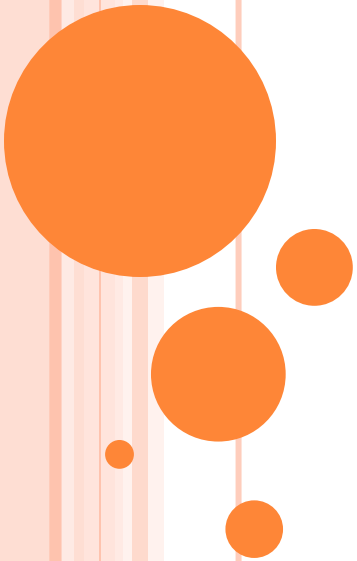


IPv6

Philip Heimer

Why?

- We're running out of IPv4 addresses.
  - Inefficiently allocated
  - ARPANet-universitety took a lot of class A/B-addresser.
    http://bgpmon.net/weathermap.php?inet=4
    http://www.iana.org/reports/2008/sample-ipv4-address-space.xhtml
    http://www.potaroo.net/tools/ipv4/index.html
- NAT-problem
  - Header Checksums
  - Fragmentation
  - Encryption
- Features
  - New header format

    Large address space

    Efficient and hierarchical addressing and routing infrastructure

    Stateless and stateful address configuration

    Built-in security

    Better support for quality of service (QoS)

    New protocol for neighboring node interaction

    Extensibility

Globacl Allocation of IPv4 Addresses

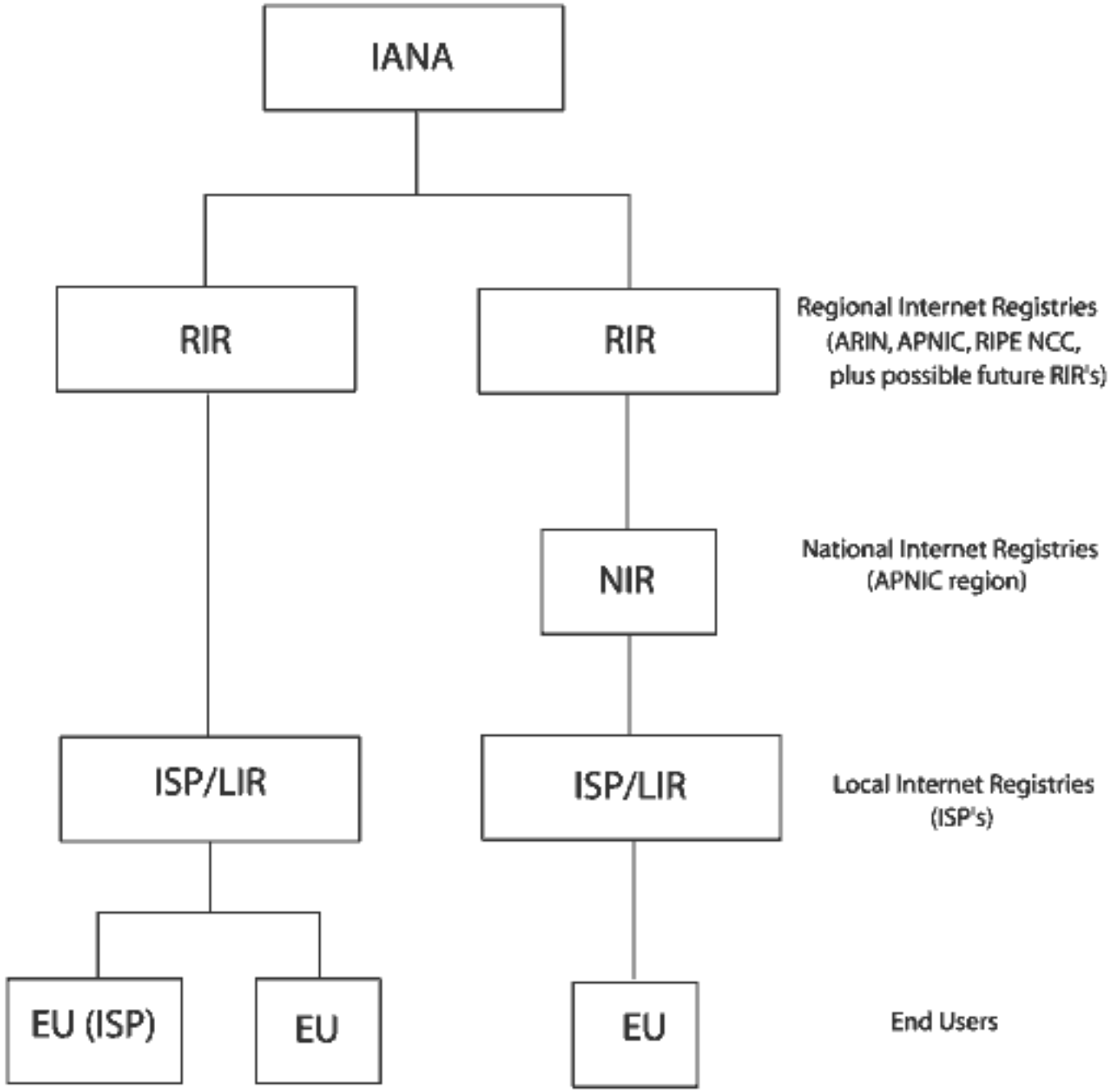
- http://www.ipv6actnow.org/info/statistics/#alloc
- http://bgpmon.net/weathermap.php?inet=6
- http://labs.ripe.net/Members/mirjam/ipv6-crawler-and-matrix

Regional Internet Registries

- The system of managing Internet address space involves Regional Internet Registries (RIRs), which together share a global responsibility delegated to them by the Internet Assigned Numbers Authority (IANA).

- AfriNIC
  - (African Network Information Center) is the Regional Internet Registry (RIR) for Africa.
- APNIC
  - The Asia Pacific Network Information Centre (APNIC) is the Regional Internet Registry for the Asia Pacific region.
- ARIN
  - The American Registry for Internet Numbers (ARIN) is the Regional Internet Registry (RIR) for Canada, the United States, and many island nations in the Caribbean and North Atlantic Ocean.
- LACNIC
  - The Latin American and Caribbean Internet Addresses Registry (LACNIC) is the Regional Internet Registry (RIR) for the Latin American and Caribbean area.
- RIPE NCC
  - The Réseaux IP Européens Network Coordination Centre (RIPE NCC) is the Regional Internet Registry (RIR) for Europe, the Middle East, and parts of Central Asia.

  - http://www.bgpexpert.com/v6micro.php
  - http://tools.whois.net/whoisbyip/

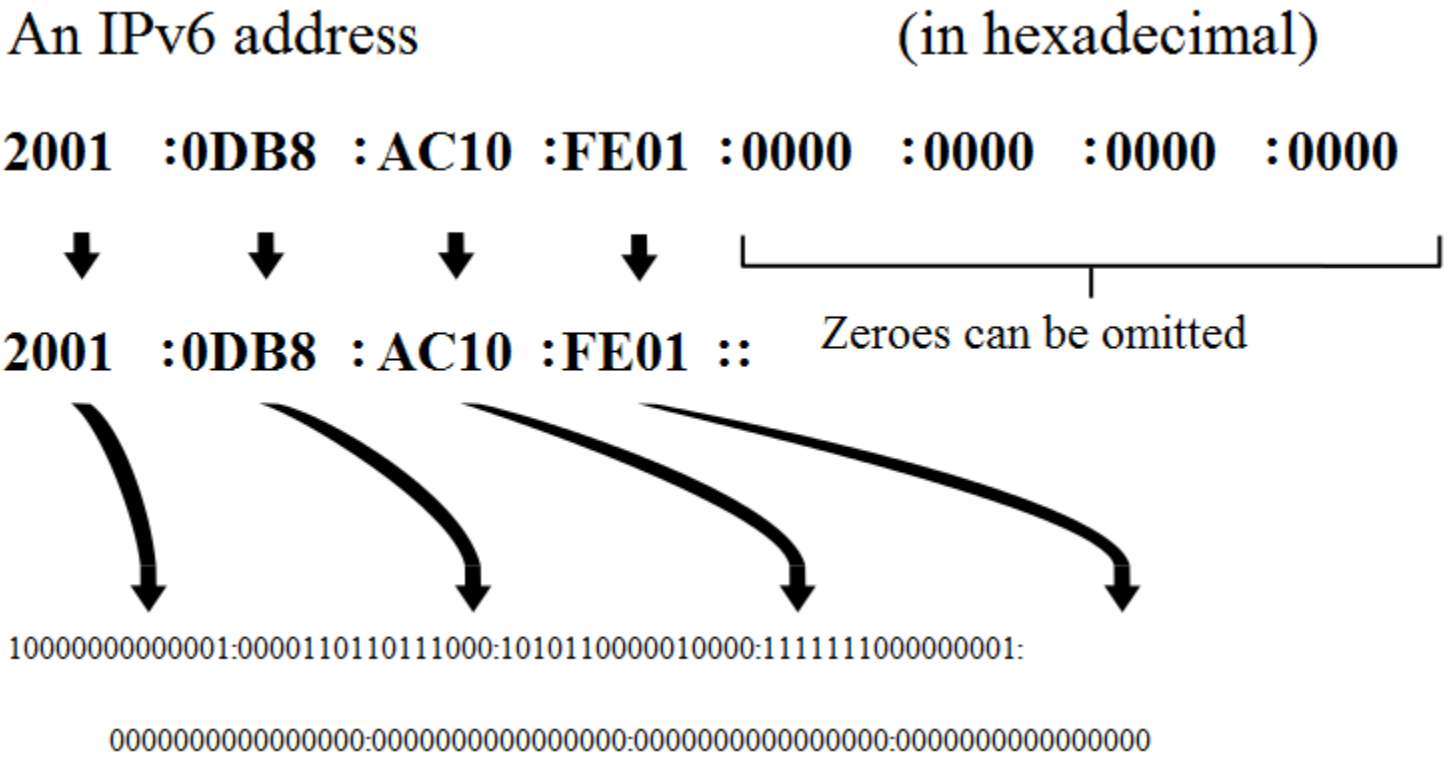

IANA
RIR
RIR
Regional Internet Registries
(ARIN, APNIC, RIPE NCC,
plus possible future RIR's)
NIR
National Internet Registries
(APNIC region)
ISP/LIR
ISP/LIR
Local Internet Registries
(ISP's)
EU (ISP)
EU
EU
End Users

IPv6 – IPv4

- IPv6
  - 128 bitar
  - 2^128 = 3,4*10^38
  - 16 byte
  - Noteras hexadecimalt

- IPv4
  - 32 bitar
  - 2^32 = 4,2*10^9
  - 4 byte
  - Noteras decimalt

IPV6 ADDRESSING



IPv6 addressing

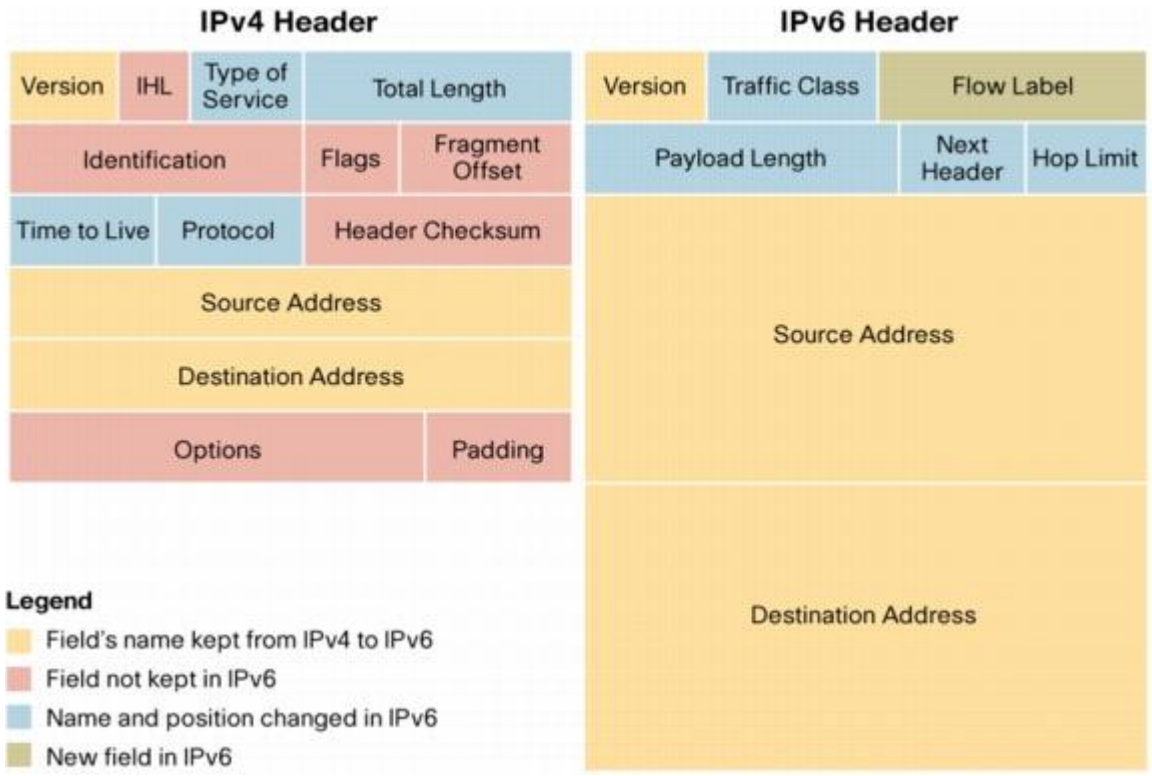
- 2001:AAAA:0000:0000:0000:EEEE:0FFF:1234
  - Consecutive zeroes can be omitted::
- 2001:AAAA::EEEE:0FFF:1234
  - Leading zeroes may be removed.
- 2001:AAAA::EEEE:FFF:1234

- Slash notation is used to describe the subnet mask:
  - 2001:AAAA::EEEE:FFF:1234/64
  - =2001:AAAA:0000:0000:0000:EEEE:FFF:1234

IPv6 addressing

- FE80:AB0A:003F:0000:0000:EEEE:0000:0234
  - FE80:AB0A:003F:0000:0000:EEEE:0000:0234
  - FE80:AB0A:3F::EEEE:0:234/64
- 2001:AAAA::1/64
  - 2001:AAAA:0000:0000:0000:0000:0000:0001/64

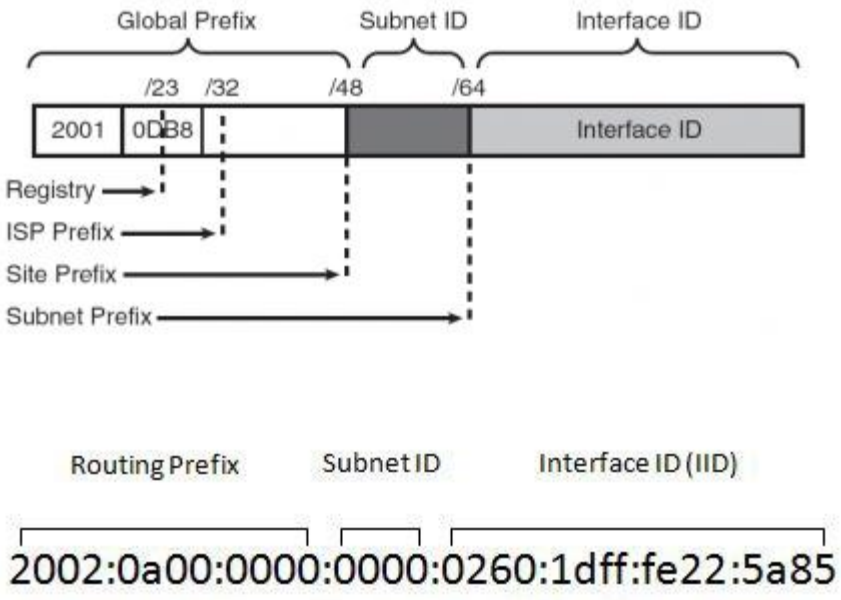
IPv4 – IPv6 header



Communication types and addressing

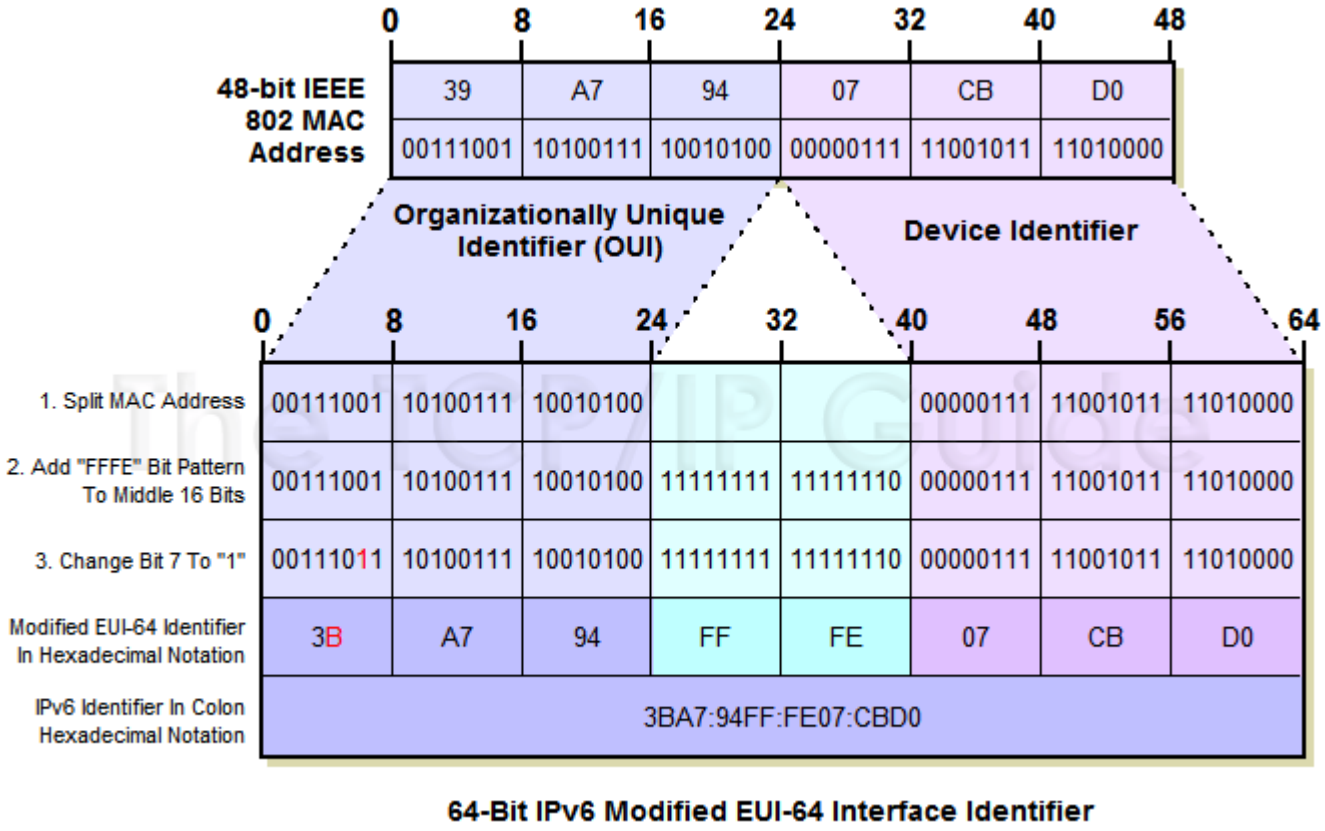
- Unicast
- Multicast
  - Replacing broadcast
- Anycast
  - Connect to the closest server/service
- Link-local address – Layer 2.
  - Prefix: FE80
- Global address – Internet
  - Prefix: 2000(1) and up.
    - High level 3 bits 001 (2000::/3)

Global Routing Prefix, the Subnet Identifier, and the Interface Identifier.

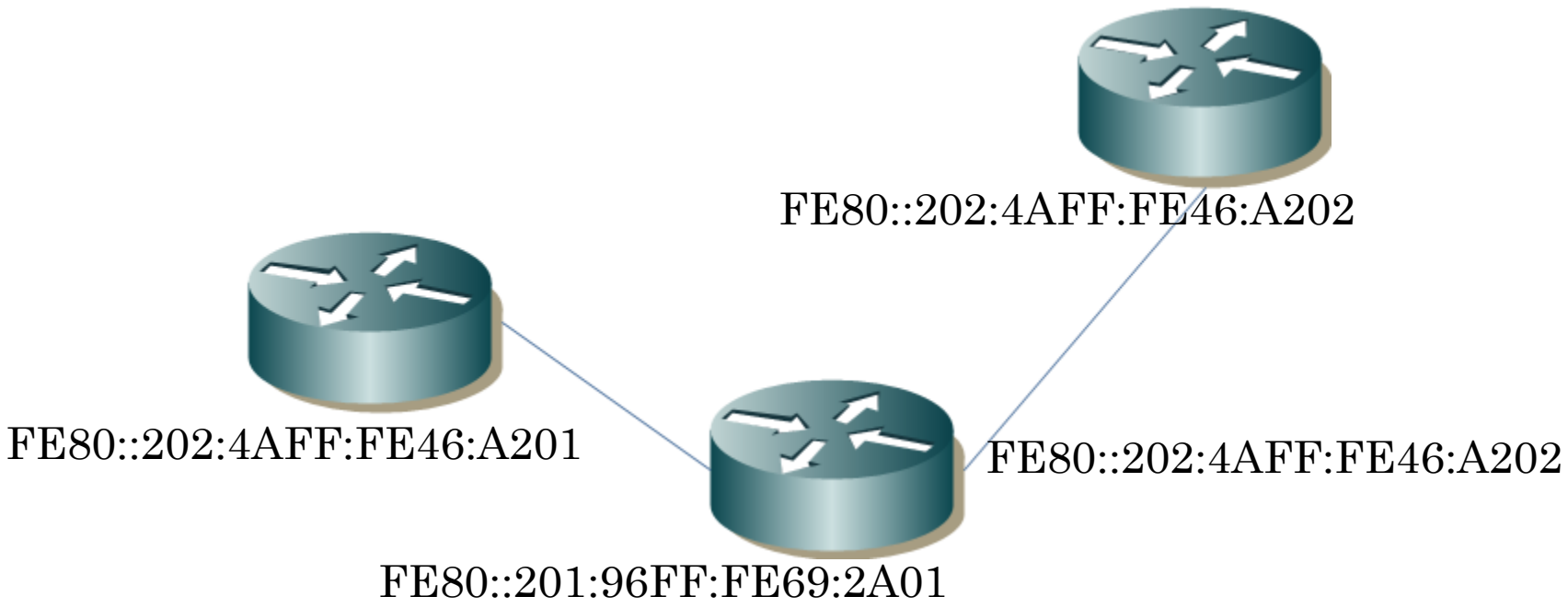


Kan jämföras med:
162.16 Routing Prefix
. 32 Subnet ID
.125 Interface

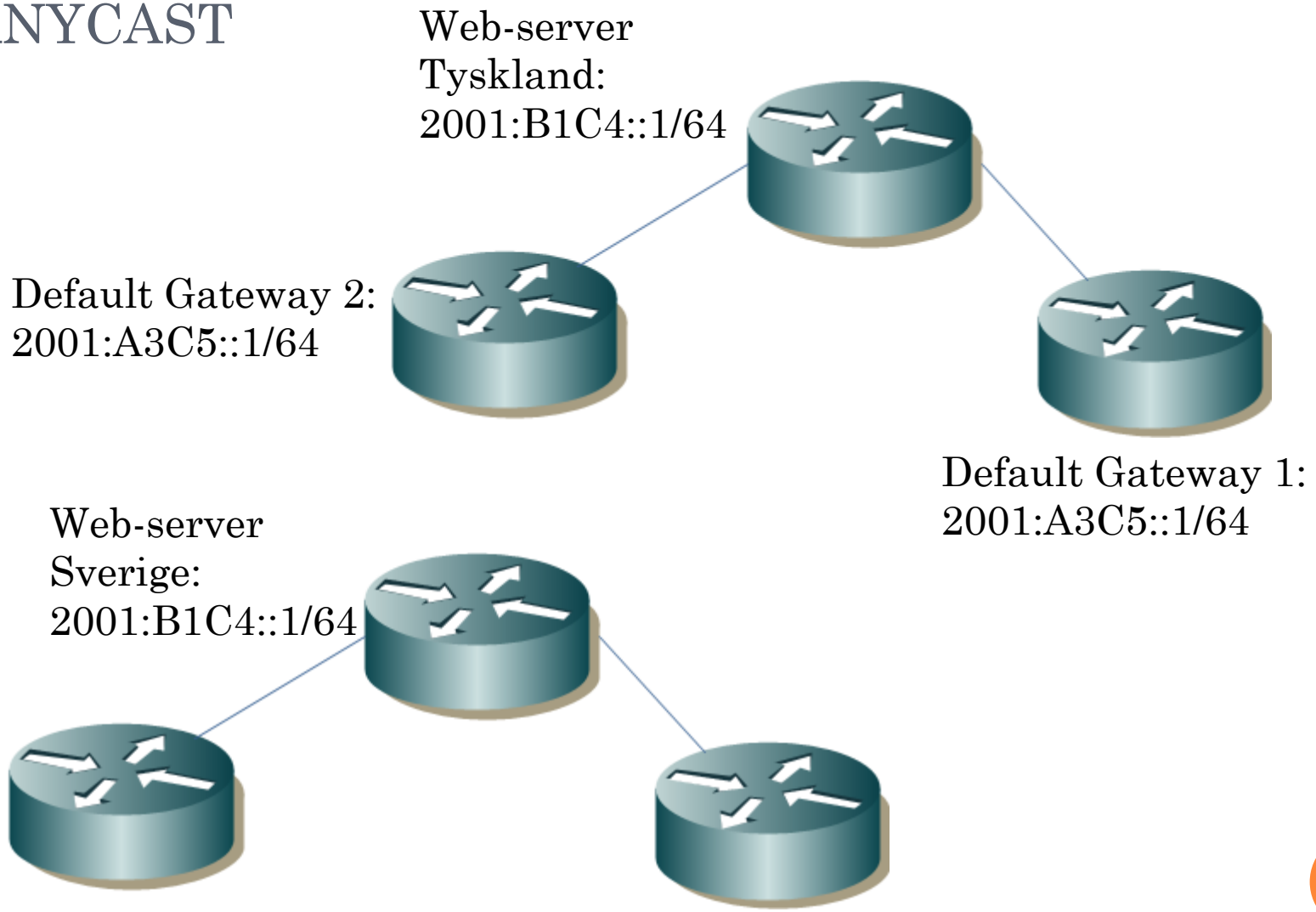
Link-Local – EUI-64 Interface Identifier



Link-Local


FE80::202:4AFF:FE46:A202
FE80::202:4AFF:FE46:A201
FE80::202:4AFF:FE46:A202
FE80::201:96FF:FE69:2A01

ANYCAST


Web-server
Tyskland:
2001:B1C4::1/64
Default Gateway 2:
2001:A3C5::1/64
Default Gateway 1:
2001:A3C5::1/64
Web-server
Sverige:
2001:B1C4::1/64

IPv6 HISTORY

- Year Major development and availability milestones
- 1996 Alpha quality IPv6 support in Linux kernel development version 2.1.8.[48]
- 6bone (an IPv6 virtual network for testing) is started.
- 1997 By the end of 1997 IBM's AIX 4.3 is the first commercial platform supporting IPv6.[49][50]
- Also in 1997, Early Adopter Kits for DEC's operating systems, Tru64 and OpenVMS, are made available.[51]
- 1998 Microsoft Research[52] releases its first experimental IPv6 stack. This support is not intended for use in a production environment.
- 2000 Production-quality BSD support for IPv6 becomes generally available in early to mid-2000 in FreeBSD, OpenBSD, and NetBSD via the KAME project.[53]
- Microsoft releases an IPv6 technology preview version for Windows 2000 in March 2000.[52]
- Sun Solaris supports IPv6 in Solaris 8 in February.[54]
- Compaq ships IPv6 with Tru64.[51]
- 2001 In January, Compaq ships IPv6 with OpenVMS.[51]
- Cisco Systems introduces IPv6 support on Cisco IOS routers and L3 switches.[55]
- HP introduces IPv6 with HP-UX 11i v1.[56]
- 2002 Microsoft Windows NT 4.0 and Windows 2000 SP1 have limited IPv6 support for research and testing since at least 2002.
- Microsoft Windows XP (2001) supports IPv6 for developmental purposes. In Windows XP SP1 (2002) and Windows Server 2003, IPv6 is included as a core networking technology, suitable for commercial deployment.[57]
- IBM z/OS supports IPv6 since version 1.4 (generally availability in September 2002).[58]
- 2003 Apple Mac OS X v10.3 "Panther" (2003) supports IPv6 which is enabled by default.[59]
- 2004 In July, ICANN announces that IPv6 address records for the Japan (jp) and Korea (kr) country code top-level domain nameservers are visible in the DNS root server zone files with serial number 2004072000. The IPv6 records for France (fr) are added later. This makes IPv6 DNS publicly operational.
- 2005 Linux 2.6.12 removes experimental status from its IPv6 implementation.[60]
- 2007 Microsoft Windows Vista (2007) supports IPv6 which is enabled by default.[57]
- Apple's AirPort Extreme 802.11n base station includes an IPv6 gateway in its default configuration. It uses 6to4 tunneling and manually configured static tunnels.[61] (Note: 6to4 was disabled by default in later firmware revisions.)
- 2008 On February 4, 2008, IANA adds AAAA records for the IPv6 addresses of six root name servers.[62][63] With this transition, it is now possible for two Internet hosts to resolve domain names without using IPv4.
- On March 12, 2008, Google launches a public IPv6 web interface to its popular search engine at the URL http://ipv6.google.com.[43]
- On March 12, 2008, IETF does an hour long IPv4 blackout at its meeting as an opportunity to capture informal experience data to inform protocol design work going forward[64], this led to many fixes in operating systems and applications.
- 2009 In January 2009, Google extends its IPv6 initiative with Google over IPv6, which offers IPv6 support for Google services to compatible networks.
- 2010 In May/June 2010, Facebook became accessible on IPv6 via http://www.v6.facebook.com/

IPv6

- **Implementing Cisco IP Routing (ROUTE) Foundation Learning Guide: Foundation Learning for the ROUTE 642-902 Exam**
- DHCP
  - http://ciscoarticles.com/Cisco-IOS/1273.html