16.6. logging — Logging facility for Python

Source code: Lib/logging/__init__.py

Important

This page contains the API reference information. For tutorial information and discussion of more advanced topics, see

- Basic Tutorial
- Advanced Tutorial
- Logging Cookbook

This module defines functions and classes which implement a flexible event logging system for applications and libraries.

The key benefit of having the logging API provided by a standard library module is that all Python modules can participate in logging, so your application log can include your own messages integrated with messages from third-party modules.

The module provides a lot of functionality and flexibility. If you are unfamiliar with logging, the best way to get to grips with it is to see the tutorials (see the links on the right).

The basic classes defined by the module, together with their functions, are listed below.

- Loggers expose the interface that application code directly uses.
- Handlers send the log records (created by loggers) to the appropriate destination.
- Filters provide a finer grained facility for determining which log records to output.
- Formatters specify the layout of log records in the final output.

16.6.1. Logger Objects

Loggers have the following attributes and methods. Note that Loggers are never instantiated directly, but always through the module-level function `logging.getLogger(name)`. Multiple calls to `getLogger()` with the same name will always return a reference to the same Logger object.

The `name` is potentially a period-separated hierarchical value, like `foo.bar.baz` (though it could also be just plain `foo`, for example). Loggers that are further down in the hierarchical list are children of loggers higher up in the list. For example, given a logger with a name of `foo`, loggers with names of `foo.bar`, `foo.bar.baz`, and `foo.bam` are all descendants of `foo`. The logger name hierarchy is analogous to the

Python package hierarchy, and identical to it if you organise your loggers on a per-module basis using the recommended construction `logging.getLogger(__name__)`. That's because in a module, `__name__` is the module's name in the Python package namespace.

class `logging.`**`Logger`**

`propagate`

If this attribute evaluates to true, events logged to this logger will be passed to the handlers of higher level (ancestor) loggers, in addition to any handlers attached to this logger. Messages are passed directly to the ancestor loggers' handlers - neither the level nor filters of the ancestor loggers in question are considered.

If this evaluates to false, logging messages are not passed to the handlers of ancestor loggers.

The constructor sets this attribute to `True`.

> **Note:** If you attach a handler to a logger *and* one or more of its ancestors, it may emit the same record multiple times. In general, you should not need to attach a handler to more than one logger - if you just attach it to the appropriate logger which is highest in the logger hierarchy, then it will see all events logged by all descendant loggers, provided that their propagate setting is left set to `True`. A common scenario is to attach handlers only to the root logger, and to let propagation take care of the rest.

`setLevel`(*level*)

Sets the threshold for this logger to *level*. Logging messages which are less severe than *level* will be ignored; logging messages which have severity *level* or higher will be emitted by whichever handler or handlers service this logger, unless a handler's level has been set to a higher severity level than *level*.

When a logger is created, the level is set to `NOTSET` (which causes all messages to be processed when the logger is the root logger, or delegation to the parent when the logger is a non-root logger). Note that the root logger is created with level `WARNING`.

The term 'delegation to the parent' means that if a logger has a level of NOTSET, its chain of ancestor loggers is traversed until either an ancestor with a level other than NOTSET is found, or the root is reached.

If an ancestor is found with a level other than NOTSET, then that ancestor's level is treated as the effective level of the logger where the ancestor search began, and is used to determine how a logging event is handled.

If the root is reached, and it has a level of NOTSET, then all messages will be processed. Otherwise, the root's level will be used as the effective level.

See Logging Levels for a list of levels.

Changed in version 3.2: The *level* parameter now accepts a string representation of the level such as 'INFO' as an alternative to the integer constants such as `INFO`. Note, however, that levels are internally stored as integers, and methods such as e.g. `getEffectiveLevel()` and `isEnabledFor()` will return/expect to be passed integers.

isEnabledFor(*lvl*)

Indicates if a message of severity *lvl* would be processed by this logger. This method checks first the module-level level set by `logging.disable(lvl)` and then the logger's effective level as determined by `getEffectiveLevel()`.

getEffectiveLevel()

Indicates the effective level for this logger. If a value other than `NOTSET` has been set using `setLevel()`, it is returned. Otherwise, the hierarchy is traversed towards the root until a value other than `NOTSET` is found, and that value is returned. The value returned is an integer, typically one of `logging.DEBUG`, `logging.INFO` etc.

getChild(*suffix*)

Returns a logger which is a descendant to this logger, as determined by the suffix. Thus, `logging.getLogger('abc').getChild('def.ghi')` would return the same logger as would be returned by `logging.getLogger('abc.def.ghi')`. This is a convenience method, useful when the parent logger is named using e.g. `__name__` rather than a literal string.

New in version 3.2.

debug(*msg*, **args*, ***kwargs*)

Logs a message with level `DEBUG` on this logger. The *msg* is the message format string, and the *args* are the arguments which are merged into *msg* using the string formatting operator. (Note that this means that you can use keywords in the format string, together with a single dictionary argument.)

There are three keyword arguments in *kwargs* which are inspected: *exc_info*, *stack_info*, and *extra*.

If *exc_info* does not evaluate as false, it causes exception information to be added to the logging message. If an exception tuple (in the format returned by `sys.exc_info()`) or an exception instance is provided, it is used; otherwise, `sys.exc_info()` is called to get the exception information.

The second optional keyword argument is *stack_info*, which defaults to `False`. If true, stack information is added to the logging message, including the actual logging call. Note that this is not the same stack information as that displayed through specifying *exc_info*: The former is stack frames from the bottom of the stack up to the logging call in the current thread, whereas the latter is information about stack frames which have been unwound, following an exception, while searching for exception handlers.

You can specify *stack_info* independently of *exc_info*, e.g. to just show how you got to a certain point in your code, even when no exceptions were raised. The stack frames are printed following a header line which says:

```
Stack (most recent call last):
```

This mimics the `Traceback (most recent call last):` which is used when displaying exception frames.

The third keyword argument is *extra* which can be used to pass a dictionary which is used to populate the __dict__ of the LogRecord created for the logging event with user-defined attributes. These custom attributes can then be used as you like. For example, they could be incorporated into logged messages. For example:

```
FORMAT = '%(asctime)-15s %(clientip)s %(user)-8s %(message)s'
logging.basicConfig(format=FORMAT)
d = {'clientip': '192.168.0.1', 'user': 'fbloggs'}
logger = logging.getLogger('tcpserver')
logger.warning('Protocol problem: %s', 'connection reset', extr
```

would print something like

```
2006-02-08 22:20:02,165 192.168.0.1 fbloggs  Protocol problem:
```

The keys in the dictionary passed in *extra* should not clash with the keys used by the logging system. (See the `Formatter` documentation for more information on which keys are used by the logging system.)

If you choose to use these attributes in logged messages, you need to exercise some care. In the above example, for instance, the `Formatter` has been set up with a format string which expects ‘clientip’ and ‘user’ in the attribute dictionary of the LogRecord. If these are missing, the message will not be logged because a string formatting exception will occur. So in this case, you always need to pass the *extra* dictionary with these keys.

While this might be annoying, this feature is intended for use in specialized circumstances, such as multi-threaded servers where the same code executes in many contexts, and interesting conditions which arise are dependent on this context (such as remote client IP address and authenticated user name, in the above example). In such circumstances, it is likely that specialized `Formatter`s would be used with particular `Handler`s.

New in version 3.2: The *stack_info* parameter was added.

Changed in version 3.5: The *exc_info* parameter can now accept exception instances.

`info`(*msg*, **args*, ***kwargs*)

Logs a message with level `INFO` on this logger. The arguments are interpreted as for `debug()`.

`warning`(*msg*, **args*, ***kwargs*)

Logs a message with level `WARNING` on this logger. The arguments are interpreted as for `debug()`.

> **Note:** There is an obsolete method `warn` which is functionally identical to `warning`. As `warn` is deprecated, please do not use it - use `warning` instead.

`error`(*msg*, **args*, ***kwargs*)

Logs a message with level `ERROR` on this logger. The arguments are interpreted as for `debug()`.

`critical`(*msg*, **args*, ***kwargs*)

Logs a message with level `CRITICAL` on this logger. The arguments are interpreted as for `debug()`.

`log`(*lvl*, *msg*, **args*, ***kwargs*)

Logs a message with integer level *lvl* on this logger. The other arguments are interpreted as for `debug()`.

`exception`(*msg*, **args*, ***kwargs*)

Logs a message with level `ERROR` on this logger. The arguments are interpreted as for `debug()`. Exception info is added to the logging message. This method should only be called from an exception handler.

`addFilter`(*filter*)

Adds the specified filter *filter* to this logger.

`removeFilter`(*filter*)

Removes the specified filter *filter* from this logger.

`filter`(*record*)

Applies this logger's filters to the record and returns a true value if the record is to be processed. The filters are consulted in turn, until one of them returns a false value. If none of them return a false value, the record will be processed (passed to handlers). If one returns a false value, no further processing of the record occurs.

`addHandler`(*hdlr*)

Adds the specified handler *hdlr* to this logger.

`removeHandler`(*hdlr*)

Removes the specified handler *hdlr* from this logger.

`findCaller`(*stack_info=False*)

Finds the caller's source filename and line number. Returns the filename, line number, function name and stack information as a 4-element tuple. The stack information is returned as `None` unless *stack_info* is `True`.

`handle`(*record*)

Handles a record by passing it to all handlers associated with this logger and its ancestors (until a false value of *propagate* is found). This method is used for unpickled records received from a socket, as well as those created locally. Logger-level filtering is applied using `filter()`.

`makeRecord`(*name*, *lvl*, *fn*, *lno*, *msg*, *args*, *exc_info*, *func=None*, *extra=None*, *sinfo=None*)

This is a factory method which can be overridden in subclasses to create specialized `LogRecord` instances.

`hasHandlers`()

Checks to see if this logger has any handlers configured. This is done by looking for handlers in this logger and its parents in the logger hierarchy. Returns `True` if a handler was found, else `False`. The method stops searching up the hierarchy whenever a logger with the 'propagate' attribute set to false is found - that will be the last logger which is checked for the existence of handlers.

New in version 3.2.

Changed in version 3.7: Loggers can now be picked and unpickled.

16.6.2. Logging Levels

The numeric values of logging levels are given in the following table. These are primarily of interest if you want to define your own levels, and need them to have specific values relative to the predefined levels. If you define a level with the same numeric value, it overwrites the predefined value; the predefined name is lost.

Level	Numeric value
`CRITICAL`	50
`ERROR`	40
`WARNING`	30
`INFO`	20
`DEBUG`	10
`NOTSET`	0

16.6.3. Handler Objects

Handlers have the following attributes and methods. Note that `Handler` is never instantiated directly; this class acts as a base for more useful subclasses. However, the `__init__()` method in subclasses needs to call `Handler.__init__()`.

class `logging.`**`Handler`**

`__init__`(*level=NOTSET*)

Initializes the `Handler` instance by setting its level, setting the list of filters to the empty list and creating a lock (using `createLock()`) for serializing access to an I/O mechanism.

`createLock`()

Initializes a thread lock which can be used to serialize access to underlying I/O functionality which may not be threadsafe.

`acquire`()

Acquires the thread lock created with `createLock()`.

`release`()

Releases the thread lock acquired with `acquire()`.

`setLevel`(*level*)

Sets the threshold for this handler to *level*. Logging messages which are less severe than *level* will be ignored. When a handler is created, the level is set to `NOTSET` (which causes all messages to be processed).

See Logging Levels for a list of levels.

Changed in version 3.2: The *level* parameter now accepts a string representation of the level such as 'INFO' as an alternative to the integer constants such as `INFO`.

`setFormatter`(*fmt*)

Sets the `Formatter` for this handler to *fmt*.

`addFilter`(*filter*)

Adds the specified filter *filter* to this handler.

`removeFilter`(*filter*)

Removes the specified filter *filter* from this handler.

`filter`(*record*)

Applies this handler's filters to the record and returns a true value if the record is to be processed. The filters are consulted in turn, until one of them returns a false value. If none of them return a false value, the record will be emitted. If one returns a false value, the handler will not emit the record.

`flush`()

Ensure all logging output has been flushed. This version does nothing and is intended to be implemented by subclasses.

`close`()

Tidy up any resources used by the handler. This version does no output but removes the handler from an internal list of handlers which is closed when `shutdown()` is called. Subclasses should ensure that this gets called from overridden `close()` methods.

`handle`(*record*)

Conditionally emits the specified logging record, depending on filters which may have been added to the handler. Wraps the actual emission of the record with acquisition/release of the I/O thread lock.

handleError(*record*)

This method should be called from handlers when an exception is encountered during an `emit()` call. If the module-level attribute `raiseExceptions` is `False`, exceptions get silently ignored. This is what is mostly wanted for a logging system - most users will not care about errors in the logging system, they are more interested in application errors. You could, however, replace this with a custom handler if you wish. The specified record is the one which was being processed when the exception occurred. (The default value of `raiseExceptions` is `True`, as that is more useful during development).

format(*record*)

Do formatting for a record - if a formatter is set, use it. Otherwise, use the default formatter for the module.

emit(*record*)

Do whatever it takes to actually log the specified logging record. This version is intended to be implemented by subclasses and so raises a `NotImplementedError`.

For a list of handlers included as standard, see `logging.handlers`.

16.6.4. Formatter Objects

`Formatter` objects have the following attributes and methods. They are responsible for converting a `LogRecord` to (usually) a string which can be interpreted by either a human or an external system. The base `Formatter` allows a formatting string to be specified. If none is supplied, the default value of `'%(message)s'` is used, which just includes the message in the logging call. To have additional items of information in the formatted output (such as a timestamp), keep reading.

A Formatter can be initialized with a format string which makes use of knowledge of the `LogRecord` attributes - such as the default value mentioned above making use of the fact that the user's message and arguments are pre-formatted into a `LogRecord`'s *message* attribute. This format string contains standard Python %-style mapping keys. See section printf-style String Formatting for more information on string formatting.

The useful mapping keys in a `LogRecord` are given in the section on LogRecord attributes.

class `logging.`**Formatter**(*fmt=None*, *datefmt=None*, *style='%'*)

Returns a new instance of the `Formatter` class. The instance is initialized with a format string for the message as a whole, as well as a format string for the date/time portion of a message. If no *fmt* is specified, `'%(message)s'` is used. If no *datefmt* is specified, a format is used which is described in the `formatTime()` documentation.

The *style* parameter can be one of '%', '{' or '$' and determines how the format string will be merged with its data: using one of %-formatting, `str.format()` or `string.Template`. See Using particular formatting styles throughout your application for more information on using {- and $-formatting for log messages.

Changed in version 3.2: The *style* parameter was added.

`format`(*record*)

The record's attribute dictionary is used as the operand to a string formatting operation. Returns the resulting string. Before formatting the dictionary, a couple of preparatory steps are carried out. The *message* attribute of the record is computed using *msg* % *args*. If the formatting string contains `'(asctime)'`, `formatTime()` is called to format the event time. If there is exception information, it is formatted using `formatException()` and appended to the message. Note that the formatted exception information is cached in attribute *exc_text*. This is useful because the exception information can be pickled and sent across the wire, but you should be careful if you have more than one `Formatter` subclass which customizes the formatting of exception information. In this case, you will have to clear the cached value after a formatter has done its formatting, so that the next formatter to handle the event doesn't use the cached value but recalculates it afresh.

If stack information is available, it's appended after the exception information, using `formatStack()` to transform it if necessary.

`formatTime`(*record*, *datefmt=None*)

This method should be called from `format()` by a formatter which wants to make use of a formatted time. This method can be overridden in formatters to provide for any specific requirement, but the basic behavior is as follows: if *datefmt* (a string) is specified, it is used with `time.strftime()` to format the creation time of the record. Otherwise, the format '%Y-%m-%d %H:%M:%S,uuu' is used, where the uuu part is a millisecond value and the other letters are as per the `time.strftime()` documentation. An example time in this format is `2003-01-23 00:29:50,411`. The resulting string is returned.

This function uses a user-configurable function to convert the creation time to a tuple. By default, `time.localtime()` is used; to change this for a particular formatter instance, set the `converter` attribute to a function with the same signature as `time.localtime()` or `time.gmtime()`. To change it for all formatters, for example if you want all logging times to be shown in GMT, set the `converter` attribute in the `Formatter` class.

Changed in version 3.3: Previously, the default format was hard-coded as in this example: `2010-09-06 22:38:15,292` where the part before the comma is handled by a strptime format string (`'%Y-%m-%d %H:%M:%S'`), and the part after the comma is a millisecond value. Because strptime does not have a format placeholder for milliseconds, the millisecond value is appended using another format string, `'%s,%03d'` — and both of these format strings have been hardcoded into this method. With the change, these strings are defined as class-level attributes which can be overridden at the instance level when desired. The names of the attributes are `default_time_format` (for the strptime format string) and `default_msec_format` (for appending the millisecond value).

`formatException`(*exc_info*)

Formats the specified exception information (a standard exception tuple as returned by `sys.exc_info()`) as a string. This default implementation just uses `traceback.print_exception()`. The resulting string is returned.

`formatStack`(*stack_info*)

Formats the specified stack information (a string as returned by `traceback.print_stack()`, but with the last newline removed) as a string. This default implementation just returns the input value.

16.6.5. Filter Objects

`Filters` can be used by `Handlers` and `Loggers` for more sophisticated filtering than is provided by levels. The base filter class only allows events which are below a certain point in the logger hierarchy. For example, a filter initialized with 'A.B' will allow events logged by loggers 'A.B', 'A.B.C', 'A.B.C.D', 'A.B.D' etc. but not 'A.BB', 'B.A.B' etc. If initialized with the empty string, all events are passed.

class `logging.`**`Filter`**(*name=''*)

Returns an instance of the `Filter` class. If *name* is specified, it names a logger which, together with its children, will have its events allowed through the filter. If *name* is the empty string, allows every event.

`filter`(*record*)

Is the specified record to be logged? Returns zero for no, nonzero for yes. If deemed appropriate, the record may be modified in-place by this method.

Note that filters attached to handlers are consulted before an event is emitted by the handler, whereas filters attached to loggers are consulted whenever an event is logged (using `debug()`, `info()`, etc.), before sending an event to handlers. This means that events which have been generated by descendant loggers will not be filtered by a logger's filter setting, unless the filter has also been applied to those descendant loggers.

You don't actually need to subclass `Filter`: you can pass any instance which has a `filter` method with the same semantics.

Changed in version 3.2: You don't need to create specialized `Filter` classes, or use other classes with a `filter` method: you can use a function (or other callable) as a filter. The filtering logic will check to see if the filter object has a `filter` attribute: if it does, it's assumed to be a `Filter` and its `filter()` method is called. Otherwise, it's assumed to be a callable and called with the record as the single parameter. The returned value should conform to that returned by `filter()`.

Although filters are used primarily to filter records based on more sophisticated criteria than levels, they get to see every record which is processed by the handler or logger they're attached to: this can be useful if you want to do things like counting how many records were processed by a particular logger or handler, or adding, changing or removing attributes in the LogRecord being processed. Obviously changing the LogRecord needs to be done with some care, but it does allow the injection of contextual information into logs (see Using Filters to impart contextual information).

16.6.6. LogRecord Objects

`LogRecord` instances are created automatically by the `Logger` every time something is logged, and can be created manually via `makeLogRecord()` (for example, from a pickled event received over the wire).

class `logging.`**`LogRecord`**(*name*, *level*, *pathname*, *lineno*, *msg*, *args*, *exc_info*, *func=None*, *sinfo=None*)

Contains all the information pertinent to the event being logged.

The primary information is passed in `msg` and `args`, which are combined using `msg % args` to create the `message` field of the record.

Parameters:	• **name** – The name of the logger used to log the event represented by this LogRecord. Note that this name will always have this value, even though it may be emitted by a handler attached to a different (ancestor) logger.

- **level** – The numeric level of the logging event (one of DEBUG, INFO etc.) Note that this is converted to *two* attributes of the LogRecord: `levelno` for the numeric value and `levelname` for the corresponding level name.
- **pathname** – The full pathname of the source file where the logging call was made.
- **lineno** – The line number in the source file where the logging call was made.
- **msg** – The event description message, possibly a format string with placeholders for variable data.
- **args** – Variable data to merge into the *msg* argument to obtain the event description.
- **exc_info** – An exception tuple with the current exception information, or `None` if no exception information is available.
- **func** – The name of the function or method from which the logging call was invoked.
- **sinfo** – A text string representing stack information from the base of the stack in the current thread, up to the logging call.

getMessage()

Returns the message for this `LogRecord` instance after merging any user-supplied arguments with the message. If the user-supplied message argument to the logging call is not a string, `str()` is called on it to convert it to a string. This allows use of user-defined classes as messages, whose `__str__` method can return the actual format string to be used.

Changed in version 3.2: The creation of a `LogRecord` has been made more configurable by providing a factory which is used to create the record. The factory can be set using `getLogRecordFactory()` and `setLogRecordFactory()` (see this for the factory's signature).

This functionality can be used to inject your own values into a LogRecord at creation time. You can use the following pattern:

```
old_factory = logging.getLogRecordFactory()

def record_factory(*args, **kwargs):
    record = old_factory(*args, **kwargs)
    record.custom_attribute = 0xdecafbad
    return record

logging.setLogRecordFactory(record_factory)
```

With this pattern, multiple factories could be chained, and as long as they don't overwrite each other's attributes or unintentionally overwrite the standard attributes listed above, there should be no surprises.

16.6.7. LogRecord attributes

The LogRecord has a number of attributes, most of which are derived from the parameters to the constructor. (Note that the names do not always correspond exactly between the LogRecord constructor parameters and the LogRecord attributes.) These attributes can be used to merge data from the record into the format string. The following table lists (in alphabetical order) the attribute names, their meanings and the corresponding placeholder in a %-style format string.

If you are using {}-formatting (`str.format()`), you can use `{attrname}` as the placeholder in the format string. If you are using $-formatting (`string.Template`), use the form `${attrname}`. In both cases, of course, replace `attrname` with the actual attribute name you want to use.

In the case of {}-formatting, you can specify formatting flags by placing them after the attribute name, separated from it with a colon. For example: a placeholder of `{msecs:03d}` would format a millisecond value of `4` as `004`. Refer to the `str.format()` documentation for full details on the options available to you.

Attribute name	Format	Description
args	You shouldn't need to format this yourself.	The tuple of arguments merged into `msg` to produce `message`, or a dict whose values are used for the merge (when there is only one argument, and it is a dictionary).
asctime	`%(asctime)s`	Human-readable time when the `LogRecord` was created. By default this is of the form '2003-07-08 16:49:45,896' (the numbers after the comma are millisecond portion of the time).
created	`%(created)f`	Time when the `LogRecord` was created (as returned by `time.time()`).
exc_info	You shouldn't need to format this yourself.	Exception tuple (à la `sys.exc_info`) or, if no exception has occurred, `None`.
filename	`%(filename)s`	Filename portion of `pathname`.
funcName	`%(funcName)s`	Name of function containing the logging call.

Attribute name	Format	Description
levelname	`%(levelname)s`	Text logging level for the message (`'DEBUG'`, `'INFO'`, `'WARNING'`, `'ERROR'`, `'CRITICAL'`).
levelno	`%(levelno)s`	Numeric logging level for the message (`DEBUG`, `INFO`, `WARNING`, `ERROR`, `CRITICAL`).
lineno	`%(lineno)d`	Source line number where the logging call was issued (if available).
message	`%(message)s`	The logged message, computed as `msg % args`. This is set when `Formatter.format()` is invoked.
module	`%(module)s`	Module (name portion of `filename`).
msecs	`%(msecs)d`	Millisecond portion of the time when the `LogRecord` was created.
msg	You shouldn't need to format this yourself.	The format string passed in the original logging call. Merged with `args` to produce `message`, or an arbitrary object (see Using arbitrary objects as messages).
name	`%(name)s`	Name of the logger used to log the call.
pathname	`%(pathname)s`	Full pathname of the source file where the logging call was issued (if available).
process	`%(process)d`	Process ID (if available).
processName	`%(processName)s`	Process name (if available).
relativeCreated	`%(relativeCreated)d`	Time in milliseconds when the LogRecord was created, relative to the time the logging module was loaded.
stack_info	You shouldn't need to format this yourself.	Stack frame information (where available) from the bottom of the stack in the current thread, up to and including the stack frame of the logging call which resulted in the creation of this record.
thread	`%(thread)d`	Thread ID (if available).
threadName	`%(threadName)s`	Thread name (if available).

Changed in version 3.1: processName was added.

16.6.8. LoggerAdapter Objects

`LoggerAdapter` instances are used to conveniently pass contextual information into logging calls. For a usage example, see the section on adding contextual information to your logging output.

class `logging.`**`LoggerAdapter`**(*logger*, *extra*)

Returns an instance of `LoggerAdapter` initialized with an underlying `Logger` instance and a dict-like object.

`process`(*msg*, *kwargs*)

Modifies the message and/or keyword arguments passed to a logging call in order to insert contextual information. This implementation takes the object passed as *extra* to the constructor and adds it to *kwargs* using key 'extra'. The return value is a (*msg*, *kwargs*) tuple which has the (possibly modified) versions of the arguments passed in.

In addition to the above, `LoggerAdapter` supports the following methods of `Logger`: `debug()`, `info()`, `warning()`, `error()`, `exception()`, `critical()`, `log()`, `isEnabledFor()`, `getEffectiveLevel()`, `setLevel()` and `hasHandlers()`. These methods have the same signatures as their counterparts in `Logger`, so you can use the two types of instances interchangeably.

Changed in version 3.2: The `isEnabledFor()`, `getEffectiveLevel()`, `setLevel()` and `hasHandlers()` methods were added to `LoggerAdapter`. These methods delegate to the underlying logger.

16.6.9. Thread Safety

The logging module is intended to be thread-safe without any special work needing to be done by its clients. It achieves this though using threading locks; there is one lock to serialize access to the module's shared data, and each handler also creates a lock to serialize access to its underlying I/O.

If you are implementing asynchronous signal handlers using the `signal` module, you may not be able to use logging from within such handlers. This is because lock implementations in the `threading` module are not always re-entrant, and so cannot be invoked from such signal handlers.

16.6.10. Module-Level Functions

In addition to the classes described above, there are a number of module- level functions.

`logging.`**`getLogger`**(*name=None*)

Return a logger with the specified name or, if name is `None`, return a logger which is the root logger of the hierarchy. If specified, the name is typically a dot-separated hierarchical name like *'a'*, *'a.b'* or *'a.b.c.d'*. Choice of these names is entirely up to the developer who is using logging.

All calls to this function with a given name return the same logger instance. This means that logger instances never need to be passed between different parts of an application.

`logging.`**`getLoggerClass`**()

Return either the standard `Logger` class, or the last class passed to `setLoggerClass()`. This function may be called from within a new class definition, to ensure that installing a customized `Logger` class will not undo customizations already applied by other code. For example:

```
class MyLogger(logging.getLoggerClass()):
    # ... override behaviour here
```

`logging.`**`getLogRecordFactory`**()

Return a callable which is used to create a `LogRecord`.

New in version 3.2: This function has been provided, along with `setLogRecordFactory()`, to allow developers more control over how the `LogRecord` representing a logging event is constructed.

See `setLogRecordFactory()` for more information about the how the factory is called.

`logging.`**`debug`**(*msg*, **args*, ***kwargs*)

Logs a message with level `DEBUG` on the root logger. The *msg* is the message format string, and the *args* are the arguments which are merged into *msg* using the string formatting operator. (Note that this means that you can use keywords in the format string, together with a single dictionary argument.)

There are three keyword arguments in *kwargs* which are inspected: *exc_info* which, if it does not evaluate as false, causes exception information to be added to the logging message. If an exception tuple (in the format returned by `sys.exc_info()`) is provided, it is used; otherwise, `sys.exc_info()` is called to get the exception information.

The second optional keyword argument is *stack_info*, which defaults to `False`. If true, stack information is added to the logging message, including the actual logging call. Note that this is not the same stack information as that displayed through specifying *exc_info*: The former is stack frames from the bottom of the stack up to the logging call in the current thread, whereas the latter is information about stack frames which have been unwound, following an exception, while searching for exception handlers.

You can specify *stack_info* independently of *exc_info*, e.g. to just show how you got to a certain point in your code, even when no exceptions were raised. The stack frames are printed following a header line which says:

```
Stack (most recent call last):
```

This mimics the `Traceback (most recent call last):` which is used when displaying exception frames.

The third optional keyword argument is *extra* which can be used to pass a dictionary which is used to populate the __dict__ of the LogRecord created for the logging event with user-defined attributes. These custom attributes can then be used as you like. For example, they could be incorporated into logged messages. For example:

```
FORMAT = '%(asctime)-15s %(clientip)s %(user)-8s %(message)s'
logging.basicConfig(format=FORMAT)
d = {'clientip': '192.168.0.1', 'user': 'fbloggs'}
logging.warning('Protocol problem: %s', 'connection reset', extra=
```

would print something like:

```
2006-02-08 22:20:02,165 192.168.0.1 fbloggs  Protocol problem: con
```

The keys in the dictionary passed in *extra* should not clash with the keys used by the logging system. (See the `Formatter` documentation for more information on which keys are used by the logging system.)

If you choose to use these attributes in logged messages, you need to exercise some care. In the above example, for instance, the `Formatter` has been set up with a format string which expects ‘clientip’ and ‘user’ in the attribute dictionary of the LogRecord. If these are missing, the message will not be logged because a string formatting exception will occur. So in this case, you always need to pass the *extra* dictionary with these keys.

While this might be annoying, this feature is intended for use in specialized circumstances, such as multi-threaded servers where the same code executes in many contexts, and interesting conditions which arise are dependent on this context (such as remote client IP address and authenticated user name, in the above example). In such circumstances, it is likely that specialized `Formatter`s would be used with particular `Handler`s.

New in version 3.2: The *stack_info* parameter was added.

`logging.`**`info`**(*msg*, **args*, ***kwargs*)

Logs a message with level `INFO` on the root logger. The arguments are interpreted as for `debug()`.

`logging.`**`warning`**(*msg*, **args*, ***kwargs*)

Logs a message with level `WARNING` on the root logger. The arguments are interpreted as for `debug()`.

> **Note:** There is an obsolete function `warn` which is functionally identical to `warning`. As `warn` is deprecated, please do not use it - use `warning` instead.

`logging.`**`error`**(*msg*, **args*, ***kwargs*)

Logs a message with level `ERROR` on the root logger. The arguments are interpreted as for `debug()`.

`logging.`**`critical`**(*msg*, **args*, ***kwargs*)

Logs a message with level `CRITICAL` on the root logger. The arguments are interpreted as for `debug()`.

`logging.`**`exception`**(*msg*, **args*, ***kwargs*)

Logs a message with level `ERROR` on the root logger. The arguments are interpreted as for `debug()`. Exception info is added to the logging message. This function should only be called from an exception handler.

`logging.`**`log`**(*level*, *msg*, **args*, ***kwargs*)

Logs a message with level *level* on the root logger. The other arguments are interpreted as for `debug()`.

> **Note:** The above module-level convenience functions, which delegate to the root logger, call `basicConfig()` to ensure that at least one handler is available. Because of this, they should *not* be used in threads, in versions of Python earlier than 2.7.1 and 3.2, unless at least one handler has been added to the

root logger *before* the threads are started. In earlier versions of Python, due to a thread safety shortcoming in `basicConfig()`, this can (under rare circumstances) lead to handlers being added multiple times to the root logger, which can in turn lead to multiple messages for the same event.

`logging.`**`disable`**(*lvl=CRITICAL*)

Provides an overriding level *lvl* for all loggers which takes precedence over the logger's own level. When the need arises to temporarily throttle logging output down across the whole application, this function can be useful. Its effect is to disable all logging calls of severity *lvl* and below, so that if you call it with a value of INFO, then all INFO and DEBUG events would be discarded, whereas those of severity WARNING and above would be processed according to the logger's effective level. If `logging.disable(logging.NOTSET)` is called, it effectively removes this overriding level, so that logging output again depends on the effective levels of individual loggers.

Note that if you have defined any custom logging level higher than `CRITICAL` (this is not recommended), you won't be able to rely on the default value for the *lvl* parameter, but will have to explicitly supply a suitable value.

Changed in version 3.7: The *lvl* parameter was defaulted to level `CRITICAL`. See Issue #28524 for more information about this change.

`logging.`**`addLevelName`**(*lvl*, *levelName*)

Associates level *lvl* with text *levelName* in an internal dictionary, which is used to map numeric levels to a textual representation, for example when a `Formatter` formats a message. This function can also be used to define your own levels. The only constraints are that all levels used must be registered using this function, levels should be positive integers and they should increase in increasing order of severity.

Note: If you are thinking of defining your own levels, please see the section on Custom Levels.

`logging.`**`getLevelName`**(*lvl*)

Returns the textual representation of logging level *lvl*. If the level is one of the predefined levels `CRITICAL`, `ERROR`, `WARNING`, `INFO` or `DEBUG` then you get the corresponding string. If you have associated levels with names using `addLevelName()` then the name you have associated with *lvl* is returned. If a numeric value corresponding to one of the defined levels is passed in, the corresponding string representation is returned. Otherwise, the string 'Level %s' % lvl is returned.

Note: Levels are internally integers (as they need to be compared in the logging logic). This function is used to convert between an integer level and the level name displayed in the formatted log output by means of the `%(levelname)s` format specifier (see LogRecord attributes).

Changed in version 3.4: In Python versions earlier than 3.4, this function could also be passed a text level, and would return the corresponding numeric value of the level. This undocumented behaviour was considered a mistake, and was removed in Python 3.4, but reinstated in 3.4.2 due to retain backward compatibility.

`logging.`**`makeLogRecord`**(*attrdict*)

Creates and returns a new `LogRecord` instance whose attributes are defined by *attrdict*. This function is useful for taking a pickled `LogRecord` attribute dictionary, sent over a socket, and reconstituting it as a `LogRecord` instance at the receiving end.

`logging.`**`basicConfig`**(***kwargs*)

Does basic configuration for the logging system by creating a `StreamHandler` with a default `Formatter` and adding it to the root logger. The functions `debug()`, `info()`, `warning()`, `error()` and `critical()` will call `basicConfig()` automatically if no handlers are defined for the root logger.

This function does nothing if the root logger already has handlers configured for it.

Note: This function should be called from the main thread before other threads are started. In versions of Python prior to 2.7.1 and 3.2, if this function is called from multiple threads, it is possible (in rare circumstances) that a handler will be added to the root logger more than once, leading to unexpected results such as messages being duplicated in the log.

The following keyword arguments are supported.

Format	Description
`filename`	Specifies that a FileHandler be created, using the specified filename, rather than a StreamHandler.
`filemode`	Specifies the mode to open the file, if filename is specified (if filemode is unspecified, it defaults to ‘a’).
`format`	Use the specified format string for the handler.
`datefmt`	Use the specified date/time format.

Format	Description
`style`	If `format` is specified, use this style for the format string. One of '%', '{' or '$' for %-formatting, `str.format()` or `string.Template` respectively, and defaulting to '%' if not specified.
`level`	Set the root logger level to the specified level.
`stream`	Use the specified stream to initialize the StreamHandler. Note that this argument is incompatible with 'filename' - if both are present, a `ValueError` is raised.
`handlers`	If specified, this should be an iterable of already created handlers to add to the root logger. Any handlers which don't already have a formatter set will be assigned the default formatter created in this function. Note that this argument is incompatible with 'filename' or 'stream' - if both are present, a `ValueError` is raised.

Changed in version 3.2: The `style` argument was added.

Changed in version 3.3: The `handlers` argument was added. Additional checks were added to catch situations where incompatible arguments are specified (e.g. `handlers` together with `stream` or `filename`, or `stream` together with `filename`).

`logging.`**`shutdown`**()

Informs the logging system to perform an orderly shutdown by flushing and closing all handlers. This should be called at application exit and no further use of the logging system should be made after this call.

`logging.`**`setLoggerClass`**(*klass*)

Tells the logging system to use the class *klass* when instantiating a logger. The class should define `__init__()` such that only a name argument is required, and the `__init__()` should call `Logger.__init__()`. This function is typically called before any loggers are instantiated by applications which need to use custom logger behavior.

`logging.`**`setLogRecordFactory`**(*factory*)

Set a callable which is used to create a `LogRecord`.

Parameters:	**factory** – The factory callable to be used to instantiate a log record.

New in version 3.2: This function has been provided, along with `getLogRecordFactory()`, to allow developers more control over how the `LogRecord` representing a logging event is constructed.

The factory has the following signature:

```
factory(name, level, fn, lno, msg, args, exc_info, func=None,
sinfo=None, **kwargs)
```

name:	The logger name.
level:	The logging level (numeric).
fn:	The full pathname of the file where the logging call was made.
lno:	The line number in the file where the logging call was made.
msg:	The logging message.
args:	The arguments for the logging message.
exc_info:	An exception tuple, or `None`.
func:	The name of the function or method which invoked the logging call.
sinfo:	A stack traceback such as is provided by `traceback.print_stack()`, showing the call hierarchy.
kwargs:	Additional keyword arguments.

16.6.11. Module-Level Attributes

`logging.`**`lastResort`**

A “handler of last resort” is available through this attribute. This is a `StreamHandler` writing to `sys.stderr` with a level of `WARNING`, and is used to handle logging events in the absence of any logging configuration. The end result is to just print the message to `sys.stderr`. This replaces the earlier error message saying that “no handlers could be found for logger XYZ”. If you need the earlier behaviour for some reason, `lastResort` can be set to `None`.

New in version 3.2.

16.6.12. Integration with the warnings module

The `captureWarnings()` function can be used to integrate `logging` with the `warnings` module.

`logging.`**`captureWarnings`**(*capture*)

This function is used to turn the capture of warnings by logging on and off.

If *capture* is `True`, warnings issued by the `warnings` module will be redirected to the logging system. Specifically, a warning will be formatted using `warnings.formatwarning()` and the resulting string logged to a logger named `'py.warnings'` with a severity of `WARNING`.

If *capture* is `False`, the redirection of warnings to the logging system will stop, and warnings will be redirected to their original destinations (i.e. those in effect before `captureWarnings(True)` was called).

See also:

Module `logging.config`

Configuration API for the logging module.

Module `logging.handlers`

Useful handlers included with the logging module.

PEP 282 - A Logging System

The proposal which described this feature for inclusion in the Python standard library.

Original Python logging package

This is the original source for the `logging` package. The version of the package available from this site is suitable for use with Python 1.5.2, 2.1.x and 2.2.x, which do not include the `logging` package in the standard library.