

Internet Engineering

241-461

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Generating IPv6 Addresses

00:10:a4 : 0f:41:cf
02 10:a4 ff:fe 0f:41 cf

- ◇ **FFFE is the defined way**
 - to transform a 48 bit MAC address
 - into a 64 bit MAC address (EUI-64)
- ◇ **FFFE is inserted**
 - between the 3rd and 4th octets of 48 bit address
- ◇ **02 in the first address octet is the "locally defined" bit**
 - In MAC address bit set indicates a locally defined address
 - In IPv6 address, bit is inverted

When and How to Autoconfigure

- ◇ **Not all sites want any random node to be able to acquire an address and use it without authorisation**
 - Auto-config does not enable that
 - it does make it easy
- ◇ **DHCP used to assign addresses in IPv4,**
 - can implement policy
 - Auto-config has no policy
- ◇ **Some users concerned about privacy**
 - Every IPv6 address they use contains their MAC address
- ◇ **Hence need alternative methods**

IPv6 Address Types

- ◊ Local Loopback
- ◊ Link Local Address
- ◊ Site Local Address
- ◊ Global Address
- ◊ IPv4 compatible Address
- ◊ Multicast Address

Loopback Address

- ◊ `::1`
 - `:: (0::0)` is the "unspecified address"
- ◊ IPv6 Address Notation
 - `nnnn:nnnn::nnnn`
 - > The `::` indicates as many 0's as are needed
 - > Only one `::` in any address
 - > 16 bits in each other numeric block (between `:`'s)
- ◊ Loopback address means "this node"
 - 127.0.0.1 in IPv4

Link Local Addresses

- ◊ Defined Prefix
 - FE80::/10
- ◊ Low 64 bits contain host identifier
 - fe80::210:a4ff:fe0f:41cf
 - fe80::1

Link Local Addresses

- ◊ These addresses can be used to communicate with other nodes
- ◊ on the same link
 - Routers do not route packets containing link local addresses
 - Useful for all on-link communications
 - eg: router advertisement
 - Used where off link addressing is incorrect
 - eg: redirect
 - eg: Neighbour Discovery

Site Local Addresses

- ◊ Defined Prefix
 - FEC0::/10
- ◊ Used for communications with a site
 - "site" can mean whatever is appropriate
 - Often a company/university/...
- ◊ Packets using these addresses
 - not forwarded beyond the boundaries of the site
 - FECr:rrrr:rrrr:SSSS:EUI-64
- ◊ Now deprecated (obsolete)
 - (Before IPv6 was really ever used)

Local Addresses

- ◊ Defined Prefix
 - FC00::/7
- ◊ Unroutable address
 - Not useful to reach random destination
- ◊ Possibly unique
 - some would say probably
 - some would hope certainly
 - nothing enforces uniqueness
 - no way to test either
- ◊ FCaa:aaaa:aaaa:SSSS:EUI-64
 - Assigned by number authority
- ◊ FDr:r:rrrr:rrrr:SSSS:EUI-64
 - Generated by random number generator

Global Addresses

- ◊ 48 bit site prefix
- ◊ 16 bit subnet number
- ◊ 64 bit EUI-64



- ◊ **FP: Format Prefix (3 bits: 001)**
 - 001 010 011 100 101 110
 - All except 000 and 111
- ◊ **Prefix: Site Identification (45 bits ... 48 bits with FP included)**
 - Internal aggregation boundaries exist
- ◊ **Subnet: Network within site (16 bits)**

IPv4 Compatible Addresses

- ◊ **::a.b.c.d**
 - 96 bits of all 0
 - followed by an IPv4 address (32 bits)
- ◊ **::FFFF:a.b.c.d**
 - 80 bits of all 0
 - followed by FFFF (16 bits)
 - then IPv4 address (32 bits)
- ◊ **First form**
 - used to number any node that has IPv6
 - and also has an IPv4 address
 - IPv4 compatibility mode
- ◊ **Second form**
 - used to number all IPv4 nodes that have no IPv6

IPv4 Compatible Addresses

- ◊ **::a.b.c.d**
- ◊ **::FFFF:a.b.c.d**
- ◊ **Packet translation is possible**
 - These addresses generate the same
 - transport protocol checksums
 - as the IPv4 addresses they represent
- ◊ **Used for API purposes only**
 - Not routed on IPv6 network