CHAPTER

TWENTY

INTERNET DATA HANDLING

This chapter describes modules which support handling data formats commonly used on the Internet.

20.1 `email` — An email and MIME handling package

Source code: Lib/email/__init__.py

The *email* package is a library for managing email messages. It is specifically *not* designed to do any sending of email messages to SMTP (**RFC 2821**), NNTP, or other servers; those are functions of modules such as *smtplib* and *nntplib*. The *email* package attempts to be as RFC-compliant as possible, supporting **RFC 5233** and **RFC 6532**, as well as such MIME-related RFCs as **RFC 2045**, **RFC 2046**, **RFC 2047**, **RFC 2183**, and **RFC 2231**.

The overall structure of the email package can be divided into three major components, plus a fourth component that controls the behavior of the other components.

The central component of the package is an "object model" that represents email messages. An application interacts with the package primarily through the object model interface defined in the *message* sub-module. The application can use this API to ask questions about an existing email, to construct a new email, or to add or remove email subcomponents that themselves use the same object model interface. That is, following the nature of email messages and their MIME subcomponents, the email object model is a tree structure of objects that all provide the *EmailMessage* API.

The other two major components of the package are the *parser* and the *generator*. The parser takes the serialized version of an email message (a stream of bytes) and converts it into a tree of *EmailMessage* objects. The generator takes an *EmailMessage* and turns it back into a serialized byte stream. (The parser and generator also handle streams of text characters, but this usage is discouraged as it is too easy to end up with messages that are not valid in one way or another.)

The control component is the *policy* module. Every *EmailMessage*, every *generator*, and every *parser* has an associated *policy* object that controls its behavior. Usually an application only needs to specify the policy when an *EmailMessage* is created, either by directly instantiating an *EmailMessage* to create a new email, or by parsing an input stream using a *parser*. But the policy can be changed when the message is serialized using a *generator*. This allows, for example, a generic email message to be parsed from disk, but to serialize it using standard SMTP settings when sending it to an email server.

The email package does its best to hide the details of the various governing RFCs from the application. Conceptually the application should be able to treat the email message as a structured tree of unicode text and binary attachments, without having to worry about how these are represented when serialized. In practice, however, it is often necessary to be aware of at least some of the rules governing MIME messages and their structure, specifically the names and nature of the MIME "content types" and how they identify multipart documents. For the most part this knowledge should only be required for more complex applications, and even then it should only be the high level structure in question, and not the details of how those structures

are represented. Since MIME content types are used widely in modern internet software (not just email), this will be a familiar concept to many programmers.

The following sections describe the functionality of the *email* package. We start with the *message* object model, which is the primary interface an application will use, and follow that with the *parser* and *generator* components. Then we cover the *policy* controls, which completes the treatment of the main components of the library.

The next three sections cover the exceptions the package may raise and the defects (non-compliance with the RFCs) that the *parser* may detect. Then we cover the *headerregistry* and the *contentmanager* subcomponents, which provide tools for doing more detailed manipulation of headers and payloads, respectively. Both of these components contain features relevant to consuming and producing non-trivial messages, but also document their extensibility APIs, which will be of interest to advanced applications.

Following those is a set of examples of using the fundamental parts of the APIs covered in the preceding sections.

The foregoing represent the modern (unicode friendly) API of the email package. The remaining sections, starting with the *Message* class, cover the legacy *compat32* API that deals much more directly with the details of how email messages are represented. The *compat32* API does *not* hide the details of the RFCs from the application, but for applications that need to operate at that level, they can be useful tools. This documentation is also relevant for applications that are still using the *compat32* API for backward compatibility reasons.

Changed in version 3.6: Docs reorganized and rewritten to promote the new *EmailMessage*/*EmailPolicy* API.

Contents of the *email* package documentation:

20.1.1 email.message: Representing an email message

Source code: Lib/email/message.py

New in version 3.6:[1]

The central class in the *email* package is the *EmailMessage* class, imported from the *email.message* module. It is the base class for the *email* object model. *EmailMessage* provides the core functionality for setting and querying header fields, for accessing message bodies, and for creating or modifying structured messages.

An email message consists of *headers* and a *payload* (which is also referred to as the *content*). Headers are **RFC 5322** or **RFC 6532** style field names and values, where the field name and value are separated by a colon. The colon is not part of either the field name or the field value. The payload may be a simple text message, or a binary object, or a structured sequence of sub-messages each with their own set of headers and their own payload. The latter type of payload is indicated by the message having a MIME type such as *multipart/** or *message/rfc822*.

The conceptual model provided by an *EmailMessage* object is that of an ordered dictionary of headers coupled with a *payload* that represents the **RFC 5322** body of the message, which might be a list of sub-`EmailMessage` objects. In addition to the normal dictionary methods for accessing the header names and values, there are methods for accessing specialized information from the headers (for example the MIME content type), for operating on the payload, for generating a serialized version of the message, and for recursively walking over the object tree.

The *EmailMessage* dictionary-like interface is indexed by the header names, which must be ASCII values. The values of the dictionary are strings with some extra methods. Headers are stored and returned in case-preserving form, but field names are matched case-insensitively. Unlike a real dict, there is an ordering to

[1] Originally added in 3.4 as a *provisional module*. Docs for legacy message class moved to *email.message.Message: Representing an email message using the compat32 API*.

the keys, and there can be duplicate keys. Additional methods are provided for working with headers that have duplicate keys.

The *payload* is either a string or bytes object, in the case of simple message objects, or a list of *EmailMessage* objects, for MIME container documents such as *multipart/** and *message/rfc822* message objects.

class email.message.EmailMessage(*policy=default*)

If *policy* is specified use the rules it specifies to update and serialize the representation of the message. If *policy* is not set, use the *default* policy, which follows the rules of the email RFCs except for line endings (instead of the RFC mandated `\r\n`, it uses the Python standard `\n` line endings). For more information see the *policy* documentation.

as_string(*unixfrom=False*, *maxheaderlen=None*, *policy=None*)

Return the entire message flattened as a string. When optional *unixfrom* is true, the envelope header is included in the returned string. *unixfrom* defaults to `False`. For backward compatibility with the base *Message* class *maxheaderlen* is accepted, but defaults to `None`, which means that by default the line length is controlled by the `max_line_length` of the policy. The *policy* argument may be used to override the default policy obtained from the message instance. This can be used to control some of the formatting produced by the method, since the specified *policy* will be passed to the *Generator*.

Flattening the message may trigger changes to the *EmailMessage* if defaults need to be filled in to complete the transformation to a string (for example, MIME boundaries may be generated or modified).

Note that this method is provided as a convenience and may not be the most useful way to serialize messages in your application, especially if you are dealing with multiple messages. See *email.generator.Generator* for a more flexible API for serializing messages. Note also that this method is restricted to producing messages serialized as "7 bit clean" when *utf8* is `False`, which is the default.

Changed in version 3.6: the default behavior when *maxheaderlen* is not specified was changed from defaulting to 0 to defaulting to the value of *max_line_length* from the policy.

__str__()

Equivalent to `as_string(policy=self.policy.clone(utf8=True))`. Allows `str(msg)` to produce a string containing the serialized message in a readable format.

Changed in version 3.4: the method was changed to use `utf8=True`, thus producing an **RFC 6531**-like message representation, instead of being a direct alias for *as_string()*.

as_bytes(*unixfrom=False*, *policy=None*)

Return the entire message flattened as a bytes object. When optional *unixfrom* is true, the envelope header is included in the returned string. *unixfrom* defaults to `False`. The *policy* argument may be used to override the default policy obtained from the message instance. This can be used to control some of the formatting produced by the method, since the specified *policy* will be passed to the *BytesGenerator*.

Flattening the message may trigger changes to the *EmailMessage* if defaults need to be filled in to complete the transformation to a string (for example, MIME boundaries may be generated or modified).

Note that this method is provided as a convenience and may not be the most useful way to serialize messages in your application, especially if you are dealing with multiple messages. See *email.generator.BytesGenerator* for a more flexible API for serializing messages.

__bytes__()

Equivalent to *as_bytes()*. Allows `bytes(msg)` to produce a bytes object containing the serialized message.

is_multipart()
Return `True` if the message's payload is a list of sub-*EmailMessage* objects, otherwise return `False`. When *is_multipart()* returns `False`, the payload should be a string object (which might be a CTE encoded binary payload). Note that *is_multipart()* returning `True` does not necessarily mean that "msg.get_content_maintype() == 'multipart'" will return the `True`. For example, `is_multipart` will return `True` when the *EmailMessage* is of type `message/rfc822`.

set_unixfrom(*unixfrom*)
Set the message's envelope header to *unixfrom*, which should be a string. (See *mboxMessage* for a brief description of this header.)

get_unixfrom()
Return the message's envelope header. Defaults to `None` if the envelope header was never set.

The following methods implement the mapping-like interface for accessing the message's headers. Note that there are some semantic differences between these methods and a normal mapping (i.e. dictionary) interface. For example, in a dictionary there are no duplicate keys, but here there may be duplicate message headers. Also, in dictionaries there is no guaranteed order to the keys returned by *keys()*, but in an *EmailMessage* object, headers are always returned in the order they appeared in the original message, or in which they were added to the message later. Any header deleted and then re-added is always appended to the end of the header list.

These semantic differences are intentional and are biased toward convenience in the most common use cases.

Note that in all cases, any envelope header present in the message is not included in the mapping interface.

__len__()
Return the total number of headers, including duplicates.

__contains__(*name*)
Return true if the message object has a field named *name*. Matching is done without regard to case and *name* does not include the trailing colon. Used for the `in` operator. For example:

```
if 'message-id' in myMessage:
   print('Message-ID:', myMessage['message-id'])
```

__getitem__(*name*)
Return the value of the named header field. *name* does not include the colon field separator. If the header is missing, `None` is returned; a *KeyError* is never raised.

Note that if the named field appears more than once in the message's headers, exactly which of those field values will be returned is undefined. Use the *get_all()* method to get the values of all the extant headers named *name*.

Using the standard (non-`compat32`) policies, the returned value is an instance of a subclass of *email.headerregistry.BaseHeader*.

__setitem__(*name*, *val*)
Add a header to the message with field name *name* and value *val*. The field is appended to the end of the message's existing headers.

Note that this does *not* overwrite or delete any existing header with the same name. If you want to ensure that the new header is the only one present in the message with field name *name*, delete the field first, e.g.:

```
del msg['subject']
msg['subject'] = 'Python roolz!'
```

If the `policy` defines certain headers to be unique (as the standard policies do), this method may raise a *ValueError* when an attempt is made to assign a value to such a header when one already exists. This behavior is intentional for consistency's sake, but do not depend on it as we may choose to make such assignments do an automatic deletion of the existing header in the future.

__delitem__(*name*)
Delete all occurrences of the field with name *name* from the message's headers. No exception is raised if the named field isn't present in the headers.

keys()
Return a list of all the message's header field names.

values()
Return a list of all the message's field values.

items()
Return a list of 2-tuples containing all the message's field headers and values.

get(*name*, *failobj=None*)
Return the value of the named header field. This is identical to *__getitem__()* except that optional *failobj* is returned if the named header is missing (*failobj* defaults to `None`).

Here are some additional useful header related methods:

get_all(*name*, *failobj=None*)
Return a list of all the values for the field named *name*. If there are no such named headers in the message, *failobj* is returned (defaults to `None`).

add_header(*_name*, *_value*, ***_params*)
Extended header setting. This method is similar to *__setitem__()* except that additional header parameters can be provided as keyword arguments. *_name* is the header field to add and *_value* is the *primary* value for the header.

For each item in the keyword argument dictionary *_params*, the key is taken as the parameter name, with underscores converted to dashes (since dashes are illegal in Python identifiers). Normally, the parameter will be added as `key="value"` unless the value is `None`, in which case only the key will be added.

If the value contains non-ASCII characters, the charset and language may be explicitly controlled by specifying the value as a three tuple in the format `(CHARSET, LANGUAGE, VALUE)`, where `CHARSET` is a string naming the charset to be used to encode the value, `LANGUAGE` can usually be set to `None` or the empty string (see **RFC 2231** for other possibilities), and `VALUE` is the string value containing non-ASCII code points. If a three tuple is not passed and the value contains non-ASCII characters, it is automatically encoded in **RFC 2231** format using a `CHARSET` of `utf-8` and a `LANGUAGE` of `None`.

Here is an example:

```
msg.add_header('Content-Disposition', 'attachment', filename='bud.gif')
```

This will add a header that looks like

```
Content-Disposition: attachment; filename="bud.gif"
```

An example of the extended interface with non-ASCII characters:

```
msg.add_header('Content-Disposition', 'attachment',
               filename=('iso-8859-1', '', 'Fußballer.ppt'))
```

replace_header(*_name*, *_value*)
Replace a header. Replace the first header found in the message that matches *_name*, retaining

header order and field name case of the original header. If no matching header is found, raise a *KeyError*.

get_content_type()
Return the message's content type, coerced to lower case of the form *maintype/subtype*. If there is no *Content-Type* header in the message return the value returned by *get_default_type()*. If the *Content-Type* header is invalid, return `text/plain`.

(According to **RFC 2045**, messages always have a default type, *get_content_type()* will always return a value. **RFC 2045** defines a message's default type to be *text/plain* unless it appears inside a *multipart/digest* container, in which case it would be *message/rfc822*. If the *Content-Type* header has an invalid type specification, **RFC 2045** mandates that the default type be *text/plain*.)

get_content_maintype()
Return the message's main content type. This is the *maintype* part of the string returned by *get_content_type()*.

get_content_subtype()
Return the message's sub-content type. This is the *subtype* part of the string returned by *get_content_type()*.

get_default_type()
Return the default content type. Most messages have a default content type of *text/plain*, except for messages that are subparts of *multipart/digest* containers. Such subparts have a default content type of *message/rfc822*.

set_default_type(*ctype*)
Set the default content type. *ctype* should either be *text/plain* or *message/rfc822*, although this is not enforced. The default content type is not stored in the *Content-Type* header, so it only affects the return value of the `get_content_type` methods when no *Content-Type* header is present in the message.

set_param(*param*, *value*, *header='Content-Type'*, *requote=True*, *charset=None*, *language=''*, *replace=False*)
Set a parameter in the *Content-Type* header. If the parameter already exists in the header, replace its value with *value*. When *header* is `Content-Type` (the default) and the header does not yet exist in the message, add it, set its value to *text/plain*, and append the new parameter value. Optional *header* specifies an alternative header to *Content-Type*.

If the value contains non-ASCII characters, the charset and language may be explicitly specified using the optional *charset* and *language* parameters. Optional *language* specifies the **RFC 2231** language, defaulting to the empty string. Both *charset* and *language* should be strings. The default is to use the `utf8` *charset* and `None` for the *language*.

If *replace* is `False` (the default) the header is moved to the end of the list of headers. If *replace* is `True`, the header will be updated in place.

Use of the *requote* parameter with *EmailMessage* objects is deprecated.

Note that existing parameter values of headers may be accessed through the `params` attribute of the header value (for example, `msg['Content-Type'].params['charset']`).

Changed in version 3.4: `replace` keyword was added.

del_param(*param*, *header='content-type'*, *requote=True*)
Remove the given parameter completely from the *Content-Type* header. The header will be rewritten in place without the parameter or its value. Optional *header* specifies an alternative to *Content-Type*.

Use of the *requote* parameter with *EmailMessage* objects is deprecated.

get_filename(*failobj=None*)
Return the value of the `filename` parameter of the *Content-Disposition* header of the message. If the header does not have a `filename` parameter, this method falls back to looking for the `name` parameter on the *Content-Type* header. If neither is found, or the header is missing, then *failobj* is returned. The returned string will always be unquoted as per *email.utils.unquote()*.

get_boundary(*failobj=None*)
Return the value of the `boundary` parameter of the *Content-Type* header of the message, or *failobj* if either the header is missing, or has no `boundary` parameter. The returned string will always be unquoted as per *email.utils.unquote()*.

set_boundary(*boundary*)
Set the `boundary` parameter of the *Content-Type* header to *boundary*. *set_boundary()* will always quote *boundary* if necessary. A *HeaderParseError* is raised if the message object has no *Content-Type* header.

Note that using this method is subtly different from deleting the old *Content-Type* header and adding a new one with the new boundary via *add_header()*, because *set_boundary()* preserves the order of the *Content-Type* header in the list of headers.

get_content_charset(*failobj=None*)
Return the `charset` parameter of the *Content-Type* header, coerced to lower case. If there is no *Content-Type* header, or if that header has no `charset` parameter, *failobj* is returned.

get_charsets(*failobj=None*)
Return a list containing the character set names in the message. If the message is a *multipart*, then the list will contain one element for each subpart in the payload, otherwise, it will be a list of length 1.

Each item in the list will be a string which is the value of the `charset` parameter in the *Content-Type* header for the represented subpart. If the subpart has no *Content-Type* header, no `charset` parameter, or is not of the *text* main MIME type, then that item in the returned list will be *failobj*.

is_attachment()
Return `True` if there is a *Content-Disposition* header and its (case insensitive) value is `attachment`, `False` otherwise.

Changed in version 3.4.2: is_attachment is now a method instead of a property, for consistency with *is_multipart()*.

get_content_disposition()
Return the lowercased value (without parameters) of the message's *Content-Disposition* header if it has one, or `None`. The possible values for this method are *inline*, *attachment* or `None` if the message follows **RFC 2183**.

New in version 3.5.

The following methods relate to interrogating and manipulating the content (payload) of the message.

walk()
The *walk()* method is an all-purpose generator which can be used to iterate over all the parts and subparts of a message object tree, in depth-first traversal order. You will typically use *walk()* as the iterator in a `for` loop; each iteration returns the next subpart.

Here's an example that prints the MIME type of every part of a multipart message structure:

```
>>> for part in msg.walk():
...     print(part.get_content_type())
multipart/report
```

(continues on next page)

(continued from previous page)

```
text/plain
message/delivery-status
text/plain
text/plain
message/rfc822
text/plain
```

`walk` iterates over the subparts of any part where *is_multipart()* returns `True`, even though `msg.get_content_maintype() == 'multipart'` may return `False`. We can see this in our example by making use of the `_structure` debug helper function:

```
>>> for part in msg.walk():
...     print(part.get_content_maintype() == 'multipart',
...           part.is_multipart())
True True
False False
False True
False False
False False
False True
False False
>>> _structure(msg)
multipart/report
    text/plain
    message/delivery-status
        text/plain
        text/plain
    message/rfc822
        text/plain
```

Here the `message` parts are not `multiparts`, but they do contain subparts. `is_multipart()` returns `True` and `walk` descends into the subparts.

`get_body`(*preferencelist=('related', 'html', 'plain')*)
Return the MIME part that is the best candidate to be the "body" of the message.

preferencelist must be a sequence of strings from the set `related`, `html`, and `plain`, and indicates the order of preference for the content type of the part returned.

Start looking for candidate matches with the object on which the `get_body` method is called.

If `related` is not included in *preferencelist*, consider the root part (or subpart of the root part) of any related encountered as a candidate if the (sub-)part matches a preference.

When encountering a `multipart/related`, check the `start` parameter and if a part with a matching *Content-ID* is found, consider only it when looking for candidate matches. Otherwise consider only the first (default root) part of the `multipart/related`.

If a part has a *Content-Disposition* header, only consider the part a candidate match if the value of the header is `inline`.

If none of the candidates matches any of the preferences in *preferencelist*, return `None`.

Notes: (1) For most applications the only *preferencelist* combinations that really make sense are `('plain',)`, `('html', 'plain')`, and the default `('related', 'html', 'plain')`. (2) Because matching starts with the object on which `get_body` is called, calling `get_body` on a `multipart/related` will return the object itself unless *preferencelist* has a non-default value. (3) Messages (or message parts) that do not specify a *Content-Type* or whose *Content-Type* header is invalid

will be treated as if they are of type `text/plain`, which may occasionally cause `get_body` to return unexpected results.

`iter_attachments()`
: Return an iterator over all of the immediate sub-parts of the message that are not candidate "body" parts. That is, skip the first occurrence of each of `text/plain`, `text/html`, `multipart/related`, or `multipart/alternative` (unless they are explicitly marked as attachments via *`Content-Disposition: attachment`*), and return all remaining parts. When applied directly to a `multipart/related`, return an iterator over the all the related parts except the root part (ie: the part pointed to by the `start` parameter, or the first part if there is no `start` parameter or the `start` parameter doesn't match the *`Content-ID`* of any of the parts). When applied directly to a `multipart/alternative` or a non-`multipart`, return an empty iterator.

`iter_parts()`
: Return an iterator over all of the immediate sub-parts of the message, which will be empty for a non-`multipart`. (See also *`walk()`*.)

`get_content`(**args*, *content_manager=None*, ***kw*)
: Call the *`get_content()`* method of the *content_manager*, passing self as the message object, and passing along any other arguments or keywords as additional arguments. If *content_manager* is not specified, use the `content_manager` specified by the current *`policy`*.

`set_content`(**args*, *content_manager=None*, ***kw*)
: Call the *`set_content()`* method of the *content_manager*, passing self as the message object, and passing along any other arguments or keywords as additional arguments. If *content_manager* is not specified, use the `content_manager` specified by the current *`policy`*.

`make_related`(*boundary=None*)
: Convert a non-`multipart` message into a `multipart/related` message, moving any existing *`Content-`* headers and payload into a (new) first part of the `multipart`. If *boundary* is specified, use it as the boundary string in the multipart, otherwise leave the boundary to be automatically created when it is needed (for example, when the message is serialized).

`make_alternative`(*boundary=None*)
: Convert a non-`multipart` or a `multipart/related` into a `multipart/alternative`, moving any existing *`Content-`* headers and payload into a (new) first part of the `multipart`. If *boundary* is specified, use it as the boundary string in the multipart, otherwise leave the boundary to be automatically created when it is needed (for example, when the message is serialized).

`make_mixed`(*boundary=None*)
: Convert a non-`multipart`, a `multipart/related`, or a `multipart-alternative` into a `multipart/mixed`, moving any existing *`Content-`* headers and payload into a (new) first part of the `multipart`. If *boundary* is specified, use it as the boundary string in the multipart, otherwise leave the boundary to be automatically created when it is needed (for example, when the message is serialized).

`add_related`(**args*, *content_manager=None*, ***kw*)
: If the message is a `multipart/related`, create a new message object, pass all of the arguments to its *`set_content()`* method, and *`attach()`* it to the `multipart`. If the message is a non-`multipart`, call *`make_related()`* and then proceed as above. If the message is any other type of `multipart`, raise a *`TypeError`*. If *content_manager* is not specified, use the `content_manager` specified by the current *`policy`*. If the added part has no *`Content-Disposition`* header, add one with the value `inline`.

`add_alternative`(**args*, *content_manager=None*, ***kw*)
: If the message is a `multipart/alternative`, create a new message object, pass all of the arguments to its *`set_content()`* method, and *`attach()`* it to the `multipart`. If the message is a non-`multipart` or `multipart/related`, call *`make_alternative()`* and then proceed as above.

If the message is any other type of `multipart`, raise a *TypeError*. If *content_manager* is not specified, use the `content_manager` specified by the current *policy*.

`add_attachment`(**args*, *content_manager=None*, ***kw*)
If the message is a `multipart/mixed`, create a new message object, pass all of the arguments to its *set_content()* method, and *attach()* it to the `multipart`. If the message is a non-`multipart`, `multipart/related`, or `multipart/alternative`, call *make_mixed()* and then proceed as above. If *content_manager* is not specified, use the `content_manager` specified by the current *policy*. If the added part has no *Content-Disposition* header, add one with the value `attachment`. This method can be used both for explicit attachments (*Content-Disposition: attachment*) and `inline` attachments (*Content-Disposition: inline*), by passing appropriate options to the `content_manager`.

`clear`()
Remove the payload and all of the headers.

`clear_content`()
Remove the payload and all of the `Content-` headers, leaving all other headers intact and in their original order.

EmailMessage objects have the following instance attributes:

`preamble`
The format of a MIME document allows for some text between the blank line following the headers, and the first multipart boundary string. Normally, this text is never visible in a MIME-aware mail reader because it falls outside the standard MIME armor. However, when viewing the raw text of the message, or when viewing the message in a non-MIME aware reader, this text can become visible.

The *preamble* attribute contains this leading extra-armor text for MIME documents. When the *Parser* discovers some text after the headers but before the first boundary string, it assigns this text to the message's *preamble* attribute. When the *Generator* is writing out the plain text representation of a MIME message, and it finds the message has a *preamble* attribute, it will write this text in the area between the headers and the first boundary. See *email.parser* and *email.generator* for details.

Note that if the message object has no preamble, the *preamble* attribute will be `None`.

`epilogue`
The *epilogue* attribute acts the same way as the *preamble* attribute, except that it contains text that appears between the last boundary and the end of the message. As with the *preamble*, if there is no epilog text this attribute will be `None`.

`defects`
The *defects* attribute contains a list of all the problems found when parsing this message. See *email.errors* for a detailed description of the possible parsing defects.

`class email.message.MIMEPart`(*policy=default*)
This class represents a subpart of a MIME message. It is identical to *EmailMessage*, except that no *MIME-Version* headers are added when *set_content()* is called, since sub-parts do not need their own *MIME-Version* headers.

20.1.2 `email.parser`: Parsing email messages

Source code: Lib/email/parser.py

Message object structures can be created in one of two ways: they can be created from whole cloth by creating an *EmailMessage* object, adding headers using the dictionary interface, and adding payload(s)

using *set_content()* and related methods, or they can be created by parsing a serialized representation of the email message.

The *email* package provides a standard parser that understands most email document structures, including MIME documents. You can pass the parser a bytes, string or file object, and the parser will return to you the root *EmailMessage* instance of the object structure. For simple, non-MIME messages the payload of this root object will likely be a string containing the text of the message. For MIME messages, the root object will return `True` from its *is_multipart()* method, and the subparts can be accessed via the payload manipulation methods, such as *get_body()*, *iter_parts()*, and *walk()*.

There are actually two parser interfaces available for use, the *Parser* API and the incremental *FeedParser* API. The *Parser* API is most useful if you have the entire text of the message in memory, or if the entire message lives in a file on the file system. *FeedParser* is more appropriate when you are reading the message from a stream which might block waiting for more input (such as reading an email message from a socket). The *FeedParser* can consume and parse the message incrementally, and only returns the root object when you close the parser.

Note that the parser can be extended in limited ways, and of course you can implement your own parser completely from scratch. All of the logic that connects the *email* package's bundled parser and the *EmailMessage* class is embodied in the `policy` class, so a custom parser can create message object trees any way it finds necessary by implementing custom versions of the appropriate `policy` methods.

FeedParser API

The *BytesFeedParser*, imported from the `email.feedparser` module, provides an API that is conducive to incremental parsing of email messages, such as would be necessary when reading the text of an email message from a source that can block (such as a socket). The *BytesFeedParser* can of course be used to parse an email message fully contained in a *bytes-like object*, string, or file, but the *BytesParser* API may be more convenient for such use cases. The semantics and results of the two parser APIs are identical.

The *BytesFeedParser*'s API is simple; you create an instance, feed it a bunch of bytes until there's no more to feed it, then close the parser to retrieve the root message object. The *BytesFeedParser* is extremely accurate when parsing standards-compliant messages, and it does a very good job of parsing non-compliant messages, providing information about how a message was deemed broken. It will populate a message object's *defects* attribute with a list of any problems it found in a message. See the *email.errors* module for the list of defects that it can find.

Here is the API for the *BytesFeedParser*:

class email.parser.BytesFeedParser(*_factory=None*, ***, *policy=policy.compat32*)

Create a *BytesFeedParser* instance. Optional *_factory* is a no-argument callable; if not specified use the *message_factory* from the *policy*. Call *_factory* whenever a new message object is needed.

If *policy* is specified use the rules it specifies to update the representation of the message. If *policy* is not set, use the *compat32* policy, which maintains backward compatibility with the Python 3.2 version of the email package and provides *Message* as the default factory. All other policies provide *EmailMessage* as the default *_factory*. For more information on what else *policy* controls, see the *policy* documentation.

Note: **The policy keyword should always be specified**; The default will change to *email.policy.default* in a future version of Python.

New in version 3.2.

Changed in version 3.3: Added the *policy* keyword.

Changed in version 3.6: *_factory* defaults to the policy `message_factory`.

feed(*data*)

Feed the parser some more data. *data* should be a *bytes-like object* containing one or more lines.

The lines can be partial and the parser will stitch such partial lines together properly. The lines can have any of the three common line endings: carriage return, newline, or carriage return and newline (they can even be mixed).

`close()`
Complete the parsing of all previously fed data and return the root message object. It is undefined what happens if *feed()* is called after this method has been called.

`class email.parser.FeedParser(`*_factory=None*, *, *policy=policy.compat32*`)`
Works like *BytesFeedParser* except that the input to the *feed()* method must be a string. This is of limited utility, since the only way for such a message to be valid is for it to contain only ASCII text or, if `utf8` is `True`, no binary attachments.

Changed in version 3.3: Added the *policy* keyword.

Parser API

The *BytesParser* class, imported from the *email.parser* module, provides an API that can be used to parse a message when the complete contents of the message are available in a *bytes-like object* or file. The *email.parser* module also provides *Parser* for parsing strings, and header-only parsers, *BytesHeaderParser* and *HeaderParser*, which can be used if you're only interested in the headers of the message. *BytesHeaderParser* and *HeaderParser* can be much faster in these situations, since they do not attempt to parse the message body, instead setting the payload to the raw body.

`class email.parser.BytesParser(`*_class=None*, *, *policy=policy.compat32*`)`
Create a *BytesParser* instance. The *_class* and *policy* arguments have the same meaning and semantics as the *_factory* and *policy* arguments of *BytesFeedParser*.

Note: **The policy keyword should always be specified**; The default will change to *email.policy.default* in a future version of Python.

Changed in version 3.3: Removed the *strict* argument that was deprecated in 2.4. Added the *policy* keyword.

Changed in version 3.6: *_class* defaults to the policy `message_factory`.

`parse(`*fp*, *headersonly=False*`)`
Read all the data from the binary file-like object *fp*, parse the resulting bytes, and return the message object. *fp* must support both the *readline()* and the `read()` methods.

The bytes contained in *fp* must be formatted as a block of **RFC 5322** (or, if `utf8` is `True`, **RFC 6532**) style headers and header continuation lines, optionally preceded by an envelope header. The header block is terminated either by the end of the data or by a blank line. Following the header block is the body of the message (which may contain MIME-encoded subparts, including subparts with a *Content-Transfer-Encoding* of `8bit`).

Optional *headersonly* is a flag specifying whether to stop parsing after reading the headers or not. The default is `False`, meaning it parses the entire contents of the file.

`parsebytes(`*bytes*, *headersonly=False*`)`
Similar to the *parse()* method, except it takes a *bytes-like object* instead of a file-like object. Calling this method on a *bytes-like object* is equivalent to wrapping *bytes* in a *BytesIO* instance first and calling *parse()*.

Optional *headersonly* is as with the *parse()* method.

New in version 3.2.

`class email.parser.BytesHeaderParser(`*_class=None*, *, *policy=policy.compat32*`)`
Exactly like *BytesParser*, except that *headersonly* defaults to `True`.

New in version 3.3.

class email.parser.Parser(*_class=None*, ***, *policy=policy.compat32*)
This class is parallel to *BytesParser*, but handles string input.

Changed in version 3.3: Removed the *strict* argument. Added the *policy* keyword.

Changed in version 3.6: *_class* defaults to the policy `message_factory`.

parse(*fp*, *headersonly=False*)
Read all the data from the text-mode file-like object *fp*, parse the resulting text, and return the root message object. *fp* must support both the *readline()* and the *read()* methods on file-like objects.

Other than the text mode requirement, this method operates like *BytesParser.parse()*.

parsestr(*text*, *headersonly=False*)
Similar to the *parse()* method, except it takes a string object instead of a file-like object. Calling this method on a string is equivalent to wrapping *text* in a *StringIO* instance first and calling *parse()*.

Optional *headersonly* is as with the *parse()* method.

class email.parser.HeaderParser(*_class=None*, ***, *policy=policy.compat32*)
Exactly like *Parser*, except that *headersonly* defaults to `True`.

Since creating a message object structure from a string or a file object is such a common task, four functions are provided as a convenience. They are available in the top-level *email* package namespace.

email.message_from_bytes(*s*, *_class=None*, ***, *policy=policy.compat32*)
Return a message object structure from a *bytes-like object*. This is equivalent to `BytesParser().parsebytes(s)`. Optional *_class* and *policy* are interpreted as with the *BytesParser* class constructor.

New in version 3.2.

Changed in version 3.3: Removed the *strict* argument. Added the *policy* keyword.

email.message_from_binary_file(*fp*, *_class=None*, ***, *policy=policy.compat32*)
Return a message object structure tree from an open binary *file object*. This is equivalent to `BytesParser().parse(fp)`. *_class* and *policy* are interpreted as with the *BytesParser* class constructor.

New in version 3.2.

Changed in version 3.3: Removed the *strict* argument. Added the *policy* keyword.

email.message_from_string(*s*, *_class=None*, ***, *policy=policy.compat32*)
Return a message object structure from a string. This is equivalent to `Parser().parsestr(s)`. *_class* and *policy* are interpreted as with the *Parser* class constructor.

Changed in version 3.3: Removed the *strict* argument. Added the *policy* keyword.

email.message_from_file(*fp*, *_class=None*, ***, *policy=policy.compat32*)
Return a message object structure tree from an open *file object*. This is equivalent to `Parser().parse(fp)`. *_class* and *policy* are interpreted as with the *Parser* class constructor.

Changed in version 3.3: Removed the *strict* argument. Added the *policy* keyword.

Changed in version 3.6: *_class* defaults to the policy `message_factory`.

Here's an example of how you might use *message_from_bytes()* at an interactive Python prompt:

```
>>> import email
>>> msg = email.message_from_bytes(myBytes)
```

Additional notes

Here are some notes on the parsing semantics:

- Most non-*multipart* type messages are parsed as a single message object with a string payload. These objects will return `False` for *is_multipart()*, and *iter_parts()* will yield an empty list.
- All *multipart* type messages will be parsed as a container message object with a list of sub-message objects for their payload. The outer container message will return `True` for *is_multipart()*, and *iter_parts()* will yield a list of subparts.
- Most messages with a content type of *message/** (such as *message/delivery-status* and *message/rfc822*) will also be parsed as container object containing a list payload of length 1. Their *is_multipart()* method will return `True`. The single element yielded by *iter_parts()* will be a sub-message object.
- Some non-standards-compliant messages may not be internally consistent about their *multipart*-edness. Such messages may have a *Content-Type* header of type *multipart*, but their *is_multipart()* method may return `False`. If such messages were parsed with the *FeedParser*, they will have an instance of the `MultipartInvariantViolationDefect` class in their *defects* attribute list. See *email.errors* for details.

20.1.3 `email.generator`: Generating MIME documents

Source code: Lib/email/generator.py

One of the most common tasks is to generate the flat (serialized) version of the email message represented by a message object structure. You will need to do this if you want to send your message via *smtplib.SMTP.sendmail()* or the *nntplib* module, or print the message on the console. Taking a message object structure and producing a serialized representation is the job of the generator classes.

As with the *email.parser* module, you aren't limited to the functionality of the bundled generator; you could write one from scratch yourself. However the bundled generator knows how to generate most email in a standards-compliant way, should handle MIME and non-MIME email messages just fine, and is designed so that the bytes-oriented parsing and generation operations are inverses, assuming the same non-transforming *policy* is used for both. That is, parsing the serialized byte stream via the *BytesParser* class and then regenerating the serialized byte stream using *BytesGenerator* should produce output identical to the input[1]. (On the other hand, using the generator on an *EmailMessage* constructed by program may result in changes to the *EmailMessage* object as defaults are filled in.)

The *Generator* class can be used to flatten a message into a text (as opposed to binary) serialized representation, but since Unicode cannot represent binary data directly, the message is of necessity transformed into something that contains only ASCII characters, using the standard email RFC Content Transfer Encoding techniques for encoding email messages for transport over channels that are not "8 bit clean".

`class email.generator.BytesGenerator(`*outfp*, *mangle_from_=None*, *maxheaderlen=None*, ***, *policy=None*`)`

Return a *BytesGenerator* object that will write any message provided to the *flatten()* method, or any surrogateescape encoded text provided to the *write()* method, to the *file-like object* *outfp*. *outfp* must support a `write` method that accepts binary data.

If optional *mangle_from_* is `True`, put a `>` character in front of any line in the body that starts with the exact string `"From "`, that is `From` followed by a space at the beginning of a line. *mangle_from_*

[1] This statement assumes that you use the appropriate setting for `unixfrom`, and that there are no `policy` settings calling for automatic adjustments (for example, `refold_source` must be `none`, which is *not* the default). It is also not 100% true, since if the message does not conform to the RFC standards occasionally information about the exact original text is lost during parsing error recovery. It is a goal to fix these latter edge cases when possible.

defaults to the value of the *mangle_from_* setting of the *policy* (which is `True` for the *compat32* policy and `False` for all others). *mangle_from_* is intended for use when messages are stored in unix mbox format (see *mailbox* and WHY THE CONTENT-LENGTH FORMAT IS BAD).

If *maxheaderlen* is not `None`, refold any header lines that are longer than *maxheaderlen*, or if `0`, do not rewrap any headers. If *manheaderlen* is `None` (the default), wrap headers and other message lines according to the *policy* settings.

If *policy* is specified, use that policy to control message generation. If *policy* is `None` (the default), use the policy associated with the *Message* or *EmailMessage* object passed to `flatten` to control the message generation. See *email.policy* for details on what *policy* controls.

New in version 3.2.

Changed in version 3.3: Added the *policy* keyword.

Changed in version 3.6: The default behavior of the *mangle_from_* and *maxheaderlen* parameters is to follow the policy.

flatten(*msg*, *unixfrom=False*, *linesep=None*)

Print the textual representation of the message object structure rooted at *msg* to the output file specified when the *BytesGenerator* instance was created.

If the *policy* option *cte_type* is `8bit` (the default), copy any headers in the original parsed message that have not been modified to the output with any bytes with the high bit set reproduced as in the original, and preserve the non-ASCII *Content-Transfer-Encoding* of any body parts that have them. If `cte_type` is `7bit`, convert the bytes with the high bit set as needed using an ASCII-compatible *Content-Transfer-Encoding*. That is, transform parts with non-ASCII *Content-Transfer-Encoding* (*Content-Transfer-Encoding: 8bit*) to an ASCII compatible *Content-Transfer-Encoding*, and encode RFC-invalid non-ASCII bytes in headers using the MIME `unknown-8bit` character set, thus rendering them RFC-compliant.

If *unixfrom* is `True`, print the envelope header delimiter used by the Unix mailbox format (see *mailbox*) before the first of the **RFC 5322** headers of the root message object. If the root object has no envelope header, craft a standard one. The default is `False`. Note that for subparts, no envelope header is ever printed.

If *linesep* is not `None`, use it as the separator character between all the lines of the flattened message. If *linesep* is `None` (the default), use the value specified in the *policy*.

clone(*fp*)

Return an independent clone of this *BytesGenerator* instance with the exact same option settings, and *fp* as the new *outfp*.

write(*s*)

Encode *s* using the `ASCII` codec and the `surrogateescape` error handler, and pass it to the *write* method of the *outfp* passed to the *BytesGenerator*'s constructor.

As a convenience, *EmailMessage* provides the methods *as_bytes()* and `bytes(aMessage)` (a.k.a. *__bytes__()*), which simplify the generation of a serialized binary representation of a message object. For more detail, see *email.message*.

Because strings cannot represent binary data, the *Generator* class must convert any binary data in any message it flattens to an ASCII compatible format, by converting them to an ASCII compatible *Content-Transfer_Encoding*. Using the terminology of the email RFCs, you can think of this as *Generator* serializing to an I/O stream that is not "8 bit clean". In other words, most applications will want to be using *BytesGenerator*, and not *Generator*.

class email.generator.Generator(*outfp*, *mangle_from_=None*, *maxheaderlen=None*, ***, *policy=None*)

Return a *Generator* object that will write any message provided to the *flatten()* method, or any

text provided to the *write()* method, to the *file-like object* *outfp*. *outfp* must support a `write` method that accepts string data.

If optional *mangle_from_* is `True`, put a `>` character in front of any line in the body that starts with the exact string `"From "`, that is `From` followed by a space at the beginning of a line. *mangle_from_* defaults to the value of the *mangle_from_* setting of the *policy* (which is `True` for the *compat32* policy and `False` for all others). *mangle_from_* is intended for use when messages are stored in unix mbox format (see *mailbox* and WHY THE CONTENT-LENGTH FORMAT IS BAD).

If *maxheaderlen* is not `None`, refold any header lines that are longer than *maxheaderlen*, or if `0`, do not rewrap any headers. If *manheaderlen* is `None` (the default), wrap headers and other message lines according to the *policy* settings.

If *policy* is specified, use that policy to control message generation. If *policy* is `None` (the default), use the policy associated with the *Message* or *EmailMessage* object passed to `flatten` to control the message generation. See *email.policy* for details on what *policy* controls.

Changed in version 3.3: Added the *policy* keyword.

Changed in version 3.6: The default behavior of the *mangle_from_* and *maxheaderlen* parameters is to follow the policy.

`flatten`(*msg*, *unixfrom=False*, *linesep=None*)
: Print the textual representation of the message object structure rooted at *msg* to the output file specified when the *Generator* instance was created.

  If the *policy* option *cte_type* is `8bit`, generate the message as if the option were set to `7bit`. (This is required because strings cannot represent non-ASCII bytes.) Convert any bytes with the high bit set as needed using an ASCII-compatible *Content-Transfer-Encoding*. That is, transform parts with non-ASCII *Cotnent-Transfer-Encoding* (*Content-Transfer-Encoding: 8bit*) to an ASCII compatible *Content-Transfer-Encoding*, and encode RFC-invalid non-ASCII bytes in headers using the MIME `unknown-8bit` character set, thus rendering them RFC-compliant.

  If *unixfrom* is `True`, print the envelope header delimiter used by the Unix mailbox format (see *mailbox*) before the first of the **RFC 5322** headers of the root message object. If the root object has no envelope header, craft a standard one. The default is `False`. Note that for subparts, no envelope header is ever printed.

  If *linesep* is not `None`, use it as the separator character between all the lines of the flattened message. If *linesep* is `None` (the default), use the value specified in the *policy*.

  Changed in version 3.2: Added support for re-encoding `8bit` message bodies, and the *linesep* argument.

`clone`(*fp*)
: Return an independent clone of this *Generator* instance with the exact same options, and *fp* as the new *outfp*.

`write`(*s*)
: Write *s* to the *write* method of the *outfp* passed to the *Generator*'s constructor. This provides just enough file-like API for *Generator* instances to be used in the *print()* function.

As a convenience, *EmailMessage* provides the methods *as_string()* and `str(aMessage)` (a.k.a. *__str__()*), which simplify the generation of a formatted string representation of a message object. For more detail, see *email.message*.

The *email.generator* module also provides a derived class, *DecodedGenerator*, which is like the *Generator* base class, except that non-*text* parts are not serialized, but are instead represented in the output stream by a string derived from a template filled in with information about the part.

class email.generator.DecodedGenerator(*outfp*, *mangle_from_=None*, *maxheaderlen=None*, *fmt=None*, ***, *policy=None*)

Act like *Generator*, except that for any subpart of the message passed to *Generator.flatten()*, if the subpart is of main type *text*, print the decoded payload of the subpart, and if the main type is not *text*, instead of printing it fill in the string *fmt* using information from the part and print the resulting filled-in string.

To fill in *fmt*, execute `fmt % part_info`, where `part_info` is a dictionary composed of the following keys and values:

- `type` – Full MIME type of the non-*text* part
- `maintype` – Main MIME type of the non-*text* part
- `subtype` – Sub-MIME type of the non-*text* part
- `filename` – Filename of the non-*text* part
- `description` – Description associated with the non-*text* part
- `encoding` – Content transfer encoding of the non-*text* part

If *fmt* is `None`, use the following default *fmt*:

"[Non-text (%(type)s) part of message omitted, filename %(filename)s]"

Optional *_mangle_from_* and *maxheaderlen* are as with the *Generator* base class.

20.1.4 email.policy: Policy Objects

New in version 3.3.

Source code: Lib/email/policy.py

The *email* package's prime focus is the handling of email messages as described by the various email and MIME RFCs. However, the general format of email messages (a block of header fields each consisting of a name followed by a colon followed by a value, the whole block followed by a blank line and an arbitrary 'body'), is a format that has found utility outside of the realm of email. Some of these uses conform fairly closely to the main email RFCs, some do not. Even when working with email, there are times when it is desirable to break strict compliance with the RFCs, such as generating emails that interoperate with email servers that do not themselves follow the standards, or that implement extensions you want to use in ways that violate the standards.

Policy objects give the email package the flexibility to handle all these disparate use cases.

A *Policy* object encapsulates a set of attributes and methods that control the behavior of various components of the email package during use. *Policy* instances can be passed to various classes and methods in the email package to alter the default behavior. The settable values and their defaults are described below.

There is a default policy used by all classes in the email package. For all of the *parser* classes and the related convenience functions, and for the *Message* class, this is the *Compat32* policy, via its corresponding pre-defined instance *compat32*. This policy provides for complete backward compatibility (in some cases, including bug compatibility) with the pre-Python3.3 version of the email package.

This default value for the *policy* keyword to *EmailMessage* is the *EmailPolicy* policy, via its pre-defined instance *default*.

When a *Message* or *EmailMessage* object is created, it acquires a policy. If the message is created by a *parser*, a policy passed to the parser will be the policy used by the message it creates. If the message is created by the program, then the policy can be specified when it is created. When a message is passed to a *generator*, the generator uses the policy from the message by default, but you can also pass a specific policy to the generator that will override the one stored on the message object.

The default value for the *policy* keyword for the *email.parser* classes and the parser convenience functions **will be changing** in a future version of Python. Therefore you should **always specify explicitly which policy you want to use** when calling any of the classes and functions described in the *parser* module.

The first part of this documentation covers the features of *Policy*, an *abstract base class* that defines the features that are common to all policy objects, including *compat32*. This includes certain hook methods that are called internally by the email package, which a custom policy could override to obtain different behavior. The second part describes the concrete classes *EmailPolicy* and *Compat32*, which implement the hooks that provide the standard behavior and the backward compatible behavior and features, respectively.

Policy instances are immutable, but they can be cloned, accepting the same keyword arguments as the class constructor and returning a new *Policy* instance that is a copy of the original but with the specified attributes values changed.

As an example, the following code could be used to read an email message from a file on disk and pass it to the system `sendmail` program on a Unix system:

```
>>> from email import message_from_binary_file
>>> from email.generator import BytesGenerator
>>> from email import policy
>>> from subprocess import Popen, PIPE
>>> with open('mymsg.txt', 'rb') as f:
...     msg = message_from_binary_file(f, policy=policy.default)
>>> p = Popen(['sendmail', msg['To'].addresses[0]], stdin=PIPE)
>>> g = BytesGenerator(p.stdin, policy=msg.policy.clone(linesep='\r\n'))
>>> g.flatten(msg)
>>> p.stdin.close()
>>> rc = p.wait()
```

Here we are telling *BytesGenerator* to use the RFC correct line separator characters when creating the binary string to feed into `sendmail's stdin`, where the default policy would use `\n` line separators.

Some email package methods accept a *policy* keyword argument, allowing the policy to be overridden for that method. For example, the following code uses the *as_bytes()* method of the *msg* object from the previous example and writes the message to a file using the native line separators for the platform on which it is running:

```
>>> import os
>>> with open('converted.txt', 'wb') as f:
...     f.write(msg.as_bytes(policy=msg.policy.clone(linesep=os.linesep)))
17
```

Policy objects can also be combined using the addition operator, producing a policy object whose settings are a combination of the non-default values of the summed objects:

```
>>> compat_SMTP = policy.compat32.clone(linesep='\r\n')
>>> compat_strict = policy.compat32.clone(raise_on_defect=True)
>>> compat_strict_SMTP = compat_SMTP + compat_strict
```

This operation is not commutative; that is, the order in which the objects are added matters. To illustrate:

```
>>> policy100 = policy.compat32.clone(max_line_length=100)
>>> policy80 = policy.compat32.clone(max_line_length=80)
>>> apolicy = policy100 + policy80
>>> apolicy.max_line_length
80
```

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```
>>> apolicy = policy80 + policy100
>>> apolicy.max_line_length
100
```

class email.policy.Policy(***kw*)

This is the *abstract base class* for all policy classes. It provides default implementations for a couple of trivial methods, as well as the implementation of the immutability property, the *clone()* method, and the constructor semantics.

The constructor of a policy class can be passed various keyword arguments. The arguments that may be specified are any non-method properties on this class, plus any additional non-method properties on the concrete class. A value specified in the constructor will override the default value for the corresponding attribute.

This class defines the following properties, and thus values for the following may be passed in the constructor of any policy class:

max_line_length
The maximum length of any line in the serialized output, not counting the end of line character(s). Default is 78, per **RFC 5322**. A value of `0` or *None* indicates that no line wrapping should be done at all.

linesep
The string to be used to terminate lines in serialized output. The default is `\n` because that's the internal end-of-line discipline used by Python, though `\r\n` is required by the RFCs.

cte_type
Controls the type of Content Transfer Encodings that may be or are required to be used. The possible values are:

`7bit`	all data must be "7 bit clean" (ASCII-only). This means that where necessary data will be encoded using either quoted-printable or base64 encoding.
`8bit`	data is not constrained to be 7 bit clean. Data in headers is still required to be ASCII-only and so will be encoded (see *fold_binary()* and *utf8* below for exceptions), but body parts may use the `8bit` CTE.

A `cte_type` value of `8bit` only works with `BytesGenerator`, not `Generator`, because strings cannot contain binary data. If a `Generator` is operating under a policy that specifies `cte_type=8bit`, it will act as if `cte_type` is `7bit`.

raise_on_defect
If *True*, any defects encountered will be raised as errors. If *False* (the default), defects will be passed to the *register_defect()* method.

mangle_from_
If *True*, lines starting with *"From "* in the body are escaped by putting a `>` in front of them. This parameter is used when the message is being serialized by a generator. Default: *False*.

New in version 3.5: The *mangle_from_* parameter.

message_factory
A factory function for constructing a new empty message object. Used by the parser when building messages. Defaults to `None`, in which case *Message* is used.

New in version 3.6.

The following *Policy* method is intended to be called by code using the email library to create policy instances with custom settings:

`clone`(***kw*)
Return a new *Policy* instance whose attributes have the same values as the current instance, except where those attributes are given new values by the keyword arguments.

The remaining *Policy* methods are called by the email package code, and are not intended to be called by an application using the email package. A custom policy must implement all of these methods.

`handle_defect`(*obj*, *defect*)
Handle a *defect* found on *obj*. When the email package calls this method, *defect* will always be a subclass of `Defect`.

The default implementation checks the *raise_on_defect* flag. If it is `True`, *defect* is raised as an exception. If it is `False` (the default), *obj* and *defect* are passed to *register_defect()*.

`register_defect`(*obj*, *defect*)
Register a *defect* on *obj*. In the email package, *defect* will always be a subclass of `Defect`.

The default implementation calls the `append` method of the `defects` attribute of *obj*. When the email package calls *handle_defect*, *obj* will normally have a `defects` attribute that has an `append` method. Custom object types used with the email package (for example, custom `Message` objects) should also provide such an attribute, otherwise defects in parsed messages will raise unexpected errors.

`header_max_count`(*name*)
Return the maximum allowed number of headers named *name*.

Called when a header is added to an *EmailMessage* or *Message* object. If the returned value is not `0` or `None`, and there are already a number of headers with the name *name* greater than or equal to the value returned, a *ValueError* is raised.

Because the default behavior of `Message.__setitem__` is to append the value to the list of headers, it is easy to create duplicate headers without realizing it. This method allows certain headers to be limited in the number of instances of that header that may be added to a `Message` programmatically. (The limit is not observed by the parser, which will faithfully produce as many headers as exist in the message being parsed.)

The default implementation returns `None` for all header names.

`header_source_parse`(*sourcelines*)
The email package calls this method with a list of strings, each string ending with the line separation characters found in the source being parsed. The first line includes the field header name and separator. All whitespace in the source is preserved. The method should return the `(name, value)` tuple that is to be stored in the `Message` to represent the parsed header.

If an implementation wishes to retain compatibility with the existing email package policies, *name* should be the case preserved name (all characters up to the '`:`' separator), while *value* should be the unfolded value (all line separator characters removed, but whitespace kept intact), stripped of leading whitespace.

sourcelines may contain surrogateescaped binary data.

There is no default implementation

`header_store_parse`(*name*, *value*)
The email package calls this method with the name and value provided by the application program when the application program is modifying a `Message` programmatically (as opposed to a `Message` created by a parser). The method should return the `(name, value)` tuple that is to be stored in the `Message` to represent the header.

If an implementation wishes to retain compatibility with the existing email package policies, the *name* and *value* should be strings or string subclasses that do not change the content of the passed in arguments.

There is no default implementation

header_fetch_parse(*name*, *value*)
The email package calls this method with the *name* and *value* currently stored in the `Message` when that header is requested by the application program, and whatever the method returns is what is passed back to the application as the value of the header being retrieved. Note that there may be more than one header with the same name stored in the `Message`; the method is passed the specific name and value of the header destined to be returned to the application.

value may contain surrogateescaped binary data. There should be no surrogateescaped binary data in the value returned by the method.

There is no default implementation

fold(*name*, *value*)
The email package calls this method with the *name* and *value* currently stored in the `Message` for a given header. The method should return a string that represents that header "folded" correctly (according to the policy settings) by composing the *name* with the *value* and inserting *linesep* characters at the appropriate places. See **RFC 5322** for a discussion of the rules for folding email headers.

value may contain surrogateescaped binary data. There should be no surrogateescaped binary data in the string returned by the method.

fold_binary(*name*, *value*)
The same as *fold()*, except that the returned value should be a bytes object rather than a string.

value may contain surrogateescaped binary data. These could be converted back into binary data in the returned bytes object.

class email.policy.EmailPolicy(***kw*)
This concrete *Policy* provides behavior that is intended to be fully compliant with the current email RFCs. These include (but are not limited to) **RFC 5322**, **RFC 2047**, and the current MIME RFCs.

This policy adds new header parsing and folding algorithms. Instead of simple strings, headers are `str` subclasses with attributes that depend on the type of the field. The parsing and folding algorithm fully implement **RFC 2047** and **RFC 5322**.

The default value for the *message_factory* attribute is *EmailMessage*.

In addition to the settable attributes listed above that apply to all policies, this policy adds the following additional attributes:

New in version 3.6:[1]

utf8
If `False`, follow **RFC 5322**, supporting non-ASCII characters in headers by encoding them as "encoded words". If `True`, follow **RFC 6532** and use `utf-8` encoding for headers. Messages formatted in this way may be passed to SMTP servers that support the `SMTPUTF8` extension (**RFC 6531**).

refold_source
If the value for a header in the `Message` object originated from a *parser* (as opposed to being set by a program), this attribute indicates whether or not a generator should refold that value when transforming the message back into serialized form. The possible values are:

`none`	all source values use original folding
`long`	source values that have any line that is longer than `max_line_length` will be refolded
`all`	all values are refolded.

[1] Originally added in 3.3 as a *provisional feature*.

The default is `long`.

header_factory
A callable that takes two arguments, `name` and `value`, where `name` is a header field name and `value` is an unfolded header field value, and returns a string subclass that represents that header. A default `header_factory` (see *headerregistry*) is provided that supports custom parsing for the various address and date **RFC 5322** header field types, and the major MIME header field stypes. Support for additional custom parsing will be added in the future.

content_manager
An object with at least two methods: get_content and set_content. When the *get_content()* or *set_content()* method of an *EmailMessage* object is called, it calls the corresponding method of this object, passing it the message object as its first argument, and any arguments or keywords that were passed to it as additional arguments. By default `content_manager` is set to *raw_data_manager*.

New in version 3.4.

The class provides the following concrete implementations of the abstract methods of *Policy*:

header_max_count(*name*)
Returns the value of the *max_count* attribute of the specialized class used to represent the header with the given name.

header_source_parse(*sourcelines*)
The name is parsed as everything up to the ':' and returned unmodified. The value is determined by stripping leading whitespace off the remainder of the first line, joining all subsequent lines together, and stripping any trailing carriage return or linefeed characters.

header_store_parse(*name*, *value*)
The name is returned unchanged. If the input value has a `name` attribute and it matches *name* ignoring case, the value is returned unchanged. Otherwise the *name* and *value* are passed to `header_factory`, and the resulting header object is returned as the value. In this case a `ValueError` is raised if the input value contains CR or LF characters.

header_fetch_parse(*name*, *value*)
If the value has a `name` attribute, it is returned to unmodified. Otherwise the *name*, and the *value* with any CR or LF characters removed, are passed to the `header_factory`, and the resulting header object is returned. Any surrogateescaped bytes get turned into the unicode unknown-character glyph.

fold(*name*, *value*)
Header folding is controlled by the *refold_source* policy setting. A value is considered to be a 'source value' if and only if it does not have a `name` attribute (having a `name` attribute means it is a header object of some sort). If a source value needs to be refolded according to the policy, it is converted into a header object by passing the *name* and the *value* with any CR and LF characters removed to the `header_factory`. Folding of a header object is done by calling its `fold` method with the current policy.

Source values are split into lines using *splitlines()*. If the value is not to be refolded, the lines are rejoined using the `linesep` from the policy and returned. The exception is lines containing non-ascii binary data. In that case the value is refolded regardless of the `refold_source` setting, which causes the binary data to be CTE encoded using the `unknown-8bit` charset.

fold_binary(*name*, *value*)
The same as *fold()* if *cte_type* is `7bit`, except that the returned value is bytes.

If *cte_type* is `8bit`, non-ASCII binary data is converted back into bytes. Headers with binary data are not refolded, regardless of the `refold_header` setting, since there is no way to know whether the binary data consists of single byte characters or multibyte characters.

The following instances of *EmailPolicy* provide defaults suitable for specific application domains. Note that in the future the behavior of these instances (in particular the HTTP instance) may be adjusted to conform even more closely to the RFCs relevant to their domains.

email.policy.default
An instance of EmailPolicy with all defaults unchanged. This policy uses the standard Python \n line endings rather than the RFC-correct \r\n.

email.policy.SMTP
Suitable for serializing messages in conformance with the email RFCs. Like default, but with linesep set to \r\n, which is RFC compliant.

email.policy.SMTPUTF8
The same as SMTP except that *utf8* is True. Useful for serializing messages to a message store without using encoded words in the headers. Should only be used for SMTP transmission if the sender or recipient addresses have non-ASCII characters (the *smtplib.SMTP.send_message()* method handles this automatically).

email.policy.HTTP
Suitable for serializing headers with for use in HTTP traffic. Like SMTP except that max_line_length is set to None (unlimited).

email.policy.strict
Convenience instance. The same as default except that raise_on_defect is set to True. This allows any policy to be made strict by writing:

```
somepolicy + policy.strict
```

With all of these *EmailPolicies*, the effective API of the email package is changed from the Python 3.2 API in the following ways:

- Setting a header on a *Message* results in that header being parsed and a header object created.
- Fetching a header value from a *Message* results in that header being parsed and a header object created and returned.
- Any header object, or any header that is refolded due to the policy settings, is folded using an algorithm that fully implements the RFC folding algorithms, including knowing where encoded words are required and allowed.

From the application view, this means that any header obtained through the *EmailMessage* is a header object with extra attributes, whose string value is the fully decoded unicode value of the header. Likewise, a header may be assigned a new value, or a new header created, using a unicode string, and the policy will take care of converting the unicode string into the correct RFC encoded form.

The header objects and their attributes are described in *headerregistry*.

class email.policy.Compat32(***kw*)
This concrete *Policy* is the backward compatibility policy. It replicates the behavior of the email package in Python 3.2. The *policy* module also defines an instance of this class, *compat32*, that is used as the default policy. Thus the default behavior of the email package is to maintain compatibility with Python 3.2.

The following attributes have values that are different from the *Policy* default:

mangle_from_
The default is True.

The class provides the following concrete implementations of the abstract methods of *Policy*:

header_source_parse(*sourcelines*)
The name is parsed as everything up to the ':' and returned unmodified. The value is determined

by stripping leading whitespace off the remainder of the first line, joining all subsequent lines together, and stripping any trailing carriage return or linefeed characters.

header_store_parse(*name*, *value*)
The name and value are returned unmodified.

header_fetch_parse(*name*, *value*)
If the value contains binary data, it is converted into a *Header* object using the `unknown-8bit` charset. Otherwise it is returned unmodified.

fold(*name*, *value*)
Headers are folded using the *Header* folding algorithm, which preserves existing line breaks in the value, and wraps each resulting line to the `max_line_length`. Non-ASCII binary data are CTE encoded using the `unknown-8bit` charset.

fold_binary(*name*, *value*)
Headers are folded using the *Header* folding algorithm, which preserves existing line breaks in the value, and wraps each resulting line to the `max_line_length`. If `cte_type` is `7bit`, non-ascii binary data is CTE encoded using the `unknown-8bit` charset. Otherwise the original source header is used, with its existing line breaks and any (RFC invalid) binary data it may contain.

`email.policy.compat32`
An instance of *Compat32*, providing backward compatibility with the behavior of the email package in Python 3.2.

20.1.5 `email.errors`: Exception and Defect classes

Source code: Lib/email/errors.py

The following exception classes are defined in the *email.errors* module:

exception email.errors.MessageError
This is the base class for all exceptions that the *email* package can raise. It is derived from the standard *Exception* class and defines no additional methods.

exception email.errors.MessageParseError
This is the base class for exceptions raised by the *Parser* class. It is derived from *MessageError*. This class is also used internally by the parser used by *headerregistry*.

exception email.errors.HeaderParseError
Raised under some error conditions when parsing the **RFC 5322** headers of a message, this class is derived from *MessageParseError*. The *set_boundary()* method will raise this error if the content type is unknown when the method is called. *Header* may raise this error for certain base64 decoding errors, and when an attempt is made to create a header that appears to contain an embedded header (that is, there is what is supposed to be a continuation line that has no leading whitespace and looks like a header).

exception email.errors.BoundaryError
Deprecated and no longer used.

exception email.errors.MultipartConversionError
Raised when a payload is added to a *Message* object using `add_payload()`, but the payload is already a scalar and the message's *Content-Type* main type is not either *multipart* or missing. *MultipartConversionError* multiply inherits from *MessageError* and the built-in *TypeError*.

Since `Message.add_payload()` is deprecated, this exception is rarely raised in practice. However the exception may also be raised if the *attach()* method is called on an instance of a class derived from *MIMENonMultipart* (e.g. *MIMEImage*).

Here is the list of the defects that the *FeedParser* can find while parsing messages. Note that the defects are added to the message where the problem was found, so for example, if a message nested inside a *multipart/alternative* had a malformed header, that nested message object would have a defect, but the containing messages would not.

All defect classes are subclassed from `email.errors.MessageDefect`.

- `NoBoundaryInMultipartDefect` – A message claimed to be a multipart, but had no *boundary* parameter.
- `StartBoundaryNotFoundDefect` – The start boundary claimed in the *Content-Type* header was never found.
- `CloseBoundaryNotFoundDefect` – A start boundary was found, but no corresponding close boundary was ever found.

  New in version 3.3.
- `FirstHeaderLineIsContinuationDefect` – The message had a continuation line as its first header line.
- `MisplacedEnvelopeHeaderDefect` - A "Unix From" header was found in the middle of a header block.
- `MissingHeaderBodySeparatorDefect` - A line was found while parsing headers that had no leading white space but contained no ':'. Parsing continues assuming that the line represents the first line of the body.

  New in version 3.3.
- `MalformedHeaderDefect` – A header was found that was missing a colon, or was otherwise malformed.

  Deprecated since version 3.3: This defect has not been used for several Python versions.
- `MultipartInvariantViolationDefect` – A message claimed to be a *multipart*, but no subparts were found. Note that when a message has this defect, its *is_multipart()* method may return false even though its content type claims to be *multipart*.
- `InvalidBase64PaddingDefect` – When decoding a block of base64 encoded bytes, the padding was not correct. Enough padding is added to perform the decode, but the resulting decoded bytes may be invalid.
- `InvalidBase64CharactersDefect` – When decoding a block of base64 encoded bytes, characters outside the base64 alphabet were encountered. The characters are ignored, but the resulting decoded bytes may be invalid.
- `InvalidBase64LengthDefect` – When decoding a block of base64 encoded bytes, the number of non-padding base64 characters was invalid (1 more than a multiple of 4). The encoded block was kept as-is.

20.1.6 `email.headerregistry`: Custom Header Objects

Source code: Lib/email/headerregistry.py

New in version 3.6:[1]

Headers are represented by customized subclasses of *str*. The particular class used to represent a given header is determined by the *header_factory* of the *policy* in effect when the headers are created. This section documents the particular `header_factory` implemented by the email package for handling **RFC 5322** compliant email messages, which not only provides customized header objects for various header types, but also provides an extension mechanism for applications to add their own custom header types.

[1] Originally added in 3.3 as a *provisional module*

When using any of the policy objects derived from *EmailPolicy*, all headers are produced by *HeaderRegistry* and have *BaseHeader* as their last base class. Each header class has an additional base class that is determined by the type of the header. For example, many headers have the class *UnstructuredHeader* as their other base class. The specialized second class for a header is determined by the name of the header, using a lookup table stored in the *HeaderRegistry*. All of this is managed transparently for the typical application program, but interfaces are provided for modifying the default behavior for use by more complex applications.

The sections below first document the header base classes and their attributes, followed by the API for modifying the behavior of *HeaderRegistry*, and finally the support classes used to represent the data parsed from structured headers.

class email.headerregistry.**BaseHeader**(*name*, *value*)

name and *value* are passed to BaseHeader from the *header_factory* call. The string value of any header object is the *value* fully decoded to unicode.

This base class defines the following read-only properties:

name

The name of the header (the portion of the field before the ':'). This is exactly the value passed in the *header_factory* call for *name*; that is, case is preserved.

defects

A tuple of HeaderDefect instances reporting any RFC compliance problems found during parsing. The email package tries to be complete about detecting compliance issues. See the *errors* module for a discussion of the types of defects that may be reported.

max_count

The maximum number of headers of this type that can have the same name. A value of None means unlimited. The BaseHeader value for this attribute is None; it is expected that specialized header classes will override this value as needed.

BaseHeader also provides the following method, which is called by the email library code and should not in general be called by application programs:

fold(**, *policy*)

Return a string containing *linesep* characters as required to correctly fold the header according to *policy*. A *cte_type* of 8bit will be treated as if it were 7bit, since headers may not contain arbitrary binary data. If *utf8* is False, non-ASCII data will be **RFC 2047** encoded.

BaseHeader by itself cannot be used to create a header object. It defines a protocol that each specialized header cooperates with in order to produce the header object. Specifically, BaseHeader requires that the specialized class provide a *classmethod()* named parse. This method is called as follows:

```
parse(string, kwds)
```

kwds is a dictionary containing one pre-initialized key, defects. defects is an empty list. The parse method should append any detected defects to this list. On return, the kwds dictionary *must* contain values for at least the keys decoded and defects. decoded should be the string value for the header (that is, the header value fully decoded to unicode). The parse method should assume that *string* may contain content-transfer-encoded parts, but should correctly handle all valid unicode characters as well so that it can parse un-encoded header values.

BaseHeader's __new__ then creates the header instance, and calls its init method. The specialized class only needs to provide an init method if it wishes to set additional attributes beyond those provided by BaseHeader itself. Such an init method should look like this:

```
def init(self, *args, **kw):
    self._myattr = kw.pop('myattr')
    super().init(*args, **kw)
```

That is, anything extra that the specialized class puts in to the `kwds` dictionary should be removed and handled, and the remaining contents of `kw` (and `args`) passed to the `BaseHeader` `init` method.

`class email.headerregistry.UnstructuredHeader`

An "unstructured" header is the default type of header in **RFC 5322**. Any header that does not have a specified syntax is treated as unstructured. The classic example of an unstructured header is the *Subject* header.

In **RFC 5322**, an unstructured header is a run of arbitrary text in the ASCII character set. **RFC 2047**, however, has an **RFC 5322** compatible mechanism for encoding non-ASCII text as ASCII characters within a header value. When a *value* containing encoded words is passed to the constructor, the `UnstructuredHeader` parser converts such encoded words into unicode, following the **RFC 2047** rules for unstructured text. The parser uses heuristics to attempt to decode certain non-compliant encoded words. Defects are registered in such cases, as well as defects for issues such as invalid characters within the encoded words or the non-encoded text.

This header type provides no additional attributes.

`class email.headerregistry.DateHeader`

RFC 5322 specifies a very specific format for dates within email headers. The `DateHeader` parser recognizes that date format, as well as recognizing a number of variant forms that are sometimes found "in the wild".

This header type provides the following additional attributes:

datetime

If the header value can be recognized as a valid date of one form or another, this attribute will contain a *datetime* instance representing that date. If the timezone of the input date is specified as `-0000` (indicating it is in UTC but contains no information about the source timezone), then *datetime* will be a naive *datetime*. If a specific timezone offset is found (including *+0000*), then *datetime* will contain an aware `datetime` that uses *datetime.timezone* to record the timezone offset.

The `decoded` value of the header is determined by formatting the `datetime` according to the **RFC 5322** rules; that is, it is set to:

```
email.utils.format_datetime(self.datetime)
```

When creating a `DateHeader`, *value* may be *datetime* instance. This means, for example, that the following code is valid and does what one would expect:

```
msg['Date'] = datetime(2011, 7, 15, 21)
```

Because this is a naive `datetime` it will be interpreted as a UTC timestamp, and the resulting value will have a timezone of `-0000`. Much more useful is to use the *localtime()* function from the *utils* module:

```
msg['Date'] = utils.localtime()
```

This example sets the date header to the current time and date using the current timezone offset.

`class email.headerregistry.AddressHeader`

Address headers are one of the most complex structured header types. The `AddressHeader` class provides a generic interface to any address header.

This header type provides the following additional attributes:

groups

A tuple of *Group* objects encoding the addresses and groups found in the header value. Addresses that are not part of a group are represented in this list as single-address `Groups` whose *display_name* is `None`.

addresses
A tuple of *Address* objects encoding all of the individual addresses from the header value. If the header value contains any groups, the individual addresses from the group are included in the list at the point where the group occurs in the value (that is, the list of addresses is "flattened" into a one dimensional list).

The `decoded` value of the header will have all encoded words decoded to unicode. *idna* encoded domain names are also decoded to unicode. The `decoded` value is set by *join*ing the *str* value of the elements of the `groups` attribute with `', '`.

A list of *Address* and *Group* objects in any combination may be used to set the value of an address header. `Group` objects whose `display_name` is `None` will be interpreted as single addresses, which allows an address list to be copied with groups intact by using the list obtained from the `groups` attribute of the source header.

class email.headerregistry.SingleAddressHeader
A subclass of *AddressHeader* that adds one additional attribute:

address
The single address encoded by the header value. If the header value actually contains more than one address (which would be a violation of the RFC under the default *policy*), accessing this attribute will result in a *ValueError*.

Many of the above classes also have a `Unique` variant (for example, `UniqueUnstructuredHeader`). The only difference is that in the `Unique` variant, *max_count* is set to 1.

class email.headerregistry.MIMEVersionHeader
There is really only one valid value for the *MIME-Version* header, and that is `1.0`. For future proofing, this header class supports other valid version numbers. If a version number has a valid value per **RFC 2045**, then the header object will have non-`None` values for the following attributes:

version
The version number as a string, with any whitespace and/or comments removed.

major
The major version number as an integer

minor
The minor version number as an integer

class email.headerregistry.ParameterizedMIMEHeader
MIME headers all start with the prefix 'Content-'. Each specific header has a certain value, described under the class for that header. Some can also take a list of supplemental parameters, which have a common format. This class serves as a base for all the MIME headers that take parameters.

params
A dictionary mapping parameter names to parameter values.

class email.headerregistry.ContentTypeHeader
A *ParameterizedMIMEHeader* class that handles the *Content-Type* header.

content_type
The content type string, in the form `maintype/subtype`.

maintype

subtype

class email.headerregistry.ContentDispositionHeader
A *ParameterizedMIMEHeader* class that handles the *Content-Disposition* header.

content-disposition
`inline` and `attachment` are the only valid values in common use.

class email.headerregistry.ContentTransferEncoding

Handles the *Content-Transfer-Encoding* header.

cte

Valid values are `7bit`, `8bit`, `base64`, and `quoted-printable`. See **RFC 2045** for more information.

class email.headerregistry.HeaderRegistry(*base_class=BaseHeader*, *default_class=UnstructuredHeader*, *use_default_map=True*)

This is the factory used by *EmailPolicy* by default. `HeaderRegistry` builds the class used to create a header instance dynamically, using *base_class* and a specialized class retrieved from a registry that it holds. When a given header name does not appear in the registry, the class specified by *default_class* is used as the specialized class. When *use_default_map* is `True` (the default), the standard mapping of header names to classes is copied in to the registry during initialization. *base_class* is always the last class in the generated class's `__bases__` list.

The default mappings are:

subject UniqueUnstructuredHeader

date UniqueDateHeader

resent-date DateHeader

orig-date UniqueDateHeader

sender UniqueSingleAddressHeader

resent-sender SingleAddressHeader

to UniqueAddressHeader

resent-to AddressHeader

cc UniqueAddressHeader

resent-cc AddressHeader

from UniqueAddressHeader

resent-from AddressHeader

reply-to UniqueAddressHeader

`HeaderRegistry` has the following methods:

map_to_type(*self*, *name*, *cls*)

name is the name of the header to be mapped. It will be converted to lower case in the registry. *cls* is the specialized class to be used, along with *base_class*, to create the class used to instantiate headers that match *name*.

__getitem__(*name*)

Construct and return a class to handle creating a *name* header.

__call__(*name*, *value*)

Retrieves the specialized header associated with *name* from the registry (using *default_class* if *name* does not appear in the registry) and composes it with *base_class* to produce a class, calls the constructed class's constructor, passing it the same argument list, and finally returns the class instance created thereby.

The following classes are the classes used to represent data parsed from structured headers and can, in general, be used by an application program to construct structured values to assign to specific headers.

class email.headerregistry.Address(*display_name=''*, *username=''*, *domain=''*, *addr_spec=None*)

The class used to represent an email address. The general form of an address is:

```
[display_name] <username@domain>
```

or:

```
username@domain
```

where each part must conform to specific syntax rules spelled out in **RFC 5322**.

As a convenience *addr_spec* can be specified instead of *username* and *domain*, in which case *username* and *domain* will be parsed from the *addr_spec*. An *addr_spec* must be a properly RFC quoted string; if it is not `Address` will raise an error. Unicode characters are allowed and will be property encoded when serialized. However, per the RFCs, unicode is *not* allowed in the username portion of the address.

display_name
: The display name portion of the address, if any, with all quoting removed. If the address does not have a display name, this attribute will be an empty string.

username
: The `username` portion of the address, with all quoting removed.

domain
: The `domain` portion of the address.

addr_spec
: The `username@domain` portion of the address, correctly quoted for use as a bare address (the second form shown above). This attribute is not mutable.

__str__()
: The `str` value of the object is the address quoted according to **RFC 5322** rules, but with no Content Transfer Encoding of any non-ASCII characters.

To support SMTP (**RFC 5321**), `Address` handles one special case: if `username` and `domain` are both the empty string (or `None`), then the string value of the `Address` is `<>`.

class email.headerregistry.Group(*display_name=None*, *addresses=None*)
: The class used to represent an address group. The general form of an address group is:

```
display_name: [address-list];
```

As a convenience for processing lists of addresses that consist of a mixture of groups and single addresses, a `Group` may also be used to represent single addresses that are not part of a group by setting *display_name* to `None` and providing a list of the single address as *addresses*.

display_name
: The `display_name` of the group. If it is `None` and there is exactly one `Address` in `addresses`, then the `Group` represents a single address that is not in a group.

addresses
: A possibly empty tuple of *`Address`* objects representing the addresses in the group.

__str__()
: The `str` value of a `Group` is formatted according to **RFC 5322**, but with no Content Transfer Encoding of any non-ASCII characters. If `display_name` is none and there is a single `Address` in the `addresses` list, the `str` value will be the same as the `str` of that single `Address`.

20.1.7 email.contentmanager: Managing MIME Content

Source code: Lib/email/contentmanager.py

New in version 3.6:[1]

class email.contentmanager.ContentManager

Base class for content managers. Provides the standard registry mechanisms to register converters between MIME content and other representations, as well as the `get_content` and `set_content` dispatch methods.

get_content(*msg*, **args*, ***kw*)

Look up a handler function based on the `mimetype` of *msg* (see next paragraph), call it, passing through all arguments, and return the result of the call. The expectation is that the handler will extract the payload from *msg* and return an object that encodes information about the extracted data.

To find the handler, look for the following keys in the registry, stopping with the first one found:

- the string representing the full MIME type (`maintype/subtype`)
- the string representing the `maintype`
- the empty string

If none of these keys produce a handler, raise a *KeyError* for the full MIME type.

set_content(*msg*, *obj*, **args*, ***kw*)

If the `maintype` is `multipart`, raise a *TypeError*; otherwise look up a handler function based on the type of *obj* (see next paragraph), call *clear_content()* on the *msg*, and call the handler function, passing through all arguments. The expectation is that the handler will transform and store *obj* into *msg*, possibly making other changes to *msg* as well, such as adding various MIME headers to encode information needed to interpret the stored data.

To find the handler, obtain the type of *obj* (`typ = type(obj)`), and look for the following keys in the registry, stopping with the first one found:

- the type itself (`typ`)
- the type's fully qualified name (`typ.__module__ + '.' + typ.__qualname__`).
- the type's qualname (`typ.__qualname__`)
- the type's name (`typ.__name__`).

If none of the above match, repeat all of the checks above for each of the types in the *MRO* (`typ.__mro__`). Finally, if no other key yields a handler, check for a handler for the key `None`. If there is no handler for `None`, raise a *KeyError* for the fully qualified name of the type.

Also add a *MIME-Version* header if one is not present (see also *MIMEPart*).

add_get_handler(*key*, *handler*)

Record the function *handler* as the handler for *key*. For the possible values of *key*, see *get_content()*.

add_set_handler(*typekey*, *handler*)

Record *handler* as the function to call when an object of a type matching *typekey* is passed to *set_content()*. For the possible values of *typekey*, see *set_content()*.

Content Manager Instances

Currently the email package provides only one concrete content manager, *raw_data_manager*, although more may be added in the future. *raw_data_manager* is the *content_manager* provided by *EmailPolicy* and its derivatives.

[1] Originally added in 3.4 as a *provisional module*

email.contentmanager.raw_data_manager

This content manager provides only a minimum interface beyond that provided by *Message* itself: it deals only with text, raw byte strings, and *Message* objects. Nevertheless, it provides significant advantages compared to the base API: `get_content` on a text part will return a unicode string without the application needing to manually decode it, `set_content` provides a rich set of options for controlling the headers added to a part and controlling the content transfer encoding, and it enables the use of the various `add_` methods, thereby simplifying the creation of multipart messages.

`email.contentmanager.get_content`(*msg*, *errors='replace'*)

Return the payload of the part as either a string (for `text` parts), an *EmailMessage* object (for `message/rfc822` parts), or a `bytes` object (for all other non-multipart types). Raise a *KeyError* if called on a `multipart`. If the part is a `text` part and *errors* is specified, use it as the error handler when decoding the payload to unicode. The default error handler is `replace`.

`email.contentmanager.set_content`(*msg*, *<'str'>*, *subtype="plain"*, *charset='utf-8'* *cte=None*, *disposition=None*, *filename=None*, *cid=None*, *params=None*, *headers=None*)
`email.contentmanager.set_content`(*msg*, *<'bytes'>*, *maintype*, *subtype*, *cte="base64"*, *disposition=None*, *filename=None*, *cid=None*, *params=None*, *headers=None*)
`email.contentmanager.set_content`(*msg*, *<'EmailMessage'>*, *cte=None*, *disposition=None*, *filename=None*, *cid=None*, *params=None*, *headers=None*)

Add headers and payload to *msg*:

Add a *Content-Type* header with a `maintype/subtype` value.

- For `str`, set the MIME `maintype` to `text`, and set the subtype to *subtype* if it is specified, or `plain` if it is not.
- For `bytes`, use the specified *maintype* and *subtype*, or raise a *TypeError* if they are not specified.
- For *EmailMessage* objects, set the maintype to `message`, and set the subtype to *subtype* if it is specified or `rfc822` if it is not. If *subtype* is `partial`, raise an error (`bytes` objects must be used to construct `message/partial` parts).

If *charset* is provided (which is valid only for `str`), encode the string to bytes using the specified character set. The default is `utf-8`. If the specified *charset* is a known alias for a standard MIME charset name, use the standard charset instead.

If *cte* is set, encode the payload using the specified content transfer encoding, and set the *Content-Transfer-Encoding* header to that value. Possible values for *cte* are `quoted-printable`, `base64`, `7bit`, `8bit`, and `binary`. If the input cannot be encoded in the specified encoding (for example, specifying a *cte* of `7bit` for an input that contains non-ASCII values), raise a *ValueError*.

- For `str` objects, if *cte* is not set use heuristics to determine the most compact encoding.
- For *EmailMessage*, per **RFC 2046**, raise an error if a *cte* of `quoted-printable` or `base64` is requested for *subtype* `rfc822`, and for any *cte* other than `7bit` for *subtype* `external-body`. For `message/rfc822`, use `8bit` if *cte* is not specified. For all other values of *subtype*, use `7bit`.

Note: A *cte* of `binary` does not actually work correctly yet. The `EmailMessage` object as modified by `set_content` is correct, but *BytesGenerator* does not serialize it correctly.

If *disposition* is set, use it as the value of the *Content-Disposition* header. If not specified, and *filename* is specified, add the header with the value `attachment`. If *disposition* is not specified

and *filename* is also not specified, do not add the header. The only valid values for *disposition* are `attachment` and `inline`.

If *filename* is specified, use it as the value of the `filename` parameter of the *Content-Disposition* header.

If *cid* is specified, add a *Content-ID* header with *cid* as its value.

If *params* is specified, iterate its `items` method and use the resulting `(key, value)` pairs to set additional parameters on the *Content-Type* header.

If *headers* is specified and is a list of strings of the form `headername: headervalue` or a list of `header` objects (distinguished from strings by having a `name` attribute), add the headers to *msg*.

20.1.8 email: Examples

Here are a few examples of how to use the *email* package to read, write, and send simple email messages, as well as more complex MIME messages.

First, let's see how to create and send a simple text message (both the text content and the addresses may contain unicode characters):

```
# Import smtplib for the actual sending function
import smtplib

# Import the email modules we'll need
from email.message import EmailMessage

# Open the plain text file whose name is in textfile for reading.
with open(textfile) as fp:
    # Create a text/plain message
    msg = EmailMessage()
    msg.set_content(fp.read())

# me == the sender's email address
# you == the recipient's email address
msg['Subject'] = 'The contents of %s' % textfile
msg['From'] = me
msg['To'] = you

# Send the message via our own SMTP server.
s = smtplib.SMTP('localhost')
s.send_message(msg)
s.quit()
```

Parsing **RFC 822** headers can easily be done by the using the classes from the *parser* module:

```
# Import the email modules we'll need
from email.parser import BytesParser, Parser
from email.policy import default

# If the e-mail headers are in a file, uncomment these two lines:
# with open(messagefile, 'rb') as fp:
#     headers = BytesParser(policy=default).parse(fp)

#  Or for parsing headers in a string (this is an uncommon operation), use:
```

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```
headers = Parser(policy=default).parsestr(
        'From: Foo Bar <user@example.com>\n'
        'To: <someone_else@example.com>\n'
        'Subject: Test message\n'
        '\n'
        'Body would go here\n')

#  Now the header items can be accessed as a dictionary:
print('To: {}'.format(headers['to']))
print('From: {}'.format(headers['from']))
print('Subject: {}'.format(headers['subject']))

# You can also access the parts of the addresses:
print('Recipient username: {}'.format(headers['to'].addresses[0].username))
print('Sender name: {}'.format(headers['from'].addresses[0].display_name))
```

Here's an example of how to send a MIME message containing a bunch of family pictures that may be residing in a directory:

```
# Import smtplib for the actual sending function
import smtplib

# And imghdr to find the types of our images
import imghdr

# Here are the email package modules we'll need
from email.message import EmailMessage

# Create the container email message.
msg = EmailMessage()
msg['Subject'] = 'Our family reunion'
# me == the sender's email address
# family = the list of all recipients' email addresses
msg['From'] = me
msg['To'] = ', '.join(family)
msg.preamble = 'Our family reunion'

# Open the files in binary mode.  Use imghdr to figure out the
# MIME subtype for each specific image.
for file in pngfiles:
    with open(file, 'rb') as fp:
        img_data = fp.read()
    msg.add_attachment(img_data, maintype='image',
                                 subtype=imghdr.what(None, img_data))

# Send the email via our own SMTP server.
with smtplib.SMTP('localhost') as s:
    s.send_message(msg)
```

Here's an example of how to send the entire contents of a directory as an email message:[1]

[1] Thanks to Matthew Dixon Cowles for the original inspiration and examples.

```
#!/usr/bin/env python3

"""Send the contents of a directory as a MIME message."""

import os
import smtplib
# For guessing MIME type based on file name extension
import mimetypes

from argparse import ArgumentParser

from email.message import EmailMessage
from email.policy import SMTP


def main():
    parser = ArgumentParser(description="""\
Send the contents of a directory as a MIME message.
Unless the -o option is given, the email is sent by forwarding to your local
SMTP server, which then does the normal delivery process.  Your local machine
must be running an SMTP server.
""")
    parser.add_argument('-d', '--directory',
                        help="""Mail the contents of the specified directory,
                        otherwise use the current directory.  Only the regular
                        files in the directory are sent, and we don't recurse to
                        subdirectories.""")
    parser.add_argument('-o', '--output',
                        metavar='FILE',
                        help="""Print the composed message to FILE instead of
                        sending the message to the SMTP server.""")
    parser.add_argument('-s', '--sender', required=True,
                        help='The value of the From: header (required)')
    parser.add_argument('-r', '--recipient', required=True,
                        action='append', metavar='RECIPIENT',
                        default=[], dest='recipients',
                        help='A To: header value (at least one required)')
    args = parser.parse_args()
    directory = args.directory
    if not directory:
        directory = '.'
    # Create the message
    msg = EmailMessage()
    msg['Subject'] = 'Contents of directory %s' % os.path.abspath(directory)
    msg['To'] = ', '.join(args.recipients)
    msg['From'] = args.sender
    msg.preamble = 'You will not see this in a MIME-aware mail reader.\n'

    for filename in os.listdir(directory):
        path = os.path.join(directory, filename)
        if not os.path.isfile(path):
            continue
```

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```
        # Guess the content type based on the file's extension.  Encoding
        # will be ignored, although we should check for simple things like
        # gzip'd or compressed files.
        ctype, encoding = mimetypes.guess_type(path)
        if ctype is None or encoding is not None:
            # No guess could be made, or the file is encoded (compressed), so
            # use a generic bag-of-bits type.
            ctype = 'application/octet-stream'
        maintype, subtype = ctype.split('/', 1)
        with open(path, 'rb') as fp:
            msg.add_attachment(fp.read(),
                               maintype=maintype,
                               subtype=subtype,
                               filename=filename)
    # Now send or store the message
    if args.output:
        with open(args.output, 'wb') as fp:
            fp.write(msg.as_bytes(policy=SMTP))
    else:
        with smtplib.SMTP('localhost') as s:
            s.send_message(msg)


if __name__ == '__main__':
    main()
```

Here's an example of how to unpack a MIME message like the one above, into a directory of files:

```
#!/usr/bin/env python3

"""Unpack a MIME message into a directory of files."""

import os
import email
import mimetypes

from email.policy import default

from argparse import ArgumentParser


def main():
    parser = ArgumentParser(description="""\
Unpack a MIME message into a directory of files.
""")
    parser.add_argument('-d', '--directory', required=True,
                        help="""Unpack the MIME message into the named
                        directory, which will be created if it doesn't already
                        exist.""")
    parser.add_argument('msgfile')
    args = parser.parse_args()
```

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```
    with open(args.msgfile, 'rb') as fp:
        msg = email.message_from_binary_file(fp, policy=default)

    try:
        os.mkdir(args.directory)
    except FileExistsError:
        pass

    counter = 1
    for part in msg.walk():
        # multipart/* are just containers
        if part.get_content_maintype() == 'multipart':
            continue
        # Applications should really sanitize the given filename so that an
        # email message can't be used to overwrite important files
        filename = part.get_filename()
        if not filename:
            ext = mimetypes.guess_extension(part.get_content_type())
            if not ext:
                # Use a generic bag-of-bits extension
                ext = '.bin'
            filename = 'part-%03d%s' % (counter, ext)
        counter += 1
        with open(os.path.join(args.directory, filename), 'wb') as fp:
            fp.write(part.get_payload(decode=True))


if __name__ == '__main__':
    main()
```

Here's an example of how to create an HTML message with an alternative plain text version. To make things a bit more interesting, we include a related image in the html part, and we save a copy of what we are going to send to disk, as well as sending it.

```
#!/usr/bin/env python3

import smtplib

from email.message import EmailMessage
from email.headerregistry import Address
from email.utils import make_msgid

# Create the base text message.
msg = EmailMessage()
msg['Subject'] = "Ayons asperges pour le déjeuner"
msg['From'] = Address("Pepé Le Pew", "pepe", "example.com")
msg['To'] = (Address("Penelope Pussycat", "penelope", "example.com"),
             Address("Fabrette Pussycat", "fabrette", "example.com"))
msg.set_content("""\
Salut!

Cela ressemble à un excellent recipie[1] déjeuner.
```

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```
[1] http://www.yummly.com/recipe/Roasted-Asparagus-Epicurious-203718

--Pepé
""")

# Add the html version.  This converts the message into a multipart/alternative
# container, with the original text message as the first part and the new html
# message as the second part.
asparagus_cid = make_msgid()
msg.add_alternative("""\
<html>
  <head></head>
  <body>
    <p>Salut!</p>
    <p>Cela ressemble à un excellent
        <a href="http://www.yummly.com/recipe/Roasted-Asparagus-Epicurious-203718">
            recipie
        </a> déjeuner.
    </p>
    <img src="cid:{asparagus_cid}" />
  </body>
</html>
""".format(asparagus_cid=asparagus_cid[1:-1]), subtype='html')
# note that we needed to peel the <> off the msgid for use in the html.

# Now add the related image to the html part.
with open("roasted-asparagus.jpg", 'rb') as img:
    msg.get_payload()[1].add_related(img.read(), 'image', 'jpeg',
                                     cid=asparagus_cid)

# Make a local copy of what we are going to send.
with open('outgoing.msg', 'wb') as f:
    f.write(bytes(msg))

# Send the message via local SMTP server.
with smtplib.SMTP('localhost') as s:
    s.send_message(msg)
```

If we were sent the message from the last example, here is one way we could process it:

```
import os
import sys
import tempfile
import mimetypes
import webbrowser

# Import the email modules we'll need
from email import policy
from email.parser import BytesParser

# An imaginary module that would make this work and be safe.
```

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```
from imaginary import magic_html_parser

# In a real program you'd get the filename from the arguments.
with open('outgoing.msg', 'rb') as fp:
    msg = BytesParser(policy=policy.default).parse(fp)

# Now the header items can be accessed as a dictionary, and any non-ASCII will
# be converted to unicode:
print('To:', msg['to'])
print('From:', msg['from'])
print('Subject:', msg['subject'])

# If we want to print a preview of the message content, we can extract whatever
# the least formatted payload is and print the first three lines.  Of course,
# if the message has no plain text part printing the first three lines of html
# is probably useless, but this is just a conceptual example.
simplest = msg.get_body(preferencelist=('plain', 'html'))
print()
print(''.join(simplest.get_content().splitlines(keepends=True)[:3]))

ans = input("View full message?")
if ans.lower()[0] == 'n':
    sys.exit()

# We can extract the richest alternative in order to display it:
richest = msg.get_body()
partfiles = {}
if richest['content-type'].maintype == 'text':
    if richest['content-type'].subtype == 'plain':
        for line in richest.get_content().splitlines():
            print(line)
        sys.exit()
    elif richest['content-type'].subtype == 'html':
        body = richest
    else:
        print("Don't know how to display {}".format(richest.get_content_type()))
        sys.exit()
elif richest['content-type'].content_type == 'multipart/related':
    body = richest.get_body(preferencelist=('html'))
    for part in richest.iter_attachments():
        fn = part.get_filename()
        if fn:
            extension = os.path.splitext(part.get_filename())[1]
        else:
            extension = mimetypes.guess_extension(part.get_content_type())
        with tempfile.NamedTemporaryFile(suffix=extension, delete=False) as f:
            f.write(part.get_content())
            # again strip the <> to go from email form of cid to html form.
            partfiles[part['content-id'][1:-1]] = f.name
else:
    print("Don't know how to display {}".format(richest.get_content_type()))
    sys.exit()
```

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```
with tempfile.NamedTemporaryFile(mode='w', delete=False) as f:
    # The magic_html_parser has to rewrite the href="cid:...." attributes to
    # point to the filenames in partfiles.  It also has to do a safety-sanitize
    # of the html.  It could be written using html.parser.
    f.write(magic_html_parser(body.get_content(), partfiles))
webbrowser.open(f.name)
os.remove(f.name)
for fn in partfiles.values():
    os.remove(fn)

# Of course, there are lots of email messages that could break this simple
# minded program, but it will handle the most common ones.
```

Up to the prompt, the output from the above is:

```
To: Penelope Pussycat <penelope@example.com>, Fabrette Pussycat <fabrette@example.com>
From: Pepé Le Pew <pepe@example.com>
Subject: Ayons asperges pour le déjeuner

Salut!

Cela ressemble à un excellent recipie[1] déjeuner.
```

Legacy API:

20.1.9 email.message.Message: Representing an email message using the compat32 API

The *Message* class is very similar to the *EmailMessage* class, without the methods added by that class, and with the default behavior of certain other methods being slightly different. We also document here some methods that, while supported by the *EmailMessage* class, are not recommended unless you are dealing with legacy code.

The philosophy and structure of the two classes is otherwise the same.

This document describes the behavior under the default (for *Message*) policy *Compat32*. If you are going to use another policy, you should be using the *EmailMessage* class instead.

An email message consists of *headers* and a *payload*. Headers must be **RFC 5233** style names and values, where the field name and value are separated by a colon. The colon is not part of either the field name or the field value. The payload may be a simple text message, or a binary object, or a structured sequence of sub-messages each with their own set of headers and their own payload. The latter type of payload is indicated by the message having a MIME type such as *multipart/** or *message/rfc822*.

The conceptual model provided by a *Message* object is that of an ordered dictionary of headers with additional methods for accessing both specialized information from the headers, for accessing the payload, for generating a serialized version of the message, and for recursively walking over the object tree. Note that duplicate headers are supported but special methods must be used to access them.

The *Message* pseudo-dictionary is indexed by the header names, which must be ASCII values. The values of the dictionary are strings that are supposed to contain only ASCII characters; there is some special handling for non-ASCII input, but it doesn't always produce the correct results. Headers are stored and returned in case-preserving form, but field names are matched case-insensitively. There may also be a single envelope header, also known as the *Unix-From* header or the `From_` header. The *payload* is either a string or bytes,

in the case of simple message objects, or a list of *Message* objects, for MIME container documents (e.g. *multipart/** and *message/rfc822*).

Here are the methods of the *Message* class:

class email.message.Message(*policy=compat32*)

If *policy* is specified (it must be an instance of a *policy* class) use the rules it specifies to update and serialize the representation of the message. If *policy* is not set, use the *compat32* policy, which maintains backward compatibility with the Python 3.2 version of the email package. For more information see the *policy* documentation.

Changed in version 3.3: The *policy* keyword argument was added.

as_string(*unixfrom=False*, *maxheaderlen=0*, *policy=None*)

Return the entire message flattened as a string. When optional *unixfrom* is true, the envelope header is included in the returned string. *unixfrom* defaults to `False`. For backward compatibility reasons, *maxheaderlen* defaults to `0`, so if you want a different value you must override it explicitly (the value specified for *max_line_length* in the policy will be ignored by this method). The *policy* argument may be used to override the default policy obtained from the message instance. This can be used to control some of the formatting produced by the method, since the specified *policy* will be passed to the `Generator`.

Flattening the message may trigger changes to the *Message* if defaults need to be filled in to complete the transformation to a string (for example, MIME boundaries may be generated or modified).

Note that this method is provided as a convenience and may not always format the message the way you want. For example, by default it does not do the mangling of lines that begin with `From` that is required by the unix mbox format. For more flexibility, instantiate a *Generator* instance and use its *flatten()* method directly. For example:

```
from io import StringIO
from email.generator import Generator
fp = StringIO()
g = Generator(fp, mangle_from_=True, maxheaderlen=60)
g.flatten(msg)
text = fp.getvalue()
```

If the message object contains binary data that is not encoded according to RFC standards, the non-compliant data will be replaced by unicode "unknown character" code points. (See also *as_bytes()* and *BytesGenerator*.)

Changed in version 3.4: the *policy* keyword argument was added.

__str__()

Equivalent to *as_string()*. Allows `str(msg)` to produce a string containing the formatted message.

as_bytes(*unixfrom=False*, *policy=None*)

Return the entire message flattened as a bytes object. When optional *unixfrom* is true, the envelope header is included in the returned string. *unixfrom* defaults to `False`. The *policy* argument may be used to override the default policy obtained from the message instance. This can be used to control some of the formatting produced by the method, since the specified *policy* will be passed to the `BytesGenerator`.

Flattening the message may trigger changes to the *Message* if defaults need to be filled in to complete the transformation to a string (for example, MIME boundaries may be generated or modified).

Note that this method is provided as a convenience and may not always format the message the way you want. For example, by default it does not do the mangling of lines that begin with `From`

that is required by the unix mbox format. For more flexibility, instantiate a *BytesGenerator* instance and use its *flatten()* method directly. For example:

```
from io import BytesIO
from email.generator import BytesGenerator
fp = BytesIO()
g = BytesGenerator(fp, mangle_from_=True, maxheaderlen=60)
g.flatten(msg)
text = fp.getvalue()
```

New in version 3.4.

__bytes__()
Equivalent to *as_bytes()*. Allows `bytes(msg)` to produce a bytes object containing the formatted message.

New in version 3.4.

is_multipart()
Return `True` if the message's payload is a list of sub-*Message* objects, otherwise return `False`. When *is_multipart()* returns `False`, the payload should be a string object (which might be a CTE encoded binary payload). (Note that *is_multipart()* returning `True` does not necessarily mean that "msg.get_content_maintype() == 'multipart'" will return the `True`. For example, `is_multipart` will return `True` when the *Message* is of type `message/rfc822`.)

set_unixfrom(*unixfrom*)
Set the message's envelope header to *unixfrom*, which should be a string.

get_unixfrom()
Return the message's envelope header. Defaults to `None` if the envelope header was never set.

attach(*payload*)
Add the given *payload* to the current payload, which must be `None` or a list of *Message* objects before the call. After the call, the payload will always be a list of *Message* objects. If you want to set the payload to a scalar object (e.g. a string), use *set_payload()* instead.

This is a legacy method. On the `EmailMessage` class its functionality is replaced by *set_content()* and the related `make` and `add` methods.

get_payload(*i=None*, *decode=False*)
Return the current payload, which will be a list of *Message* objects when *is_multipart()* is `True`, or a string when *is_multipart()* is `False`. If the payload is a list and you mutate the list object, you modify the message's payload in place.

With optional argument *i*, *get_payload()* will return the *i*-th element of the payload, counting from zero, if *is_multipart()* is `True`. An *IndexError* will be raised if *i* is less than 0 or greater than or equal to the number of items in the payload. If the payload is a string (i.e. *is_multipart()* is `False`) and *i* is given, a *TypeError* is raised.

Optional *decode* is a flag indicating whether the payload should be decoded or not, according to the *Content-Transfer-Encoding* header. When `True` and the message is not a multipart, the payload will be decoded if this header's value is `quoted-printable` or `base64`. If some other encoding is used, or *Content-Transfer-Encoding* header is missing, the payload is returned as-is (undecoded). In all cases the returned value is binary data. If the message is a multipart and the *decode* flag is `True`, then `None` is returned. If the payload is base64 and it was not perfectly formed (missing padding, characters outside the base64 alphabet), then an appropriate defect will be added to the message's defect property (`InvalidBase64PaddingDefect` or `InvalidBase64CharactersDefect`, respectively).

When *decode* is `False` (the default) the body is returned as a string without decoding the *Content-Transfer-Encoding*. However, for a *Content-Transfer-Encoding* of 8bit, an attempt

is made to decode the original bytes using the `charset` specified by the *Content-Type* header, using the `replace` error handler. If no `charset` is specified, or if the `charset` given is not recognized by the email package, the body is decoded using the default ASCII charset.

This is a legacy method. On the `EmailMessage` class its functionality is replaced by *get_content()* and *iter_parts()*.

set_payload(*payload*, *charset=None*)
Set the entire message object's payload to *payload*. It is the client's responsibility to ensure the payload invariants. Optional *charset* sets the message's default character set; see *set_charset()* for details.

This is a legacy method. On the `EmailMessage` class its functionality is replaced by *set_content()*.

set_charset(*charset*)
Set the character set of the payload to *charset*, which can either be a *Charset* instance (see *email.charset*), a string naming a character set, or `None`. If it is a string, it will be converted to a *Charset* instance. If *charset* is `None`, the `charset` parameter will be removed from the *Content-Type* header (the message will not be otherwise modified). Anything else will generate a *TypeError*.

If there is no existing *MIME-Version* header one will be added. If there is no existing *Content-Type* header, one will be added with a value of *text/plain*. Whether the *Content-Type* header already exists or not, its `charset` parameter will be set to *charset.output_charset*. If *charset.input_charset* and *charset.output_charset* differ, the payload will be re-encoded to the *output_charset*. If there is no existing *Content-Transfer-Encoding* header, then the payload will be transfer-encoded, if needed, using the specified *Charset*, and a header with the appropriate value will be added. If a *Content-Transfer-Encoding* header already exists, the payload is assumed to already be correctly encoded using that *Content-Transfer-Encoding* and is not modified.

This is a legacy method. On the `EmailMessage` class its functionality is replaced by the *charset* parameter of the `email.emailmessage.EmailMessage.set_content()` method.

get_charset()
Return the *Charset* instance associated with the message's payload.

This is a legacy method. On the `EmailMessage` class it always returns `None`.

The following methods implement a mapping-like interface for accessing the message's **RFC 2822** headers. Note that there are some semantic differences between these methods and a normal mapping (i.e. dictionary) interface. For example, in a dictionary there are no duplicate keys, but here there may be duplicate message headers. Also, in dictionaries there is no guaranteed order to the keys returned by *keys()*, but in a *Message* object, headers are always returned in the order they appeared in the original message, or were added to the message later. Any header deleted and then re-added are always appended to the end of the header list.

These semantic differences are intentional and are biased toward maximal convenience.

Note that in all cases, any envelope header present in the message is not included in the mapping interface.

In a model generated from bytes, any header values that (in contravention of the RFCs) contain non-ASCII bytes will, when retrieved through this interface, be represented as *Header* objects with a charset of *unknown-8bit*.

__len__()
Return the total number of headers, including duplicates.

__contains__(*name*)
Return true if the message object has a field named *name*. Matching is done case-insensitively and *name* should not include the trailing colon. Used for the `in` operator, e.g.:

```
if 'message-id' in myMessage:
   print('Message-ID:', myMessage['message-id'])
```

__getitem__(*name*)
Return the value of the named header field. *name* should not include the colon field separator. If the header is missing, `None` is returned; a *KeyError* is never raised.

Note that if the named field appears more than once in the message's headers, exactly which of those field values will be returned is undefined. Use the *get_all()* method to get the values of all the extant named headers.

__setitem__(*name*, *val*)
Add a header to the message with field name *name* and value *val*. The field is appended to the end of the message's existing fields.

Note that this does *not* overwrite or delete any existing header with the same name. If you want to ensure that the new header is the only one present in the message with field name *name*, delete the field first, e.g.:

```
del msg['subject']
msg['subject'] = 'Python roolz!'
```

__delitem__(*name*)
Delete all occurrences of the field with name *name* from the message's headers. No exception is raised if the named field isn't present in the headers.

keys()
Return a list of all the message's header field names.

values()
Return a list of all the message's field values.

items()
Return a list of 2-tuples containing all the message's field headers and values.

get(*name*, *failobj=None*)
Return the value of the named header field. This is identical to *__getitem__()* except that optional *failobj* is returned if the named header is missing (defaults to `None`).

Here are some additional useful methods:

get_all(*name*, *failobj=None*)
Return a list of all the values for the field named *name*. If there are no such named headers in the message, *failobj* is returned (defaults to `None`).

add_header(*_name*, *_value*, ***_params*)
Extended header setting. This method is similar to *__setitem__()* except that additional header parameters can be provided as keyword arguments. *_name* is the header field to add and *_value* is the *primary* value for the header.

For each item in the keyword argument dictionary *_params*, the key is taken as the parameter name, with underscores converted to dashes (since dashes are illegal in Python identifiers). Normally, the parameter will be added as `key="value"` unless the value is `None`, in which case only the key will be added. If the value contains non-ASCII characters, it can be specified as a three tuple in the format `(CHARSET, LANGUAGE, VALUE)`, where `CHARSET` is a string naming the charset to be used to encode the value, `LANGUAGE` can usually be set to `None` or the empty string (see **RFC 2231** for other possibilities), and `VALUE` is the string value containing non-ASCII code points. If a three tuple is not passed and the value contains non-ASCII characters, it is automatically encoded in **RFC 2231** format using a `CHARSET` of `utf-8` and a `LANGUAGE` of `None`.

Here's an example:

```
msg.add_header('Content-Disposition', 'attachment', filename='bud.gif')
```

This will add a header that looks like

```
Content-Disposition: attachment; filename="bud.gif"
```

An example with non-ASCII characters:

```
msg.add_header('Content-Disposition', 'attachment',
               filename=('iso-8859-1', '', 'Fußballer.ppt'))
```

Which produces

```
Content-Disposition: attachment; filename*="iso-8859-1''Fu%DFballer.ppt"
```

replace_header(*_name*, *_value*)
Replace a header. Replace the first header found in the message that matches *_name*, retaining header order and field name case. If no matching header was found, a *KeyError* is raised.

get_content_type()
Return the message's content type. The returned string is coerced to lower case of the form *maintype/subtype*. If there was no *Content-Type* header in the message the default type as given by *get_default_type()* will be returned. Since according to **RFC 2045**, messages always have a default type, *get_content_type()* will always return a value.

RFC 2045 defines a message's default type to be *text/plain* unless it appears inside a *multipart/digest* container, in which case it would be *message/rfc822*. If the *Content-Type* header has an invalid type specification, **RFC 2045** mandates that the default type be *text/plain*.

get_content_maintype()
Return the message's main content type. This is the *maintype* part of the string returned by *get_content_type()*.

get_content_subtype()
Return the message's sub-content type. This is the *subtype* part of the string returned by *get_content_type()*.

get_default_type()
Return the default content type. Most messages have a default content type of *text/plain*, except for messages that are subparts of *multipart/digest* containers. Such subparts have a default content type of *message/rfc822*.

set_default_type(*ctype*)
Set the default content type. *ctype* should either be *text/plain* or *message/rfc822*, although this is not enforced. The default content type is not stored in the *Content-Type* header.

get_params(*failobj=None*, *header='content-type'*, *unquote=True*)
Return the message's *Content-Type* parameters, as a list. The elements of the returned list are 2-tuples of key/value pairs, as split on the `'='` sign. The left hand side of the `'='` is the key, while the right hand side is the value. If there is no `'='` sign in the parameter the value is the empty string, otherwise the value is as described in *get_param()* and is unquoted if optional *unquote* is `True` (the default).

Optional *failobj* is the object to return if there is no *Content-Type* header. Optional *header* is the header to search instead of *Content-Type*.

This is a legacy method. On the `EmailMessage` class its functionality is replaced by the *params* property of the individual header objects returned by the header access methods.

get_param(*param*, *failobj=None*, *header='content-type'*, *unquote=True*)
Return the value of the *Content-Type* header's parameter *param* as a string. If the message has no *Content-Type* header or if there is no such parameter, then *failobj* is returned (defaults to `None`).

Optional *header* if given, specifies the message header to use instead of *Content-Type*.

Parameter keys are always compared case insensitively. The return value can either be a string, or a 3-tuple if the parameter was **RFC 2231** encoded. When it's a 3-tuple, the elements of the value are of the form `(CHARSET, LANGUAGE, VALUE)`. Note that both `CHARSET` and `LANGUAGE` can be `None`, in which case you should consider `VALUE` to be encoded in the `us-ascii` charset. You can usually ignore `LANGUAGE`.

If your application doesn't care whether the parameter was encoded as in **RFC 2231**, you can collapse the parameter value by calling *email.utils.collapse_rfc2231_value()*, passing in the return value from *get_param()*. This will return a suitably decoded Unicode string when the value is a tuple, or the original string unquoted if it isn't. For example:

```
rawparam = msg.get_param('foo')
param = email.utils.collapse_rfc2231_value(rawparam)
```

In any case, the parameter value (either the returned string, or the `VALUE` item in the 3-tuple) is always unquoted, unless *unquote* is set to `False`.

This is a legacy method. On the `EmailMessage` class its functionality is replaced by the *params* property of the individual header objects returned by the header access methods.

set_param(*param*, *value*, *header='Content-Type'*, *requote=True*, *charset=None*, *language=''*, *replace=False*)
Set a parameter in the *Content-Type* header. If the parameter already exists in the header, its value will be replaced with *value*. If the *Content-Type* header as not yet been defined for this message, it will be set to *text/plain* and the new parameter value will be appended as per **RFC 2045**.

Optional *header* specifies an alternative header to *Content-Type*, and all parameters will be quoted as necessary unless optional *requote* is `False` (the default is `True`).

If optional *charset* is specified, the parameter will be encoded according to **RFC 2231**. Optional *language* specifies the RFC 2231 language, defaulting to the empty string. Both *charset* and *language* should be strings.

If *replace* is `False` (the default) the header is moved to the end of the list of headers. If *replace* is `True`, the header will be updated in place.

Changed in version 3.4: `replace` keyword was added.

del_param(*param*, *header='content-type'*, *requote=True*)
Remove the given parameter completely from the *Content-Type* header. The header will be rewritten in place without the parameter or its value. All values will be quoted as necessary unless *requote* is `False` (the default is `True`). Optional *header* specifies an alternative to *Content-Type*.

set_type(*type*, *header='Content-Type'*, *requote=True*)
Set the main type and subtype for the *Content-Type* header. *type* must be a string in the form *maintype/subtype*, otherwise a *ValueError* is raised.

This method replaces the *Content-Type* header, keeping all the parameters in place. If *requote* is `False`, this leaves the existing header's quoting as is, otherwise the parameters will be quoted (the default).

An alternative header can be specified in the *header* argument. When the *Content-Type* header is set a *MIME-Version* header is also added.

This is a legacy method. On the `EmailMessage` class its functionality is replaced by the `make_` and `add_` methods.

get_filename(*failobj=None*)
Return the value of the `filename` parameter of the *Content-Disposition* header of the message. If the header does not have a `filename` parameter, this method falls back to looking for the `name` parameter on the *Content-Type* header. If neither is found, or the header is missing, then *failobj* is returned. The returned string will always be unquoted as per *email.utils.unquote()*.

get_boundary(*failobj=None*)
Return the value of the `boundary` parameter of the *Content-Type* header of the message, or *failobj* if either the header is missing, or has no `boundary` parameter. The returned string will always be unquoted as per *email.utils.unquote()*.

set_boundary(*boundary*)
Set the `boundary` parameter of the *Content-Type* header to *boundary*. *set_boundary()* will always quote *boundary* if necessary. A *HeaderParseError* is raised if the message object has no *Content-Type* header.

Note that using this method is subtly different than deleting the old *Content-Type* header and adding a new one with the new boundary via *add_header()*, because *set_boundary()* preserves the order of the *Content-Type* header in the list of headers. However, it does *not* preserve any continuation lines which may have been present in the original *Content-Type* header.

get_content_charset(*failobj=None*)
Return the `charset` parameter of the *Content-Type* header, coerced to lower case. If there is no *Content-Type* header, or if that header has no `charset` parameter, *failobj* is returned.

Note that this method differs from *get_charset()* which returns the *Charset* instance for the default encoding of the message body.

get_charsets(*failobj=None*)
Return a list containing the character set names in the message. If the message is a *multipart*, then the list will contain one element for each subpart in the payload, otherwise, it will be a list of length 1.

Each item in the list will be a string which is the value of the `charset` parameter in the *Content-Type* header for the represented subpart. However, if the subpart has no *Content-Type* header, no `charset` parameter, or is not of the *text* main MIME type, then that item in the returned list will be *failobj*.

get_content_disposition()
Return the lowercased value (without parameters) of the message's *Content-Disposition* header if it has one, or `None`. The possible values for this method are *inline*, *attachment* or `None` if the message follows **RFC 2183**.

New in version 3.5.

walk()
The *walk()* method is an all-purpose generator which can be used to iterate over all the parts and subparts of a message object tree, in depth-first traversal order. You will typically use *walk()* as the iterator in a `for` loop; each iteration returns the next subpart.

Here's an example that prints the MIME type of every part of a multipart message structure:

```
>>> for part in msg.walk():
...     print(part.get_content_type())
multipart/report
text/plain
message/delivery-status
```

(continues on next page)

(continued from previous page)

```
text/plain
text/plain
message/rfc822
text/plain
```

`walk` iterates over the subparts of any part where *is_multipart()* returns `True`, even though `msg.get_content_maintype() == 'multipart'` may return `False`. We can see this in our example by making use of the `_structure` debug helper function:

```
>>> for part in msg.walk():
...     print(part.get_content_maintype() == 'multipart',
...           part.is_multipart())
True True
False False
False True
False False
False False
False True
False False
>>> _structure(msg)
multipart/report
    text/plain
    message/delivery-status
        text/plain
        text/plain
    message/rfc822
        text/plain
```

Here the `message` parts are not `multiparts`, but they do contain subparts. `is_multipart()` returns `True` and `walk` descends into the subparts.

Message objects can also optionally contain two instance attributes, which can be used when generating the plain text of a MIME message.

preamble

The format of a MIME document allows for some text between the blank line following the headers, and the first multipart boundary string. Normally, this text is never visible in a MIME-aware mail reader because it falls outside the standard MIME armor. However, when viewing the raw text of the message, or when viewing the message in a non-MIME aware reader, this text can become visible.

The *preamble* attribute contains this leading extra-armor text for MIME documents. When the *Parser* discovers some text after the headers but before the first boundary string, it assigns this text to the message's *preamble* attribute. When the *Generator* is writing out the plain text representation of a MIME message, and it finds the message has a *preamble* attribute, it will write this text in the area between the headers and the first boundary. See *email.parser* and *email.generator* for details.

Note that if the message object has no preamble, the *preamble* attribute will be `None`.

epilogue

The *epilogue* attribute acts the same way as the *preamble* attribute, except that it contains text that appears between the last boundary and the end of the message.

You do not need to set the epilogue to the empty string in order for the *Generator* to print a newline at the end of the file.

defects
The *defects* attribute contains a list of all the problems found when parsing this message. See *email.errors* for a detailed description of the possible parsing defects.

20.1.10 email.mime: Creating email and MIME objects from scratch

Source code: Lib/email/mime/

This module is part of the legacy (Compat32) email API. Its functionality is partially replaced by the *contentmanager* in the new API, but in certain applications these classes may still be useful, even in non-legacy code.

Ordinarily, you get a message object structure by passing a file or some text to a parser, which parses the text and returns the root message object. However you can also build a complete message structure from scratch, or even individual *Message* objects by hand. In fact, you can also take an existing structure and add new *Message* objects, move them around, etc. This makes a very convenient interface for slicing-and-dicing MIME messages.

You can create a new object structure by creating *Message* instances, adding attachments and all the appropriate headers manually. For MIME messages though, the *email* package provides some convenient subclasses to make things easier.

Here are the classes:

class email.mime.base.MIMEBase(*_maintype*, *_subtype*, ***, *policy=compat32*, ***_params*)
Module: email.mime.base

This is the base class for all the MIME-specific subclasses of *Message*. Ordinarily you won't create instances specifically of *MIMEBase*, although you could. *MIMEBase* is provided primarily as a convenient base class for more specific MIME-aware subclasses.

_maintype is the *Content-Type* major type (e.g. *text* or *image*), and *_subtype* is the *Content-Type* minor type (e.g. *plain* or *gif*). *_params* is a parameter key/value dictionary and is passed directly to *Message.add_header*.

If *policy* is specified, (defaults to the *compat32* policy) it will be passed to *Message*.

The *MIMEBase* class always adds a *Content-Type* header (based on *_maintype*, *_subtype*, and *_params*), and a *MIME-Version* header (always set to 1.0).

Changed in version 3.6: Added *policy* keyword-only parameter.

class email.mime.nonmultipart.MIMENonMultipart
Module: email.mime.nonmultipart

A subclass of *MIMEBase*, this is an intermediate base class for MIME messages that are not *multipart*. The primary purpose of this class is to prevent the use of the *attach()* method, which only makes sense for *multipart* messages. If *attach()* is called, a *MultipartConversionError* exception is raised.

class email.mime.multipart.MIMEMultipart(*_subtype='mixed'*, *boundary=None*, *_subparts=None*, ***, *policy=compat32*, ***_params*)
Module: email.mime.multipart

A subclass of *MIMEBase*, this is an intermediate base class for MIME messages that are *multipart*. Optional *_subtype* defaults to *mixed*, but can be used to specify the subtype of the message. A *Content-Type* header of *multipart/_subtype* will be added to the message object. A *MIME-Version* header will also be added.

Optional *boundary* is the multipart boundary string. When None (the default), the boundary is calculated when needed (for example, when the message is serialized).

_subparts is a sequence of initial subparts for the payload. It must be possible to convert this sequence to a list. You can always attach new subparts to the message by using the *Message.attach* method.

Optional *policy* argument defaults to *compat32*.

Additional parameters for the *Content-Type* header are taken from the keyword arguments, or passed into the *_params* argument, which is a keyword dictionary.

Changed in version 3.6: Added *policy* keyword-only parameter.

class email.mime.application.**MIMEApplication**(*_data*, *_subtype='octet-stream'*, *_encoder=email.encoders.encode_base64*, ***, *policy=compat32*, ***_params*)

Module: email.mime.application

A subclass of *MIMENonMultipart*, the *MIMEApplication* class is used to represent MIME message objects of major type *application*. *_data* is a string containing the raw byte data. Optional *_subtype* specifies the MIME subtype and defaults to *octet-stream*.

Optional *_encoder* is a callable (i.e. function) which will perform the actual encoding of the data for transport. This callable takes one argument, which is the *MIMEApplication* instance. It should use *get_payload()* and *set_payload()* to change the payload to encoded form. It should also add any *Content-Transfer-Encoding* or other headers to the message object as necessary. The default encoding is base64. See the *email.encoders* module for a list of the built-in encoders.

Optional *policy* argument defaults to *compat32*.

_params are passed straight through to the base class constructor.

Changed in version 3.6: Added *policy* keyword-only parameter.

class email.mime.audio.**MIMEAudio**(*_audiodata*, *_subtype=None*, *_encoder=email.encoders.encode_base64*, ***, *policy=compat32*, ***_params*)

Module: email.mime.audio

A subclass of *MIMENonMultipart*, the *MIMEAudio* class is used to create MIME message objects of major type *audio*. *_audiodata* is a string containing the raw audio data. If this data can be decoded by the standard Python module *sndhdr*, then the subtype will be automatically included in the *Content-Type* header. Otherwise you can explicitly specify the audio subtype via the *_subtype* argument. If the minor type could not be guessed and *_subtype* was not given, then *TypeError* is raised.

Optional *_encoder* is a callable (i.e. function) which will perform the actual encoding of the audio data for transport. This callable takes one argument, which is the *MIMEAudio* instance. It should use *get_payload()* and *set_payload()* to change the payload to encoded form. It should also add any *Content-Transfer-Encoding* or other headers to the message object as necessary. The default encoding is base64. See the *email.encoders* module for a list of the built-in encoders.

Optional *policy* argument defaults to *compat32*.

_params are passed straight through to the base class constructor.

Changed in version 3.6: Added *policy* keyword-only parameter.

class email.mime.image.**MIMEImage**(*_imagedata*, *_subtype=None*, *_encoder=email.encoders.encode_base64*, ***, *policy=compat32*, ***_params*)

Module: email.mime.image

A subclass of *MIMENonMultipart*, the *MIMEImage* class is used to create MIME message objects of major type *image*. *_imagedata* is a string containing the raw image data. If this data can be decoded by the standard Python module *imghdr*, then the subtype will be automatically included in the *Content-Type* header. Otherwise you can explicitly specify the image subtype via the *_subtype* argument. If the minor type could not be guessed and *_subtype* was not given, then *TypeError* is raised.

Optional *_encoder* is a callable (i.e. function) which will perform the actual encoding of the image data for transport. This callable takes one argument, which is the *MIMEImage* instance. It should use *get_payload()* and *set_payload()* to change the payload to encoded form. It should also add any *Content-Transfer-Encoding* or other headers to the message object as necessary. The default encoding is base64. See the *email.encoders* module for a list of the built-in encoders.

Optional *policy* argument defaults to *compat32*.

_params are passed straight through to the *MIMEBase* constructor.

Changed in version 3.6: Added *policy* keyword-only parameter.

class email.mime.message.MIMEMessage(*_msg*, *_subtype='rfc822'*, ***, *policy=compat32*)
Module: email.mime.message

A subclass of *MIMENonMultipart*, the *MIMEMessage* class is used to create MIME objects of main type *message*. *_msg* is used as the payload, and must be an instance of class *Message* (or a subclass thereof), otherwise a *TypeError* is raised.

Optional *_subtype* sets the subtype of the message; it defaults to *rfc822*.

Optional *policy* argument defaults to *compat32*.

Changed in version 3.6: Added *policy* keyword-only parameter.

class email.mime.text.MIMEText(*_text*, *_subtype='plain'*, *_charset=None*, ***, *policy=compat32*)
Module: email.mime.text

A subclass of *MIMENonMultipart*, the *MIMEText* class is used to create MIME objects of major type *text*. *_text* is the string for the payload. *_subtype* is the minor type and defaults to *plain*. *_charset* is the character set of the text and is passed as an argument to the *MIMENonMultipart* constructor; it defaults to us-ascii if the string contains only ascii code points, and utf-8 otherwise. The *_charset* parameter accepts either a string or a *Charset* instance.

Unless the *_charset* argument is explicitly set to None, the MIMEText object created will have both a *Content-Type* header with a charset parameter, and a *Content-Transfer-Encoding* header. This means that a subsequent set_payload call will not result in an encoded payload, even if a charset is passed in the set_payload command. You can "reset" this behavior by deleting the Content-Transfer-Encoding header, after which a set_payload call will automatically encode the new payload (and add a new *Content-Transfer-Encoding* header).

Optional *policy* argument defaults to *compat32*.

Changed in version 3.5: *_charset* also accepts *Charset* instances.

Changed in version 3.6: Added *policy* keyword-only parameter.

20.1.11 email.header: Internationalized headers

Source code: Lib/email/header.py

This module is part of the legacy (Compat32) email API. In the current API encoding and decoding of headers is handled transparently by the dictionary-like API of the *EmailMessage* class. In addition to uses in legacy code, this module can be useful in applications that need to completely control the character sets used when encoding headers.

The remaining text in this section is the original documentation of the module.

RFC 2822 is the base standard that describes the format of email messages. It derives from the older **RFC 822** standard which came into widespread use at a time when most email was composed of ASCII characters only. **RFC 2822** is a specification written assuming email contains only 7-bit ASCII characters.

Of course, as email has been deployed worldwide, it has become internationalized, such that language specific character sets can now be used in email messages. The base standard still requires email messages to be transferred using only 7-bit ASCII characters, so a slew of RFCs have been written describing how to encode email containing non-ASCII characters into **RFC 2822**-compliant format. These RFCs include **RFC 2045**, **RFC 2046**, **RFC 2047**, and **RFC 2231**. The *email* package supports these standards in its *email.header* and *email.charset* modules.

If you want to include non-ASCII characters in your email headers, say in the *Subject* or *To* fields, you should use the *Header* class and assign the field in the *Message* object to an instance of *Header* instead of using a string for the header value. Import the *Header* class from the *email.header* module. For example:

```
>>> from email.message import Message
>>> from email.header import Header
>>> msg = Message()
>>> h = Header('p\xf6stal', 'iso-8859-1')
>>> msg['Subject'] = h
>>> msg.as_string()
'Subject: =?iso-8859-1?q?p=F6stal?=\n\n'
```

Notice here how we wanted the *Subject* field to contain a non-ASCII character? We did this by creating a *Header* instance and passing in the character set that the byte string was encoded in. When the subsequent *Message* instance was flattened, the *Subject* field was properly **RFC 2047** encoded. MIME-aware mail readers would show this header using the embedded ISO-8859-1 character.

Here is the *Header* class description:

class email.header.**Header**(*s=None*, *charset=None*, *maxlinelen=None*, *header_name=None*, *continuation_ws=' '*, *errors='strict'*)

Create a MIME-compliant header that can contain strings in different character sets.

Optional *s* is the initial header value. If `None` (the default), the initial header value is not set. You can later append to the header with *append()* method calls. *s* may be an instance of *bytes* or *str*, but see the *append()* documentation for semantics.

Optional *charset* serves two purposes: it has the same meaning as the *charset* argument to the *append()* method. It also sets the default character set for all subsequent *append()* calls that omit the *charset* argument. If *charset* is not provided in the constructor (the default), the `us-ascii` character set is used both as *s*'s initial charset and as the default for subsequent *append()* calls.

The maximum line length can be specified explicitly via *maxlinelen*. For splitting the first line to a shorter value (to account for the field header which isn't included in *s*, e.g. *Subject*) pass in the name of the field in *header_name*. The default *maxlinelen* is 76, and the default value for *header_name* is `None`, meaning it is not taken into account for the first line of a long, split header.

Optional *continuation_ws* must be **RFC 2822**-compliant folding whitespace, and is usually either a space or a hard tab character. This character will be prepended to continuation lines. *continuation_ws* defaults to a single space character.

Optional *errors* is passed straight through to the *append()* method.

append(*s*, *charset=None*, *errors='strict'*)

Append the string *s* to the MIME header.

Optional *charset*, if given, should be a *Charset* instance (see *email.charset*) or the name of a character set, which will be converted to a *Charset* instance. A value of `None` (the default) means that the *charset* given in the constructor is used.

s may be an instance of *bytes* or *str*. If it is an instance of *bytes*, then *charset* is the encoding of that byte string, and a *UnicodeError* will be raised if the string cannot be decoded with that character set.

If *s* is an instance of *str*, then *charset* is a hint specifying the character set of the characters in the string.

In either case, when producing an **RFC 2822**-compliant header using **RFC 2047** rules, the string will be encoded using the output codec of the charset. If the string cannot be encoded using the output codec, a UnicodeError will be raised.

Optional *errors* is passed as the errors argument to the decode call if *s* is a byte string.

encode(*splitchars=';, \t', maxlinelen=None, linesep='\n'*)
Encode a message header into an RFC-compliant format, possibly wrapping long lines and encapsulating non-ASCII parts in base64 or quoted-printable encodings.

Optional *splitchars* is a string containing characters which should be given extra weight by the splitting algorithm during normal header wrapping. This is in very rough support of **RFC 2822**'s 'higher level syntactic breaks': split points preceded by a splitchar are preferred during line splitting, with the characters preferred in the order in which they appear in the string. Space and tab may be included in the string to indicate whether preference should be given to one over the other as a split point when other split chars do not appear in the line being split. Splitchars does not affect **RFC 2047** encoded lines.

maxlinelen, if given, overrides the instance's value for the maximum line length.

linesep specifies the characters used to separate the lines of the folded header. It defaults to the most useful value for Python application code (`\n`), but `\r\n` can be specified in order to produce headers with RFC-compliant line separators.

Changed in version 3.2: Added the *linesep* argument.

The *Header* class also provides a number of methods to support standard operators and built-in functions.

__str__()
Returns an approximation of the *Header* as a string, using an unlimited line length. All pieces are converted to unicode using the specified encoding and joined together appropriately. Any pieces with a charset of `'unknown-8bit'` are decoded as ASCII using the `'replace'` error handler.

Changed in version 3.2: Added handling for the `'unknown-8bit'` charset.

__eq__(*other*)
This method allows you to compare two *Header* instances for equality.

__ne__(*other*)
This method allows you to compare two *Header* instances for inequality.

The *email.header* module also provides the following convenient functions.

email.header.decode_header(*header*)
Decode a message header value without converting the character set. The header value is in *header*.

This function returns a list of `(decoded_string, charset)` pairs containing each of the decoded parts of the header. *charset* is `None` for non-encoded parts of the header, otherwise a lower case string containing the name of the character set specified in the encoded string.

Here's an example:

```
>>> from email.header import decode_header
>>> decode_header('=?iso-8859-1?q?p=F6stal?=')
[(b'p\xf6stal', 'iso-8859-1')]
```

email.header.make_header(*decoded_seq, maxlinelen=None, header_name=None, continuation_ws=' '*)
Create a *Header* instance from a sequence of pairs as returned by *decode_header()*.

decode_header() takes a header value string and returns a sequence of pairs of the format `(decoded_string, charset)` where *charset* is the name of the character set.

This function takes one of those sequence of pairs and returns a *Header* instance. Optional *maxlinelen*, *header_name*, and *continuation_ws* are as in the *Header* constructor.

20.1.12 `email.charset`: Representing character sets

Source code: Lib/email/charset.py

This module is part of the legacy (`Compat32`) email API. In the new API only the aliases table is used.

The remaining text in this section is the original documentation of the module.

This module provides a class *Charset* for representing character sets and character set conversions in email messages, as well as a character set registry and several convenience methods for manipulating this registry. Instances of *Charset* are used in several other modules within the *email* package.

Import this class from the *email.charset* module.

class `email.charset.Charset`(*input_charset=DEFAULT_CHARSET*)

Map character sets to their email properties.

This class provides information about the requirements imposed on email for a specific character set. It also provides convenience routines for converting between character sets, given the availability of the applicable codecs. Given a character set, it will do its best to provide information on how to use that character set in an email message in an RFC-compliant way.

Certain character sets must be encoded with quoted-printable or base64 when used in email headers or bodies. Certain character sets must be converted outright, and are not allowed in email.

Optional *input_charset* is as described below; it is always coerced to lower case. After being alias normalized it is also used as a lookup into the registry of character sets to find out the header encoding, body encoding, and output conversion codec to be used for the character set. For example, if *input_charset* is `iso-8859-1`, then headers and bodies will be encoded using quoted-printable and no output conversion codec is necessary. If *input_charset* is `euc-jp`, then headers will be encoded with base64, bodies will not be encoded, but output text will be converted from the `euc-jp` character set to the `iso-2022-jp` character set.

Charset instances have the following data attributes:

input_charset

The initial character set specified. Common aliases are converted to their *official* email names (e.g. `latin_1` is converted to `iso-8859-1`). Defaults to 7-bit `us-ascii`.

header_encoding

If the character set must be encoded before it can be used in an email header, this attribute will be set to `Charset.QP` (for quoted-printable), `Charset.BASE64` (for base64 encoding), or `Charset.SHORTEST` for the shortest of QP or BASE64 encoding. Otherwise, it will be `None`.

body_encoding

Same as *header_encoding*, but describes the encoding for the mail message's body, which indeed may be different than the header encoding. `Charset.SHORTEST` is not allowed for *body_encoding*.

output_charset

Some character sets must be converted before they can be used in email headers or bodies. If the *input_charset* is one of them, this attribute will contain the name of the character set output will be converted to. Otherwise, it will be `None`.

input_codec
The name of the Python codec used to convert the *input_charset* to Unicode. If no conversion codec is necessary, this attribute will be `None`.

output_codec
The name of the Python codec used to convert Unicode to the *output_charset*. If no conversion codec is necessary, this attribute will have the same value as the *input_codec*.

Charset instances also have the following methods:

get_body_encoding()
Return the content transfer encoding used for body encoding.

This is either the string `quoted-printable` or `base64` depending on the encoding used, or it is a function, in which case you should call the function with a single argument, the Message object being encoded. The function should then set the *Content-Transfer-Encoding* header itself to whatever is appropriate.

Returns the string `quoted-printable` if *body_encoding* is `QP`, returns the string `base64` if *body_encoding* is `BASE64`, and returns the string `7bit` otherwise.

get_output_charset()
Return the output character set.

This is the *output_charset* attribute if that is not `None`, otherwise it is *input_charset*.

header_encode(*string*)
Header-encode the string *string*.

The type of encoding (base64 or quoted-printable) will be based on the *header_encoding* attribute.

header_encode_lines(*string*, *maxlengths*)
Header-encode a *string* by converting it first to bytes.

This is similar to *header_encode()* except that the string is fit into maximum line lengths as given by the argument *maxlengths*, which must be an iterator: each element returned from this iterator will provide the next maximum line length.

body_encode(*string*)
Body-encode the string *string*.

The type of encoding (base64 or quoted-printable) will be based on the *body_encoding* attribute.

The *Charset* class also provides a number of methods to support standard operations and built-in functions.

__str__()
Returns *input_charset* as a string coerced to lower case. **__repr__()** is an alias for *__str__()*.

__eq__(*other*)
This method allows you to compare two *Charset* instances for equality.

__ne__(*other*)
This method allows you to compare two *Charset* instances for inequality.

The *email.charset* module also provides the following functions for adding new entries to the global character set, alias, and codec registries:

email.charset.add_charset(*charset*, *header_enc=None*, *body_enc=None*, *output_charset=None*)
Add character properties to the global registry.

charset is the input character set, and must be the canonical name of a character set.

Optional *header_enc* and *body_enc* is either `Charset.QP` for quoted-printable, `Charset.BASE64` for base64 encoding, `Charset.SHORTEST` for the shortest of quoted-printable or base64 encoding, or `None` for no encoding. `SHORTEST` is only valid for *header_enc*. The default is `None` for no encoding.

Optional *output_charset* is the character set that the output should be in. Conversions will proceed from input charset, to Unicode, to the output charset when the method `Charset.convert()` is called. The default is to output in the same character set as the input.

Both *input_charset* and *output_charset* must have Unicode codec entries in the module's character set-to-codec mapping; use *add_codec()* to add codecs the module does not know about. See the *codecs* module's documentation for more information.

The global character set registry is kept in the module global dictionary `CHARSETS`.

`email.charset.add_alias`(*alias*, *canonical*)
Add a character set alias. *alias* is the alias name, e.g. `latin-1`. *canonical* is the character set's canonical name, e.g. `iso-8859-1`.

The global charset alias registry is kept in the module global dictionary `ALIASES`.

`email.charset.add_codec`(*charset*, *codecname*)
Add a codec that map characters in the given character set to and from Unicode.

charset is the canonical name of a character set. *codecname* is the name of a Python codec, as appropriate for the second argument to the *str*'s *encode()* method.

20.1.13 `email.encoders`: Encoders

Source code: Lib/email/encoders.py

This module is part of the legacy (`Compat32`) email API. In the new API the functionality is provided by the *cte* parameter of the *set_content()* method.

The remaining text in this section is the original documentation of the module.

When creating *Message* objects from scratch, you often need to encode the payloads for transport through compliant mail servers. This is especially true for *image/** and *text/** type messages containing binary data.

The *email* package provides some convenient encodings in its `encoders` module. These encoders are actually used by the *MIMEAudio* and *MIMEImage* class constructors to provide default encodings. All encoder functions take exactly one argument, the message object to encode. They usually extract the payload, encode it, and reset the payload to this newly encoded value. They should also set the *Content-Transfer-Encoding* header as appropriate.

Note that these functions are not meaningful for a multipart message. They must be applied to individual subparts instead, and will raise a *TypeError* if passed a message whose type is multipart.

Here are the encoding functions provided:

`email.encoders.encode_quopri`(*msg*)
Encodes the payload into quoted-printable form and sets the *Content-Transfer-Encoding* header to `quoted-printable`[1]. This is a good encoding to use when most of your payload is normal printable data, but contains a few unprintable characters.

`email.encoders.encode_base64`(*msg*)
Encodes the payload into base64 form and sets the *Content-Transfer-Encoding* header to `base64`. This is a good encoding to use when most of your payload is unprintable data since it is a more compact form than quoted-printable. The drawback of base64 encoding is that it renders the text non-human readable.

[1] Note that encoding with *encode_quopri()* also encodes all tabs and space characters in the data.

email.encoders.**encode_7or8bit**(*msg*)
: This doesn't actually modify the message's payload, but it does set the *Content-Transfer-Encoding* header to either `7bit` or `8bit` as appropriate, based on the payload data.

email.encoders.**encode_noop**(*msg*)
: This does nothing; it doesn't even set the *Content-Transfer-Encoding* header.

20.1.14 email.utils: Miscellaneous utilities

Source code: Lib/email/utils.py

There are a couple of useful utilities provided in the *email.utils* module:

email.utils.**localtime**(*dt=None*)
: Return local time as an aware datetime object. If called without arguments, return current time. Otherwise *dt* argument should be a *datetime* instance, and it is converted to the local time zone according to the system time zone database. If *dt* is naive (that is, `dt.tzinfo` is `None`), it is assumed to be in local time. In this case, a positive or zero value for *isdst* causes `localtime` to presume initially that summer time (for example, Daylight Saving Time) is or is not (respectively) in effect for the specified time. A negative value for *isdst* causes the `localtime` to attempt to divine whether summer time is in effect for the specified time.

  New in version 3.3.

email.utils.**make_msgid**(*idstring=None*, *domain=None*)
: Returns a string suitable for an **RFC 2822**-compliant *Message-ID* header. Optional *idstring* if given, is a string used to strengthen the uniqueness of the message id. Optional *domain* if given provides the portion of the msgid after the '@'. The default is the local hostname. It is not normally necessary to override this default, but may be useful certain cases, such as a constructing distributed system that uses a consistent domain name across multiple hosts.

  Changed in version 3.2: Added the *domain* keyword.

The remaining functions are part of the legacy (`Compat32`) email API. There is no need to directly use these with the new API, since the parsing and formatting they provide is done automatically by the header parsing machinery of the new API.

email.utils.**quote**(*str*)
: Return a new string with backslashes in *str* replaced by two backslashes, and double quotes replaced by backslash-double quote.

email.utils.**unquote**(*str*)
: Return a new string which is an *unquoted* version of *str*. If *str* ends and begins with double quotes, they are stripped off. Likewise if *str* ends and begins with angle brackets, they are stripped off.

email.utils.**parseaddr**(*address*)
: Parse address – which should be the value of some address-containing field such as *To* or *Cc* – into its constituent *realname* and *email address* parts. Returns a tuple of that information, unless the parse fails, in which case a 2-tuple of `('', '')` is returned.

email.utils.**formataddr**(*pair*, *charset='utf-8'*)
: The inverse of *parseaddr()*, this takes a 2-tuple of the form `(realname, email_address)` and returns the string value suitable for a *To* or *Cc* header. If the first element of *pair* is false, then the second element is returned unmodified.

  Optional *charset* is the character set that will be used in the **RFC 2047** encoding of the `realname` if the `realname` contains non-ASCII characters. Can be an instance of *str* or a *Charset*. Defaults to `utf-8`.

  Changed in version 3.3: Added the *charset* option.

email.utils.**getaddresses**(*fieldvalues*)

This method returns a list of 2-tuples of the form returned by `parseaddr()`. *fieldvalues* is a sequence of header field values as might be returned by *Message.get_all*. Here's a simple example that gets all the recipients of a message:

```
from email.utils import getaddresses

tos = msg.get_all('to', [])
ccs = msg.get_all('cc', [])
resent_tos = msg.get_all('resent-to', [])
resent_ccs = msg.get_all('resent-cc', [])
all_recipients = getaddresses(tos + ccs + resent_tos + resent_ccs)
```

email.utils.**parsedate**(*date*)

Attempts to parse a date according to the rules in **RFC 2822**. however, some mailers don't follow that format as specified, so *parsedate()* tries to guess correctly in such cases. *date* is a string containing an **RFC 2822** date, such as `"Mon, 20 Nov 1995 19:12:08 -0500"`. If it succeeds in parsing the date, *parsedate()* returns a 9-tuple that can be passed directly to *time.mktime()*; otherwise `None` will be returned. Note that indexes 6, 7, and 8 of the result tuple are not usable.

email.utils.**parsedate_tz**(*date*)

Performs the same function as *parsedate()*, but returns either `None` or a 10-tuple; the first 9 elements make up a tuple that can be passed directly to *time.mktime()*, and the tenth is the offset of the date's timezone from UTC (which is the official term for Greenwich Mean Time)[1]. If the input string has no timezone, the last element of the tuple returned is `None`. Note that indexes 6, 7, and 8 of the result tuple are not usable.

email.utils.**parsedate_to_datetime**(*date*)

The inverse of *format_datetime()*. Performs the same function as *parsedate()*, but on success returns a *datetime*. If the input date has a timezone of `-0000`, the `datetime` will be a naive `datetime`, and if the date is conforming to the RFCs it will represent a time in UTC but with no indication of the actual source timezone of the message the date comes from. If the input date has any other valid timezone offset, the `datetime` will be an aware `datetime` with the corresponding a *timezone tzinfo*.

New in version 3.3.

email.utils.**mktime_tz**(*tuple*)

Turn a 10-tuple as returned by *parsedate_tz()* into a UTC timestamp (seconds since the Epoch). If the timezone item in the tuple is `None`, assume local time.

email.utils.**formatdate**(*timeval=None*, *localtime=False*, *usegmt=False*)

Returns a date string as per **RFC 2822**, e.g.:

```
Fri, 09 Nov 2001 01:08:47 -0000
```

Optional *timeval* if given is a floating point time value as accepted by *time.gmtime()* and *time.localtime()*, otherwise the current time is used.

Optional *localtime* is a flag that when `True`, interprets *timeval*, and returns a date relative to the local timezone instead of UTC, properly taking daylight savings time into account. The default is `False` meaning UTC is used.

Optional *usegmt* is a flag that when `True`, outputs a date string with the timezone as an ascii string `GMT`, rather than a numeric `-0000`. This is needed for some protocols (such as HTTP). This only applies when *localtime* is `False`. The default is `False`.

[1] Note that the sign of the timezone offset is the opposite of the sign of the `time.timezone` variable for the same timezone; the latter variable follows the POSIX standard while this module follows **RFC 2822**.

email.utils.format_datetime(*dt*, *usegmt=False*)
: Like `formatdate`, but the input is a *datetime* instance. If it is a naive datetime, it is assumed to be "UTC with no information about the source timezone", and the conventional `-0000` is used for the timezone. If it is an aware `datetime`, then the numeric timezone offset is used. If it is an aware timezone with offset zero, then *usegmt* may be set to `True`, in which case the string `GMT` is used instead of the numeric timezone offset. This provides a way to generate standards conformant HTTP date headers.

  New in version 3.3.

email.utils.decode_rfc2231(*s*)
: Decode the string *s* according to **RFC 2231**.

email.utils.encode_rfc2231(*s*, *charset=None*, *language=None*)
: Encode the string *s* according to **RFC 2231**. Optional *charset* and *language*, if given is the character set name and language name to use. If neither is given, *s* is returned as-is. If *charset* is given but *language* is not, the string is encoded using the empty string for *language*.

email.utils.collapse_rfc2231_value(*value*, *errors='replace'*, *fallback_charset='us-ascii'*)
: When a header parameter is encoded in **RFC 2231** format, *Message.get_param* may return a 3-tuple containing the character set, language, and value. *collapse_rfc2231_value()* turns this into a unicode string. Optional *errors* is passed to the *errors* argument of *str*'s *encode()* method; it defaults to `'replace'`. Optional *fallback_charset* specifies the character set to use if the one in the **RFC 2231** header is not known by Python; it defaults to `'us-ascii'`.

  For convenience, if the *value* passed to *collapse_rfc2231_value()* is not a tuple, it should be a string and it is returned unquoted.

email.utils.decode_params(*params*)
: Decode parameters list according to **RFC 2231**. *params* is a sequence of 2-tuples containing elements of the form `(content-type, string-value)`.

20.1.15 email.iterators: Iterators

Source code: Lib/email/iterators.py

Iterating over a message object tree is fairly easy with the *Message.walk* method. The *email.iterators* module provides some useful higher level iterations over message object trees.

email.iterators.body_line_iterator(*msg*, *decode=False*)
: This iterates over all the payloads in all the subparts of *msg*, returning the string payloads line-by-line. It skips over all the subpart headers, and it skips over any subpart with a payload that isn't a Python string. This is somewhat equivalent to reading the flat text representation of the message from a file using *readline()*, skipping over all the intervening headers.

  Optional *decode* is passed through to *Message.get_payload*.

email.iterators.typed_subpart_iterator(*msg*, *maintype='text'*, *subtype=None*)
: This iterates over all the subparts of *msg*, returning only those subparts that match the MIME type specified by *maintype* and *subtype*.

  Note that *subtype* is optional; if omitted, then subpart MIME type matching is done only with the main type. *maintype* is optional too; it defaults to *text*.

  Thus, by default *typed_subpart_iterator()* returns each subpart that has a MIME type of *text/**.

The following function has been added as a useful debugging tool. It should *not* be considered part of the supported public interface for the package.

email.iterators._structure(*msg*, *fp=None*, *level=0*, *include_default=False*)

Prints an indented representation of the content types of the message object structure. For example:

```
>>> msg = email.message_from_file(somefile)
>>> _structure(msg)
multipart/mixed
    text/plain
    text/plain
    multipart/digest
        message/rfc822
            text/plain
        message/rfc822
            text/plain
        message/rfc822
            text/plain
        message/rfc822
            text/plain
        message/rfc822
            text/plain
    text/plain
```

Optional *fp* is a file-like object to print the output to. It must be suitable for Python's *print()* function. *level* is used internally. *include_default*, if true, prints the default type as well.

See also:

Module *smtplib* SMTP (Simple Mail Transport Protocol) client

Module *poplib* POP (Post Office Protocol) client

Module *imaplib* IMAP (Internet Message Access Protocol) client

Module *nntplib* NNTP (Net News Transport Protocol) client

Module *mailbox* Tools for creating, reading, and managing collections of messages on disk using a variety standard formats.

Module *smtpd* SMTP server framework (primarily useful for testing)

20.2 json — JSON encoder and decoder

Source code: Lib/json/__init__.py

JSON (JavaScript Object Notation), specified by **RFC 7159** (which obsoletes **RFC 4627**) and by ECMA-404, is a lightweight data interchange format inspired by JavaScript object literal syntax (although it is not a strict subset of JavaScript[1]).

json exposes an API familiar to users of the standard library *marshal* and *pickle* modules.

Encoding basic Python object hierarchies:

```
>>> import json
>>> json.dumps(['foo', {'bar': ('baz', None, 1.0, 2)}])
'["foo", {"bar": ["baz", null, 1.0, 2]}]'
```

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[1] As noted in the errata for RFC 7159, JSON permits literal U+2028 (LINE SEPARATOR) and U+2029 (PARAGRAPH SEPARATOR) characters in strings, whereas JavaScript (as of ECMAScript Edition 5.1) does not.

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```
>>> print(json.dumps("\"foo\bar"))
"\"foo\bar"
>>> print(json.dumps('\u1234'))
"\u1234"
>>> print(json.dumps('\\'))
"\\"
>>> print(json.dumps({"c": 0, "b": 0, "a": 0}, sort_keys=True))
{"a": 0, "b": 0, "c": 0}
>>> from io import StringIO
>>> io = StringIO()
>>> json.dump(['streaming API'], io)
>>> io.getvalue()
'["streaming API"]'
```

Compact encoding:

```
>>> import json
>>> json.dumps([1, 2, 3, {'4': 5, '6': 7}], separators=(',', ':'))
'[1,2,3,{"4":5,"6":7}]'
```

Pretty printing:

```
>>> import json
>>> print(json.dumps({'4': 5, '6': 7}, sort_keys=True, indent=4))
{
    "4": 5,
    "6": 7
}
```

Decoding JSON:

```
>>> import json
>>> json.loads('["foo", {"bar":["baz", null, 1.0, 2]}]')
['foo', {'bar': ['baz', None, 1.0, 2]}]
>>> json.loads('"\\"foo\\bar"')
'"foo\x08ar'
>>> from io import StringIO
>>> io = StringIO('["streaming API"]')
>>> json.load(io)
['streaming API']
```

Specializing JSON object decoding:

```
>>> import json
>>> def as_complex(dct):
...     if '__complex__' in dct:
...         return complex(dct['real'], dct['imag'])
...     return dct
...
>>> json.loads('{"__complex__": true, "real": 1, "imag": 2}',
...     object_hook=as_complex)
(1+2j)
>>> import decimal
```

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```
>>> json.loads('1.1', parse_float=decimal.Decimal)
Decimal('1.1')
```

Extending *JSONEncoder*:

```
>>> import json
>>> class ComplexEncoder(json.JSONEncoder):
...     def default(self, obj):
...         if isinstance(obj, complex):
...             return [obj.real, obj.imag]
...         # Let the base class default method raise the TypeError
...         return json.JSONEncoder.default(self, obj)
...
>>> json.dumps(2 + 1j, cls=ComplexEncoder)
'[2.0, 1.0]'
>>> ComplexEncoder().encode(2 + 1j)
'[2.0, 1.0]'
>>> list(ComplexEncoder().iterencode(2 + 1j))
['[2.0', ', 1.0', ']']
```

Using *json.tool* from the shell to validate and pretty-print:

```
$ echo '{"json":"obj"}' | python -m json.tool
{
    "json": "obj"
}
$ echo '{1.2:3.4}' | python -m json.tool
Expecting property name enclosed in double quotes: line 1 column 2 (char 1)
```

See *Command Line Interface* for detailed documentation.

Note: JSON is a subset of YAML 1.2. The JSON produced by this module's default settings (in particular, the default *separators* value) is also a subset of YAML 1.0 and 1.1. This module can thus also be used as a YAML serializer.

20.2.1 Basic Usage

json.dump(*obj*, *fp*, ***, *skipkeys=False*, *ensure_ascii=True*, *check_circular=True*, *allow_nan=True*, *cls=None*, *indent=None*, *separators=None*, *default=None*, *sort_keys=False*, ***kw*)

Serialize *obj* as a JSON formatted stream to *fp* (a `.write()`-supporting *file-like object*) using this *conversion table*.

If *skipkeys* is true (default: `False`), then dict keys that are not of a basic type (*str*, *int*, *float*, *bool*, `None`) will be skipped instead of raising a *TypeError*.

The *json* module always produces *str* objects, not *bytes* objects. Therefore, `fp.write()` must support *str* input.

If *ensure_ascii* is true (the default), the output is guaranteed to have all incoming non-ASCII characters escaped. If *ensure_ascii* is false, these characters will be output as-is.

If *check_circular* is false (default: `True`), then the circular reference check for container types will be skipped and a circular reference will result in an *OverflowError* (or worse).

If *allow_nan* is false (default: `True`), then it will be a *ValueError* to serialize out of range *float* values (`nan`, `inf`, `-inf`) in strict compliance of the JSON specification. If *allow_nan* is true, their JavaScript equivalents (`NaN`, `Infinity`, `-Infinity`) will be used.

If *indent* is a non-negative integer or string, then JSON array elements and object members will be pretty-printed with that indent level. An indent level of 0, negative, or `""` will only insert newlines. `None` (the default) selects the most compact representation. Using a positive integer indent indents that many spaces per level. If *indent* is a string (such as `"\t"`), that string is used to indent each level.

Changed in version 3.2: Allow strings for *indent* in addition to integers.

If specified, *separators* should be an `(item_separator, key_separator)` tuple. The default is `(', ', ': ')` if *indent* is `None` and `(',', ': ')` otherwise. To get the most compact JSON representation, you should specify `(',', ':')` to eliminate whitespace.

Changed in version 3.4: Use `(',', ': ')` as default if *indent* is not `None`.

If specified, *default* should be a function that gets called for objects that can't otherwise be serialized. It should return a JSON encodable version of the object or raise a *TypeError*. If not specified, *TypeError* is raised.

If *sort_keys* is true (default: `False`), then the output of dictionaries will be sorted by key.

To use a custom *JSONEncoder* subclass (e.g. one that overrides the `default()` method to serialize additional types), specify it with the *cls* kwarg; otherwise *JSONEncoder* is used.

Changed in version 3.6: All optional parameters are now *keyword-only*.

Note: Unlike *pickle* and *marshal*, JSON is not a framed protocol, so trying to serialize multiple objects with repeated calls to *dump()* using the same *fp* will result in an invalid JSON file.

`json.dumps`(*obj*, ***, *skipkeys=False*, *ensure_ascii=True*, *check_circular=True*, *allow_nan=True*, *cls=None*, *indent=None*, *separators=None*, *default=None*, *sort_keys=False*, ***kw*)

Serialize *obj* to a JSON formatted *str* using this *conversion table*. The arguments have the same meaning as in *dump()*.

Note: Keys in key/value pairs of JSON are always of the type *str*. When a dictionary is converted into JSON, all the keys of the dictionary are coerced to strings. As a result of this, if a dictionary is converted into JSON and then back into a dictionary, the dictionary may not equal the original one. That is, `loads(dumps(x)) != x` if x has non-string keys.

`json.load`(*fp*, ***, *cls=None*, *object_hook=None*, *parse_float=None*, *parse_int=None*, *parse_constant=None*, *object_pairs_hook=None*, ***kw*)

Deserialize *fp* (a `.read()`-supporting *text file* or *binary file* containing a JSON document) to a Python object using this *conversion table*.

object_hook is an optional function that will be called with the result of any object literal decoded (a *dict*). The return value of *object_hook* will be used instead of the *dict*. This feature can be used to implement custom decoders (e.g. JSON-RPC class hinting).

object_pairs_hook is an optional function that will be called with the result of any object literal decoded with an ordered list of pairs. The return value of *object_pairs_hook* will be used instead of the *dict*. This feature can be used to implement custom decoders. If *object_hook* is also defined, the *object_pairs_hook* takes priority.

Changed in version 3.1: Added support for *object_pairs_hook*.

parse_float, if specified, will be called with the string of every JSON float to be decoded. By default, this is equivalent to `float(num_str)`. This can be used to use another datatype or parser for JSON

floats (e.g. *decimal.Decimal*).

parse_int, if specified, will be called with the string of every JSON int to be decoded. By default, this is equivalent to `int(num_str)`. This can be used to use another datatype or parser for JSON integers (e.g. *float*).

parse_constant, if specified, will be called with one of the following strings: `'-Infinity'`, `'Infinity'`, `'NaN'`. This can be used to raise an exception if invalid JSON numbers are encountered.

Changed in version 3.1: *parse_constant* doesn't get called on 'null', 'true', 'false' anymore.

To use a custom *JSONDecoder* subclass, specify it with the `cls` kwarg; otherwise *JSONDecoder* is used. Additional keyword arguments will be passed to the constructor of the class.

If the data being deserialized is not a valid JSON document, a *JSONDecodeError* will be raised.

Changed in version 3.6: All optional parameters are now *keyword-only*.

Changed in version 3.6: *fp* can now be a *binary file*. The input encoding should be UTF-8, UTF-16 or UTF-32.

`json.loads`(*s*, ***, *encoding=None*, *cls=None*, *object_hook=None*, *parse_float=None*, *parse_int=None*, *parse_constant=None*, *object_pairs_hook=None*, ***kw*)

Deserialize *s* (a *str*, *bytes* or *bytearray* instance containing a JSON document) to a Python object using this *conversion table*.

The other arguments have the same meaning as in *load()*, except *encoding* which is ignored and deprecated.

If the data being deserialized is not a valid JSON document, a *JSONDecodeError* will be raised.

Changed in version 3.6: *s* can now be of type *bytes* or *bytearray*. The input encoding should be UTF-8, UTF-16 or UTF-32.

20.2.2 Encoders and Decoders

`class json.JSONDecoder`(***, *object_hook=None*, *parse_float=None*, *parse_int=None*, *parse_constant=None*, *strict=True*, *object_pairs_hook=None*)

Simple JSON decoder.

Performs the following translations in decoding by default:

JSON	Python
object	dict
array	list
string	str
number (int)	int
number (real)	float
true	True
false	False
null	None

It also understands `NaN`, `Infinity`, and `-Infinity` as their corresponding `float` values, which is outside the JSON spec.

object_hook, if specified, will be called with the result of every JSON object decoded and its return value will be used in place of the given *dict*. This can be used to provide custom deserializations (e.g. to support JSON-RPC class hinting).

object_pairs_hook, if specified will be called with the result of every JSON object decoded with an ordered list of pairs. The return value of *object_pairs_hook* will be used instead of the *dict*. This

feature can be used to implement custom decoders. If *object_hook* is also defined, the *object_pairs_hook* takes priority.

Changed in version 3.1: Added support for *object_pairs_hook*.

parse_float, if specified, will be called with the string of every JSON float to be decoded. By default, this is equivalent to `float(num_str)`. This can be used to use another datatype or parser for JSON floats (e.g. *decimal.Decimal*).

parse_int, if specified, will be called with the string of every JSON int to be decoded. By default, this is equivalent to `int(num_str)`. This can be used to use another datatype or parser for JSON integers (e.g. *float*).

parse_constant, if specified, will be called with one of the following strings: `'-Infinity'`, `'Infinity'`, `'NaN'`. This can be used to raise an exception if invalid JSON numbers are encountered.

If *strict* is false (`True` is the default), then control characters will be allowed inside strings. Control characters in this context are those with character codes in the 0–31 range, including `'\t'` (tab), `'\n'`, `'\r'` and `'\0'`.

If the data being deserialized is not a valid JSON document, a *JSONDecodeError* will be raised.

Changed in version 3.6: All parameters are now *keyword-only*.

`decode(`*s*`)`
Return the Python representation of *s* (a *str* instance containing a JSON document).

JSONDecodeError will be raised if the given JSON document is not valid.

`raw_decode(`*s*`)`
Decode a JSON document from *s* (a *str* beginning with a JSON document) and return a 2-tuple of the Python representation and the index in *s* where the document ended.

This can be used to decode a JSON document from a string that may have extraneous data at the end.

`class json.JSONEncoder(`**, skipkeys=False, ensure_ascii=True, check_circular=True, allow_nan=True, sort_keys=False, indent=None, separators=None, default=None*`)`
Extensible JSON encoder for Python data structures.

Supports the following objects and types by default:

Python	JSON
dict	object
list, tuple	array
str	string
int, float, int- & float-derived Enums	number
True	true
False	false
None	null

Changed in version 3.4: Added support for int- and float-derived Enum classes.

To extend this to recognize other objects, subclass and implement a *default()* method with another method that returns a serializable object for `o` if possible, otherwise it should call the superclass implementation (to raise *TypeError*).

If *skipkeys* is false (the default), then it is a *TypeError* to attempt encoding of keys that are not *str*, *int*, *float* or `None`. If *skipkeys* is true, such items are simply skipped.

If *ensure_ascii* is true (the default), the output is guaranteed to have all incoming non-ASCII characters escaped. If *ensure_ascii* is false, these characters will be output as-is.

If *check_circular* is true (the default), then lists, dicts, and custom encoded objects will be checked for circular references during encoding to prevent an infinite recursion (which would cause an *OverflowError*). Otherwise, no such check takes place.

If *allow_nan* is true (the default), then `NaN`, `Infinity`, and `-Infinity` will be encoded as such. This behavior is not JSON specification compliant, but is consistent with most JavaScript based encoders and decoders. Otherwise, it will be a *ValueError* to encode such floats.

If *sort_keys* is true (default: `False`), then the output of dictionaries will be sorted by key; this is useful for regression tests to ensure that JSON serializations can be compared on a day-to-day basis.

If *indent* is a non-negative integer or string, then JSON array elements and object members will be pretty-printed with that indent level. An indent level of 0, negative, or `""` will only insert newlines. `None` (the default) selects the most compact representation. Using a positive integer indent indents that many spaces per level. If *indent* is a string (such as `"\t"`), that string is used to indent each level.

Changed in version 3.2: Allow strings for *indent* in addition to integers.

If specified, *separators* should be an `(item_separator, key_separator)` tuple. The default is `(', ', ': ')` if *indent* is `None` and `(',', ': ')` otherwise. To get the most compact JSON representation, you should specify `(',', ':')` to eliminate whitespace.

Changed in version 3.4: Use `(',', ': ')` as default if *indent* is not `None`.

If specified, *default* should be a function that gets called for objects that can't otherwise be serialized. It should return a JSON encodable version of the object or raise a *TypeError*. If not specified, *TypeError* is raised.

Changed in version 3.6: All parameters are now *keyword-only*.

default(*o*)
Implement this method in a subclass such that it returns a serializable object for *o*, or calls the base implementation (to raise a *TypeError*).

For example, to support arbitrary iterators, you could implement default like this:

```
def default(self, o):
   try:
       iterable = iter(o)
   except TypeError:
       pass
   else:
       return list(iterable)
   # Let the base class default method raise the TypeError
   return json.JSONEncoder.default(self, o)
```

encode(*o*)
Return a JSON string representation of a Python data structure, *o*. For example:

```
>>> json.JSONEncoder().encode({"foo": ["bar", "baz"]})
'{"foo": ["bar", "baz"]}'
```

iterencode(*o*)
Encode the given object, *o*, and yield each string representation as available. For example:

```
for chunk in json.JSONEncoder().iterencode(bigobject):
    mysocket.write(chunk)
```

20.2.3 Exceptions

exception json.**JSONDecodeError**(*msg*, *doc*, *pos*)
Subclass of *ValueError* with the following additional attributes:

msg
The unformatted error message.

doc
The JSON document being parsed.

pos
The start index of *doc* where parsing failed.

lineno
The line corresponding to *pos*.

colno
The column corresponding to *pos*.

New in version 3.5.

20.2.4 Standard Compliance and Interoperability

The JSON format is specified by **RFC 7159** and by ECMA-404. This section details this module's level of compliance with the RFC. For simplicity, *JSONEncoder* and *JSONDecoder* subclasses, and parameters other than those explicitly mentioned, are not considered.

This module does not comply with the RFC in a strict fashion, implementing some extensions that are valid JavaScript but not valid JSON. In particular:

- Infinite and NaN number values are accepted and output;
- Repeated names within an object are accepted, and only the value of the last name-value pair is used.

Since the RFC permits RFC-compliant parsers to accept input texts that are not RFC-compliant, this module's deserializer is technically RFC-compliant under default settings.

Character Encodings

The RFC requires that JSON be represented using either UTF-8, UTF-16, or UTF-32, with UTF-8 being the recommended default for maximum interoperability.

As permitted, though not required, by the RFC, this module's serializer sets *ensure_ascii=True* by default, thus escaping the output so that the resulting strings only contain ASCII characters.

Other than the *ensure_ascii* parameter, this module is defined strictly in terms of conversion between Python objects and *Unicode strings*, and thus does not otherwise directly address the issue of character encodings.

The RFC prohibits adding a byte order mark (BOM) to the start of a JSON text, and this module's serializer does not add a BOM to its output. The RFC permits, but does not require, JSON deserializers to ignore an initial BOM in their input. This module's deserializer raises a *ValueError* when an initial BOM is present.

The RFC does not explicitly forbid JSON strings which contain byte sequences that don't correspond to valid Unicode characters (e.g. unpaired UTF-16 surrogates), but it does note that they may cause interoperability problems. By default, this module accepts and outputs (when present in the original *str*) code points for such sequences.

Infinite and NaN Number Values

The RFC does not permit the representation of infinite or NaN number values. Despite that, by default, this module accepts and outputs `Infinity`, `-Infinity`, and `NaN` as if they were valid JSON number literal values:

```
>>> # Neither of these calls raises an exception, but the results are not valid JSON
>>> json.dumps(float('-inf'))
'-Infinity'
>>> json.dumps(float('nan'))
'NaN'
>>> # Same when deserializing
>>> json.loads('-Infinity')
-inf
>>> json.loads('NaN')
nan
```

In the serializer, the *allow_nan* parameter can be used to alter this behavior. In the deserializer, the *parse_constant* parameter can be used to alter this behavior.

Repeated Names Within an Object

The RFC specifies that the names within a JSON object should be unique, but does not mandate how repeated names in JSON objects should be handled. By default, this module does not raise an exception; instead, it ignores all but the last name-value pair for a given name:

```
>>> weird_json = '{"x": 1, "x": 2, "x": 3}'
>>> json.loads(weird_json)
{'x': 3}
```

The *object_pairs_hook* parameter can be used to alter this behavior.

Top-level Non-Object, Non-Array Values

The old version of JSON specified by the obsolete **RFC 4627** required that the top-level value of a JSON text must be either a JSON object or array (Python *dict* or *list*), and could not be a JSON null, boolean, number, or string value. **RFC 7159** removed that restriction, and this module does not and has never implemented that restriction in either its serializer or its deserializer.

Regardless, for maximum interoperability, you may wish to voluntarily adhere to the restriction yourself.

Implementation Limitations

Some JSON deserializer implementations may set limits on:

- the size of accepted JSON texts
- the maximum level of nesting of JSON objects and arrays
- the range and precision of JSON numbers
- the content and maximum length of JSON strings

This module does not impose any such limits beyond those of the relevant Python datatypes themselves or the Python interpreter itself.

When serializing to JSON, beware any such limitations in applications that may consume your JSON. In particular, it is common for JSON numbers to be deserialized into IEEE 754 double precision numbers and thus subject to that representation's range and precision limitations. This is especially relevant when serializing Python *int* values of extremely large magnitude, or when serializing instances of "exotic" numerical types such as *decimal.Decimal*.

20.2.5 Command Line Interface

Source code: Lib/json/tool.py

The *json.tool* module provides a simple command line interface to validate and pretty-print JSON objects.

If the optional `infile` and `outfile` arguments are not specified, *sys.stdin* and *sys.stdout* will be used respectively:

```
$ echo '{"json": "obj"}' | python -m json.tool
{
    "json": "obj"
}
$ echo '{1.2:3.4}' | python -m json.tool
Expecting property name enclosed in double quotes: line 1 column 2 (char 1)
```

Changed in version 3.5: The output is now in the same order as the input. Use the *--sort-keys* option to sort the output of dictionaries alphabetically by key.

Command line options

infile
The JSON file to be validated or pretty-printed:

```
$ python -m json.tool mp_films.json
[
    {
        "title": "And Now for Something Completely Different",
        "year": 1971
    },
    {
        "title": "Monty Python and the Holy Grail",
        "year": 1975
    }
]
```

If *infile* is not specified, read from *sys.stdin*.

outfile
Write the output of the *infile* to the given *outfile*. Otherwise, write it to *sys.stdout*.

--sort-keys
Sort the output of dictionaries alphabetically by key.

New in version 3.5.

-h, --help
Show the help message.

20.3 mailcap — Mailcap file handling

Source code: Lib/mailcap.py

Mailcap files are used to configure how MIME-aware applications such as mail readers and Web browsers react to files with different MIME types. (The name "mailcap" is derived from the phrase "mail capability".) For example, a mailcap file might contain a line like `video/mpeg; xmpeg %s`. Then, if the user encounters an email message or Web document with the MIME type *video/mpeg*, `%s` will be replaced by a filename (usually one belonging to a temporary file) and the **xmpeg** program can be automatically started to view the file.

The mailcap format is documented in **RFC 1524**, "A User Agent Configuration Mechanism For Multimedia Mail Format Information," but is not an Internet standard. However, mailcap files are supported on most Unix systems.

`mailcap.findmatch`(*caps*, *MIMEtype*, *key='view'*, *filename='/dev/null'*, *plist=[]*)

Return a 2-tuple; the first element is a string containing the command line to be executed (which can be passed to *os.system()*), and the second element is the mailcap entry for a given MIME type. If no matching MIME type can be found, `(None, None)` is returned.

key is the name of the field desired, which represents the type of activity to be performed; the default value is 'view', since in the most common case you simply want to view the body of the MIME-typed data. Other possible values might be 'compose' and 'edit', if you wanted to create a new body of the given MIME type or alter the existing body data. See **RFC 1524** for a complete list of these fields.

filename is the filename to be substituted for `%s` in the command line; the default value is `'/dev/null'` which is almost certainly not what you want, so usually you'll override it by specifying a filename.

plist can be a list containing named parameters; the default value is simply an empty list. Each entry in the list must be a string containing the parameter name, an equals sign (`'='`), and the parameter's value. Mailcap entries can contain named parameters like `%{foo}`, which will be replaced by the value of the parameter named 'foo'. For example, if the command line `showpartial %{id} %{number} %{total}` was in a mailcap file, and *plist* was set to `['id=1', 'number=2', 'total=3']`, the resulting command line would be `'showpartial 1 2 3'`.

In a mailcap file, the "test" field can optionally be specified to test some external condition (such as the machine architecture, or the window system in use) to determine whether or not the mailcap line applies. *findmatch()* will automatically check such conditions and skip the entry if the check fails.

`mailcap.getcaps`()

Returns a dictionary mapping MIME types to a list of mailcap file entries. This dictionary must be passed to the *findmatch()* function. An entry is stored as a list of dictionaries, but it shouldn't be necessary to know the details of this representation.

The information is derived from all of the mailcap files found on the system. Settings in the user's mailcap file `$HOME/.mailcap` will override settings in the system mailcap files `/etc/mailcap`, `/usr/etc/mailcap`, and `/usr/local/etc/mailcap`.

An example usage:

```
>>> import mailcap
>>> d = mailcap.getcaps()
>>> mailcap.findmatch(d, 'video/mpeg', filename='tmp1223')
('xmpeg tmp1223', {'view': 'xmpeg %s'})
```

20.4 mailbox — Manipulate mailboxes in various formats

Source code: Lib/mailbox.py

This module defines two classes, *Mailbox* and *Message*, for accessing and manipulating on-disk mailboxes and the messages they contain. *Mailbox* offers a dictionary-like mapping from keys to messages. *Message* extends the *email.message* module's *Message* class with format-specific state and behavior. Supported mailbox formats are Maildir, mbox, MH, Babyl, and MMDF.

See also:

Module *email* Represent and manipulate messages.

20.4.1 Mailbox objects

class mailbox.Mailbox

A mailbox, which may be inspected and modified.

The *Mailbox* class defines an interface and is not intended to be instantiated. Instead, format-specific subclasses should inherit from *Mailbox* and your code should instantiate a particular subclass.

The *Mailbox* interface is dictionary-like, with small keys corresponding to messages. Keys are issued by the *Mailbox* instance with which they will be used and are only meaningful to that *Mailbox* instance. A key continues to identify a message even if the corresponding message is modified, such as by replacing it with another message.

Messages may be added to a *Mailbox* instance using the set-like method *add()* and removed using a `del` statement or the set-like methods *remove()* and *discard()*.

Mailbox interface semantics differ from dictionary semantics in some noteworthy ways. Each time a message is requested, a new representation (typically a *Message* instance) is generated based upon the current state of the mailbox. Similarly, when a message is added to a *Mailbox* instance, the provided message representation's contents are copied. In neither case is a reference to the message representation kept by the *Mailbox* instance.

The default *Mailbox* iterator iterates over message representations, not keys as the default dictionary iterator does. Moreover, modification of a mailbox during iteration is safe and well-defined. Messages added to the mailbox after an iterator is created will not be seen by the iterator. Messages removed from the mailbox before the iterator yields them will be silently skipped, though using a key from an iterator may result in a *KeyError* exception if the corresponding message is subsequently removed.

> **Warning:** Be very cautious when modifying mailboxes that might be simultaneously changed by some other process. The safest mailbox format to use for such tasks is Maildir; try to avoid using single-file formats such as mbox for concurrent writing. If you're modifying a mailbox, you *must* lock it by calling the *lock()* and *unlock()* methods *before* reading any messages in the file or making any changes by adding or deleting a message. Failing to lock the mailbox runs the risk of losing messages or corrupting the entire mailbox.

Mailbox instances have the following methods:

add(*message*)

Add *message* to the mailbox and return the key that has been assigned to it.

Parameter *message* may be a *Message* instance, an *email.message.Message* instance, a string, a byte string, or a file-like object (which should be open in binary mode). If *message* is an instance of the appropriate format-specific *Message* subclass (e.g., if it's an *mboxMessage* instance and this

is an *mbox* instance), its format-specific information is used. Otherwise, reasonable defaults for format-specific information are used.

Changed in version 3.2: Support for binary input was added.

remove(*key*)
__delitem__(*key*)
discard(*key*)
Delete the message corresponding to *key* from the mailbox.

If no such message exists, a *KeyError* exception is raised if the method was called as *remove()* or *__delitem__()* but no exception is raised if the method was called as *discard()*. The behavior of *discard()* may be preferred if the underlying mailbox format supports concurrent modification by other processes.

__setitem__(*key*, *message*)
Replace the message corresponding to *key* with *message*. Raise a *KeyError* exception if no message already corresponds to *key*.

As with *add()*, parameter *message* may be a *Message* instance, an *email.message.Message* instance, a string, a byte string, or a file-like object (which should be open in binary mode). If *message* is an instance of the appropriate format-specific *Message* subclass (e.g., if it's an *mboxMessage* instance and this is an *mbox* instance), its format-specific information is used. Otherwise, the format-specific information of the message that currently corresponds to *key* is left unchanged.

iterkeys()
keys()
Return an iterator over all keys if called as *iterkeys()* or return a list of keys if called as *keys()*.

itervalues()
__iter__()
values()
Return an iterator over representations of all messages if called as *itervalues()* or *__iter__()* or return a list of such representations if called as *values()*. The messages are represented as instances of the appropriate format-specific *Message* subclass unless a custom message factory was specified when the *Mailbox* instance was initialized.

Note: The behavior of *__iter__()* is unlike that of dictionaries, which iterate over keys.

iteritems()
items()
Return an iterator over (*key*, *message*) pairs, where *key* is a key and *message* is a message representation, if called as *iteritems()* or return a list of such pairs if called as *items()*. The messages are represented as instances of the appropriate format-specific *Message* subclass unless a custom message factory was specified when the *Mailbox* instance was initialized.

get(*key*, *default=None*)
__getitem__(*key*)
Return a representation of the message corresponding to *key*. If no such message exists, *default* is returned if the method was called as *get()* and a *KeyError* exception is raised if the method was called as *__getitem__()*. The message is represented as an instance of the appropriate format-specific *Message* subclass unless a custom message factory was specified when the *Mailbox* instance was initialized.

get_message(*key*)
Return a representation of the message corresponding to *key* as an instance of the appropriate format-specific *Message* subclass, or raise a *KeyError* exception if no such message exists.

get_bytes(*key*)
Return a byte representation of the message corresponding to *key*, or raise a *KeyError* exception if no such message exists.

New in version 3.2.

get_string(*key*)
Return a string representation of the message corresponding to *key*, or raise a *KeyError* exception if no such message exists. The message is processed through *email.message.Message* to convert it to a 7bit clean representation.

get_file(*key*)
Return a file-like representation of the message corresponding to *key*, or raise a *KeyError* exception if no such message exists. The file-like object behaves as if open in binary mode. This file should be closed once it is no longer needed.

Changed in version 3.2: The file object really is a binary file; previously it was incorrectly returned in text mode. Also, the file-like object now supports the context management protocol: you can use a **with** statement to automatically close it.

Note: Unlike other representations of messages, file-like representations are not necessarily independent of the *Mailbox* instance that created them or of the underlying mailbox. More specific documentation is provided by each subclass.

__contains__(*key*)
Return **True** if *key* corresponds to a message, **False** otherwise.

__len__()
Return a count of messages in the mailbox.

clear()
Delete all messages from the mailbox.

pop(*key*, *default=None*)
Return a representation of the message corresponding to *key* and delete the message. If no such message exists, return *default*. The message is represented as an instance of the appropriate format-specific *Message* subclass unless a custom message factory was specified when the *Mailbox* instance was initialized.

popitem()
Return an arbitrary (*key*, *message*) pair, where *key* is a key and *message* is a message representation, and delete the corresponding message. If the mailbox is empty, raise a *KeyError* exception. The message is represented as an instance of the appropriate format-specific *Message* subclass unless a custom message factory was specified when the *Mailbox* instance was initialized.

update(*arg*)
Parameter *arg* should be a *key*-to-*message* mapping or an iterable of (*key*, *message*) pairs. Updates the mailbox so that, for each given *key* and *message*, the message corresponding to *key* is set to *message* as if by using *__setitem__()*. As with *__setitem__()*, each *key* must already correspond to a message in the mailbox or else a *KeyError* exception will be raised, so in general it is incorrect for *arg* to be a *Mailbox* instance.

Note: Unlike with dictionaries, keyword arguments are not supported.

---

flush()
Write any pending changes to the filesystem. For some *Mailbox* subclasses, changes are always

written immediately and *flush()* does nothing, but you should still make a habit of calling this method.

lock()
Acquire an exclusive advisory lock on the mailbox so that other processes know not to modify it. An *ExternalClashError* is raised if the lock is not available. The particular locking mechanisms used depend upon the mailbox format. You should *always* lock the mailbox before making any modifications to its contents.

unlock()
Release the lock on the mailbox, if any.

close()
Flush the mailbox, unlock it if necessary, and close any open files. For some *Mailbox* subclasses, this method does nothing.

Maildir

class mailbox.Maildir(*dirname*, *factory=None*, *create=True*)
A subclass of *Mailbox* for mailboxes in Maildir format. Parameter *factory* is a callable object that accepts a file-like message representation (which behaves as if opened in binary mode) and returns a custom representation. If *factory* is `None`, *MaildirMessage* is used as the default message representation. If *create* is `True`, the mailbox is created if it does not exist.

It is for historical reasons that *dirname* is named as such rather than *path*.

Maildir is a directory-based mailbox format invented for the qmail mail transfer agent and now widely supported by other programs. Messages in a Maildir mailbox are stored in separate files within a common directory structure. This design allows Maildir mailboxes to be accessed and modified by multiple unrelated programs without data corruption, so file locking is unnecessary.

Maildir mailboxes contain three subdirectories, namely: `tmp`, `new`, and `cur`. Messages are created momentarily in the `tmp` subdirectory and then moved to the `new` subdirectory to finalize delivery. A mail user agent may subsequently move the message to the `cur` subdirectory and store information about the state of the message in a special "info" section appended to its file name.

Folders of the style introduced by the Courier mail transfer agent are also supported. Any subdirectory of the main mailbox is considered a folder if `'.'` is the first character in its name. Folder names are represented by *Maildir* without the leading `'.'`. Each folder is itself a Maildir mailbox but should not contain other folders. Instead, a logical nesting is indicated using `'.'` to delimit levels, e.g., "Archived.2005.07".

Note: The Maildir specification requires the use of a colon (`':'`) in certain message file names. However, some operating systems do not permit this character in file names, If you wish to use a Maildir-like format on such an operating system, you should specify another character to use instead. The exclamation point (`'!'`) is a popular choice. For example:

```
import mailbox
mailbox.Maildir.colon = '!'
```

The `colon` attribute may also be set on a per-instance basis.

Maildir instances have all of the methods of *Mailbox* in addition to the following:

list_folders()
Return a list of the names of all folders.

get_folder(*folder*)
Return a *Maildir* instance representing the folder whose name is *folder*. A *NoSuchMailboxError* exception is raised if the folder does not exist.

add_folder(*folder*)
Create a folder whose name is *folder* and return a *Maildir* instance representing it.

remove_folder(*folder*)
Delete the folder whose name is *folder*. If the folder contains any messages, a *NotEmptyError* exception will be raised and the folder will not be deleted.

clean()
Delete temporary files from the mailbox that have not been accessed in the last 36 hours. The Maildir specification says that mail-reading programs should do this occasionally.

Some *Mailbox* methods implemented by *Maildir* deserve special remarks:

add(*message*)
__setitem__(*key*, *message*)
update(*arg*)

> **Warning:** These methods generate unique file names based upon the current process ID. When using multiple threads, undetected name clashes may occur and cause corruption of the mailbox unless threads are coordinated to avoid using these methods to manipulate the same mailbox simultaneously.

flush()
All changes to Maildir mailboxes are immediately applied, so this method does nothing.

lock()
unlock()
Maildir mailboxes do not support (or require) locking, so these methods do nothing.

close()
Maildir instances do not keep any open files and the underlying mailboxes do not support locking, so this method does nothing.

get_file(*key*)
Depending upon the host platform, it may not be possible to modify or remove the underlying message while the returned file remains open.

See also:

maildir man page from qmail The original specification of the format.

Using maildir format Notes on Maildir by its inventor. Includes an updated name-creation scheme and details on "info" semantics.

maildir man page from Courier Another specification of the format. Describes a common extension for supporting folders.

mbox

class mailbox.mbox(*path*, *factory=None*, *create=True*)
A subclass of *Mailbox* for mailboxes in mbox format. Parameter *factory* is a callable object that accepts a file-like message representation (which behaves as if opened in binary mode) and returns a custom representation. If *factory* is `None`, *mboxMessage* is used as the default message representation. If *create* is `True`, the mailbox is created if it does not exist.

The mbox format is the classic format for storing mail on Unix systems. All messages in an mbox mailbox are stored in a single file with the beginning of each message indicated by a line whose first five characters are "From ".

Several variations of the mbox format exist to address perceived shortcomings in the original. In the interest of compatibility, *mbox* implements the original format, which is sometimes referred to as *mboxo*. This means that the *Content-Length* header, if present, is ignored and that any occurrences of "From " at the beginning of a line in a message body are transformed to ">From " when storing the message, although occurrences of ">From " are not transformed to "From " when reading the message.

Some *Mailbox* methods implemented by *mbox* deserve special remarks:

get_file(*key*)
: Using the file after calling `flush()` or `close()` on the *mbox* instance may yield unpredictable results or raise an exception.

lock()
unlock()
: Three locking mechanisms are used—dot locking and, if available, the `flock()` and `lockf()` system calls.

See also:

mbox man page from qmail A specification of the format and its variations.

mbox man page from tin Another specification of the format, with details on locking.

Configuring Netscape Mail on Unix: Why The Content-Length Format is Bad An argument for using the original mbox format rather than a variation.

"mbox" is a family of several mutually incompatible mailbox formats A history of mbox variations.

MH

class mailbox.MH(*path*, *factory=None*, *create=True*)
: A subclass of *Mailbox* for mailboxes in MH format. Parameter *factory* is a callable object that accepts a file-like message representation (which behaves as if opened in binary mode) and returns a custom representation. If *factory* is `None`, *MHMessage* is used as the default message representation. If *create* is `True`, the mailbox is created if it does not exist.

MH is a directory-based mailbox format invented for the MH Message Handling System, a mail user agent. Each message in an MH mailbox resides in its own file. An MH mailbox may contain other MH mailboxes (called *folders*) in addition to messages. Folders may be nested indefinitely. MH mailboxes also support *sequences*, which are named lists used to logically group messages without moving them to sub-folders. Sequences are defined in a file called `.mh_sequences` in each folder.

The *MH* class manipulates MH mailboxes, but it does not attempt to emulate all of **mh**'s behaviors. In particular, it does not modify and is not affected by the `context` or `.mh_profile` files that are used by **mh** to store its state and configuration.

MH instances have all of the methods of *Mailbox* in addition to the following:

list_folders()
: Return a list of the names of all folders.

get_folder(*folder*)
: Return an *MH* instance representing the folder whose name is *folder*. A *NoSuchMailboxError* exception is raised if the folder does not exist.

add_folder(*folder*)
: Create a folder whose name is *folder* and return an *MH* instance representing it.

remove_folder(*folder*)
Delete the folder whose name is *folder*. If the folder contains any messages, a *NotEmptyError* exception will be raised and the folder will not be deleted.

get_sequences()
Return a dictionary of sequence names mapped to key lists. If there are no sequences, the empty dictionary is returned.

set_sequences(*sequences*)
Re-define the sequences that exist in the mailbox based upon *sequences*, a dictionary of names mapped to key lists, like returned by *get_sequences()*.

pack()
Rename messages in the mailbox as necessary to eliminate gaps in numbering. Entries in the sequences list are updated correspondingly.

Note: Already-issued keys are invalidated by this operation and should not be subsequently used.

Some *Mailbox* methods implemented by *MH* deserve special remarks:

remove(*key*)
__delitem__(*key*)
discard(*key*)
These methods immediately delete the message. The MH convention of marking a message for deletion by prepending a comma to its name is not used.

lock()
unlock()
Three locking mechanisms are used—dot locking and, if available, the `flock()` and `lockf()` system calls. For MH mailboxes, locking the mailbox means locking the `.mh_sequences` file and, only for the duration of any operations that affect them, locking individual message files.

get_file(*key*)
Depending upon the host platform, it may not be possible to remove the underlying message while the returned file remains open.

flush()
All changes to MH mailboxes are immediately applied, so this method does nothing.

close()
MH instances do not keep any open files, so this method is equivalent to *unlock()*.

See also:

nmh - Message Handling System Home page of **nmh**, an updated version of the original **mh**.

MH & nmh: Email for Users & Programmers A GPL-licensed book on **mh** and **nmh**, with some information on the mailbox format.

Babyl

class mailbox.Babyl(*path*, *factory=None*, *create=True*)
A subclass of *Mailbox* for mailboxes in Babyl format. Parameter *factory* is a callable object that accepts a file-like message representation (which behaves as if opened in binary mode) and returns a custom representation. If *factory* is `None`, *BabylMessage* is used as the default message representation. If *create* is `True`, the mailbox is created if it does not exist.

Babyl is a single-file mailbox format used by the Rmail mail user agent included with Emacs. The beginning of a message is indicated by a line containing the two characters Control-Underscore (`'\037'`)

and Control-L (`'\014'`). The end of a message is indicated by the start of the next message or, in the case of the last message, a line containing a Control-Underscore (`'\037'`) character.

Messages in a Babyl mailbox have two sets of headers, original headers and so-called visible headers. Visible headers are typically a subset of the original headers that have been reformatted or abridged to be more attractive. Each message in a Babyl mailbox also has an accompanying list of *labels*, or short strings that record extra information about the message, and a list of all user-defined labels found in the mailbox is kept in the Babyl options section.

Babyl instances have all of the methods of *Mailbox* in addition to the following:

`get_labels()`
Return a list of the names of all user-defined labels used in the mailbox.

Note: The actual messages are inspected to determine which labels exist in the mailbox rather than consulting the list of labels in the Babyl options section, but the Babyl section is updated whenever the mailbox is modified.

Some *Mailbox* methods implemented by *Babyl* deserve special remarks:

`get_file(`*key*`)`
In Babyl mailboxes, the headers of a message are not stored contiguously with the body of the message. To generate a file-like representation, the headers and body are copied together into an *io.BytesIO* instance, which has an API identical to that of a file. As a result, the file-like object is truly independent of the underlying mailbox but does not save memory compared to a string representation.

`lock()`
`unlock()`
Three locking mechanisms are used—dot locking and, if available, the `flock()` and `lockf()` system calls.

See also:

Format of Version 5 Babyl Files A specification of the Babyl format.

Reading Mail with Rmail The Rmail manual, with some information on Babyl semantics.

MMDF

`class mailbox.MMDF(`*path*, *factory=None*, *create=True*`)`
A subclass of *Mailbox* for mailboxes in MMDF format. Parameter *factory* is a callable object that accepts a file-like message representation (which behaves as if opened in binary mode) and returns a custom representation. If *factory* is `None`, *MMDFMessage* is used as the default message representation. If *create* is `True`, the mailbox is created if it does not exist.

MMDF is a single-file mailbox format invented for the Multichannel Memorandum Distribution Facility, a mail transfer agent. Each message is in the same form as an mbox message but is bracketed before and after by lines containing four Control-A (`'\001'`) characters. As with the mbox format, the beginning of each message is indicated by a line whose first five characters are "From ", but additional occurrences of "From " are not transformed to ">From " when storing messages because the extra message separator lines prevent mistaking such occurrences for the starts of subsequent messages.

Some *Mailbox* methods implemented by *MMDF* deserve special remarks:

`get_file(`*key*`)`
Using the file after calling `flush()` or `close()` on the *MMDF* instance may yield unpredictable results or raise an exception.

`lock()`

`unlock()`
Three locking mechanisms are used—dot locking and, if available, the `flock()` and `lockf()` system calls.

See also:

mmdf man page from tin A specification of MMDF format from the documentation of tin, a newsreader.

MMDF A Wikipedia article describing the Multichannel Memorandum Distribution Facility.

20.4.2 `Message` objects

`class mailbox.Message(`*message=None*`)`
A subclass of the *email.message* module's *Message*. Subclasses of *mailbox.Message* add mailbox-format-specific state and behavior.

If *message* is omitted, the new instance is created in a default, empty state. If *message* is an *email.message.Message* instance, its contents are copied; furthermore, any format-specific information is converted insofar as possible if *message* is a *Message* instance. If *message* is a string, a byte string, or a file, it should contain an **RFC 2822**-compliant message, which is read and parsed. Files should be open in binary mode, but text mode files are accepted for backward compatibility.

The format-specific state and behaviors offered by subclasses vary, but in general it is only the properties that are not specific to a particular mailbox that are supported (although presumably the properties are specific to a particular mailbox format). For example, file offsets for single-file mailbox formats and file names for directory-based mailbox formats are not retained, because they are only applicable to the original mailbox. But state such as whether a message has been read by the user or marked as important is retained, because it applies to the message itself.

There is no requirement that *Message* instances be used to represent messages retrieved using *Mailbox* instances. In some situations, the time and memory required to generate *Message* representations might not be acceptable. For such situations, *Mailbox* instances also offer string and file-like representations, and a custom message factory may be specified when a *Mailbox* instance is initialized.

`MaildirMessage`

`class mailbox.MaildirMessage(`*message=None*`)`
A message with Maildir-specific behaviors. Parameter *message* has the same meaning as with the *Message* constructor.

Typically, a mail user agent application moves all of the messages in the `new` subdirectory to the `cur` subdirectory after the first time the user opens and closes the mailbox, recording that the messages are old whether or not they've actually been read. Each message in `cur` has an "info" section added to its file name to store information about its state. (Some mail readers may also add an "info" section to messages in `new`.) The "info" section may take one of two forms: it may contain "2," followed by a list of standardized flags (e.g., "2,FR") or it may contain "1," followed by so-called experimental information. Standard flags for Maildir messages are as follows:

Flag	Meaning	Explanation
D	Draft	Under composition
F	Flagged	Marked as important
P	Passed	Forwarded, resent, or bounced
R	Replied	Replied to
S	Seen	Read
T	Trashed	Marked for subsequent deletion

MaildirMessage instances offer the following methods:

get_subdir()
Return either "new" (if the message should be stored in the `new` subdirectory) or "cur" (if the message should be stored in the `cur` subdirectory).

Note: A message is typically moved from `new` to `cur` after its mailbox has been accessed, whether or not the message is has been read. A message `msg` has been read if `"S" in msg.get_flags()` is `True`.

---

set_subdir(*subdir*)
Set the subdirectory the message should be stored in. Parameter *subdir* must be either "new" or "cur".

get_flags()
Return a string specifying the flags that are currently set. If the message complies with the standard Maildir format, the result is the concatenation in alphabetical order of zero or one occurrence of each of `'D'`, `'F'`, `'P'`, `'R'`, `'S'`, and `'T'`. The empty string is returned if no flags are set or if "info" contains experimental semantics.

set_flags(*flags*)
Set the flags specified by *flags* and unset all others.

add_flag(*flag*)
Set the flag(s) specified by *flag* without changing other flags. To add more than one flag at a time, *flag* may be a string of more than one character. The current "info" is overwritten whether or not it contains experimental information rather than flags.

remove_flag(*flag*)
Unset the flag(s) specified by *flag* without changing other flags. To remove more than one flag at a time, *flag* maybe a string of more than one character. If "info" contains experimental information rather than flags, the current "info" is not modified.

get_date()
Return the delivery date of the message as a floating-point number representing seconds since the epoch.

set_date(*date*)
Set the delivery date of the message to *date*, a floating-point number representing seconds since the epoch.

get_info()
Return a string containing the "info" for a message. This is useful for accessing and modifying "info" that is experimental (i.e., not a list of flags).

set_info(*info*)
Set "info" to *info*, which should be a string.

When a *MaildirMessage* instance is created based upon an *mboxMessage* or *MMDFMessage* instance, the *Status* and *X-Status* headers are omitted and the following conversions take place:

Resulting state	*mboxMessage* or *MMDFMessage* state
"cur" subdirectory	O flag
F flag	F flag
R flag	A flag
S flag	R flag
T flag	D flag

When a *MaildirMessage* instance is created based upon an *MHMessage* instance, the following conversions take place:

Resulting state	*MHMessage* state
"cur" subdirectory	"unseen" sequence
"cur" subdirectory and S flag	no "unseen" sequence
F flag	"flagged" sequence
R flag	"replied" sequence

When a *MaildirMessage* instance is created based upon a *BabylMessage* instance, the following conversions take place:

Resulting state	*BabylMessage* state
"cur" subdirectory	"unseen" label
"cur" subdirectory and S flag	no "unseen" label
P flag	"forwarded" or "resent" label
R flag	"answered" label
T flag	"deleted" label

mboxMessage

class mailbox.**mboxMessage**(*message=None*)

A message with mbox-specific behaviors. Parameter *message* has the same meaning as with the *Message* constructor.

Messages in an mbox mailbox are stored together in a single file. The sender's envelope address and the time of delivery are typically stored in a line beginning with "From " that is used to indicate the start of a message, though there is considerable variation in the exact format of this data among mbox implementations. Flags that indicate the state of the message, such as whether it has been read or marked as important, are typically stored in ***Status*** and ***X-Status*** headers.

Conventional flags for mbox messages are as follows:

Flag	Meaning	Explanation
R	Read	Read
O	Old	Previously detected by MUA
D	Deleted	Marked for subsequent deletion
F	Flagged	Marked as important
A	Answered	Replied to

The "R" and "O" flags are stored in the ***Status*** header, and the "D", "F", and "A" flags are stored in the ***X-Status*** header. The flags and headers typically appear in the order mentioned.

mboxMessage instances offer the following methods:

get_from()

Return a string representing the "From " line that marks the start of the message in an mbox mailbox. The leading "From " and the trailing newline are excluded.

set_from(*from_*, *time_=None*)

Set the "From " line to *from_*, which should be specified without a leading "From " or trailing newline. For convenience, *time_* may be specified and will be formatted appropriately and appended to *from_*. If *time_* is specified, it should be a *time.struct_time* instance, a tuple suitable for passing to *time.strftime()*, or `True` (to use *time.gmtime()*).

`get_flags()`
Return a string specifying the flags that are currently set. If the message complies with the conventional format, the result is the concatenation in the following order of zero or one occurrence of each of `'R'`, `'O'`, `'D'`, `'F'`, and `'A'`.

`set_flags(`*flags*`)`
Set the flags specified by *flags* and unset all others. Parameter *flags* should be the concatenation in any order of zero or more occurrences of each of `'R'`, `'O'`, `'D'`, `'F'`, and `'A'`.

`add_flag(`*flag*`)`
Set the flag(s) specified by *flag* without changing other flags. To add more than one flag at a time, *flag* may be a string of more than one character.

`remove_flag(`*flag*`)`
Unset the flag(s) specified by *flag* without changing other flags. To remove more than one flag at a time, *flag* maybe a string of more than one character.

When an *mboxMessage* instance is created based upon a *MaildirMessage* instance, a "From " line is generated based upon the *MaildirMessage* instance's delivery date, and the following conversions take place:

Resulting state	*MaildirMessage* state
R flag	S flag
O flag	"cur" subdirectory
D flag	T flag
F flag	F flag
A flag	R flag

When an *mboxMessage* instance is created based upon an *MHMessage* instance, the following conversions take place:

Resulting state	*MHMessage* state
R flag and O flag	no "unseen" sequence
O flag	"unseen" sequence
F flag	"flagged" sequence
A flag	"replied" sequence

When an *mboxMessage* instance is created based upon a *BabylMessage* instance, the following conversions take place:

Resulting state	*BabylMessage* state
R flag and O flag	no "unseen" label
O flag	"unseen" label
D flag	"deleted" label
A flag	"answered" label

When a *Message* instance is created based upon an *MMDFMessage* instance, the "From " line is copied and all flags directly correspond:

Resulting state	*MMDFMessage* state
R flag	R flag
O flag	O flag
D flag	D flag
F flag	F flag
A flag	A flag

MHMessage

class mailbox.**MHMessage**(*message=None*)

A message with MH-specific behaviors. Parameter *message* has the same meaning as with the *Message* constructor.

MH messages do not support marks or flags in the traditional sense, but they do support sequences, which are logical groupings of arbitrary messages. Some mail reading programs (although not the standard **mh** and **nmh**) use sequences in much the same way flags are used with other formats, as follows:

Sequence	Explanation
unseen	Not read, but previously detected by MUA
replied	Replied to
flagged	Marked as important

MHMessage instances offer the following methods:

get_sequences()

Return a list of the names of sequences that include this message.

set_sequences(*sequences*)

Set the list of sequences that include this message.

add_sequence(*sequence*)

Add *sequence* to the list of sequences that include this message.

remove_sequence(*sequence*)

Remove *sequence* from the list of sequences that include this message.

When an *MHMessage* instance is created based upon a *MaildirMessage* instance, the following conversions take place:

Resulting state	*MaildirMessage* state
“unseen” sequence	no S flag
“replied” sequence	R flag
“flagged” sequence	F flag

When an *MHMessage* instance is created based upon an *mboxMessage* or *MMDFMessage* instance, the ***Status*** and ***X-Status*** headers are omitted and the following conversions take place:

Resulting state	*mboxMessage* or *MMDFMessage* state
“unseen” sequence	no R flag
“replied” sequence	A flag
“flagged” sequence	F flag

When an *MHMessage* instance is created based upon a *BabylMessage* instance, the following conversions take place:

Resulting state	*BabylMessage* state
“unseen” sequence	“unseen” label
“replied” sequence	“answered” label

BabylMessage

class mailbox.BabylMessage(*message=None*)

A message with Babyl-specific behaviors. Parameter *message* has the same meaning as with the *Message* constructor.

Certain message labels, called *attributes*, are defined by convention to have special meanings. The attributes are as follows:

Label	Explanation
unseen	Not read, but previously detected by MUA
deleted	Marked for subsequent deletion
filed	Copied to another file or mailbox
answered	Replied to
forwarded	Forwarded
edited	Modified by the user
resent	Resent

By default, Rmail displays only visible headers. The *BabylMessage* class, though, uses the original headers because they are more complete. Visible headers may be accessed explicitly if desired.

BabylMessage instances offer the following methods:

get_labels()
Return a list of labels on the message.

set_labels(*labels*)
Set the list of labels on the message to *labels*.

add_label(*label*)
Add *label* to the list of labels on the message.

remove_label(*label*)
Remove *label* from the list of labels on the message.

get_visible()
Return an *Message* instance whose headers are the message's visible headers and whose body is empty.

set_visible(*visible*)
Set the message's visible headers to be the same as the headers in *message*. Parameter *visible* should be a *Message* instance, an *email.message.Message* instance, a string, or a file-like object (which should be open in text mode).

update_visible()
When a *BabylMessage* instance's original headers are modified, the visible headers are not automatically modified to correspond. This method updates the visible headers as follows: each visible header with a corresponding original header is set to the value of the original header, each visible header without a corresponding original header is removed, and any of *Date*, *From*, *Reply-To*, *To*, *CC*, and *Subject* that are present in the original headers but not the visible headers are added to the visible headers.

When a *BabylMessage* instance is created based upon a *MaildirMessage* instance, the following conversions take place:

Resulting state	*MaildirMessage* state
"unseen" label	no S flag
"deleted" label	T flag
"answered" label	R flag
"forwarded" label	P flag

When a *BabylMessage* instance is created based upon an *mboxMessage* or *MMDFMessage* instance, the ***Status*** and ***X-Status*** headers are omitted and the following conversions take place:

Resulting state	*mboxMessage* or *MMDFMessage* state
"unseen" label	no R flag
"deleted" label	D flag
"answered" label	A flag

When a *BabylMessage* instance is created based upon an *MHMessage* instance, the following conversions take place:

Resulting state	*MHMessage* state
"unseen" label	"unseen" sequence
"answered" label	"replied" sequence

MMDFMessage

class mailbox.**MMDFMessage**(*message=None*)

A message with MMDF-specific behaviors. Parameter *message* has the same meaning as with the *Message* constructor.

As with message in an mbox mailbox, MMDF messages are stored with the sender's address and the delivery date in an initial line beginning with "From ". Likewise, flags that indicate the state of the message are typically stored in ***Status*** and ***X-Status*** headers.

Conventional flags for MMDF messages are identical to those of mbox message and are as follows:

Flag	Meaning	Explanation
R	Read	Read
O	Old	Previously detected by MUA
D	Deleted	Marked for subsequent deletion
F	Flagged	Marked as important
A	Answered	Replied to

The "R" and "O" flags are stored in the ***Status*** header, and the "D", "F", and "A" flags are stored in the ***X-Status*** header. The flags and headers typically appear in the order mentioned.

MMDFMessage instances offer the following methods, which are identical to those offered by *mboxMessage*:

get_from()

Return a string representing the "From " line that marks the start of the message in an mbox mailbox. The leading "From " and the trailing newline are excluded.

set_from(*from_*, *time_=None*)

Set the "From " line to *from_*, which should be specified without a leading "From " or trailing newline. For convenience, *time_* may be specified and will be formatted appropriately and

appended to *from_*. If *time_* is specified, it should be a *time.struct_time* instance, a tuple suitable for passing to *time.strftime()*, or `True` (to use *time.gmtime()*).

`get_flags()`
Return a string specifying the flags that are currently set. If the message complies with the conventional format, the result is the concatenation in the following order of zero or one occurrence of each of `'R'`, `'O'`, `'D'`, `'F'`, and `'A'`.

`set_flags(`*flags*`)`
Set the flags specified by *flags* and unset all others. Parameter *flags* should be the concatenation in any order of zero or more occurrences of each of `'R'`, `'O'`, `'D'`, `'F'`, and `'A'`.

`add_flag(`*flag*`)`
Set the flag(s) specified by *flag* without changing other flags. To add more than one flag at a time, *flag* may be a string of more than one character.

`remove_flag(`*flag*`)`
Unset the flag(s) specified by *flag* without changing other flags. To remove more than one flag at a time, *flag* maybe a string of more than one character.

When an *MMDFMessage* instance is created based upon a *MaildirMessage* instance, a "From " line is generated based upon the *MaildirMessage* instance's delivery date, and the following conversions take place:

Resulting state	*MaildirMessage* state
R flag	S flag
O flag	"cur" subdirectory
D flag	T flag
F flag	F flag
A flag	R flag

When an *MMDFMessage* instance is created based upon an *MHMessage* instance, the following conversions take place:

Resulting state	*MHMessage* state
R flag and O flag	no "unseen" sequence
O flag	"unseen" sequence
F flag	"flagged" sequence
A flag	"replied" sequence

When an *MMDFMessage* instance is created based upon a *BabylMessage* instance, the following conversions take place:

Resulting state	*BabylMessage* state
R flag and O flag	no "unseen" label
O flag	"unseen" label
D flag	"deleted" label
A flag	"answered" label

When an *MMDFMessage* instance is created based upon an *mboxMessage* instance, the "From " line is copied and all flags directly correspond:

Resulting state	*mboxMessage* state
R flag	R flag
O flag	O flag
D flag	D flag
F flag	F flag
A flag	A flag

20.4.3 Exceptions

The following exception classes are defined in the *mailbox* module:

exception mailbox.**Error**
The based class for all other module-specific exceptions.

exception mailbox.**NoSuchMailboxError**
Raised when a mailbox is expected but is not found, such as when instantiating a *Mailbox* subclass with a path that does not exist (and with the *create* parameter set to `False`), or when opening a folder that does not exist.

exception mailbox.**NotEmptyError**
Raised when a mailbox is not empty but is expected to be, such as when deleting a folder that contains messages.

exception mailbox.**ExternalClashError**
Raised when some mailbox-related condition beyond the control of the program causes it to be unable to proceed, such as when failing to acquire a lock that another program already holds a lock, or when a uniquely-generated file name already exists.

exception mailbox.**FormatError**
Raised when the data in a file cannot be parsed, such as when an *MH* instance attempts to read a corrupted `.mh_sequences` file.

20.4.4 Examples

A simple example of printing the subjects of all messages in a mailbox that seem interesting:

```
import mailbox
for message in mailbox.mbox('~/mbox'):
    subject = message['subject']       # Could possibly be None.
    if subject and 'python' in subject.lower():
        print(subject)
```

To copy all mail from a Babyl mailbox to an MH mailbox, converting all of the format-specific information that can be converted:

```
import mailbox
destination = mailbox.MH('~/Mail')
destination.lock()
for message in mailbox.Babyl('~/RMAIL'):
    destination.add(mailbox.MHMessage(message))
destination.flush()
destination.unlock()
```

This example sorts mail from several mailing lists into different mailboxes, being careful to avoid mail corruption due to concurrent modification by other programs, mail loss due to interruption of the program, or premature termination due to malformed messages in the mailbox:

```
import mailbox
import email.errors

list_names = ('python-list', 'python-dev', 'python-bugs')

boxes = {name: mailbox.mbox('~/email/%s' % name) for name in list_names}
inbox = mailbox.Maildir('~/Maildir', factory=None)

for key in inbox.iterkeys():
    try:
        message = inbox[key]
    except email.errors.MessageParseError:
        continue                # The message is malformed. Just leave it.

    for name in list_names:
        list_id = message['list-id']
        if list_id and name in list_id:
            # Get mailbox to use
            box = boxes[name]

            # Write copy to disk before removing original.
            # If there's a crash, you might duplicate a message, but
            # that's better than losing a message completely.
            box.lock()
            box.add(message)
            box.flush()
            box.unlock()

            # Remove original message
            inbox.lock()
            inbox.discard(key)
            inbox.flush()
            inbox.unlock()
            break               # Found destination, so stop looking.

for box in boxes.itervalues():
    box.close()
```

20.5 mimetypes — Map filenames to MIME types

Source code: Lib/mimetypes.py

The *mimetypes* module converts between a filename or URL and the MIME type associated with the filename extension. Conversions are provided from filename to MIME type and from MIME type to filename extension; encodings are not supported for the latter conversion.

The module provides one class and a number of convenience functions. The functions are the normal interface to this module, but some applications may be interested in the class as well.

The functions described below provide the primary interface for this module. If the module has not been initialized, they will call *init()* if they rely on the information *init()* sets up.

mimetypes.**guess_type**(*url*, *strict=True*)
Guess the type of a file based on its filename or URL, given by *url*. The return value is a tuple `(type, encoding)` where *type* is `None` if the type can't be guessed (missing or unknown suffix) or a string of the form `'type/subtype'`, usable for a MIME *content-type* header.

encoding is `None` for no encoding or the name of the program used to encode (e.g. **compress** or **gzip**). The encoding is suitable for use as a *Content-Encoding* header, **not** as a *Content-Transfer-Encoding* header. The mappings are table driven. Encoding suffixes are case sensitive; type suffixes are first tried case sensitively, then case insensitively.

The optional *strict* argument is a flag specifying whether the list of known MIME types is limited to only the official types registered with IANA. When *strict* is `True` (the default), only the IANA types are supported; when *strict* is `False`, some additional non-standard but commonly used MIME types are also recognized.

mimetypes.**guess_all_extensions**(*type*, *strict=True*)
Guess the extensions for a file based on its MIME type, given by *type*. The return value is a list of strings giving all possible filename extensions, including the leading dot (`'.'`). The extensions are not guaranteed to have been associated with any particular data stream, but would be mapped to the MIME type *type* by *guess_type()*.

The optional *strict* argument has the same meaning as with the *guess_type()* function.

mimetypes.**guess_extension**(*type*, *strict=True*)
Guess the extension for a file based on its MIME type, given by *type*. The return value is a string giving a filename extension, including the leading dot (`'.'`). The extension is not guaranteed to have been associated with any particular data stream, but would be mapped to the MIME type *type* by *guess_type()*. If no extension can be guessed for *type*, `None` is returned.

The optional *strict* argument has the same meaning as with the *guess_type()* function.

Some additional functions and data items are available for controlling the behavior of the module.

mimetypes.**init**(*files=None*)
Initialize the internal data structures. If given, *files* must be a sequence of file names which should be used to augment the default type map. If omitted, the file names to use are taken from *knownfiles*; on Windows, the current registry settings are loaded. Each file named in *files* or *knownfiles* takes precedence over those named before it. Calling *init()* repeatedly is allowed.

Specifying an empty list for *files* will prevent the system defaults from being applied: only the well-known values will be present from a built-in list.

Changed in version 3.2: Previously, Windows registry settings were ignored.

mimetypes.**read_mime_types**(*filename*)
Load the type map given in the file *filename*, if it exists. The type map is returned as a dictionary mapping filename extensions, including the leading dot (`'.'`), to strings of the form `'type/subtype'`. If the file *filename* does not exist or cannot be read, `None` is returned.

mimetypes.**add_type**(*type*, *ext*, *strict=True*)
Add a mapping from the MIME type *type* to the extension *ext*. When the extension is already known, the new type will replace the old one. When the type is already known the extension will be added to the list of known extensions.

When *strict* is `True` (the default), the mapping will be added to the official MIME types, otherwise to the non-standard ones.

mimetypes.**inited**
Flag indicating whether or not the global data structures have been initialized. This is set to `True` by *init()*.

mimetypes.knownfiles
List of type map file names commonly installed. These files are typically named `mime.types` and are installed in different locations by different packages.

mimetypes.suffix_map
Dictionary mapping suffixes to suffixes. This is used to allow recognition of encoded files for which the encoding and the type are indicated by the same extension. For example, the `.tgz` extension is mapped to `.tar.gz` to allow the encoding and type to be recognized separately.

mimetypes.encodings_map
Dictionary mapping filename extensions to encoding types.

mimetypes.types_map
Dictionary mapping filename extensions to MIME types.

mimetypes.common_types
Dictionary mapping filename extensions to non-standard, but commonly found MIME types.

An example usage of the module:

```
>>> import mimetypes
>>> mimetypes.init()
>>> mimetypes.knownfiles
['/etc/mime.types', '/etc/httpd/mime.types', ... ]
>>> mimetypes.suffix_map['.tgz']
'.tar.gz'
>>> mimetypes.encodings_map['.gz']
'gzip'
>>> mimetypes.types_map['.tgz']
'application/x-tar-gz'
```

20.5.1 MimeTypes Objects

The *MimeTypes* class may be useful for applications which may want more than one MIME-type database; it provides an interface similar to the one of the *mimetypes* module.

class mimetypes.MimeTypes(*filenames=()*, *strict=True*)
This class represents a MIME-types database. By default, it provides access to the same database as the rest of this module. The initial database is a copy of that provided by the module, and may be extended by loading additional `mime.types`-style files into the database using the *read()* or *readfp()* methods. The mapping dictionaries may also be cleared before loading additional data if the default data is not desired.

The optional *filenames* parameter can be used to cause additional files to be loaded "on top" of the default database.

suffix_map
Dictionary mapping suffixes to suffixes. This is used to allow recognition of encoded files for which the encoding and the type are indicated by the same extension. For example, the `.tgz` extension is mapped to `.tar.gz` to allow the encoding and type to be recognized separately. This is initially a copy of the global *suffix_map* defined in the module.

encodings_map
Dictionary mapping filename extensions to encoding types. This is initially a copy of the global *encodings_map* defined in the module.

types_map
Tuple containing two dictionaries, mapping filename extensions to MIME types: the first dic-

tionary is for the non-standards types and the second one is for the standard types. They are initialized by *common_types* and *types_map*.

types_map_inv
Tuple containing two dictionaries, mapping MIME types to a list of filename extensions: the first dictionary is for the non-standards types and the second one is for the standard types. They are initialized by *common_types* and *types_map*.

guess_extension(*type*, *strict=True*)
Similar to the *guess_extension()* function, using the tables stored as part of the object.

guess_type(*url*, *strict=True*)
Similar to the *guess_type()* function, using the tables stored as part of the object.

guess_all_extensions(*type*, *strict=True*)
Similar to the *guess_all_extensions()* function, using the tables stored as part of the object.

read(*filename*, *strict=True*)
Load MIME information from a file named *filename*. This uses *readfp()* to parse the file.

If *strict* is `True`, information will be added to list of standard types, else to the list of non-standard types.

readfp(*fp*, *strict=True*)
Load MIME type information from an open file *fp*. The file must have the format of the standard `mime.types` files.

If *strict* is `True`, information will be added to the list of standard types, else to the list of non-standard types.

read_windows_registry(*strict=True*)
Load MIME type information from the Windows registry.

Availability: Windows.

If *strict* is `True`, information will be added to the list of standard types, else to the list of non-standard types.

New in version 3.2.

20.6 base64 — Base16, Base32, Base64, Base85 Data Encodings

Source code: Lib/base64.py

This module provides functions for encoding binary data to printable ASCII characters and decoding such encodings back to binary data. It provides encoding and decoding functions for the encodings specified in **RFC 3548**, which defines the Base16, Base32, and Base64 algorithms, and for the de-facto standard Ascii85 and Base85 encodings.

The **RFC 3548** encodings are suitable for encoding binary data so that it can safely sent by email, used as parts of URLs, or included as part of an HTTP POST request. The encoding algorithm is not the same as the **uuencode** program.

There are two interfaces provided by this module. The modern interface supports encoding *bytes-like objects* to ASCII *bytes*, and decoding *bytes-like objects* or strings containing ASCII to *bytes*. Both base-64 alphabets defined in **RFC 3548** (normal, and URL- and filesystem-safe) are supported.

The legacy interface does not support decoding from strings, but it does provide functions for encoding and decoding to and from *file objects*. It only supports the Base64 standard alphabet, and it adds newlines every

76 characters as per **RFC 2045**. Note that if you are looking for **RFC 2045** support you probably want to be looking at the *email* package instead.

Changed in version 3.3: ASCII-only Unicode strings are now accepted by the decoding functions of the modern interface.

Changed in version 3.4: Any *bytes-like objects* are now accepted by all encoding and decoding functions in this module. Ascii85/Base85 support added.

The modern interface provides:

`base64.b64encode(`*s*, *altchars=None*`)`
Encode the *bytes-like object* *s* using Base64 and return the encoded *bytes*.

Optional *altchars* must be a *bytes-like object* of at least length 2 (additional characters are ignored) which specifies an alternative alphabet for the `+` and `/` characters. This allows an application to e.g. generate URL or filesystem safe Base64 strings. The default is `None`, for which the standard Base64 alphabet is used.

`base64.b64decode(`*s*, *altchars=None*, *validate=False*`)`
Decode the Base64 encoded *bytes-like object* or ASCII string *s* and return the decoded *bytes*.

Optional *altchars* must be a *bytes-like object* or ASCII string of at least length 2 (additional characters are ignored) which specifies the alternative alphabet used instead of the `+` and `/` characters.

A *binascii.Error* exception is raised if *s* is incorrectly padded.

If *validate* is `False` (the default), characters that are neither in the normal base-64 alphabet nor the alternative alphabet are discarded prior to the padding check. If *validate* is `True`, these non-alphabet characters in the input result in a *binascii.Error*.

`base64.standard_b64encode(`*s*`)`
Encode *bytes-like object* *s* using the standard Base64 alphabet and return the encoded *bytes*.

`base64.standard_b64decode(`*s*`)`
Decode *bytes-like object* or ASCII string *s* using the standard Base64 alphabet and return the decoded *bytes*.

`base64.urlsafe_b64encode(`*s*`)`
Encode *bytes-like object* *s* using the URL- and filesystem-safe alphabet, which substitutes `-` instead of `+` and `_` instead of `/` in the standard Base64 alphabet, and return the encoded *bytes*. The result can still contain `=`.

`base64.urlsafe_b64decode(`*s*`)`
Decode *bytes-like object* or ASCII string *s* using the URL- and filesystem-safe alphabet, which substitutes `-` instead of `+` and `_` instead of `/` in the standard Base64 alphabet, and return the decoded *bytes*.

`base64.b32encode(`*s*`)`
Encode the *bytes-like object* *s* using Base32 and return the encoded *bytes*.

`base64.b32decode(`*s*, *casefold=False*, *map01=None*`)`
Decode the Base32 encoded *bytes-like object* or ASCII string *s* and return the decoded *bytes*.

Optional *casefold* is a flag specifying whether a lowercase alphabet is acceptable as input. For security purposes, the default is `False`.

RFC 3548 allows for optional mapping of the digit 0 (zero) to the letter O (oh), and for optional mapping of the digit 1 (one) to either the letter I (eye) or letter L (el). The optional argument *map01* when not `None`, specifies which letter the digit 1 should be mapped to (when *map01* is not `None`, the digit 0 is always mapped to the letter O). For security purposes the default is `None`, so that 0 and 1 are not allowed in the input.

A *binascii.Error* is raised if *s* is incorrectly padded or if there are non-alphabet characters present in the input.

base64.b16encode(*s*)
Encode the *bytes-like object* *s* using Base16 and return the encoded *bytes*.

base64.b16decode(*s*, *casefold=False*)
Decode the Base16 encoded *bytes-like object* or ASCII string *s* and return the decoded *bytes*.

Optional *casefold* is a flag specifying whether a lowercase alphabet is acceptable as input. For security purposes, the default is `False`.

A *binascii.Error* is raised if *s* is incorrectly padded or if there are non-alphabet characters present in the input.

base64.a85encode(*b*, ***, *foldspaces=False*, *wrapcol=0*, *pad=False*, *adobe=False*)
Encode the *bytes-like object* *b* using Ascii85 and return the encoded *bytes*.

foldspaces is an optional flag that uses the special short sequence 'y' instead of 4 consecutive spaces (ASCII 0x20) as supported by 'btoa'. This feature is not supported by the "standard" Ascii85 encoding.

wrapcol controls whether the output should have newline (`b'\n'`) characters added to it. If this is non-zero, each output line will be at most this many characters long.

pad controls whether the input is padded to a multiple of 4 before encoding. Note that the `btoa` implementation always pads.

adobe controls whether the encoded byte sequence is framed with `<~` and `~>`, which is used by the Adobe implementation.

New in version 3.4.

base64.a85decode(*b*, ***, *foldspaces=False*, *adobe=False*, *ignorechars=b' \t\n\r\v'*)
Decode the Ascii85 encoded *bytes-like object* or ASCII string *b* and return the decoded *bytes*.

foldspaces is a flag that specifies whether the 'y' short sequence should be accepted as shorthand for 4 consecutive spaces (ASCII 0x20). This feature is not supported by the "standard" Ascii85 encoding.

adobe controls whether the input sequence is in Adobe Ascii85 format (i.e. is framed with <~ and ~>).

ignorechars should be a *bytes-like object* or ASCII string containing characters to ignore from the input. This should only contain whitespace characters, and by default contains all whitespace characters in ASCII.

New in version 3.4.

base64.b85encode(*b*, *pad=False*)
Encode the *bytes-like object* *b* using base85 (as used in e.g. git-style binary diffs) and return the encoded *bytes*.

If *pad* is true, the input is padded with `b'\0'` so its length is a multiple of 4 bytes before encoding.

New in version 3.4.

base64.b85decode(*b*)
Decode the base85-encoded *bytes-like object* or ASCII string *b* and return the decoded *bytes*. Padding is implicitly removed, if necessary.

New in version 3.4.

The legacy interface:

base64.decode(*input*, *output*)
Decode the contents of the binary *input* file and write the resulting binary data to the *output* file. *input* and *output* must be *file objects*. *input* will be read until `input.readline()` returns an empty bytes object.

base64.**decodebytes**(*s*)
Decode the *bytes-like object* *s*, which must contain one or more lines of base64 encoded data, and return the decoded *bytes*.

New in version 3.1.

base64.**decodestring**(*s*)
Deprecated alias of *decodebytes()*.

Deprecated since version 3.1.

base64.**encode**(*input*, *output*)
Encode the contents of the binary *input* file and write the resulting base64 encoded data to the *output* file. *input* and *output* must be *file objects*. *input* will be read until `input.read()` returns an empty bytes object. *encode()* inserts a newline character (`b'\n'`) after every 76 bytes of the output, as well as ensuring that the output always ends with a newline, as per **RFC 2045** (MIME).

base64.**encodebytes**(*s*)
Encode the *bytes-like object* *s*, which can contain arbitrary binary data, and return *bytes* containing the base64-encoded data, with newlines (`b'\n'`) inserted after every 76 bytes of output, and ensuring that there is a trailing newline, as per **RFC 2045** (MIME).

New in version 3.1.

base64.**encodestring**(*s*)
Deprecated alias of *encodebytes()*.

Deprecated since version 3.1.

An example usage of the module:

```
>>> import base64
>>> encoded = base64.b64encode(b'data to be encoded')
>>> encoded
b'ZGF0YSBOYmiZSBlbmNvZGVk'
>>> data = base64.b64decode(encoded)
>>> data
b'data to be encoded'
```

See also:

Module *binascii* Support module containing ASCII-to-binary and binary-to-ASCII conversions.

RFC 1521 - MIME (Multipurpose Internet Mail Extensions) Part One: Mechanisms for Specifying and Des
Section 5.2, "Base64 Content-Transfer-Encoding," provides the definition of the base64 encoding.

20.7 `binhex` — Encode and decode binhex4 files

Source code: Lib/binhex.py

This module encodes and decodes files in binhex4 format, a format allowing representation of Macintosh files in ASCII. Only the data fork is handled.

The *binhex* module defines the following functions:

binhex.**binhex**(*input*, *output*)
Convert a binary file with filename *input* to binhex file *output*. The *output* parameter can either be a filename or a file-like object (any object supporting a `write()` and `close()` method).

binhex.**hexbin**(*input*, *output*)
Decode a binhex file *input*. *input* may be a filename or a file-like object supporting `read()` and `close()` methods. The resulting file is written to a file named *output*, unless the argument is `None` in which case the output filename is read from the binhex file.

The following exception is also defined:

exception binhex.**Error**
Exception raised when something can't be encoded using the binhex format (for example, a filename is too long to fit in the filename field), or when input is not properly encoded binhex data.

See also:

Module *binascii* Support module containing ASCII-to-binary and binary-to-ASCII conversions.

20.7.1 Notes

There is an alternative, more powerful interface to the coder and decoder, see the source for details.

If you code or decode textfiles on non-Macintosh platforms they will still use the old Macintosh newline convention (carriage-return as end of line).

20.8 binascii — Convert between binary and ASCII

The *binascii* module contains a number of methods to convert between binary and various ASCII-encoded binary representations. Normally, you will not use these functions directly but use wrapper modules like *uu*, *base64*, or *binhex* instead. The *binascii* module contains low-level functions written in C for greater speed that are used by the higher-level modules.

Note: `a2b_*` functions accept Unicode strings containing only ASCII characters. Other functions only accept *bytes-like objects* (such as *bytes*, *bytearray* and other objects that support the buffer protocol).

Changed in version 3.3: ASCII-only unicode strings are now accepted by the `a2b_*` functions.

The *binascii* module defines the following functions:

binascii.**a2b_uu**(*string*)
Convert a single line of uuencoded data back to binary and return the binary data. Lines normally contain 45 (binary) bytes, except for the last line. Line data may be followed by whitespace.

binascii.**b2a_uu**(*data*, ***, *backtick=False*)
Convert binary data to a line of ASCII characters, the return value is the converted line, including a newline char. The length of *data* should be at most 45. If *backtick* is true, zeros are represented by `'`'` instead of spaces.

Changed in version 3.7: Added the *backtick* parameter.

binascii.**a2b_base64**(*string*)
Convert a block of base64 data back to binary and return the binary data. More than one line may be passed at a time.

binascii.**b2a_base64**(*data*, ***, *newline=True*)
Convert binary data to a line of ASCII characters in base64 coding. The return value is the converted line, including a newline char if *newline* is true. The output of this function conforms to **RFC 3548**.

Changed in version 3.6: Added the *newline* parameter.

binascii.**a2b_qp**(*data*, *header=False*)
Convert a block of quoted-printable data back to binary and return the binary data. More than one line may be passed at a time. If the optional argument *header* is present and true, underscores will be decoded as spaces.

binascii.**b2a_qp**(*data*, *quotetabs=False*, *istext=True*, *header=False*)
Convert binary data to a line(s) of ASCII characters in quoted-printable encoding. The return value is the converted line(s). If the optional argument *quotetabs* is present and true, all tabs and spaces will be encoded. If the optional argument *istext* is present and true, newlines are not encoded but trailing whitespace will be encoded. If the optional argument *header* is present and true, spaces will be encoded as underscores per **RFC 1522**. If the optional argument *header* is present and false, newline characters will be encoded as well; otherwise linefeed conversion might corrupt the binary data stream.

binascii.**a2b_hqx**(*string*)
Convert binhex4 formatted ASCII data to binary, without doing RLE-decompression. The string should contain a complete number of binary bytes, or (in case of the last portion of the binhex4 data) have the remaining bits zero.

binascii.**rledecode_hqx**(*data*)
Perform RLE-decompression on the data, as per the binhex4 standard. The algorithm uses `0x90` after a byte as a repeat indicator, followed by a count. A count of `0` specifies a byte value of `0x90`. The routine returns the decompressed data, unless data input data ends in an orphaned repeat indicator, in which case the *Incomplete* exception is raised.

Changed in version 3.2: Accept only bytestring or bytearray objects as input.

binascii.**rlecode_hqx**(*data*)
Perform binhex4 style RLE-compression on *data* and return the result.

binascii.**b2a_hqx**(*data*)
Perform hexbin4 binary-to-ASCII translation and return the resulting string. The argument should already be RLE-coded, and have a length divisible by 3 (except possibly the last fragment).

binascii.**crc_hqx**(*data*, *value*)
Compute a 16-bit CRC value of *data*, starting with *value* as the initial CRC, and return the result. This uses the CRC-CCITT polynomial $x^{16} + x^{12} + x^5 + 1$, often represented as 0x1021. This CRC is used in the binhex4 format.

binascii.**crc32**(*data*[, *value*])
Compute CRC-32, the 32-bit checksum of *data*, starting with an initial CRC of *value*. The default initial CRC is zero. The algorithm is consistent with the ZIP file checksum. Since the algorithm is designed for use as a checksum algorithm, it is not suitable for use as a general hash algorithm. Use as follows:

```
print(binascii.crc32(b"hello world"))
# Or, in two pieces:
crc = binascii.crc32(b"hello")
crc = binascii.crc32(b" world", crc)
print('crc32 = {:#010x}'.format(crc))
```

Changed in version 3.0: The result is always unsigned. To generate the same numeric value across all Python versions and platforms, use `crc32(data) & 0xffffffff`.

binascii.**b2a_hex**(*data*)
binascii.**hexlify**(*data*)
Return the hexadecimal representation of the binary *data*. Every byte of *data* is converted into the corresponding 2-digit hex representation. The returned bytes object is therefore twice as long as the length of *data*.

Similar functionality (but returning a text string) is also conveniently accessible using the *bytes.hex()* method.

binascii.a2b_hex(*hexstr*)
binascii.unhexlify(*hexstr*)
Return the binary data represented by the hexadecimal string *hexstr*. This function is the inverse of *b2a_hex()*. *hexstr* must contain an even number of hexadecimal digits (which can be upper or lower case), otherwise an *Error* exception is raised.

Similar functionality (accepting only text string arguments, but more liberal towards whitespace) is also accessible using the *bytes.fromhex()* class method.

exception binascii.Error
Exception raised on errors. These are usually programming errors.

exception binascii.Incomplete
Exception raised on incomplete data. These are usually not programming errors, but may be handled by reading a little more data and trying again.

See also:

Module *base64* Support for RFC compliant base64-style encoding in base 16, 32, 64, and 85.

Module *binhex* Support for the binhex format used on the Macintosh.

Module *uu* Support for UU encoding used on Unix.

Module *quopri* Support for quoted-printable encoding used in MIME email messages.

20.9 quopri — Encode and decode MIME quoted-printable data

Source code: Lib/quopri.py

This module performs quoted-printable transport encoding and decoding, as defined in **RFC 1521**: "MIME (Multipurpose Internet Mail Extensions) Part One: Mechanisms for Specifying and Describing the Format of Internet Message Bodies". The quoted-printable encoding is designed for data where there are relatively few nonprintable characters; the base64 encoding scheme available via the *base64* module is more compact if there are many such characters, as when sending a graphics file.

quopri.decode(*input*, *output*, *header=False*)
Decode the contents of the *input* file and write the resulting decoded binary data to the *output* file. *input* and *output* must be *binary file objects*. If the optional argument *header* is present and true, underscore will be decoded as space. This is used to decode "Q"-encoded headers as described in **RFC 1522**: "MIME (Multipurpose Internet Mail Extensions) Part Two: Message Header Extensions for Non-ASCII Text".

quopri.encode(*input*, *output*, *quotetabs*, *header=False*)
Encode the contents of the *input* file and write the resulting quoted-printable data to the *output* file. *input* and *output* must be *binary file objects*. *quotetabs*, a non-optional flag which controls whether to encode embedded spaces and tabs; when true it encodes such embedded whitespace, and when false it leaves them unencoded. Note that spaces and tabs appearing at the end of lines are always encoded, as per **RFC 1521**. *header* is a flag which controls if spaces are encoded as underscores as per **RFC 1522**.

quopri.decodestring(*s*, *header=False*)
Like *decode()*, except that it accepts a source *bytes* and returns the corresponding decoded *bytes*.

quopri.**encodestring**(*s*, *quotetabs=False*, *header=False*)
Like *encode()*, except that it accepts a source *bytes* and returns the corresponding encoded *bytes*. By default, it sends a `False` value to *quotetabs* parameter of the *encode()* function.

See also:

Module *base64* Encode and decode MIME base64 data

20.10 uu — Encode and decode uuencode files

Source code: Lib/uu.py

This module encodes and decodes files in uuencode format, allowing arbitrary binary data to be transferred over ASCII-only connections. Wherever a file argument is expected, the methods accept a file-like object. For backwards compatibility, a string containing a pathname is also accepted, and the corresponding file will be opened for reading and writing; the pathname `'-'` is understood to mean the standard input or output. However, this interface is deprecated; it's better for the caller to open the file itself, and be sure that, when required, the mode is `'rb'` or `'wb'` on Windows.

This code was contributed by Lance Ellinghouse, and modified by Jack Jansen.

The *uu* module defines the following functions:

uu.**encode**(*in_file*, *out_file*, *name=None*, *mode=None*, ***, *backtick=False*)
Uuencode file *in_file* into file *out_file*. The uuencoded file will have the header specifying *name* and *mode* as the defaults for the results of decoding the file. The default defaults are taken from *in_file*, or `'-'` and `0o666` respectively. If *backtick* is true, zeros are represented by `'`'` instead of spaces.

Changed in version 3.7: Added the *backtick* parameter.

uu.**decode**(*in_file*, *out_file=None*, *mode=None*, *quiet=False*)
This call decodes uuencoded file *in_file* placing the result on file *out_file*. If *out_file* is a pathname, *mode* is used to set the permission bits if the file must be created. Defaults for *out_file* and *mode* are taken from the uuencode header. However, if the file specified in the header already exists, a *uu.Error* is raised.

decode() may print a warning to standard error if the input was produced by an incorrect uuencoder and Python could recover from that error. Setting *quiet* to a true value silences this warning.

exception uu.**Error**
Subclass of *Exception*, this can be raised by *uu.decode()* under various situations, such as described above, but also including a badly formatted header, or truncated input file.

See also:

Module *binascii* Support module containing ASCII-to-binary and binary-to-ASCII conversions.