:mod:`ipaddress` --- IPv4/IPv6 manipulation library

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 1); *backlink*

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 4)

Unknown directive type "module".

```
.. module:: ipaddress
   :synopsis: IPv4/IPv6 manipulation library.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 7)

Unknown directive type "moduleauthor".

```
.. moduleauthor:: Peter Moody
```

Source code: :source:`Lib/ipaddress.py`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 9); *backlink*

Unknown interpreted text role "source".

:mod:`ipaddress` provides the capabilities to create, manipulate and operate on IPv4 and IPv6 addresses and networks.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 13); *backlink*

Unknown interpreted text role "mod".

The functions and classes in this module make it straightforward to handle various tasks related to IP addresses, including checking whether or not two hosts are on the same subnet, iterating over all hosts in a particular subnet, checking whether or not a string represents a valid IP address or network definition, and so on.

This is the full module API referenceâ€”for an overview and introduction, see :ref:`ipaddress-howto`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 22); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 25)

Unknown directive type "versionadded".

```
.. versionadded:: 3.3
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 27)

Unknown directive type "testsetup".

```
.. testsetup::

   import ipaddress
   from ipaddress import (
       ip_network, IPv4Address, IPv4Interface, IPv4Network,
   )
```

Convenience factory functions

The :mod:`ipaddress` module provides factory functions to conveniently create IP addresses, networks and interfaces:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 37); *backlink*

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 40)

Unknown directive type "function".

```
.. function:: ip_address(address)

   Return an :class:`IPv4Address` or :class:`IPv6Address` object depending on
   the IP address passed as argument.  Either IPv4 or IPv6 addresses may be
   supplied; integers less than ``2**32`` will be considered to be IPv4 by default.
   A :exc:`ValueError` is raised if *address* does not represent a valid IPv4
   or IPv6 address.

   >>> ipaddress.ip_address('192.168.0.1')
   IPv4Address('192.168.0.1')
   >>> ipaddress.ip_address('2001:db8::')
   IPv6Address('2001:db8::')
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 54)

Unknown directive type "function".

```
.. function:: ip_network(address, strict=True)

   Return an :class:`IPv4Network` or :class:`IPv6Network` object depending on
   the IP address passed as argument.  *address* is a string or integer
   representing the IP network.  Either IPv4 or IPv6 networks may be supplied;
   integers less than ``2**32`` will be considered to be IPv4 by default.  *strict*
   is passed to :class:`IPv4Network` or :class:`IPv6Network` constructor.  A
   :exc:`ValueError` is raised if *address* does not represent a valid IPv4 or
   IPv6 address, or if the network has host bits set.

   >>> ipaddress.ip_network('192.168.0.0/28')
   IPv4Network('192.168.0.0/28')
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 68)

Unknown directive type "function".

```
.. function:: ip_interface(address)

   Return an :class:`IPv4Interface` or :class:`IPv6Interface` object depending
   on the IP address passed as argument.  *address* is a string or integer
   representing the IP address.  Either IPv4 or IPv6 addresses may be supplied;
   integers less than ``2**32`` will be considered to be IPv4 by default.  A
   :exc:`ValueError` is raised if *address* does not represent a valid IPv4 or
   IPv6 address.
```

One downside of these convenience functions is that the need to handle both IPv4 and IPv6 formats means that error messages provide minimal information on the precise error, as the functions don't know whether the IPv4 or IPv6 format was intended. More detailed error reporting can be obtained by calling the appropriate version specific class constructors directly.

IP Addresses

Address objects

The :class:`IPv4Address` and :class:`IPv6Address` objects share a lot of common attributes. Some attributes that are only meaningful for IPv6 addresses are also implemented by :class:`IPv4Address` objects, in order to make it easier to write code that handles both IP versions correctly. Address objects are :term:`hashable`, so they can be used as keys in dictionaries.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 91); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 91); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 91); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 91); *backlink*

Unknown interpreted text role "term".

Construct an IPv4 address. An :exc:`AddressValueError` is raised if *address* is not a valid IPv4 address.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 99); *backlink*

Unknown interpreted text role "exc".

The following constitutes a valid IPv4 address:

1. A string in decimal-dot notation, consisting of four decimal integers in the inclusive range 0--255, separated by dots (e.g. `192.168.0.1`). Each integer represents an octet (byte) in the address. Leading zeroes are not tolerated to prevent confusion with octal notation.
2. An integer that fits into 32 bits.
3. An integer packed into a :class:`bytes` object of length 4 (most significant octet first).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 109); *backlink*

Unknown interpreted text role "class".

```
>>> ipaddress.IPv4Address('192.168.0.1')
IPv4Address('192.168.0.1')
>>> ipaddress.IPv4Address(3232235521)
IPv4Address('192.168.0.1')
>>> ipaddress.IPv4Address(b'\xC0\xA8\x00\x01')
IPv4Address('192.168.0.1')
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 119)

Unknown directive type "versionchanged".

```
.. versionchanged:: 3.8

   Leading zeros are tolerated, even in ambiguous cases that look like
   octal notation.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 124)

Unknown directive type "versionchanged".

```
.. versionchanged:: 3.10

   Leading zeros are no longer tolerated and are treated as an error.
   IPv4 address strings are now parsed as strict as glibc
   :func:`~socket.inet_pton`.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 130)

Unknown directive type "versionchanged".

```
.. versionchanged:: 3.9.5

   The above change was also included in Python 3.9 starting with
   version 3.9.5.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 135)

Unknown directive type "versionchanged".

```
.. versionchanged:: 3.8.12

   The above change was also included in Python 3.8 starting with
   version 3.8.12.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 140)

Unknown directive type "attribute".

```
.. attribute:: version

   The appropriate version number: ``4`` for IPv4, ``6`` for IPv6.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 144)

Unknown directive type "attribute".

```
.. attribute:: max_prefixlen

   The total number of bits in the address representation for this
   version: ``32`` for IPv4, ``128`` for IPv6.

   The prefix defines the number of leading bits in an  address that
   are compared to determine whether or not an address is part of a
   network.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 153)

Unknown directive type "attribute".

```
.. attribute:: compressed
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 154)

Unknown directive type "attribute".

```
.. attribute:: exploded

   The string representation in dotted decimal notation. Leading zeroes
   are never included in the representation.

   As IPv4 does not define a shorthand notation for addresses with octets
   set to zero, these two attributes are always the same as ``str(addr)``
   for IPv4 addresses. Exposing these attributes makes it easier to
   write display code that can handle both IPv4 and IPv6 addresses.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 164)

Unknown directive type "attribute".

```
.. attribute:: packed
```

```
   The binary representation of this address - a :class:`bytes` object of
   the appropriate length (most significant octet first). This is 4 bytes
   for IPv4 and 16 bytes for IPv6.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 170)

Unknown directive type "attribute".

```
.. attribute:: reverse_pointer

   The name of the reverse DNS PTR record for the IP address, e.g.::

       >>> ipaddress.ip_address("127.0.0.1").reverse_pointer
       '1.0.0.127.in-addr.arpa'
       >>> ipaddress.ip_address("2001:db8::1").reverse_pointer
       '1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.8.b.d.0.1.0.0.2.ip6.arpa'

   This is the name that could be used for performing a PTR lookup, not the
   resolved hostname itself.

   .. versionadded:: 3.5
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 184)

Unknown directive type "attribute".

```
.. attribute:: is_multicast

   ``True`` if the address is reserved for multicast use.  See
   :RFC:`3171` (for IPv4) or :RFC:`2373` (for IPv6).
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 189)

Unknown directive type "attribute".

```
.. attribute:: is_private

   ``True`` if the address is allocated for private networks.  See
   iana-ipv4-special-registry_ (for IPv4) or iana-ipv6-special-registry_
   (for IPv6).
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 195)

Unknown directive type "attribute".

```
.. attribute:: is_global

   ``True`` if the address is allocated for public networks.  See
   iana-ipv4-special-registry_ (for IPv4) or iana-ipv6-special-registry_
   (for IPv6).

   .. versionadded:: 3.4
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 203)

Unknown directive type "attribute".

```
.. attribute:: is_unspecified

   ``True`` if the address is unspecified.  See :RFC:`5735` (for IPv4)
   or :RFC:`2373` (for IPv6).
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 208)

Unknown directive type "attribute".

```
.. attribute:: is_reserved

   ``True`` if the address is otherwise IETF reserved.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 212)

Unknown directive type "attribute".

```
.. attribute:: is_loopback

   ``True`` if this is a loopback address.  See :RFC:`3330` (for IPv4)
   or :RFC:`2373` (for IPv6).
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 217)

Unknown directive type "attribute".

```
.. attribute:: is_link_local

   ``True`` if the address is reserved for link-local usage.  See
   :RFC:`3927`.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 225)

Unknown directive type "method".

```
.. method:: IPv4Address.__format__(fmt)

   Returns a string representation of the IP address, controlled by
   an explicit format string.
   *fmt* can be one of the following: ``'s'``, the default option,
   equivalent to :func:`str`, ``'b'`` for a zero-padded binary string,
   ``'X'`` or ``'x'`` for an uppercase or lowercase hexadecimal
   representation, or ``'n'``, which is equivalent to ``'b'`` for IPv4
   addresses and ``'x'`` for IPv6. For binary and hexadecimal
   representations, the form specifier ``'#'`` and the grouping option
   ``'_'`` are available. ``__format__`` is used by ``format``, ``str.format``
   and f-strings.

      >>> format(ipaddress.IPv4Address('192.168.0.1'))
      '192.168.0.1'
      >>> '{:#b}'.format(ipaddress.IPv4Address('192.168.0.1'))
      '0b11000000101010000000000000000001'
      >>> f'{ipaddress.IPv6Address("2001:db8::1000"):s}'
      '2001:db8::1000'
      >>> format(ipaddress.IPv6Address('2001:db8::1000'), '_X')
      '2001_0DB8_0000_0000_0000_0000_0000_1000'
      >>> '{:#_n}'.format(ipaddress.IPv6Address('2001:db8::1000'))
      '0x2001_0db8_0000_0000_0000_0000_0000_1000'

   .. versionadded:: 3.9
```

Construct an IPv6 address. An :exc:`AddressValueError` is raised if *address* is not a valid IPv6 address.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 254); *backlink*

Unknown interpreted text role "exc".

The following constitutes a valid IPv6 address:

1. A string consisting of eight groups of four hexadecimal digits, each group representing 16 bits. The groups are separated by colons. This describes an *exploded* (longhand) notation. The string can also be *compressed* (shorthand notation) by various means. See RFC 4291 for details. For example, `"0000:0000:0000:0000:0000:0abc:0007:0def"` can be compressed to `"::abc:7:def"`.

   Optionally, the string may also have a scope zone ID, expressed with a suffix `%scope_id`. If present, the scope ID must be non-empty, and may not contain `%`. See RFC 4007 for details. For example, `fe80::1234%1` might identify address `fe80::1234` on the first link of the node.

2. An integer that fits into 128 bits.

3. An integer packed into a :class:`bytes` object of length 16, big-endian.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 273); *backlink*

Unknown interpreted text role "class".

```
>>> ipaddress.IPv6Address('2001:db8::1000')
IPv6Address('2001:db8::1000')
>>> ipaddress.IPv6Address('ff02::5678%1')
IPv6Address('ff02::5678%1')
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 281)

Unknown directive type "attribute".

```
.. attribute:: compressed
```

The short form of the address representation, with leading zeroes in groups omitted and the longest sequence of groups consisting entirely of zeroes collapsed to a single empty group.

This is also the value returned by `str(addr)` for IPv6 addresses.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 289)

Unknown directive type "attribute".

```
.. attribute:: exploded
```

The long form of the address representation, with all leading zeroes and groups consisting entirely of zeroes included.

For the following attributes and methods, see the corresponding documentation of the :class:`IPv4Address` class:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 295); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 298)

Unknown directive type "attribute".

```
.. attribute:: packed
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 299)

Unknown directive type "attribute".

```
.. attribute:: reverse_pointer
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 300)

Unknown directive type "attribute".

```
.. attribute:: version
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 301)

Unknown directive type "attribute".

```
.. attribute:: max_prefixlen
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 302)

Unknown directive type "attribute".

```
.. attribute:: is_multicast
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 303)

Unknown directive type "attribute".

```
.. attribute:: is_private
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 304)

Unknown directive type "attribute".

```
.. attribute:: is_global
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 305)

Unknown directive type "attribute".

```
.. attribute:: is_unspecified
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 306)

Unknown directive type "attribute".

```
.. attribute:: is_reserved
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 307)

Unknown directive type "attribute".

```
.. attribute:: is_loopback
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 308)

Unknown directive type "attribute".

```
.. attribute:: is_link_local

   .. versionadded:: 3.4
      is_global
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 313)

Unknown directive type "attribute".

```
.. attribute:: is_site_local

   ``True`` if the address is reserved for site-local usage.  Note that
   the site-local address space has been deprecated by :RFC:`3879`. Use
   :attr:`~IPv4Address.is_private` to test if this address is in the
   space of unique local addresses as defined by :RFC:`4193`.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 320)

Unknown directive type "attribute".

```
.. attribute:: ipv4_mapped

   For addresses that appear to be IPv4 mapped addresses (starting with
   ``::FFFF/96``), this property will report the embedded IPv4 address.
   For any other address, this property will be ``None``.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 326)

Unknown directive type "attribute".

```
.. attribute:: scope_id

   For scoped addresses as defined by :RFC:`4007`, this property identifies
   the particular zone of the address's scope that the address belongs to,
   as a string. When no scope zone is specified, this property will be ``None``.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 332)

Unknown directive type "attribute".

```
.. attribute:: sixtofour

   For addresses that appear to be 6to4 addresses  (starting with
   ``2002::/16``) as defined by :RFC:`3056`, this property will report
   the embedded IPv4 address.  For any other address, this property will
   be ``None``.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 339)

Unknown directive type "attribute".

```
.. attribute:: teredo

   For addresses that appear to be Teredo addresses (starting with
   ``2001::/32``) as defined by :RFC:`4380`, this property will report
   the embedded ``(server, client)`` IP address pair.  For any other
   address, this property will be ``None``.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 346)

Unknown directive type "method".

```
.. method:: IPv6Address.__format__(fmt)

   Refer to the corresponding method documentation in
   :class:`IPv4Address`.

   .. versionadded:: 3.9
```

Conversion to Strings and Integers

To interoperate with networking interfaces such as the socket module, addresses must be converted to strings or integers. This is handled using the :func:`str` and :func:`int` builtin functions:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 356); *backlink*

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 356); *backlink*

Unknown interpreted text role "func".

```
>>> str(ipaddress.IPv4Address('192.168.0.1'))
'192.168.0.1'
>>> int(ipaddress.IPv4Address('192.168.0.1'))
3232235521
```

```
>>> str(ipaddress.IPv6Address('::1'))
'::1'
>>> int(ipaddress.IPv6Address('::1'))
1
```

Note that IPv6 scoped addresses are converted to integers without scope zone ID.

Operators

Address objects support some operators. Unless stated otherwise, operators can only be applied between compatible objects (i.e. IPv4 with IPv4, IPv6 with IPv6).

Comparison operators

Address objects can be compared with the usual set of comparison operators. Same IPv6 addresses with different scope zone IDs are not equal. Some examples:

```
>>> IPv4Address('127.0.0.2') > IPv4Address('127.0.0.1')
True
>>> IPv4Address('127.0.0.2') == IPv4Address('127.0.0.1')
False
>>> IPv4Address('127.0.0.2') != IPv4Address('127.0.0.1')
True
>>> IPv6Address('fe80::1234') == IPv6Address('fe80::1234%1')
False
>>> IPv6Address('fe80::1234%1') != IPv6Address('fe80::1234%2')
True
```

Arithmetic operators

Integers can be added to or subtracted from address objects. Some examples:

```
>>> IPv4Address('127.0.0.2') + 3
IPv4Address('127.0.0.5')
>>> IPv4Address('127.0.0.2') - 3
IPv4Address('126.255.255.255')
>>> IPv4Address('255.255.255.255') + 1
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ipaddress.AddressValueError: 4294967296 (>= 2**32) is not permitted as an IPv4 address
```

IP Network definitions

The :class:`IPv4Network` and :class:`IPv6Network` objects provide a mechanism for defining and inspecting IP network definitions. A network definition consists of a *mask* and a *network address*, and as such defines a range of IP addresses that equal the network address when masked (binary AND) with the mask. For example, a network definition with the mask `255.255.255.0` and the network address `192.168.1.0` consists of IP addresses in the inclusive range `192.168.1.0` to `192.168.1.255`.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 417); *backlink*
>
> Unknown interpreted text role "class".

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 417); *backlink*
>
> Unknown interpreted text role "class".

Prefix, net mask and host mask

There are several equivalent ways to specify IP network masks. A *prefix* `/<nbits>` is a notation that denotes how many high-order bits are set in the network mask. A *net mask* is an IP address with some number of high-order bits set. Thus the prefix `/24` is equivalent to the net mask `255.255.255.0` in IPv4, or `ffff:ff00::` in IPv6. In addition, a *host mask* is the logical inverse of a *net mask*, and is sometimes used (for example in Cisco access control lists) to denote a network mask. The host mask equivalent to `/24` in IPv4 is `0.0.0.255`.

Network objects

All attributes implemented by address objects are implemented by network objects as well. In addition, network objects implement additional attributes. All of these are common between :class:`IPv4Network` and :class:`IPv6Network`, so to avoid duplication they are only documented for :class:`IPv4Network`. Network objects are :term:`hashable`, so they can be used as keys in dictionaries.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 442); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 442); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 442); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 442); *backlink*

Unknown interpreted text role "term".

Construct an IPv4 network definition. *address* can be one of the following:

1. A string consisting of an IP address and an optional mask, separated by a slash (`/`). The IP address is the network address, and the mask can be either a single number, which means it's a *prefix*, or a string representation of an IPv4 address. If it's the latter, the mask is interpreted as a *net mask* if it starts with a non-zero field, or as a *host mask* if it starts with a zero field, with the single exception of an all-zero mask which is treated as a *net mask*. If no mask is provided, it's considered to be `/32`.

   For example, the following *address* specifications are equivalent: `192.168.1.0/24`, `192.168.1.0/255.255.255.0` and `192.168.1.0/0.0.0.255`.

2. An integer that fits into 32 bits. This is equivalent to a single-address network, with the network address being *address* and the mask being `/32`.

3. An integer packed into a :class:`bytes` object of length 4, big-endian. The interpretation is similar to an integer *address*.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 470); *backlink*

   Unknown interpreted text role "class".

4. A two-tuple of an address description and a netmask, where the address description is either a string, a 32-bits integer, a 4-bytes packed integer, or an existing IPv4Address object; and the netmask is either an integer representing the prefix length (e.g. `24`) or a string representing the prefix mask (e.g. `255.255.255.0`).

An :exc:`AddressValueError` is raised if *address* is not a valid IPv4 address. A :exc:`NetmaskValueError` is raised if the mask is not valid for an IPv4 address.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 479); *backlink*

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 479); *backlink*

Unknown interpreted text role "exc".

If *strict* is `True` and host bits are set in the supplied address, then :exc:`ValueError` is raised. Otherwise, the host bits are masked out to determine the appropriate network address.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 483); *backlink*

Unknown interpreted text role "exc".

Unless stated otherwise, all network methods accepting other network/address objects will raise :exc:`TypeError` if the argument's IP version is incompatible to `self`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 487); *backlink*

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 491)

Unknown directive type "versionchanged".

```
.. versionchanged:: 3.5

   Added the two-tuple form for the *address* constructor parameter.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 495)

Unknown directive type "attribute".

```
.. attribute:: version
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 496)

Unknown directive type "attribute".

```
.. attribute:: max_prefixlen

   Refer to the corresponding attribute documentation in
   :class:`IPv4Address`.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 501)

Unknown directive type "attribute".

```
.. attribute:: is_multicast
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 502)

Unknown directive type "attribute".

```
.. attribute:: is_private
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 503)

Unknown directive type "attribute".

```
.. attribute:: is_unspecified
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 504)

Unknown directive type "attribute".

```
.. attribute:: is_reserved
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 505)

Unknown directive type "attribute".

```
.. attribute:: is_loopback
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 506)

Unknown directive type "attribute".

```
   .. attribute:: is_link_local

      These attributes are true for the network as a whole if they are true
      for both the network address and the broadcast address.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 511)

Unknown directive type "attribute".

```
   .. attribute:: network_address

      The network address for the network. The network address and the
      prefix length together uniquely define a network.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 516)

Unknown directive type "attribute".

```
   .. attribute:: broadcast_address

      The broadcast address for the network. Packets sent to the broadcast
      address should be received by every host on the network.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 521)

Unknown directive type "attribute".

```
   .. attribute:: hostmask

      The host mask, as an :class:`IPv4Address` object.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 525)

Unknown directive type "attribute".

```
   .. attribute:: netmask

      The net mask, as an :class:`IPv4Address` object.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 529)

Unknown directive type "attribute".

```
   .. attribute:: with_prefixlen
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 530)

Unknown directive type "attribute".

```
   .. attribute:: compressed
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 531)

Unknown directive type "attribute".

```
   .. attribute:: exploded

      A string representation of the network, with the mask in prefix
      notation.

      ``with_prefixlen`` and ``compressed`` are always the same as
      ``str(network)``.
      ``exploded`` uses the exploded form the network address.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 540)

Unknown directive type "attribute".

```
.. attribute:: with_netmask

   A string representation of the network, with the mask in net mask
   notation.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 545)

Unknown directive type "attribute".

```
.. attribute:: with_hostmask

   A string representation of the network, with the mask in host mask
   notation.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 550)

Unknown directive type "attribute".

```
.. attribute:: num_addresses

   The total number of addresses in the network.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 554)

Unknown directive type "attribute".

```
.. attribute:: prefixlen

   Length of the network prefix, in bits.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 558)

Unknown directive type "method".

```
.. method:: hosts()

   Returns an iterator over the usable hosts in the network.  The usable
   hosts are all the IP addresses that belong to the network, except the
   network address itself and the network broadcast address.  For networks
   with a mask length of 31, the network address and network broadcast
   address are also included in the result. Networks with a mask of 32
   will return a list containing the single host address.

      >>> list(ip_network('192.0.2.0/29').hosts())  #doctest: +NORMALIZE_WHITESPACE
      [IPv4Address('192.0.2.1'), IPv4Address('192.0.2.2'),
       IPv4Address('192.0.2.3'), IPv4Address('192.0.2.4'),
       IPv4Address('192.0.2.5'), IPv4Address('192.0.2.6')]
      >>> list(ip_network('192.0.2.0/31').hosts())
      [IPv4Address('192.0.2.0'), IPv4Address('192.0.2.1')]
      >>> list(ip_network('192.0.2.1/32').hosts())
      [IPv4Address('192.0.2.1')]
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 576)

Unknown directive type "method".

```
.. method:: overlaps(other)

   ``True`` if this network is partly or wholly contained in *other* or
   *other* is wholly contained in this network.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 581)

Unknown directive type "method".

```
.. method:: address_exclude(network)

   Computes the network definitions resulting from removing the given
   *network* from this one.  Returns an iterator of network objects.
   Raises :exc:`ValueError` if *network* is not completely contained in
   this network.

      >>> n1 = ip_network('192.0.2.0/28')
      >>> n2 = ip_network('192.0.2.1/32')
      >>> list(n1.address_exclude(n2))  #doctest: +NORMALIZE_WHITESPACE
      [IPv4Network('192.0.2.8/29'), IPv4Network('192.0.2.4/30'),
       IPv4Network('192.0.2.2/31'), IPv4Network('192.0.2.0/32')]
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 594)

Unknown directive type "method".

```
.. method:: subnets(prefixlen_diff=1, new_prefix=None)

   The subnets that join to make the current network definition, depending
   on the argument values.  *prefixlen_diff* is the amount our prefix
   length should be increased by.  *new_prefix* is the desired new
   prefix of the subnets; it must be larger than our prefix.  One and
   only one of *prefixlen_diff* and *new_prefix* must be set.  Returns an
   iterator of network objects.

      >>> list(ip_network('192.0.2.0/24').subnets())
      [IPv4Network('192.0.2.0/25'), IPv4Network('192.0.2.128/25')]
      >>> list(ip_network('192.0.2.0/24').subnets(prefixlen_diff=2))  #doctest: +NORMALIZE_WHITESPA
      [IPv4Network('192.0.2.0/26'), IPv4Network('192.0.2.64/26'),
       IPv4Network('192.0.2.128/26'), IPv4Network('192.0.2.192/26')]
      >>> list(ip_network('192.0.2.0/24').subnets(new_prefix=26))  #doctest: +NORMALIZE_WHITESPACE
      [IPv4Network('192.0.2.0/26'), IPv4Network('192.0.2.64/26'),
       IPv4Network('192.0.2.128/26'), IPv4Network('192.0.2.192/26')]
      >>> list(ip_network('192.0.2.0/24').subnets(new_prefix=23))
      Traceback (most recent call last):
        File "<stdin>", line 1, in <module>
          raise ValueError('new prefix must be longer')
      ValueError: new prefix must be longer
      >>> list(ip_network('192.0.2.0/24').subnets(new_prefix=25))
      [IPv4Network('192.0.2.0/25'), IPv4Network('192.0.2.128/25')]
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 619)

Unknown directive type "method".

```
.. method:: supernet(prefixlen_diff=1, new_prefix=None)

   The supernet containing this network definition, depending on the
   argument values.  *prefixlen_diff* is the amount our prefix length
   should be decreased by.  *new_prefix* is the desired new prefix of
   the supernet; it must be smaller than our prefix.  One and only one
   of *prefixlen_diff* and *new_prefix* must be set.  Returns a single
   network object.

      >>> ip_network('192.0.2.0/24').supernet()
      IPv4Network('192.0.2.0/23')
      >>> ip_network('192.0.2.0/24').supernet(prefixlen_diff=2)
      IPv4Network('192.0.0.0/22')
      >>> ip_network('192.0.2.0/24').supernet(new_prefix=20)
      IPv4Network('192.0.0.0/20')
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 635)

Unknown directive type "method".

```
.. method:: subnet_of(other)

   Return ``True`` if this network is a subnet of *other*.
```

```
        >>> a = ip_network('192.168.1.0/24')
        >>> b = ip_network('192.168.1.128/30')
        >>> b.subnet_of(a)
        True

      .. versionadded:: 3.7
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 646)

Unknown directive type "method".

```
   .. method:: supernet_of(other)

      Return ``True`` if this network is a supernet of *other*.

        >>> a = ip_network('192.168.1.0/24')
        >>> b = ip_network('192.168.1.128/30')
        >>> a.supernet_of(b)
        True

      .. versionadded:: 3.7
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 657)

Unknown directive type "method".

```
   .. method:: compare_networks(other)

      Compare this network to *other*.  In this comparison only the network
      addresses are considered; host bits aren't.  Returns either ``-1``,
      ``0`` or ``1``.

         >>> ip_network('192.0.2.1/32').compare_networks(ip_network('192.0.2.2/32'))
         -1
         >>> ip_network('192.0.2.1/32').compare_networks(ip_network('192.0.2.0/32'))
         1
         >>> ip_network('192.0.2.1/32').compare_networks(ip_network('192.0.2.1/32'))
         0

      .. deprecated:: 3.7
         It uses the same ordering and comparison algorithm as "<", "==", and ">"
```

Construct an IPv6 network definition. *address* can be one of the following:

1. A string consisting of an IP address and an optional prefix length, separated by a slash (/). The IP address is the network address, and the prefix length must be a single number, the *prefix*. If no prefix length is provided, it's considered to be `/128`.

   Note that currently expanded netmasks are not supported. That means `2001:db00::0/24` is a valid argument while `2001:db00::0/ffff:ff00::` is not.

2. An integer that fits into 128 bits. This is equivalent to a single-address network, with the network address being *address* and the mask being `/128`.

3. An integer packed into a :class:`bytes` object of length 16, big-endian. The interpretation is similar to an integer *address*.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 691); *backlink*

   Unknown interpreted text role "class".

4. A two-tuple of an address description and a netmask, where the address description is either a string, a 128-bits integer, a 16-bytes packed integer, or an existing IPv6Address object; and the netmask is an integer representing the prefix length.

An :exc:`AddressValueError` is raised if *address* is not a valid IPv6 address. A :exc:`NetmaskValueError` is raised if the mask is not valid for an IPv6 address.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 699); *backlink*

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 699); *backlink*

Unknown interpreted text role "exc".

If *strict* is `True` and host bits are set in the supplied address, then :exc:`ValueError` is raised. Otherwise, the host bits are masked out to determine the appropriate network address.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 703); *backlink*

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 707)

Unknown directive type "versionchanged".

```
.. versionchanged:: 3.5

   Added the two-tuple form for the *address* constructor parameter.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 711)

Unknown directive type "attribute".

```
.. attribute:: version
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 712)

Unknown directive type "attribute".

```
.. attribute:: max_prefixlen
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 713)

Unknown directive type "attribute".

```
.. attribute:: is_multicast
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 714)

Unknown directive type "attribute".

```
.. attribute:: is_private
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 715)

Unknown directive type "attribute".

```
.. attribute:: is_unspecified
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 716)

Unknown directive type "attribute".

```
.. attribute:: is_reserved
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 717)

Unknown directive type "attribute".

```
.. attribute:: is_loopback
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 718)

Unknown directive type "attribute".

```
.. attribute:: is_link_local
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 719)

Unknown directive type "attribute".

```
.. attribute:: network_address
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 720)

Unknown directive type "attribute".

```
.. attribute:: broadcast_address
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 721)

Unknown directive type "attribute".

```
.. attribute:: hostmask
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 722)

Unknown directive type "attribute".

```
.. attribute:: netmask
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 723)

Unknown directive type "attribute".

```
.. attribute:: with_prefixlen
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 724)

Unknown directive type "attribute".

```
.. attribute:: compressed
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 725)

Unknown directive type "attribute".

```
.. attribute:: exploded
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 726)

Unknown directive type "attribute".

```
.. attribute:: with_netmask
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 727)

Unknown directive type "attribute".

```
.. attribute:: with_hostmask
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 728)

Unknown directive type "attribute".

```
.. attribute:: num_addresses
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 729)

Unknown directive type "attribute".

```
.. attribute:: prefixlen
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 730)

Unknown directive type "method".

```
.. method:: hosts()

   Returns an iterator over the usable hosts in the network.  The usable
   hosts are all the IP addresses that belong to the network, except the
   Subnet-Router anycast address.  For networks with a mask length of 127,
   the Subnet-Router anycast address is also included in the result.
   Networks with a mask of 128 will return a list containing the
   single host address.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 739)

Unknown directive type "method".

```
.. method:: overlaps(other)
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 740)

Unknown directive type "method".

```
.. method:: address_exclude(network)
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 741)

Unknown directive type "method".

```
.. method:: subnets(prefixlen_diff=1, new_prefix=None)
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 742)

Unknown directive type "method".

```
.. method:: supernet(prefixlen_diff=1, new_prefix=None)
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 743)

Unknown directive type "method".

```
.. method:: subnet_of(other)
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 744)

Unknown directive type "method".

```
.. method:: supernet_of(other)
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 745)

Unknown directive type "method".

```
.. method:: compare_networks(other)

   Refer to the corresponding attribute documentation in
   :class:`IPv4Network`.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 750)

Unknown directive type "attribute".

```
.. attribute:: is_site_local

   These attribute is true for the network as a whole if it is true
   for both the network address and the broadcast address.
```

Operators

Network objects support some operators. Unless stated otherwise, operators can only be applied between compatible objects (i.e. IPv4 with IPv4, IPv6 with IPv6).

Logical operators

Network objects can be compared with the usual set of logical operators. Network objects are ordered first by network address, then by net mask.

Iteration

Network objects can be iterated to list all the addresses belonging to the network. For iteration, *all* hosts are returned, including unusable hosts (for usable hosts, use the :meth:`~IPv4Network.hosts` method). An example:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 774); *backlink*

Unknown interpreted text role "meth".

```
>>> for addr in IPv4Network('192.0.2.0/28'):
...     addr
...
IPv4Address('192.0.2.0')
IPv4Address('192.0.2.1')
IPv4Address('192.0.2.2')
IPv4Address('192.0.2.3')
IPv4Address('192.0.2.4')
IPv4Address('192.0.2.5')
IPv4Address('192.0.2.6')
IPv4Address('192.0.2.7')
IPv4Address('192.0.2.8')
IPv4Address('192.0.2.9')
IPv4Address('192.0.2.10')
IPv4Address('192.0.2.11')
IPv4Address('192.0.2.12')
IPv4Address('192.0.2.13')
IPv4Address('192.0.2.14')
IPv4Address('192.0.2.15')
```

Networks as containers of addresses

Network objects can act as containers of addresses. Some examples:

```
>>> IPv4Network('192.0.2.0/28')[0]
IPv4Address('192.0.2.0')
>>> IPv4Network('192.0.2.0/28')[15]
IPv4Address('192.0.2.15')
>>> IPv4Address('192.0.2.6') in IPv4Network('192.0.2.0/28')
True
>>> IPv4Address('192.0.3.6') in IPv4Network('192.0.2.0/28')
False
```

Interface objects

Interface objects are :term:`hashable`, so they can be used as keys in dictionaries.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 818); *backlink*
>
> Unknown interpreted text role "term".

Construct an IPv4 interface. The meaning of *address* is as in the constructor of :class:`IPv4Network`, except that arbitrary host addresses are always accepted.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 823); *backlink*
>
> Unknown interpreted text role "class".

:class:`IPv4Interface` is a subclass of :class:`IPv4Address`, so it inherits all the attributes from that class. In addition, the following attributes are available:

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 827); *backlink*
>
> Unknown interpreted text role "class".

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 827); *backlink*
>
> Unknown interpreted text role "class".

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 831)
>
> Unknown directive type "attribute".
>
> ```
> .. attribute:: ip
>
>    The address (:class:`IPv4Address`) without network information.
>
>       >>> interface = IPv4Interface('192.0.2.5/24')
>       >>> interface.ip
>       IPv4Address('192.0.2.5')
> ```

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 839)
>
> Unknown directive type "attribute".
>
> ```
> .. attribute:: network
>
>    The network (:class:`IPv4Network`) this interface belongs to.
>
>       >>> interface = IPv4Interface('192.0.2.5/24')
>       >>> interface.network
>       IPv4Network('192.0.2.0/24')
> ```

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 847)
>
> Unknown directive type "attribute".
>
> ```
> .. attribute:: with_prefixlen
> ```

A string representation of the interface with the mask in prefix notation.

```
>>> interface = IPv4Interface('192.0.2.5/24')
>>> interface.with_prefixlen
'192.0.2.5/24'
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 855)

Unknown directive type "attribute".

```
.. attribute:: with_netmask

   A string representation of the interface with the network as a net mask.

      >>> interface = IPv4Interface('192.0.2.5/24')
      >>> interface.with_netmask
      '192.0.2.5/255.255.255.0'
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 863)

Unknown directive type "attribute".

```
.. attribute:: with_hostmask

   A string representation of the interface with the network as a host mask.

      >>> interface = IPv4Interface('192.0.2.5/24')
      >>> interface.with_hostmask
      '192.0.2.5/0.0.0.255'
```

Construct an IPv6 interface. The meaning of *address* is as in the constructor of :class:`IPv6Network`, except that arbitrary host addresses are always accepted.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 874); *backlink*

Unknown interpreted text role "class".

:class:`IPv6Interface` is a subclass of :class:`IPv6Address`, so it inherits all the attributes from that class. In addition, the following attributes are available:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 878); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 878); *backlink*

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 882)

Unknown directive type "attribute".

```
.. attribute:: ip
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 883)

Unknown directive type "attribute".

```
.. attribute:: network
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 884)

Unknown directive type "attribute".

```
.. attribute:: with_prefixlen
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 885)

Unknown directive type "attribute".

```
.. attribute:: with_netmask
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 886)

Unknown directive type "attribute".

```
.. attribute:: with_hostmask

   Refer to the corresponding attribute documentation in
   :class:`IPv4Interface`.
```

Operators

Interface objects support some operators. Unless stated otherwise, operators can only be applied between compatible objects (i.e. IPv4 with IPv4, IPv6 with IPv6).

Logical operators

Interface objects can be compared with the usual set of logical operators.

For equality comparison (== and !=), both the IP address and network must be the same for the objects to be equal. An interface will not compare equal to any address or network object.

For ordering (<, >, etc) the rules are different. Interface and address objects with the same IP version can be compared, and the address objects will always sort before the interface objects. Two interface objects are first compared by their networks and, if those are the same, then by their IP addresses.

Other Module Level Functions

The module also provides the following module level functions:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 921)

Unknown directive type "function".

```
.. function:: v4_int_to_packed(address)

   Represent an address as 4 packed bytes in network (big-endian) order.
   *address* is an integer representation of an IPv4 IP address.  A
   :exc:`ValueError` is raised if the integer is negative or too large to be an
   IPv4 IP address.

   >>> ipaddress.ip_address(3221225985)
   IPv4Address('192.0.2.1')
   >>> ipaddress.v4_int_to_packed(3221225985)
   b'\xc0\x00\x02\x01'
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 934)

Unknown directive type "function".

```
.. function:: v6_int_to_packed(address)

   Represent an address as 16 packed bytes in network (big-endian) order.
   *address* is an integer representation of an IPv6 IP address.  A
   :exc:`ValueError` is raised if the integer is negative or too large to be an
   IPv6 IP address.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 942)

Unknown directive type "function".

```
.. function:: summarize_address_range(first, last)

   Return an iterator of the summarized network range given the first and last
   IP addresses.  *first* is the first :class:`IPv4Address` or
   :class:`IPv6Address` in the range and *last* is the last :class:`IPv4Address`
   or :class:`IPv6Address` in the range.  A :exc:`TypeError` is raised if
   *first* or *last* are not IP addresses or are not of the same version.  A
   :exc:`ValueError` is raised if *last* is not greater than *first* or if
   *first* address version is not 4 or 6.

   >>> [ipaddr for ipaddr in ipaddress.summarize_address_range(
   ...    ipaddress.IPv4Address('192.0.2.0'),
   ...    ipaddress.IPv4Address('192.0.2.130'))]
   [IPv4Network('192.0.2.0/25'), IPv4Network('192.0.2.128/31'), IPv4Network('192.0.2.130/32')]
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 958)

Unknown directive type "function".

```
.. function:: collapse_addresses(addresses)

   Return an iterator of the collapsed :class:`IPv4Network` or
   :class:`IPv6Network` objects.  *addresses* is an iterator of
   :class:`IPv4Network` or :class:`IPv6Network` objects.  A :exc:`TypeError` is
   raised if *addresses* contains mixed version objects.

   >>> [ipaddr for ipaddr in
   ... ipaddress.collapse_addresses([ipaddress.IPv4Network('192.0.2.0/25'),
   ... ipaddress.IPv4Network('192.0.2.128/25')])]
   [IPv4Network('192.0.2.0/24')]
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 971)

Unknown directive type "function".

```
.. function:: get_mixed_type_key(obj)

   Return a key suitable for sorting between networks and addresses.  Address
   and Network objects are not sortable by default; they're fundamentally
   different, so the expression::

     IPv4Address('192.0.2.0') <= IPv4Network('192.0.2.0/24')

   doesn't make sense.  There are some times however, where you may wish to
   have :mod:`ipaddress` sort these anyway.  If you need to do this, you can use
   this function as the *key* argument to :func:`sorted()`.

   *obj* is either a network or address object.
```

Custom Exceptions

To support more specific error reporting from class constructors, the module defines the following exceptions:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 992)

Unknown directive type "exception".

```
.. exception:: AddressValueError(ValueError)

   Any value error related to the address.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-

main\Doc\library\[cpython-main][Doc][library]ipaddress.rst, line 997)

Unknown directive type "exception".

```
.. exception:: NetmaskValueError(ValueError)

   Any value error related to the net mask.
```