



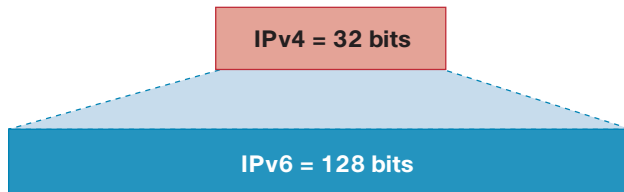
IPv6 Addressing

128:
96:
64:
32:
16:
8:
4:
2:

RFC 3513

One of the key advantages IPv6 brings is the exponentially larger address space. The following will outline the basic address architecture of IPv6.

Figure 1



128-bit-long addresses

Represented in hexadecimal format:

- Uses CIDR principles: prefix/prefix length
- x:x:x:x:x:x:x, where x is a 16-bit hex field
- The last 64 bits are used for the interface ID

2001:0DB8:C003:0001:0000:0000:0000:F00D

Can be represented in shorter format by removing leading zeros

2001:DB8:C003:1:0:0:0:F00D

- Further reduction by removing consecutive fields of zeros using the double-colon :: option
- Note the double-colon can be used only once

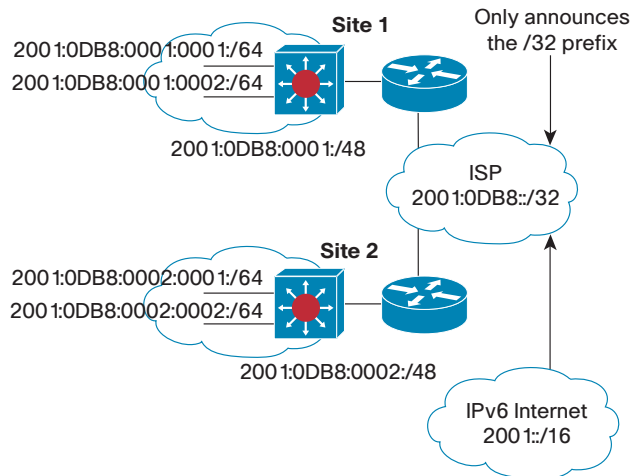
2001:DB8:C003:1::F00D

Address types are:

- Unicast: one-to-one (global, link local, unique local, compatible)
- Anycast: one-to-nearest (allocated from Unicast)
- Multicast: one-to-many (also replaces broadcast addresses)

Type	Binary	Hex
Aggregatable Global Unicast	001	2000::/3
Link-Local Unicast	1111 1110 10	FE80::/10
Unique Local Unicast	1111 1100 1111 1101	FC00::/8 FD00::/8
Multicast	1111 1111	FF00::/8

Figure 2. IPv6 Provides for a Hierarchical Address and Aggregation Model



Internet Assigned Numbers Authority (IANA) allocates address space to each regional registry:

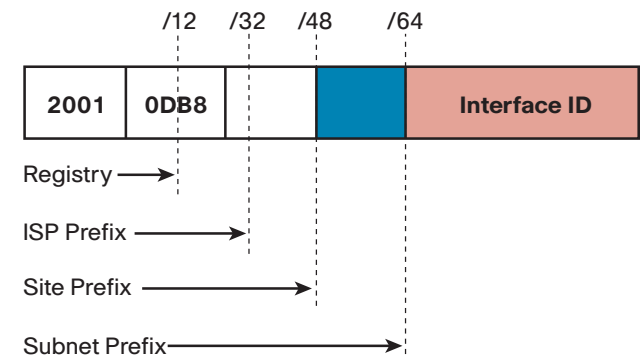
- RIPE NCC (EMEA)
- APNIC (Asia Pacific)
- ARIN (North America)
- LACNIC (Latin America)
- AfriNIC (African Region)

<http://www.iana.org/assignments/ipv6-unicast-address-assignments>

Service providers are assigned IPv6 prefixes from their regional registry (prefix length may vary).

Enterprise/consumer customers are assigned IPv6 address space from their service provider (prefix length may vary).

Figure 3. Address Allocation Follows a Generally Accepted Assignment Policy



A single interface may be assigned multiple addresses of any type (unicast, anycast, multicast).

Every IPv6-enabled interface must contain at least one loopback and one link-local address.

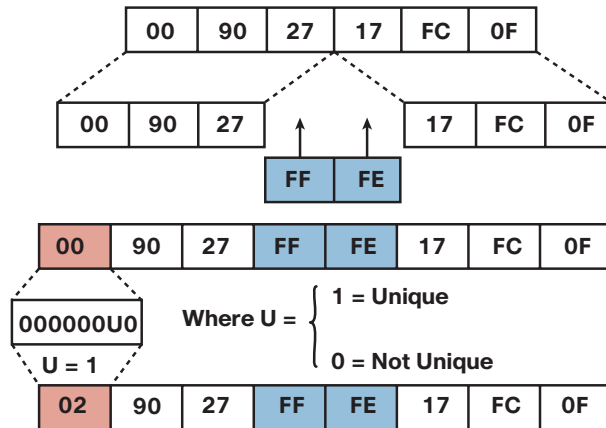
Optionally, every interface can have multiple unique local and global addresses.

IPv6 host addresses can be assigned in multiple ways:

- Static configuration
- Stateless autoconfiguration
- DHCPv6

When IPv6 is used over Ethernet networks, the Ethernet MAC address can be used to generate the 64-bit interface ID for the host. This is called the EUI-64 address. Since MAC addresses use 48 bits, additional bits must be inserted to fill the 64 bits required.

Figure 4.



EUI-64 address inserts "FFFE" in middle.

Invert "U" bit to identify uniqueness of MAC.

Dieser String kann nun als Interface-ID der IPv6-Adresse des zugehörigen IT-Systems genutzt werden.

Eine Alternative ist diesen Teil auszuwürfeln, wenn die Privacy Extensions eingeschaltet sind, dadurch wird das Tracken des Systems im Internet erschwert.

Es gibt noch eine 3. Art der Zuweisung. Welche ist das?

Server - statisch / manuell _____

Wo wird welche Art eingesetzt?

___ Clients - priv. Ext. _____

___ Drucker - MAC... _____

Finden Sie 2 Mac-Adressen heraus, welche Ihr Übungs-PC verwendet und berechnen Sie jeweils eine vergebene IPv6-Adresse nach Fig. 4. Lassen Sie das Ergebnis von Ihrem Nachbarn überprüfen.

Übung: Ping mit IPv6 den Nachbar-PC

- bekannt ist dessen MAC-Adress (vom Nachbarn erfragen)
- IPv6 an der Schnittstelle aktivieren
- ggfs. Interface-ID per Registryeintra umstellen (ipv6 privacy extentions deaktivieren win 10)
- vom Nachbarn MAC erfragen
- Nachbar-IP bilden (% nicht vergessen)
- pingen