Requirements

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The requirements below have been taken from the RFC, each requirement includes a description an example test, and in some cases a list of edge cases tests, tests and descriptions for extensions have not been given if no work has been done on their implementation.

Core - 1

Basic - 1

Control Plane - 1

Flooding - 1111

Every packet received should be forwarded to every interface but the originating one. Overridden by static.
Test: Given a packet, check every other interface receives it, and the sending interface does not
Edge cases: No other interfaces

Static - 1112

Read a configuration file with known addresses & interfaces, forward as per the file, else send to default route (also defined in the file)
Test: Given packets from every known address to every known address sent correctly, with no additional sends
Edge cases: Address not known, address very similar (last/first bit different), loopback address, multicast address, unspecified address, loopback address, link local addresses

Data Plane - 2

Header - 1

Payload Length - 11211

https://tools.ietf.org/html/rfc8200#section-3
Must correctly forward the correct amount of data based on the length in this field
Test: Given a packet containing X in this field must forward X bytes
Edge cases: Packet length 0, Packet length = packet size, packet length > packet size, packet length < packet size

Hop Limit - 11212

https://tools.ietf.org/html/rfc8200#section-3

Must correctly discard all packets to be forwarded with a hop limit of 0, and decrement the hop limit of all packets
Test: Given a packet with a hop limit of X, hop limit should be X-1 when forwarded, or not forwarded if X-1 = 0
Edge cases: Hop limit = 0, Hop limit < 0, Hop limit = 0 but router is recipient, Hop limit < 0 but router is recipient.

Addressing (Unicast) - 3

Internal Structure - 1131

Assume addresses have no internal structure - simplest
Test: Random destination addresses that are not in the immediate network are always treated the same

Advanced - 2

ICMPv6 - 1

https://tools.ietf.org/html/rfc4443

Checksum 1211

ICMPv6 packets with incorrect checksums should be dropped (only if router is destination)
Test: Random bit changes to packets so that checksum is incorrect

Unknown 1212

ICMPv6 packets of unknown type must be silently discarded (if router is destination)
Test: Packets with a variety of unknown types that are otherwise valid

Rate limit 1213

Router must apply some form of rate limiting
Test: Try and trigger more than limit of responses

Packet too big 1214

Sent to sender when a packet cannot be forwarded due to size
Test: Send a packet that is too big to be forwarded

Time exceeded 1215

Sent to a sender when a packet's hop limit is decremented to 0
Test: Send a packet with hop_limit of 0 or 1

Echo 1216

Must reply to echo request messages
Test: Send an echo request message

Parameter Problem 1217

Sent to a sender when there is an issue with an ipv6_header
Test: Send packets with an erroneous header, unrecognised next header type, and unrecognised ipv6 option

Uniquely Identify 1218

Do not send ICMPv6 responses if a packets source address is the unspecified address, a multicast address or an anycast address.
Test: Send response triggering messages with the above source addresses

Multicast - 2

https://tools.ietf.org/html/rfc4291#section-2.7
Solicited node address

(e.6) A packet whose source address does not uniquely identify a
single node -- e.g., the IPv6 Unspecified Address, an IPv6
multicast address, or an address known by the ICMP message
originator to be an IPv6 anycast address.

Anycast - 3

https://tools.ietf.org/html/rfc4291#section-2.6

Extension - 3

Optional Requirements from Core - 1

Traffic Class

https://tools.ietf.org/html/rfc8200#section-7

Flow Label

https://tools.ietf.org/html/rfc8200#section-6

Next Header

Header field, may be used to optimise

Text Representation of Addresses and Prefixes

https://tools.ietf.org/html/rfc4291#section-2.2
For logging

More Unicast

https://tools.ietf.org/html/rfc4291#section-2.5

Extension Headers - 2

https://tools.ietf.org/html/rfc8200#section-4

- Hop-by-Hop Options - https://tools.ietf.org/html/rfc8200#appendix-A
- Fragment
- Destination Options
- Routing - https://tools.ietf.org/html/rfc8200#section-8.4
- Authentication
- Encapsulating Security Payload

And order checks
Check IPv6 parameters for full list

DHCPv6 - 3

https://tools.ietf.org/html/rfc3315

SLAAC - 4

https://tools.ietf.org/html/rfc4862

TCP & UDP - 5

https://tools.ietf.org/html/rfc8200#section-8 but not 8.4

Optimisation - 6

IPSec - 7

Security - https://tools.ietf.org/html/rfc4301
Scanning - https://tools.ietf.org/html/rfc4301
Privacy - https://tools.ietf.org/html/rfc7721