IPv6 Addressing

Addressing scheme

- **RFC 3513** defines IPv6 addressing scheme
- **RFC 3587** defines IPv6 global unicast address format
- 128 bit long addresses
  - Allow hierarchy
  - Flexibility for network evolutions
- Use CIDR principles:
  - Prefix / prefix length
    - 2001:660:3003::/48
    - 2001:660:3003:2:a00:20ff:fe18:964c/64
  - Aggregation reduces routing table size
- Hexadecimal representation
- Interfaces have several IPv6 addresses

Textual Address Format

- Base format (a 16-byte **Global IPv6 Address) :**

2001:0660:3003:0001:0000:0000:6543:210F

- Compact Format:

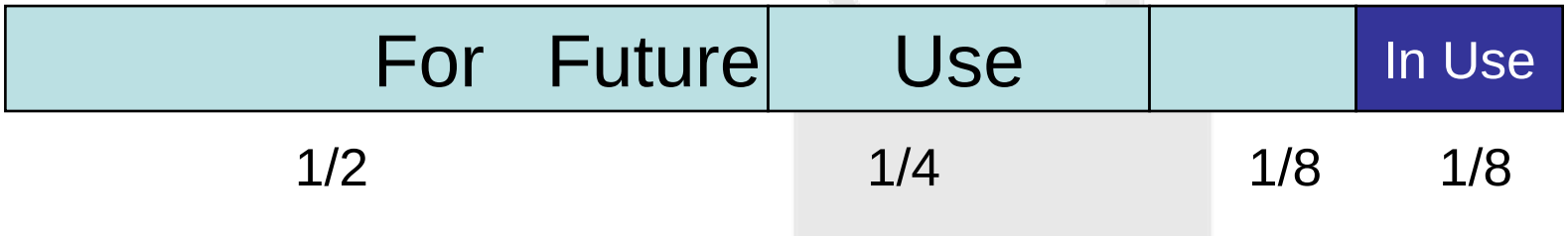
2001:660:3003:1::6543:210F

- Litteral representation

[2001:660:3003:2:a00:20ff:fe18:964c]

IPv6 Address Space
(RFC 3513)

Aggregatable Global Unicast Addresses	001	**1/8**
Unique Local Unicast addresses	1111 1110 00	**1/128**
[RFC-ietf-ipv6-unique-local-addr-09.txt]		
Link-Local Unicast Addresses	1111 1110 10	**1/1024**
Multicast Addresses	1111 1111	**1/256**



More info : http://www.iana.org/assignments/ipv6-address-space

IPv6 Addresses

- Loopback ::1
- **Link local** FE80:….
- Site local FEC0:…
- Global
  - 6bone: 3FFE:…
  - Official: 2001:…

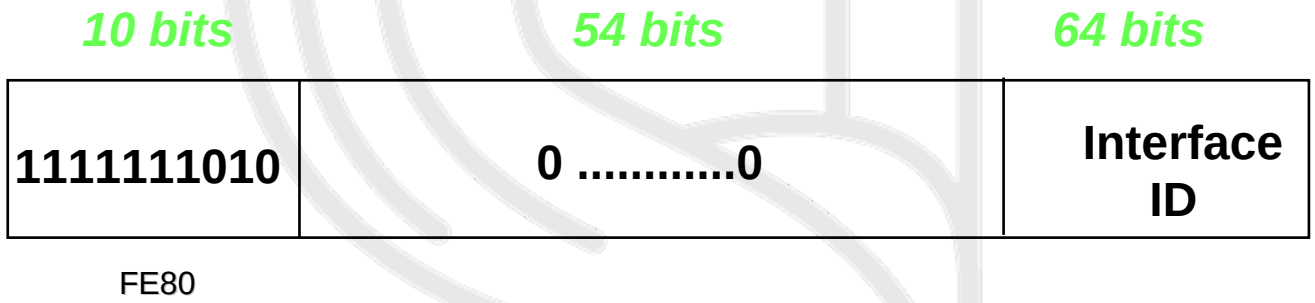
- **IPv4 mapped**
- **6to4**: 2002::…

- Unicast
- Multicast
- **Anycast**

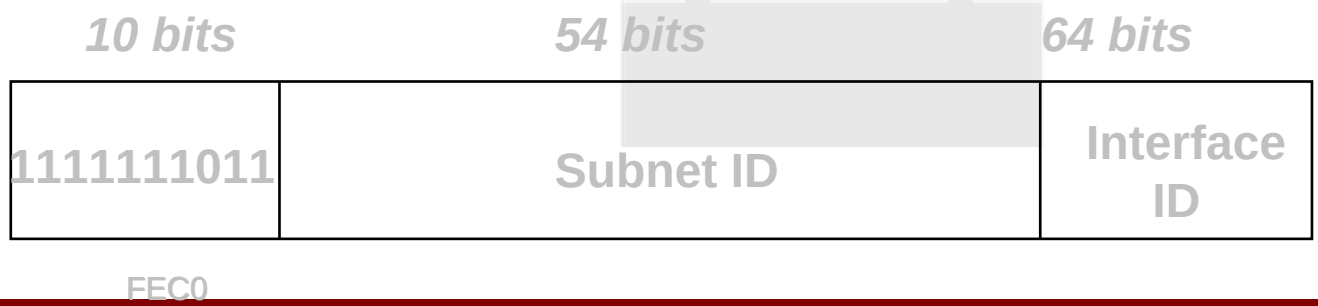
specific to IPv4/IPv6 integration

Local Addresses

Link-local

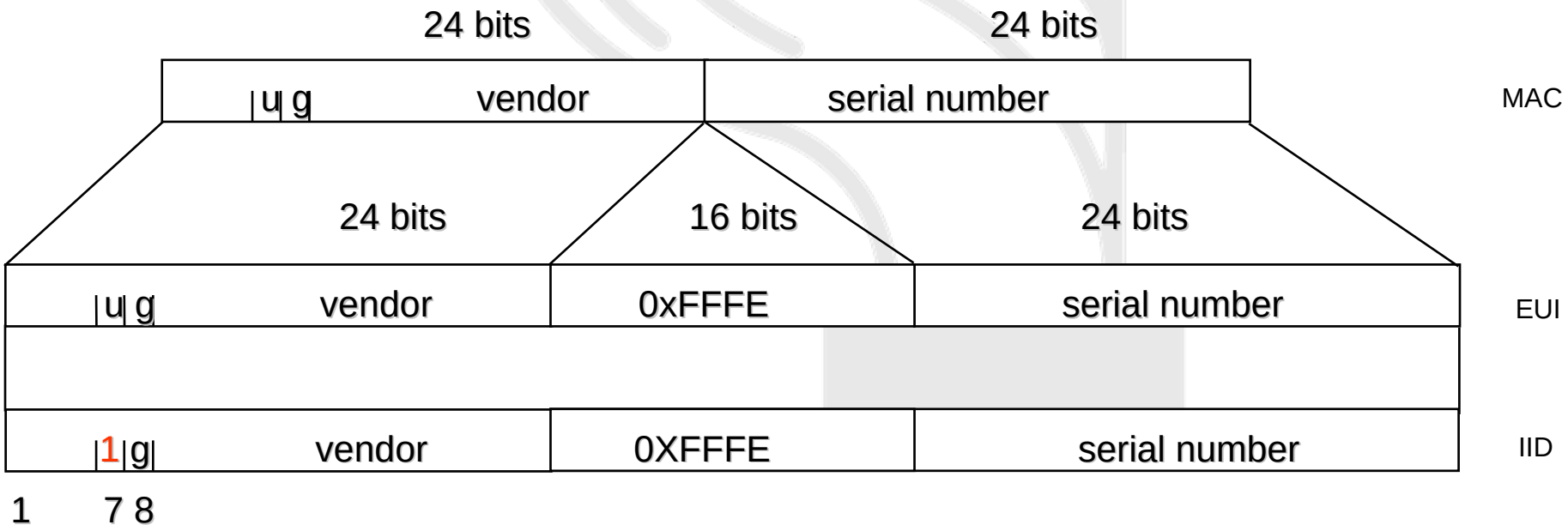


Site-local (in the process of being deprecated)

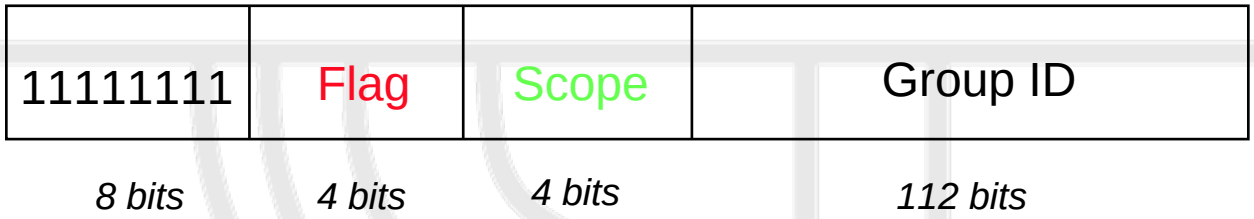


Interface Identifier

- 64 bits to be compatible with IEEE 1394 (FireWire)
- Eases auto-configuration
- IEEE defines the mechanism to create an EUI-64 from IEEE 802 MAC addresses (Ethernet, FDDI)



Multicast Addresses



Flag bits: 0 R P T

T = 0 *permanent addresses (managed by IANA)*

T = 1 *transient multicast addresses*

- P = 1 *derived from unicast prefix (RFC3306)*
  - R = 1 *embedded RP addresses (RFC 3956)*

Scope

0 : Reserved
1 : Interface-local
2 : Link-local
3 : Subnet-local
4 : Admin-local
5 : Site-local
8 : Organization-local
E : Global
F : Reserved

Anycast Addresses (RFC 3513)

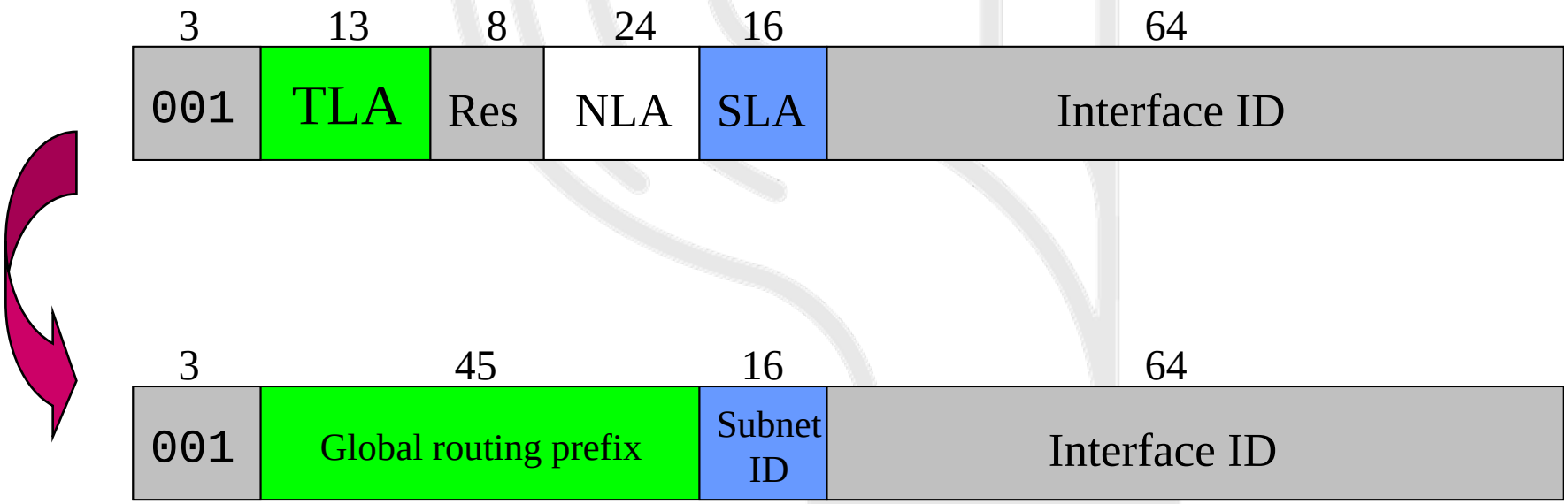
- « Anycast addresses allow a packet to be **routed to one of a number** of different nodes all responding to the same address »
- « (they) are allocated from the unicast address space, using any of the defined unicast address formats »

⇒ **It cannot be distinguished from a Unicast address**

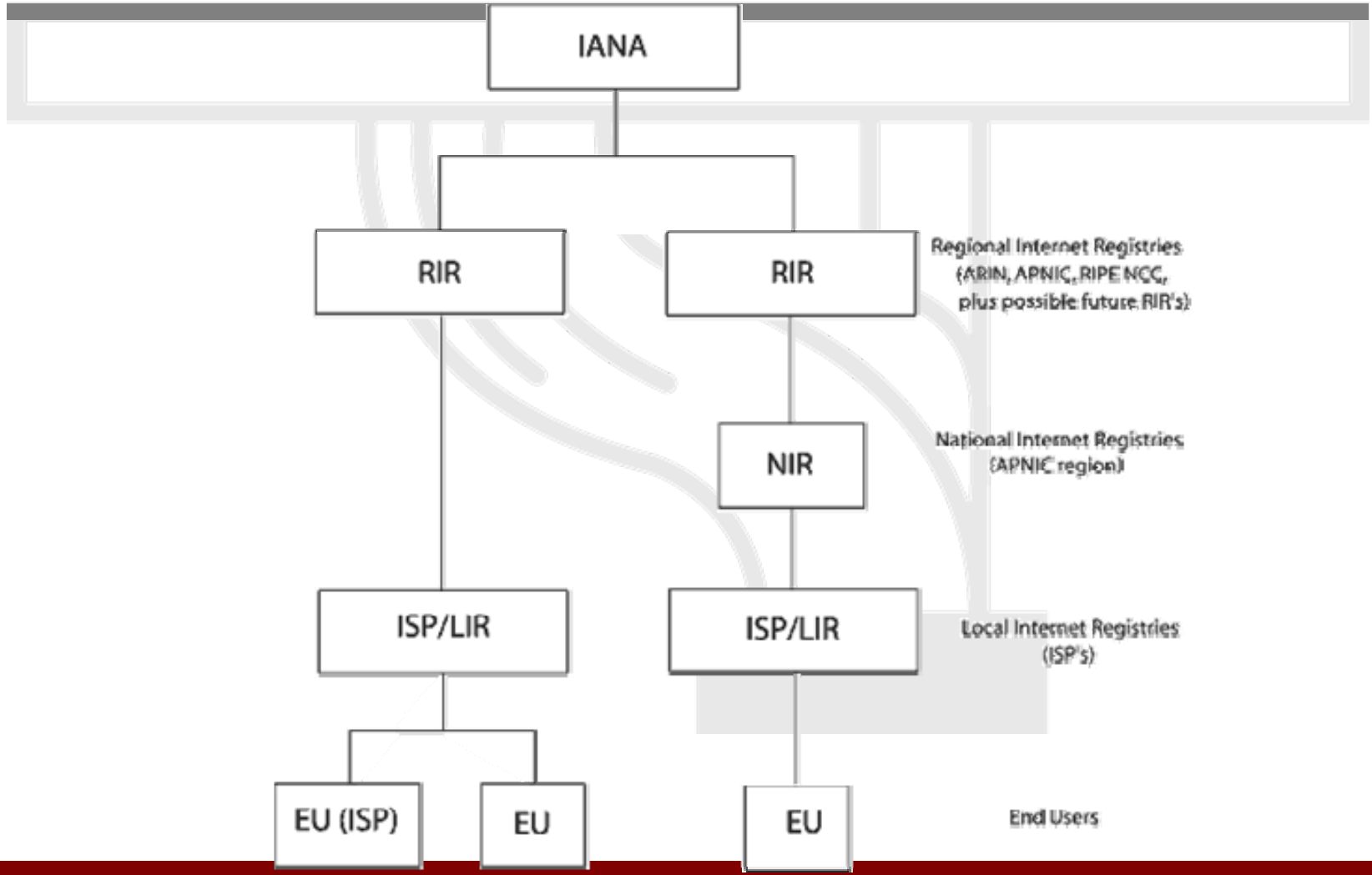
- « it may be assigned to an IPv6 router only »
- Reserved anycast addresses are defined in RFC 2526
- Subnet anycast router address is :

RFC 3587: Global Unicast address format

(obsoletes RFC 2374)



Production Addressing Scheme



Production Addressing Scheme (2)

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

IPv6 Prefix	Binary Value	Assignment
2000::/16	0010 0000 0000 0000	Reserved
2001::/16	0010 0000 0000 0001	Global Unicast Assignments [RFC3513]
2002::/16	0010 0000 0000 0010	6to4 [RFC3056 et 3068]
2003::/18	0010 0000 0000 0011	RIPE NCC Global Unicast Assignments [RFC3513]
2400::/x		APNIC
2600::/x		ARIN
2A00::/x		RIPE NCC
3FFE::/16	001 1 1111 1111 1110 0x1FFE	6bone Testing [RFC2471]
3FFF::/16	001 1 1111 1111 1111 0x1FFF	Reserved

Production Addressing Scheme (3)

IPv6 Prefix sub-TLA	Binary Values	Allocated to	Date
2001:0000::/23	0000 000X XXXX X	IANA	Jul 99
2001:0200::/23	0000 001X XXXX X	APNIC	Jul 99
2001:0400::/23	0000 010X XXXX X	ARIN	Jul 99
2001:0600::/23	0000 011X XXXX X	RIPE NCC	Jul 99
2001:0800::/23	0000 100X XXXX X	RIPE NCC	May 02
2001:0A00::/23	0000 101X XXXX X	RIPE NCC	Nov 02
2001:0C00::/23	0000 110X XXXX X	APNIC	May 02
2001:0E00::/23	0000 111X XXXX X	APNIC	Jan 03
2001:1000::/23	0001 000X XXXX X	(future assignment)	
2001:1200::/23	0001 001X XXXX X	LACNIC	Nov 02
2001:1400::/23	0001 010X XXXX X	RIPE NCC	Feb 03
2001:1600::/23	0001 011X XXXX X	RIPE NCC	Jul 03
2001:1800::/23	0001 100X XXXX X	ARIN	Apr 03
. . .			
. . .			
. . .			
2001:FE00::/23	1111 111X XXXX X	(future assignment)	

Where "X" indicates "0" or "1".
All other Sub-TLA ID values not listed above are reserved.

RIR allocations

- Started July ’99
- New allocated prefix length since July 1th 2002, ::/32 instead of ::/35
- Allocated prefixes (*up to 10 September 2005*) = **1301**
  - http://www.ripe.net/rs/ipv6/stats/

  – *APNIC*
    - **398 prefixes**
    - **within `2001:{02, 0C, 0E, …}00::/23`**

  – *ARIN*
    - **213 prefixes**
    - **within `2001:{04, 18, …}00::/23`**

  – *LACNIC*
    - **33 prefixes**
    - **within `2001:1200::/23`**

  – *RIPE-NCC*
    - **647 prefixes**
    - **within `2001:{06, 08, 0A, 14, 16, …}00::/23`**

Initial RIR allocation Policy & Procedure

- Get the RIPE documents [246-250, 256, 261, 267, 274, 275, 280-282]
  - http://www.ripe.net/ripe/docs/ipv6.html
- Criteria: RIPE-267
  - http://www.ripe.net/ripe/docs/ipv6policy.html
- To qualify for an initial allocation of IPv6 address space, an organization must:
  - be an LIR : *not be an end site*
  - plan to provide IPv6 connectivity to organizations to which it will assign /48s, by advertising that connectivity through its single aggregated address allocation (/32 prefix)

  and
  - have a plan for making at least 200 x /48 assignments to other organizations within two years.