `display`: The name to be displayed for the file in messages.
- `condition`: The *File*'s condition string.

bool **operator<** (const *File* &*rhs*) const

A less-than operator implemented with no semantics so that *File* objects can be stored in sets.

**Return** True if this *File*'s name is case-insensitively lexicographically less than the given *File*'s name, false otherwise.

bool **operator==** (const *File* &*rhs*) const

Check if two *File* objects are equal by comparing their filenames.

**Return** True if the filenames are case-insensitively equal, false otherwise.

std::string **GetName** () const

Get the filename of the file.

**Return** The file's filename.

std::string **GetDisplayName** () const

Get the display name of the file.

**Return** The file's display name.

class loot::Location

Represents a URL at which the parent plugin can be found.

## Public Functions

Location ()

Construct a *Location* with empty URL and name strings.

**Return** A *Location* object.

Location (const std::string &*url*, const std::string &*name* = "")

Construct a *Location* with the given URL and name.

**Return** A *Location* object.

### Parameters

- *url*: The URL at which the plugin can be found.
- *name*: A name for the URL, eg. the page or site name.

bool **operator<** (const *Location* &*rhs*) const

A less-than operator implemented with no semantics so that *Location* objects can be stored in sets.

**Return** True if this *Location*'s URL is case-insensitively lexicographically less than the given *Location*'s URL, false otherwise.

bool **operator==** (const *Location* &*rhs*) const

Check if two *Location* objects are equal by comparing their URLs.

**Return** True if the URLs are case-insensitively equal, false otherwise.

std::string **GetURL** () const

Get the object's URL.

**Return** A URL string.

std::string **GetName** () const

Get the object's name.

**Return** The name of the location.

**class** `loot::LootVersion`

A purely static class that provides information about the version of the LOOT API that is being run.

### Public Static Functions

**static** `std::string string ()`

Get the API version as a string.

**Return** A string of the form “major.minor.patch”.

### Public Static Attributes

**const** unsigned int `major`

The major version number.

**const** unsigned int `minor`

The minor version number.

**const** unsigned int `patch`

The patch version number.

**const** `std::string revision`

The source control revision that the API was built from.

**class** `loot::MessageContent`

Represents a message’s localised text content.

### Public Functions

**MessageContent** ()

Construct a *MessageContent* object with an empty English message string.

**Return** A *MessageContent* object.

**MessageContent** (`const std::string &text, const std::string &language = defaultLanguage`)

Construct a *Message* object with the given text in the given language.

**Return** A *MessageContent* object.

#### Parameters

- `text`: The message text.
- `language`: The language that the message is written in.

`std::string GetText () const`

Get the message text.

**Return** A string containing the message text.

`std::string GetLanguage () const`

Get the message language.

**Return** A code representing the language that the message is written in.

`bool operator< (const MessageContent &rhs) const`

A less-than operator implemented with no semantics so that *MessageContent* objects can be stored in sets.

**Return** True if this *MessageContent*'s text is case-insensitively lexicographically less than the given *MessageContent*'s text, false otherwise.

bool **operator==** (const *MessageContent* &rhs) const

Check if two *MessageContent* objects are equal by comparing their texts.

**Return** True if the texts are case-insensitively equal, false otherwise.

## Public Static Functions

static *MessageContent* **Choose** (const std::vector<*MessageContent*> content, const std::string &language)

Choose a *MessageContent* object from a vector given a language.

**Return** A *MessageContent* object. If the given vector is empty, a default-constructed *MessageContent* is returned.

### Parameters

- content: The *MessageContent* objects to choose between.
- language: The language code for the preferred language to select. If no message in the preferred language is present, the English *MessageContent* will be returned.

## Public Static Attributes

const std::string **defaultLanguage**

The code for the default language assumed for message content, which is English.

class loot::Message

Represents a message with localisable text content.

Inherits from *ConditionalMetadata*

## Public Functions

**Message** ()

Construct a *Message* object of type 'say' with blank content and condition strings.

**Return** A *Message* object.

**Message** (const MessageType type, const std::string &content, const std::string &condition = "")

Construct a *Message* object with the given type, English content and condition string.

**Return** A *Message* object.

### Parameters

- type: The message type.
- content: The English message content text.
- condition: A condition string.

**Message** (const MessageType type, const std::vector<*MessageContent*> &content, const std::string &condition = "")

Construct a *Message* object with the given type, content and condition string.

**Return** A *Message* object.

### Parameters

- `type`: The message type.
- `content`: The message content. If multilingual, one language must be English.
- `condition`: A condition string.

`bool operator< (const Message &rhs) const`

A less-than operator implemented with no semantics so that *Message* objects can be stored in sets.

**Return** If both messages have content, returns true if this *Message*'s English text is case-insensitively lexicographically less than the given *Message*'s English text, and false otherwise. Otherwise returns true if this *Message* has no content, and false otherwise.

`bool operator==(const Message &rhs) const`

Check if two *Message* objects are equal by comparing their content.

**Return** True if the contents are equal, false otherwise.

`MessageType GetType () const`

Get the message type.

**Return** The message type.

`std::vector<MessageContent> GetContent () const`

Get the message content.

**Return** The message's *MessageContent* objects.

`MessageContent GetContent (const std::string &language) const`

Get the message content given a language.

**Return** A *MessageContent* object for the preferred language, or for English if a *MessageContent* object is not available for the given language.

### Parameters

- `language`: The preferred language for the message content.

`SimpleMessage ToSimpleMessage (const std::string &language) const`

Get the message as a *SimpleMessage* given a language.

**Return** A *SimpleMessage* object for the preferred language, or for English if message text is not available for the given language.

### Parameters

- `language`: The preferred language for the message content.

`class loot::PluginCleaningData`

Represents data identifying the plugin under which it is stored as dirty or clean.

## Public Functions

`PluginCleaningData ()`

Construct a *PluginCleaningData* object with zero CRC, ITM count, deleted reference count and deleted navmesh count values, an empty utility string and no info.

**Return** A *PluginCleaningData* object.

`PluginCleaningData (uint32_t crc, const std::string &utility)`

Construct a *PluginCleaningData* object with the given CRC and utility, zero ITM count, deleted reference count and deleted navmesh count values and no info.



**Return** A *PluginCleaningData* object.

**Parameters**

- `crc`: The CRC of a plugin.
- `utility`: The utility that the plugin cleanliness was checked with.

**PluginCleaningData** (`uint32_t crc`, `const std::string &utility`, `const std::vector<MessageContent> &info`, `unsigned int itm`, `unsigned int ref`, `unsigned int nav`)  
Construct a *PluginCleaningData* object with the given values.

**Return** A *PluginCleaningData* object.

**Parameters**

- `crc`: A clean or dirty plugin's CRC.
- `utility`: The utility that the plugin cleanliness was checked with.
- `info`: A vector of localised information message strings about the plugin cleanliness.
- `itm`: The number of Identical To Master records found in the plugin.
- `ref`: The number of deleted references found in the plugin.
- `nav`: The number of deleted navmeshes found in the plugin.

`bool operator<` (`const PluginCleaningData &rhs`) `const`  
A less-than operator implemented with no semantics so that *PluginCleaningData* objects can be stored in sets.

**Return** True if this *PluginCleaningData*'s CRC is less than the given *PluginCleaningData*'s CRC, false otherwise.

`bool operator==` (`const PluginCleaningData &rhs`) `const`  
Check if two *PluginCleaningData* objects are equal by comparing their CRCs.

**Return** True if the CRCs are equal, false otherwise.

`uint32_t GetCRC` () `const`  
Get the CRC that identifies the plugin that the cleaning data is for.

**Return** A CRC-32 checksum.

`unsigned int GetITMCount` () `const`  
Get the number of Identical To Master records in the plugin.

**Return** The number of Identical To Master records in the plugin.

`unsigned int GetDeletedReferenceCount` () `const`  
Get the number of deleted references in the plugin.

**Return** The number of deleted references in the plugin.

`unsigned int GetDeletedNavmeshCount` () `const`  
Get the number of deleted navmeshes in the plugin.

**Return** The number of deleted navmeshes in the plugin.

`std::string GetCleaningUtility` () `const`  
Get the name of the cleaning utility that was used to check the plugin.

**Return** A cleaning utility name, possibly related information such as a version number and/or a Markdown-formatted URL to the utility's download location.

`std::vector<MessageContent> GetInfo () const`

Get any additional informative message content supplied with the cleaning data, eg. a link to a cleaning guide or information on wild edits or manual cleaning steps.

**Return** A vector of localised *MessageContent* objects.

*MessageContent* **ChooseInfo (const std::string &language) const**

Choose an info *MessageContent* object given a preferred language.

**Return** The *MessageContent* object for the preferred language, or if one does not exist, the English-language *MessageContent* object.

**Parameters**

- language: The preferred language's code.

`class loot::PluginMetadata`

Represents a plugin's metadata.

## Public Functions

**PluginMetadata ()**

Construct a *PluginMetadata* object with a blank plugin name and no metadata.

**Return** A *PluginMetadata* object.

**PluginMetadata (const std::string &name)**

Construct a *PluginMetadata* object with no metadata for a plugin with the given filename.

**Return** A *PluginMetadata* object.

**Parameters**

- name: The filename of the plugin that the object is constructed for.

`void MergeMetadata (const PluginMetadata &plugin)`

Merge metadata from the given *PluginMetadata* object into this object.

If an equal metadata object already exists in this *PluginMetadata* object, it is not duplicated. This object's priorities are replaced if the given *PluginMetadata* object's priorities are explicit. This object's enabled state is replaced by the given object's state.

**Parameters**

- plugin: The plugin metadata to merge.

*PluginMetadata* **NewMetadata (const PluginMetadata &plugin) const**

Get metadata in this object that isn't present in the given *PluginMetadata* object.

**Return** A *PluginMetadata* object containing the metadata in this object that is not in the given object.

The returned object inherits this object's enabled state. The returned object also inherits this plugin's priorities, unless a priority is equal to the given object's priority, in which case the returned object is given an implicit zero priority instead.

**Parameters**

- plugin: The *PluginMetadata* object to compare against.

`std::string GetName () const`

Get the plugin name.

**Return** The plugin name.

`std::string` **GetLowercasedName () const**  
 Get the lowercased plugin name.  
**Return** The lowercased plugin name.

`bool` **IsEnabled () const**  
 Check if the plugin metadata is enabled for use during sorting.  
**Return** True if the metadata will be used during sorting, false otherwise.

*Priority* **GetLocalPriority () const**  
 Get the plugin's local priority metadata.  
**Return** The plugin's local priority metadata.

*Priority* **GetGlobalPriority () const**  
 Get the plugin's global priority metadata.  
**Return** The plugin's global priority metadata.

`std::set<File>` **GetLoadAfterFiles () const**  
 Get the plugins that the plugin must load after.  
**Return** The plugins that the plugin must load after.

`std::set<File>` **GetRequirements () const**  
 Get the files that the plugin requires to be installed.  
**Return** The files that the plugin requires to be installed.

`std::set<File>` **GetIncompatibilities () const**  
 Get the files that the plugin is incompatible with.  
**Return** The files that the plugin is incompatible with.

`std::vector<Message>` **GetMessages () const**  
 Get the plugin's messages.  
**Return** The plugin's messages.

`std::set<Tag>` **GetTags () const**  
 Get the plugin's Bash *Tag* suggestions.  
**Return** The plugin's Bash *Tag* suggestions.

`std::set<PluginCleaningData>` **GetDirtyInfo () const**  
 Get the plugin's dirty plugin information.  
**Return** The *PluginCleaningData* objects that identify the plugin as dirty.

`std::set<PluginCleaningData>` **GetCleanInfo () const**  
 Get the plugin's clean plugin information.  
**Return** The *PluginCleaningData* objects that identify the plugin as clean.

`std::set<Location>` **GetLocations () const**  
 Get the locations at which this plugin can be found.  
**Return** The locations at which this plugin can be found.

`std::vector<SimpleMessage>` **GetSimpleMessages (const std::string &language) const**  
 Get the plugin's messages as *SimpleMessage* objects for the given language.  
**Return** The plugin's messages as *SimpleMessage* objects.  
**Parameters**

- `language`: The language to create the *SimpleMessage* objects for.

void **SetEnabled** (**const** bool *enabled*)

Set whether the plugin metadata is enabled for use during sorting or not.

**Parameters**

- `enabled`: The value to set.

void **SetLocalPriority** (**const** *Priority* &*priority*)

Set the plugin's local priority.

**Parameters**

- `priority`: The value to set.

void **SetGlobalPriority** (**const** *Priority* &*priority*)

Set the plugin's local priority.

**Parameters**

- `priority`: The value to set.

void **SetLoadAfterFiles** (**const** std::set<*File*> &*after*)

Set the files that the plugin must load after.

**Parameters**

- `after`: The files to set.

void **SetRequirements** (**const** std::set<*File*> &*requirements*)

Set the files that the plugin requires to be installed.

**Parameters**

- `requirements`: The files to set.

void **SetIncompatibilities** (**const** std::set<*File*> &*incompatibilities*)

Set the files that the plugin must load after.

**Parameters**

- `incompatibilities`: The files to set.

void **SetMessages** (**const** std::vector<*Message*> &*messages*)

Set the plugin's messages.

**Parameters**

- `messages`: The messages to set.

void **SetTags** (**const** std::set<*Tag*> &*tags*)

Set the plugin's Bash *Tag* suggestions.

**Parameters**

- `tags`: The Bash *Tag* suggestions to set.

void **SetDirtyInfo** (**const** std::set<*PluginCleaningData*> &*info*)

Set the plugin's dirty information.

**Parameters**

- `info`: The dirty information to set.

void **SetCleanInfo** (**const** std::set<*PluginCleaningData*> &*info*)

Set the plugin's clean information.

**Parameters**

- `info`: The clean information to set.

void **SetLocations** (**const** std::set<*Location*> &*locations*)  
Set the plugin's locations.

**Parameters**

- `locations`: The locations to set.

bool **HasNameOnly** () **const**  
Check if no plugin metadata is set.

**Return** True if the local and global priorities are implicit and the metadata containers are all empty, false otherwise.

bool **IsRegexPlugin** () **const**  
Check if the plugin name is a regular expression.

**Return** True if the plugin name contains any of the characters : \ \* ? | , false otherwise.

bool **operator==** (**const** *PluginMetadata* &*rhs*) **const**  
Check if two *PluginMetadata* objects are equal by comparing their name values.

**Return** True if the plugin names are case-insensitively equal, false otherwise.

bool **operator!=** (**const** *PluginMetadata* &*rhs*) **const**  
Check if two *PluginMetadata* objects are not equal by comparing their name values.

**Return** True if the plugin names are not case-insensitively equal, false otherwise.

bool **operator==** (**const** std::string &*rhs*) **const**  
Check if object's name value is equal to the given string.

**Return** True if the plugin name is case-insensitively equal to the given string, false otherwise.

bool **operator!=** (**const** std::string &*rhs*) **const**  
Check if object's name value is not equal to the given string.

**Return** True if the plugin name is not case-insensitively equal to the given string, false otherwise.

**class** loot::**Priority**

Represents the priority of a plugin in the load order.

Plugins have a default implicit priority of zero. Lower priority values cause plugins to be loaded earlier, and higher priority values cause plugins to be loaded later.

**Public Functions**

**Priority** ()  
Construct a *Priority* object with an implicit value of zero.

**Return** A *Priority* object.

**Priority** (**const** int *value*)  
Construct a *Priority* object with the given priority value.

If the given value is zero, it is marked as being set explicitly. This affects how priority metadata values get merged in *PluginMetadata* objects.

**Return** A *Priority* object.

**Parameters**

- `value`: The priority value to set. The valid range of values is -127 to 127 inclusive, and values passed to the constructor that lie outside this range are clamped. The input type is an int to avoid invalid values from implicitly wrapping around.

short **GetValue () const**

Get the stored priority value.

**Return** The priority value. While the valid value range fits in 8 bits, a short is returned to avoid interpreting the value as a character.

bool **IsExplicit () const**

Check if the priority value is explicit or not.

**Return** Returns true if the value is non-zero or was explicitly set to zero, and false otherwise.

bool **operator< (const Priority &rhs) const**

Check if this *Priority* object is less than another.

**Return** True if this *Priority* object's value is less than the given *Priority* object's value.

bool **operator> (const Priority &rhs) const**

Check if this *Priority* object is greater than another.

**Return** True if this *Priority* object's value is greater than the given *Priority* object's value, false otherwise.

bool **operator>= (const Priority &rhs) const**

Check if this *Priority* object is greater than or equal to another.

**Return** True if this *Priority* object's value is greater than or equal to the given *Priority* object's value, false otherwise.

bool **operator== (const Priority &rhs) const**

Check if this *Priority* object is equal to another.

**Return** True if this *Priority* object's value is equal to the given *Priority* object's value, false otherwise.

bool **operator> (const uint8\_t rhs) const**

Check if this *Priority* object is greater than a given priority value.

**Return** True if this *Priority* object's value is greater than the given value, false otherwise.

**class** `loot::Tag`

Represents a Bash *Tag* suggestion for a plugin.

Inherits from *ConditionalMetadata*

## Public Functions

**Tag ()**

Construct a *Tag* object with an empty tag name suggested for addition, with an empty condition string.

**Return** A *Tag* object.

**Tag (const std::string &tag, const bool isAddition = true, const std::string &condition = "")**

Construct a *Tag* object with the given name, for addition or removal, with the given condition string.

**Return** A *Tag* object.

### Parameters

- `tag`: The name of the Bash *Tag*.
- `isAddition`: True if the tag should be added, false if it should be removed.

- `condition`: A condition string.

bool **operator<** (const *Tag* &*rhs*) const

A less-than operator implemented with no semantics so that *Tag* objects can be stored in sets.

**Return** True if this *Tag* is suggested for addition and the other is not. If both Tags are suggested for addition or both are suggested for removal, returns true if this *Tag*'s name is case-insensitively lexicographically less than the given *Tag*'s name, false otherwise.

bool **operator==** (const *Tag* &*rhs*) const

Check if two *Tag* objects are equal.

**Return** True if both Tags are suggested for addition or both are suggested for removal, and the *Tag* names are case-insensitively equal, false otherwise.

bool **IsAddition** () const

Check if the tag should be added.

**Return** True if the tag should be added, false if it should be removed.

std::string **GetName** () const

Get the tag's name.

**Return** The tag's name.

## Exceptions

class loot::CyclicInteractionError

An exception class thrown if a cyclic interaction is detected when sorting a load order.

Inherits from runtime\_error

### Public Functions

**CyclicInteractionError** (const std::string &*firstPlugin*, const std::string &*lastPlugin*, const std::string &*backCycle*)

Construct an exception detailing a plugin graph cycle.

#### Parameters

- `firstPlugin`: A plugin in the cycle.
- `lastPlugin`: Another plugin in the cycle.
- `backCycle`: A string describing the path from `lastPlugin` to `firstPlugin`.

std::string **getFirstPlugin** ()

Get the first plugin in the chosen forward path of the cycle.

**Return** A plugin filename.

std::string **getLastPlugin** ()

Get the first plugin in the chosen forward path of the cycle.

**Return** A plugin filename.

std::string **getBackCycle** ()

Get a description of the reverse path from the chosen last plugin to the chosen first plugin of the cycle.

**Return** A string describing a path between two plugins in the plugin graph.

**class** `loot::GitStateError`

An exception class thrown if an error occurs when performing an operation on a Git repository due to invalid state.

Inherits from `logic_error`

**class** `loot::ConditionSyntaxError`

An exception class thrown if invalid syntax is encountered when parsing a metadata condition.

Inherits from `runtime_error`

**class** `loot::FileAccessError`

An exception class thrown if an error is encountered while reading or writing a file.

Inherits from `runtime_error`

## Error Categories

LOOT uses error category objects to identify errors with codes that originate in lower-level libraries.

**const** `std::error_category &loot::libloadorder_category()`

Get the error category that can be used to identify `system_error` exceptions that are due to `libloadorder` errors.

**Return** A reference to the static object of unspecified runtime type, derived from `std::error_category`.

**const** `std::error_category &loot::libgit2_category()`

Get the error category that can be used to identify `system_error` exceptions that are due to `libgit2` errors.

**Return** A reference to the static object of unspecified runtime type, derived from `std::error_category`.



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### Credits

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The LOOT API is written by [WrinklyNinja](#) in C++ and makes use of the [Boost](#), [libespm](#), [libgit2](#), [libloadorder](#), [Pseudosem](#) and [yaml-cpp](#) libraries. The copyright licenses for all of these and the LOOT API itself in *Copyright License Texts*.



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## Version History

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### 0.12.0 - 2017-11-03

#### Added

- Support for light master (.esl) plugins.
- `LoadCurrentLoadOrderState()` in `loot::GameInterface` to expose load order cache management to clients, as libloadorder no longer internally manages it.
- `loot::SetLoggingCallback()` to allow clients to handle the LOOT API's logging statements themselves.
- Logging of libloadorder error details.

#### Changed

- `LoadPlugins()` now loads the current load order state before loading plugins.
- Added a `condition` string field to `SimpleMessage`.
- Replaced libespm dependency with esplugin v1.0.6. This significantly improves safety and sorting performance, especially for large load orders.
- Updated libloadorder to v10.0.3. This significantly improves safety and the performance of load order operations, at the expense of exposing cache management to the client.
- Replaced Boost.Log with spdlog v0.14.0, removing dependencies on several other Boost libraries in the process.
- Updated libgit2 to v0.26.0.
- Update Boost to v1.65.1.

#### Removed

- `DatabaseInterface::EvalLists()` as it was superseded in v0.11.0 by the ability to evaluate conditions when getting general messages and individual plugins' metadata, which is more efficient.
- `SetLoggingVerbosity()` and `SetLogFile()` as they have been superseded by the new `loot::SetLoggingCallback()` function.
- The `loot/yaml/*` headers containing LOOT's internal YAML conversion functions are no longer exposed alongside the API headers.

- The `loot/windows_encoding_converters.h` header is no longer exposed alongside the API headers.

### Fixed

- Formatting in metadata documentation.
- Saving metadata wrote entries in an inconsistent order.
- Clang build errors.

## 0.11.1 - 2017-06-19

### Fixed

- A crash would occur when loading a plugin that had invalid data past its header. Such plugins are now just silently ignored.
- `loot::CreateGameHandle()` would not resolve game or local data paths that are junction links correctly, which caused problems later when trying to perform actions such as loading plugins.
- Performing a masterlist update on a branch where the remote and local histories had diverged would fail. The existing local branch is now discarded and the remote branch checked out anew, as intended.

## 0.11.0 - 2017-05-13

### Added

- New functions to `loot::DatabaseInterface`:
  - `WriteUserMetadata()`
  - `GetKnownBashTags()`
  - `GetGeneralMessages()`
  - `GetPluginMetadata()`
  - `GetPluginUserMetadata()`
  - `SetPluginUserMetadata()`
  - `DiscardPluginUserMetadata()`
  - `DiscardAllUserMetadata()`
  - `IsLatestMasterlist()`
- A `loot::GameInterface` pure abstract class that exposes methods for accessing game-specific functionality.
- A `loot::PluginInterface` pure abstract class that exposes methods for accessing plugin file data.
- The `loot::SetLoggingVerbosity` and `loot::SetLogFile` functions and `loot::LogVerbosity` enum for controlling the API's logging behaviour.
- An `loot::InitialiseLocale()` function that must be called to configure the API's locale before any of its other functionality is used.

- LOOT's internal metadata classes are now exposed as part of the API.

## Changed

- Renamed `loot::CreateDatabase()` to `loot::CreateGameHandle()`, and changed its signature so that it returns a shared pointer to a `loot::GameInterface` instead of a shared pointer to a `loot::DatabaseInterface`.
- Moved `SortPlugins()` into `loot::GameInterface`.
- Some `loot::DatabaseInterface` methods are now const:
  - `WriteMinimalList()`
  - `GetMasterlistRevision()`
- LOOT's internal YAML conversion functions have been refactored into the `include/loot/yaml` directory, but they are not really part of the API. They're only exposed so that they can be shared between the API and LOOT application without introducing another component.
- LOOT's internal string encoding conversion functions have been refactored into the `include/loot/windows_encoding_converters.h` header, but are not really part of the API. They're only exposed so that they can be shared between the API and LOOT application without introducing another component.
- Metadata is now cached more efficiently, reducing the API's memory footprint.
- Log timestamps now have microsecond precision.
- Updated to libgit2 v0.25.1.
- Refactored code only useful to the LOOT application out of the API internals and into the application source code.

## Removed

- `DatabaseInterface::GetPluginTags()`, `DatabaseInterface::GetPluginMessages()` and `DatabaseInterface::GetPluginCleanliness()` have been removed as they have been superseded by `DatabaseInterface::GetPluginMetadata()`.
- The `GameDetectionError` class, as it is no longer thrown by the API.
- The `PluginTags` struct, as it is no longer used.
- The `LanguageCode` enum, as the API now uses ISO language codes directly instead.
- The `PluginCleanliness` enum. as it's no longer used. Plugin cleanliness should now be checked by getting a plugin's evaluated metadata and checking if any dirty info is present. If none is present, the cleanliness is unknown. If dirty info is present, check if any of the English info strings contain the text "Do not clean": if not, the plugin is dirty.
- The LOOT API no longer caches the load order, as this is already done more accurately by `libloadorder` (which is used internally).

## Fixed

- Libgit2 error details were not being logged.

- A `FileAccessError` was thrown when the masterlist path was an empty string. The API now just skips trying to load the masterlist in this case.
- Updating the masterlist did not update the cached metadata, requiring a call to `LoadLists()`.
- The reference documentation was broken due to an incompatibility between Sphinx 1.5.x and Breathe 4.4.

### 0.10.3 - 2017-01-08

#### Added

- Automated 64-bit API builds.

#### Changed

- Replaced `std::invalid_argument` exceptions thrown during condition evaluation with `ConditionSyntaxError` exceptions.
- Improved robustness of error handling when calculating file CRCs.

#### Fixed

- Documentation was not generated correctly for enums, exceptions and structs exposed by the API.
- Added missing documentation for `CyclicInteractionError` methods.

### 0.10.2 - 2016-12-03

#### Changed

- Updated libgit2 to 0.24.3.

#### Fixed

- A crash could occur if some plugins that are hardcoded to always load were missing. Fixed by updating to libloadorder v9.5.4.
- Plugin cleaning metadata with no `info` value generated a warning message with no text.

### 0.10.1 - 2016-11-12

No API changes.

## 0.10.0 - 2016-11-06

### Added

- Support for TES V: Skyrim Special Edition.

### Changed

- Completely rewrote the API as a C++ API. The C API has been reimplemented as a wrapper around the C++ API, and can be found in a [separate repository](#).
- Windows builds now have a runtime dependency on the MSVC 2015 runtime redistributable.
- Rewrote the API documentation, which is now hosted online at [Read The Docs](#).
- The Windows release archive includes the `.lib` file for compile-time linking.
- LOOT now supports v0.10 of the metadata syntax. This breaks compatibility with existing syntax. See [the syntax version history](#) for the details.
- Updated libgit2 to 0.24.2.

### Removed

- The `loot_get_tag_map()` function has no equivalent in the new C++ API as it is obsolete.
- The `loot_apply_load_order()` function has no equivalent in the new C++ API as it just passed through to `libloadorder`, which clients can use directly instead.

### Fixed

- Database creation was failing when passing paths to symlinks that point to the game and/or game local paths.
- Cached plugin CRCs causing checksum conditions to always evaluate to false.
- Updating the masterlist when the user's `TEMP` and `TMP` environmental variables point to a different drive than the one LOOT is installed on.

## 0.9.2 - 2016-08-03

### Changed

- `libespm` (2.5.5) and `Pseudosem` (1.1.0) dependencies have been updated to the versions given in brackets.

### Fixed

- The packaging script used to create API archives was packaging the wrong binary, which caused the v0.9.0 and v0.9.1 API releases to actually be re-releases of a snapshot build made at some point between v0.8.1 and v0.9.0: the affected API releases were taken offline once this was discovered.
- `loot_get_plugin_tags()` remembering results and including them in the results of subsequent calls.

- An error occurred when the user's temporary files directory didn't exist and updating the masterlist tried to create a directory there.
- Errors when reading some Oblivion plugins during sorting, including the official DLC.

### 0.9.1 - 2016-06-23

No API changes.

### 0.9.0 - 2016-05-21

#### Changed

- Moved API header location to the more standard `include/loot/api.h`.
- Documented LOOT's masterlist versioning system.
- Made all API outputs fully `const` to make it clear they should not be modified and to avoid internal `const` casting.
- The `loot_db` type is now an opaque struct, and functions that used to take it as a value now take a pointer to it.

#### Removed

- The `loot_cleanup()` function, as the one string it used to destroy is now stored on the stack and so destroyed when the API is unloaded.
- The `loot_lang_any` constant. The `loot_lang_english` constant should be used instead.

### 0.8.1 - 2015-09-27

#### Changed

- Safety checks are now performed on file paths when parsing conditions (paths must not reference a location outside the game folder).
- Updated Boost (1.59.0), libgit2 (0.23.2) and CEF (branch 2454) dependencies.

#### Fixed

- A crash when loading plugins due to lack of thread safety.
- The masterlist updater and validator not checking for valid condition and regex syntax.
- The masterlist updater not working correctly on Windows Vista.



## 0.8.0 - 2015-07-22

### Added

- Support for metadata syntax v0.8.

### Changed

- Improved plugin loading performance for computers with weaker multithreading capabilities (eg. non-hyperthreaded dual-core or single-core CPUs).
- LOOT no longer outputs validity warnings for inactive plugins.
- Updated libgit2 to v0.23.0.

### Fixed

- Many miscellaneous bugs, including initialisation crashes and incorrect metadata input/output handling.
- LOOT silently discarding some non-unique metadata: an error will now occur when loading or attempting to apply such metadata.
- LOOT's version comparison behaviour for a wide variety of version string formats.

## 0.7.1 - 2015-06-22

### Fixed

- “No existing load order position” errors when sorting.
- Output of Bash Tag removal suggestions in `loot_write_minimal_list()`.

## 0.7.0 - 2015-05-20

Initial API release.



---

## Introduction

---

The metadata syntax is what LOOT's masterlists and userlists are written in. If you know YAML, good news: the syntax is essentially just YAML 1.2. If you don't know YAML, then its [Wikipedia page](#) is a good introduction. All you really need to know is:

- How lists and associative arrays (key-value maps) are written.
- That whitespace is important, and that only normal spaces (ie. no non-breaking spaces or tabs) count as such.
- That data entries that are siblings must be indented by the same amount, and child data nodes must be indented further than their parents (see the example later in this document if you don't understand).
- That YAML files must be written in a Unicode encoding.
- That each key in a key-value map must only appear once per map object.

An important point that is more specific to how LOOT uses YAML:

- Strings are case-sensitive, apart from file paths, regular expressions and checksums.

Some properties of file paths as used by LOOT:

- They are evaluated as paths relative to the game's Data folder.
- They cannot reference a path outside of the game's folder structure, ie. they cannot contain the substring `../../../../`.
- Regular expression file paths must be written in the [EMCAScript](#) syntax, and they must use `/` for directory separators.
- Only the filename of a regex file path may contain non-literal regex syntax, ie. if the filename part of the regex file path is removed, the remainder must be an exact folder path (though with the regex syntax special characters escaped). For example, given the regex file path `Meshes/Resources(1|2)/(upperclass)?table.nif`, LOOT will look for a file named `table.nif` or `upperclasstable.nif` in the `Meshes\Resources(1|2)` folder, rather than looking in the `Meshes\Resources1` and `Meshes\Resources2` folders.

In this document, where a value's type is given as `X list` this is equivalent to a YAML sequence of values which are of the data type `X`. Where a value's type is given as `X set`, this is equivalent to a YAML sequence of **unique** values which are of the data type `X`. Uniqueness is determined using the equality criteria for that data type. All the non-standard data types that LOOT's metadata syntax uses have their equality criteria defined later in this document.



---

## Metadata File Structure

---

The root of a metadata file is a key-value map. LOOT will recognise the following keys, none of which are required. Other keys may also be present, but are not processed by LOOT.

### **bash\_tags**

string list

A list of Bash Tags that are supported by the masterlist's game. These Bash Tags are used to provide autocomplete suggestions in LOOT's metadata editor.

### **globals**

message list

A list of message data structures for messages that are displayed independently of any plugin.

### **plugins**

plugin list *and* plugin set

The plugin data structures that hold all the plugin metadata within the file. It is a mixture of a list and a set because **no non-regex plugin value may be equal to any other non-regex plugin value**, but there may be any number of equal regex plugin values, and non-regex plugin values may be equal to regex plugin values. If multiple plugin values match a single plugin, their metadata is merged in the order the values are listed, and as defined in *Merging Behaviour*.

The message and plugin data structures are detailed in the next section.

## Example

```
bash_tags:
  - 'C.Climate'
  - 'Relev'
globals:
  - type: say
    content: 'You are using the latest version of LOOT.'
condition: 'version("LOOT", "0.5.0.0", ==)'
plugins:
  - name: 'Armamentarium.esm'
    tag:
      - Relev
  - name: 'ArmamentariumFran.esm'
    tag:
      - Relev
  - name: 'Beautiful People 2ch-Ed.esm'
```

```
tag:  
- Eyes  
- Graphics  
- Hair  
- R.Relations
```

---

## Data Structures

---

LOOT expects metadata to be laid out using a certain set of data structures, described in this section.

### Tag

LOOT metadata files can contain suggestions for the addition or removal of Bash Tags, and this is the structure used for them. It has two forms: a key-value string map and a scalar string.

#### Map Form

**name**

**Required.** A Bash Tag, prefixed with a minus sign if it is suggested for removal.

**condition**

A condition string that is evaluated to determine whether this Bash Tag should be suggested: if it evaluates to true, the Tag is suggested, otherwise it is ignored. See *Condition Strings* for details. If undefined, defaults to an empty string.

#### Scalar Form

The scalar form is simply the value of the map form's `name` key. Using the scalar form is equivalent to using the map form with an undefined `condition` key.

### Equality

Two tag data structures are equal if the lowercased values of their `name` keys are identical.

### Examples

Scalar form:

```
Relations
```

Map form:

```
name: -Relations
condition: 'file("Mart"'s Monster Mod for OOO.esm") or file("FCOM_Convergence.esm")'
```

## File

This structure can be used to hold file paths. It has two forms: a key-value string map and a scalar string.

### Map Form

**name**

**Required.** An exact (ie. not regex) file path or name.

**display**

A substitute string to be displayed instead of the file path in any generated messages, eg. the name of the mod the file belongs to. If undefined, the `name` key's value is used.

**condition**

A condition string that is evaluated to determine whether this file data should be used: if it evaluates to true, the data is used, otherwise it is ignored. See *Condition Strings* for details.

### Scalar Form

The scalar form is simply the value of the map form's `name` key. Using the scalar form is equivalent to using the map form with undefined `display` and `condition` keys.

## Equality

Two file data structures are equal if the lowercased values of their `name` keys are identical.

## Examples

Scalar form:

```
'../obse_loader.exe'
```

Map form:

```
name: '../obse_loader.exe'
condition: 'version("../obse_loader.exe", "0.0.18.0", >=) '
display: 'OBSE v18+'
```

## Localised Content

The localised content data structure is a key-value string map.

**text**

**Required.** The actual message content string.



**lang**

**Required.** The language that `text` is written in, given as a code of the form `ll` or `ll_CC`, where `ll` is an ISO 639-1 language code and `CC` is an ISO 3166 country code. For example,

Language	Code
Brazilian Portuguese	pt_BR
Chinese	zh_CN
Danish	da
English	en
Finnish	fi
French	fr
German	de
Korean	ko
Polish	pl
Russian	ru
Spanish	es
Swedish	sv

## Message

Messages are given as key-value maps.

**type**

`string`

**Required.** The type `string` can be one of three keywords.

**say**

A generic message, useful for miscellaneous notes.

**warn**

A warning message, describing a non-critical issue with the user's mods (eg. dirty mods).

**error**

An error message, describing a critical installation issue (eg. missing masters, corrupt plugins).

**content**

`string` or `localised content list`

**Required.** Either simply a string, or a list of localised content data structures. If the latter, one of the structures must be for English.

**condition**

`string`

A condition string that is evaluated to determine whether the message should be displayed: if it evaluates to true, the message is displayed, otherwise it is not. See *Condition Strings* for details.

**subs**

`string list`

A list of strings to be substituted into the message content string. The content string must use numbered specifiers (`%1%`, `%2%`, etc.), where the numbers correspond to the position of the substitution string in this list to use, to denote where these strings are to be substituted.

## Message Formatting

LOOT supports formatting of messages using [GitHub Flavored Markdown](#). Support is provided by the [Marked](#) library (v0.3). Strings that get substituted into messages, such as file display names and cleaning data utility strings, also support the same formatting options.

## Language Support

If a message's `content` value is a string, the message will use the string as its content if displayed. Otherwise, the first localised content structure with a language that matches LOOT's current language will be used as the message's content if displayed. If there are no matches, then the first structure in English will be used.

## Equality

The equality of two message data structures is determined by comparing the values of their `content` keys. As the values of the keys can be different types, a comparison value is selected for each message using the following logic:

- If a value's type is a localised content list, then the English content string in that list is selected as the comparison value.
- If a value's type is a string, then that string is selected as the comparison value.

The two message data structures are then equal if their lowercased comparison values are identical.

## Examples

*Translations by Google*

```
type: say
condition: 'file("foo.esp")'
content:
  - lang: en
    text: 'An example link: <http://www.example.com>'
  - lang: ru
    text: ' : <http://www.example.com>'
```

would be displayed as

```
 : http://www.example.com
```

if the current language was Russian and `foo.esp` was installed, while

```
type: say
content: 'An alternative [example link](http://www.example.com), with no translations.
↔'
```

would be displayed as

```
 : An alternative example link, with no translations.
```

In English,

```
type: say
content: 'A newer version of %1% [is available](%2%).'
subs:
  - 'this plugin'
  - 'http://www.example.com'
```

---

would be displayed as

Note: A newer version of this plugin is [available](#).

## Location

This data structure is used to hold information on where a plugin is hosted online. It has two forms: a key-value string map and a scalar string.

### Map Form

#### **link**

**Required.** A URL at which the plugin is found.

#### **name**

A descriptive name for the URL, which may be used as hyperlink text. If undefined, defaults to an empty string.

### Scalar Form

The scalar form is simply the value of the map form's `link` key. Using the scalar form is equivalent to using the map form with an undefined `name` key.

### Equality

Two location data structures are equal if the lowercased values of their `link` keys are identical.

### Examples

Scalar form:

```
'http://skyrim.nexusmods.com/mods/19/'
```

Map form:

```
link: 'https://steamcommunity.com/sharedfiles/filedetails/?id=419668499'
name: 'Unofficial Skyrim Patch on Steam Workshop'
```

## Cleaning Data

This structure holds information on which versions of a plugin are dirty or clean, and if dirty, how many identical-to-master records, deleted records and deleted navmeshes (if applicable) it contains. Cleaning data is given as a key-value map.

#### **crc**

hexadecimal integer

**Required.** The CRC-32 checksum of the plugin. If the plugin is dirty, this needs to be the CRC of the plugin before before cleaning. LOOT displays the CRCs of installed plugins in its report. The 8-character CRC should be preceded by `0x` so that it is interpreted correctly.

### **util**

string

**Required.** The utility that was used to check the plugin for dirty edits. If available, the version of the utility used should also be included (e.g. `TES5Edit v3.11`).

### **info**

string or localised content list

A message that will be displayed to the user. If a localised content list is provided, one of the structures must be for English. This is only used if the plugin is dirty, and is intended for providing cleaning instructions to the user. If undefined, defaults to an empty string.

### **itm**

integer

The number of identical-to-master records reported for the dirty plugin. If undefined, defaults to zero.

### **udr**

integer

The number of undeleted records reported for the dirty plugin. If undefined, defaults to zero.

### **nav**

integer

The number of deleted navmeshes reported for the dirty plugin. If undefined, defaults to zero.

## Equality

Two cleaning data structures are equal if the values of their `crc` keys are identical.

## Examples

A dirty plugin:

```
crc: 0x3DF62ABC
util: '[TES5Edit](http://www.nexusmods.com/skyrim/mods/25859) v3.1.1'
info: 'A cleaning guide is available [here](http://www.creationkit.com/index.php?
↳title=TES5Edit_Cleaning_Guide_-_TES5Edit).'
itm: 4
udr: 160
```

A clean plugin:

```
crc: 0x2ABC3DF6
util: '[TES5Edit](http://www.nexusmods.com/skyrim/mods/25859) v3.1.1'
```

## Plugin

This is the structure that brings all the others together, and forms the main component of a metadata file. It is a key-value map.

**name**

string

**Required.** Can be an exact plugin filename or a regular expression plugin filename. If the filename contains any of the characters `: \*?|`, the string will be treated as a regular expression, otherwise it will be treated as an exact filename. For example, `Example\*.esm` will be treated as a regular expression, as it contains a `\` character.

**enabled**

boolean

Enables or disables use of the plugin object. Used for user rules, but no reason to use it in the masterlist. If unspecified, defaults to `true`.

**priority**

integer

Modifies plugin position relative to others that change one or more of the same records, but which are otherwise unrelated (ie. neither plugin lists the other as a master, requirement, or in its `after` list). Plugins that don't change any of the same records are not compared, unless one of the plugins contains only a header record.

A plugin with a higher `priority` value will load after a plugin with a lower `priority` value. The value can be anything in the range `-127` to `127` inclusive, and if unspecified defaults to `0`.

**global\_priority**

integer

Modifies plugin position relative to all unrelated plugins (ie. neither plugin lists the other as a master, requirement, or in its `after` list).

A plugin with a higher `global_priority` value will load after a plugin with a lower priority value. The value can be anything in the range `-127` to `127` inclusive, and if unspecified defaults to `0`.

`global_priority` takes precedence over `priority` when comparing two plugins' priorities: the `priority` value is only compared if the two plugins have the same `global_priority` value.

**after**

file set

Plugins that this plugin must load after, but which are not dependencies. Used to resolve specific compatibility issues. If undefined, the set is empty.

**req**

file set

Files that this plugin requires to be present. This plugin will load after any plugins listed. If any of these files are missing, an error message will be displayed. Intended for use specifying implicit dependencies, as LOOT will detect a plugin's explicit masters itself. If undefined, the set is empty.

**inc**

file set

Files that this plugin is incompatible with. If any of these files are present, an error message will be displayed. If undefined, the set is empty.

**msg**

message list

The messages attached to this plugin. The messages will be displayed in the order that they are listed. If undefined, the list is empty.

**tag**

tag set

Bash Tags suggested for this plugin. If a Bash Tag is suggested for both addition and removal, the latter will override the former when the list is evaluated. If undefined, the set is empty.

**url**

location set

An unordered set of locations for this plugin. If the same version can be found at multiple locations, only one location should be recorded. If undefined, the set is empty. This metadata is not currently used by LOOT.

**dirty**

cleaning data set

Cleaning data for this plugin, identifying dirty plugins. Plugin entries with regular expression filenames **must not** contain cleaning data.

**clean**

cleaning data set

An unordered set of cleaning data structures for this plugin, identifying clean plugins. Plugin entries with regular expression filenames **must not** contain cleaning data. The `itm`, `udr` and `nav` fields are unused in this context, as they're assumed to be zero.

## Equality

The equality of two plugin data structures is determined by comparing the values of their `name` keys.

- If neither or both values are regular expressions, then the plugin data structures are equal if the lowercased values are identical.
- If one value is a regular expression, then the plugin data structures are equal if the other value is an exact match for it.

## Merging Behaviour

Key	Merge Behaviour (merging B into A)
<code>name</code>	Not merged.
<code>enabled</code>	Replaced by B's value.
<code>priority</code>	Replaced by B's value, unless that value is 0 and it was not explicitly set.
<code>global_priority</code>	Replaced by B's value, unless that value is 0 and it was not explicitly set.
<code>after</code>	Merged. If B's file set contains an item that is equal to one already present in A's file set, B's item is discarded.
<code>req</code>	Merged. If B's file set contains an item that is equal to one already present in A's file set, B's item is discarded.
<code>inc</code>	Merged. If B's file set contains an item that is equal to one already present in A's file set, B's item is discarded.
<code>msg</code>	Merged. If B's message list contains an item that is equal to one already present in A's message list, B's item is discarded.
<code>tag</code>	Merged. If B's tag set contains an item that is equal to one already present in A's tag set, B's item is discarded.
<code>url</code>	Merged. If B's location set contains an item that is equal to one already present in A's location set, B's item is discarded.
<code>dirty</code>	Merged. If B's dirty data set contain an item that is equal to one already present in A's dirty data set, B's item is discarded.
<code>clean</code>	Merged. If B's clean data set contain an item that is equal to one already present in A's clean data set, B's item is discarded.

## Examples

```
name: 'Oscuro's_Oblivion_Overhaul.esm'
req:
  - 'Oblivion.esm' # Don't do this, Oblivion.esm is a master of Oscuro's_Oblivion_
↔Overhaul.esm, so LOOT already knows it's required.
  - name: 'example.esp'
    display: '[Example Mod] (http://www.example.com)'
    condition: 'version("Oscuro's_Oblivion_Overhaul.esm", "15.0", ==) '
tag:
  - Actors.Spells
  - Graphics
  - Invent
  - Relations
  - Scripts
  - Stats
  - name: -Relations
    condition: 'file("Mart's Monster Mod for OOO.esm") or file("FCOM_Convergence.esm
↔") '
msg:
  - type: say
    content: 'Do not clean. "Dirty" edits are intentional and required for the mod to
↔function.'
```





---

## Condition Strings

---

Condition strings can be used to ensure that data is only acted on by LOOT under certain circumstances. They are very similar to boolean conditional expressions in programming languages such as Python, though more limited.

Omitting optional parentheses (see below), their [EBNF](#) grammar is:

```
compound_condition ::= condition, { ( logical_and | logical_or ), condition }
condition          ::= [ logical_not ], function
logical_and        ::= ``and''
logical_or         ::= ``or''
logical_not        ::= ``not''
```

## Types

### **file\_path**

A double-quoted file path, or "LOOT", which references the LOOT executable being run.

### **regular\_expression**

A double-quoted regular expression string to match file paths to.

### **checksum**

A string of hexadecimal digits representing an unsigned integer that is the data checksum of a file. LOOT displays the checksums of plugins in its user interface after running.

### **version**

A double-quoted string of characters representing the version of a plugin or executable. LOOT displays the versions of plugins in its user interface after running.

### **comparison\_operator**

One of the following comparison operators.

**==**

Is equal to

**!=**

Is not equal to

**<**

Is less than

**>**

Is greater than

- `<=`  
Is less than or equal to
- `>=`  
Is greater than or equal to

## Functions

There are several conditions that can be tested for using the functions detailed below. All functions return a boolean. For functions that take a path or regex, the argument is treated as regex if it contains any of the characters `: \ * ? | .`

### **file(file\_path path)**

Returns true if `path` is installed, and false otherwise.

### **file(regular\_expression regex)**

Returns true if a file matching `regex` is found, and false otherwise.

### **active(file\_path path)**

Returns true if `path` is an active plugin, and false otherwise.

### **active(regular\_expression regex)**

Returns true if an active plugin matching `regex` is found, and false otherwise.

### **many(regular\_expression regex)**

Returns true if more than one file matching `regex` is found, and false otherwise.

### **many\_active(regular\_expression regex)**

Returns true if more than one active plugin matching `regex` is found, and false otherwise.

### **checksum(file\_path path, checksum expected\_checksum)**

Returns true if the calculated CRC-32 checksum of `path` matches `expected_checksum`, and false otherwise. Returns false if `path` does not exist.

### **version(file\_path path, version given\_version, comparison\_operator comparator)**

Returns true if the boolean expression:

```
actual_version comparator given_version
```

(where `actual version` is the version read from `path`) holds true, and false otherwise. If `path` does not exist or does not have a version number, its version is assumed to be 0.

The comparison uses the precedence rules defined by [Semantic Versioning](#), extended to allow leading zeroes, an arbitrary number of release version numbers, case-insensitivity and a wider range of separator characters.

## Logical Operators

The `and`, `or` and `not` operators have their usual definitions, except that the `not` operator only ever operates on the result of the function immediately following it.

## Order of Evaluation

Condition strings are evaluated according to the usual C-style operator precedence rules, and parentheses can be used to override these rules. For example:

```
function and function or not function
```

is evaluated as:

```
( function and function ) or ( not function )
```

but:

```
function and ( function or not function )
```

is evaluated as:

```
function and ( function or ( not function ) )
```

Parentheses cannot be used between a `not` operator and the function following it.

## Performance

LOOT caches the results of condition evaluations. A regular expression check will still take longer than a file check though, so use the former only when appropriate to do so.



---

## Version History

---

The version history of the metadata syntax is given below.

### 0.10 - 2016-11-06

#### Added

- The `clean` key to the plugin data structure.
- The `global_priority` field to the plugin data structure.
- The `many_active()` condition function.
- The `info` key to the cleaning data structure.

#### Changed

- Renamed the `str` key in the localised content data structure to `text`.
- The `priority` field of the plugin data structure now stores values between -127 and 127 inclusive.
- Regular expressions no longer accept `\` as a directory separator: `/` must now be used.
- The `file()` condition function now also accepts a regular expression.
- The `active()` condition function to also accept a regular expression.
- Renamed the dirty info data structure to the cleaning data structure.

#### Removed

- The `regex()` condition function, as it has been obsoleted by the `file()` function's new regex support.

### 0.8 - 2015-07-22

#### Added

- The `name` key to the location data structure.

- The `many ("regex")` condition function.
- The documentation now defines the equality criteria for all of the metadata syntax's non-standard data structures.

### Changed

- Detection of regular expression plugin entries. Previously, a plugin entry was treated as having a regular expression filename if the filename ended with `\.esp` or `\.esp`. Now, a plugin entry is treated as having a regular expression filename if the filename contains one or more of `: \*?|.`

### Removed

- Removed the `ver` key in the location data structure.

### Fixed

- The documentation gave the values of the `after`, `req`, `inc`, `tag`, `url` and `dirty` keys as lists, when they have always been sets.

## 0.7 - 2015-05-20

### Added

- The message string substitution key, i.e. `sub`, in the message data structure.
- Support for YAML merge keys, i.e. `<<`.

### Changed

- Messages may now be formatted using most of GitHub Flavored Markdown, minus the GitHub-specific features (like @mentions, issue/repo linking and emoji).

## 0.6 - 2014-07-05

No changes.

## 0.5 - 2014-03-31

Initial release.

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Ty Coon, President of Vice
That's all there is to it!
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```

## LOOT API, Libespm & Libloadorder

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