Seminar IPv6

Compressed history of classic TCP/IP

1969: ARPANET went into operation
- four packet-switched nodes at three different sites
- connected together via 56 kbit/s circuits
- using the Network Control Protocol (NCP)
- funded by the U.S. Department of Defence

1974: TCP/IP designed by Vinton G. Cerf and Robert E. Kahn

1979: IP version 4 documented

1979: the Internet Control and Configuration Board (ICCB) formed

1979: BSD Unix with TCP/IP supplied to Universities

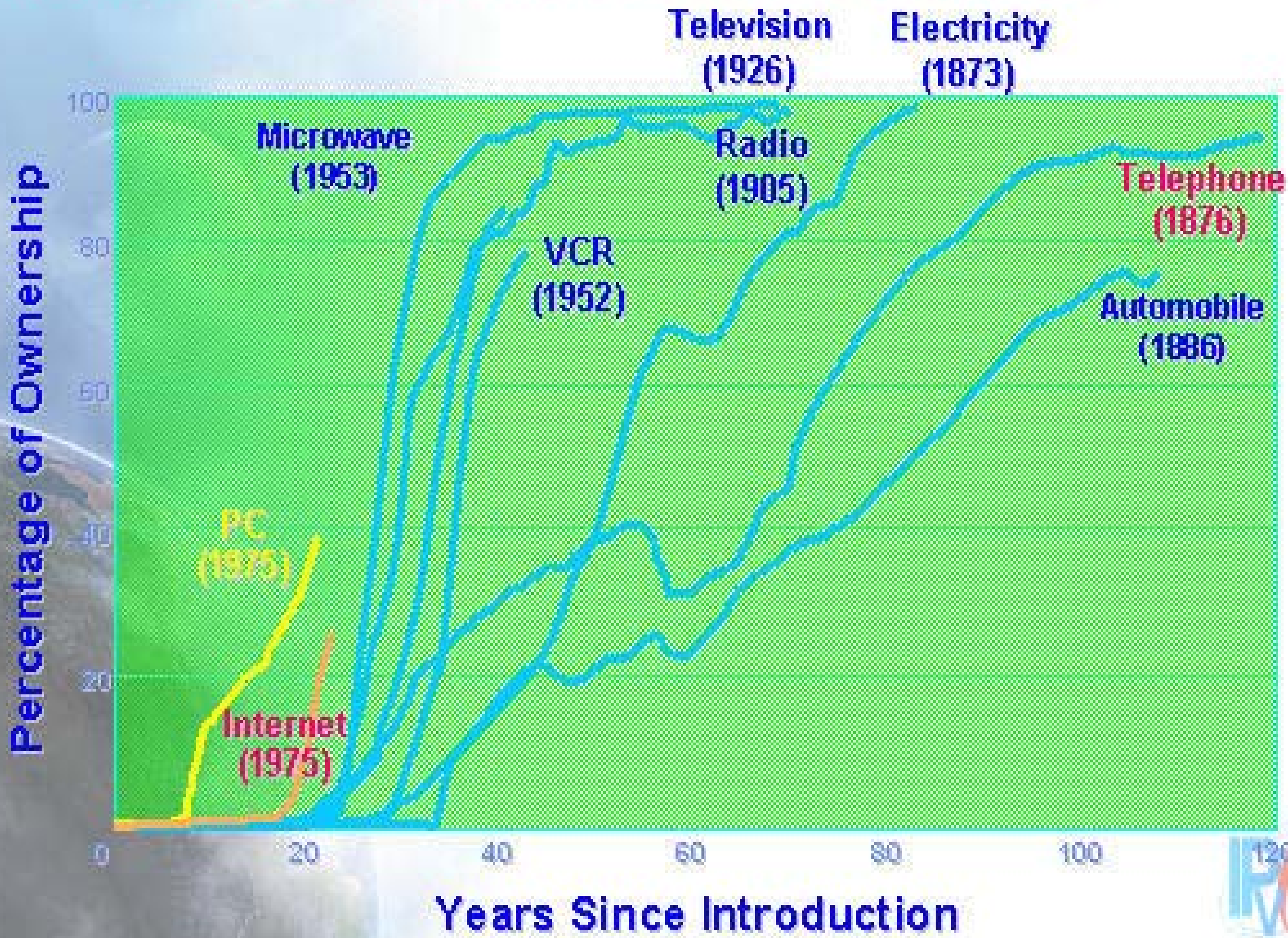
1980: ARPA started converting machines to TCP/IP

1983: mandate that all computers connected to ARPANET use TCP/IP

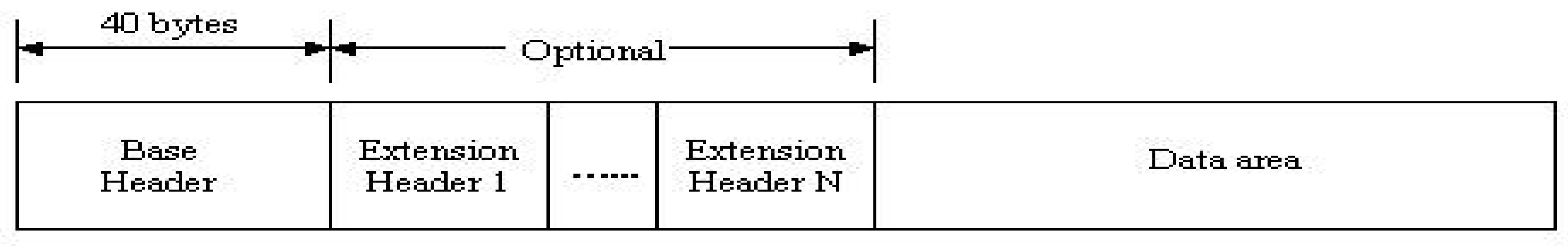
1983 ARPANET split into two separate networks, ARPANET for further research

MILNET for the military

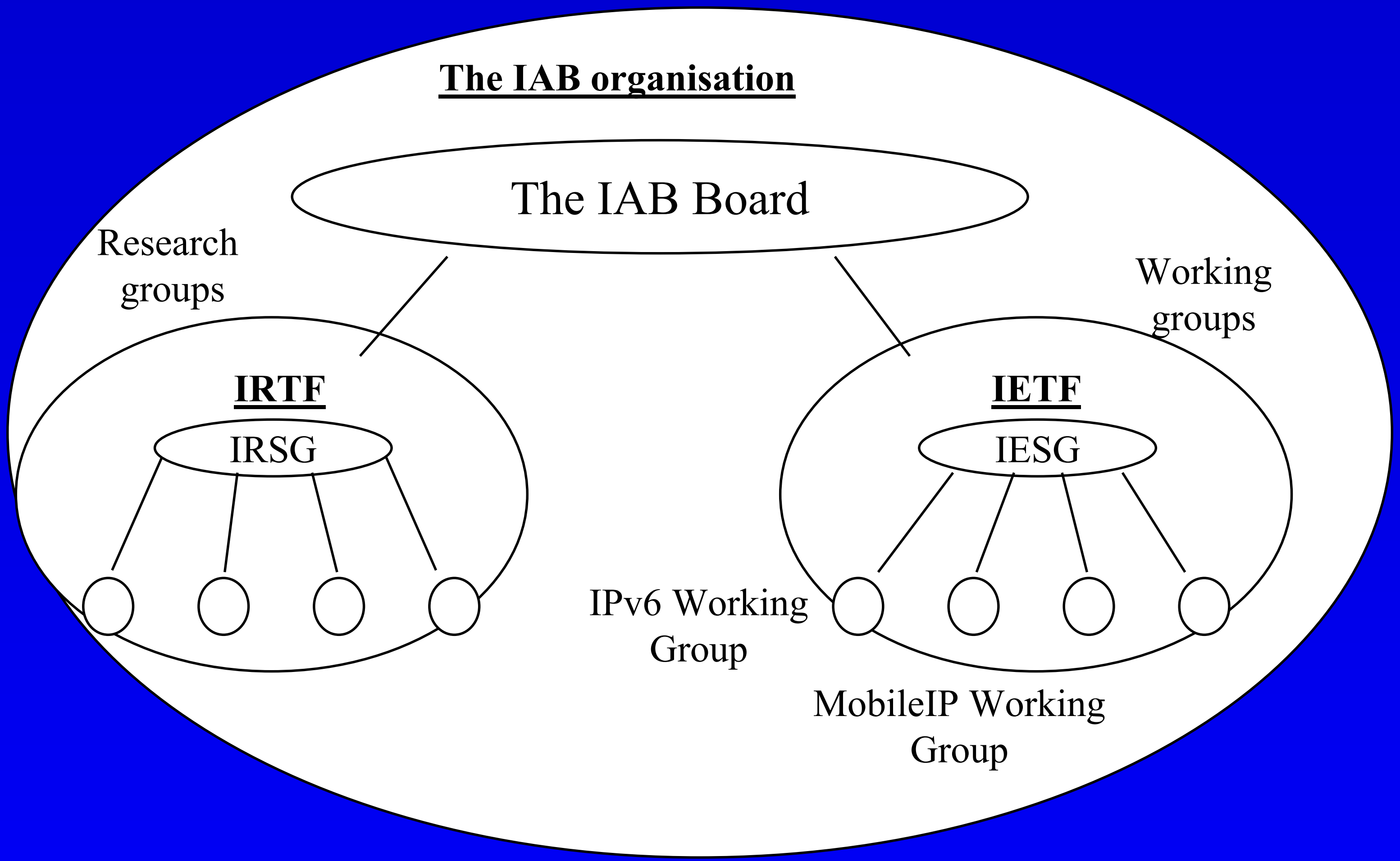
Industry Standards Drive Ubiquity



Ipv6 ?



- IPv6 is the predecessor to IPv4 which was developed almost 30 years ago.
- IPv6 base header is a simplification of IPv4.
- Extended address space, 128 bit against 32 bit.
- Addressing with Anycast, Multicast & Unicast.
- Classify different kind of data.
- Cryptation and data security.
- Effective data routing.
- Automatic generated addresses.


The IAB organisation
The IAB Board
Research groups
Working groups
IRTF
IRSG
IETF
IESG
IPv6 Working Group
MobileIP Working Group

The Network for IPv6 experiments and testing, everyone is welcome. You must apply for a tunnel, through IPv4 network, to one of the accesspoints pTLA.

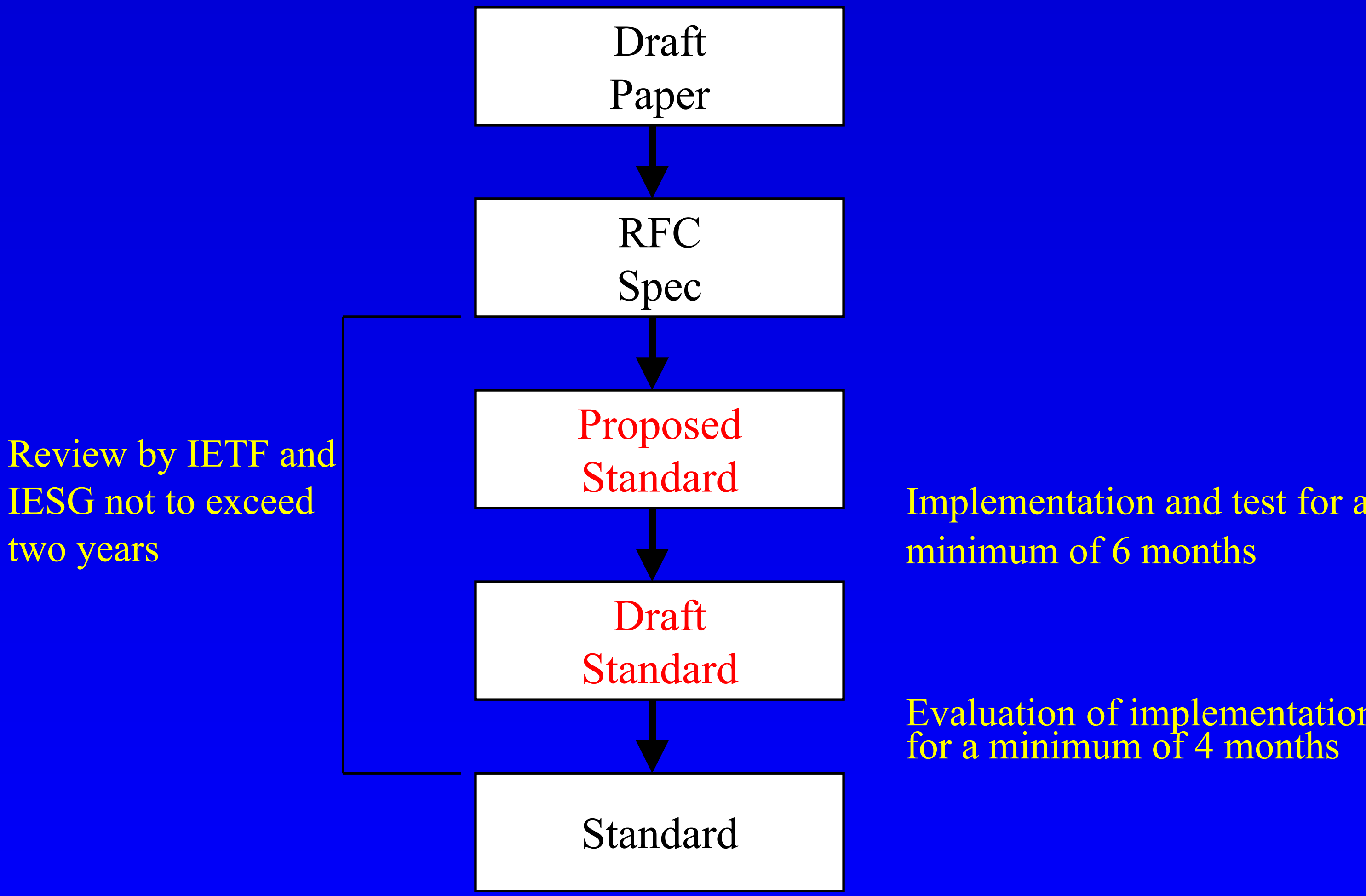
To connect, you can contact "IPv6 registry". In Sweden you have a few accesspoints, one is: http://www.ipv6.sics.se/.

For more information:

http://www.6bone.net

http://www.ipv6forum.com

Standards drafts and RFC:s



Some IPv6 RFC:s

- 2460 -- IPv6 Specification. (Dec-98)
- 2373 -- IPv6 Addressing Architecture. (Juli-98)
- 2463 -- ICMPv6 for IPv6. (Dec-98)
- 1886 -- DNS Extensions to support IPv6 (Dec-95)
- 2675 -- IPv6 Jumbograms (Aug-99)

IPv4 works so well then why change?

- IPv4 works so well then why change?
- Dramatically increase the number of IP addresses
- Provide better support for real-time applications
- Security features

New features of IPv6

- Address size 128-bit addresses
- router processing of IPv6 packets
- Address autoconfiguration dynamic assignment of IPv6 addresses
- Increased addressing flexibility anycast address
- Support for resource allocation labelling of packets to handle specialised traffic
- Security capabilities authentication and privacy

Pros & Cons

- **Advantages with IPv6**
  - Simplification of the basic protocol.
  - Reduction in the packet processing time at the routers.

- **Drawbacks with IPv6**
  - The use of several headers makes larger overhead,
  - It is expensive to transit to IPv6, and takes time.

Major design goals of Ipv6

- Providing 128-bit source address as well as 128-bit destination address
- Providing support for flow specification and priority for the time-sensitive applications.
- Allowing smooth extensibility and modifiability in the years ahead.
- Permitting Stateless as well as Stateful Address Autoconfiguration.
- Adding optional security features.
- Providing a certain degree of Interoperability with other protocol families.

Well this looks fine, but what products supports IPv6

- **A startpoint can be to visit the following website:**
  - **http://playground.sun.com/pub/ipng/html/ipng-implementations.html**

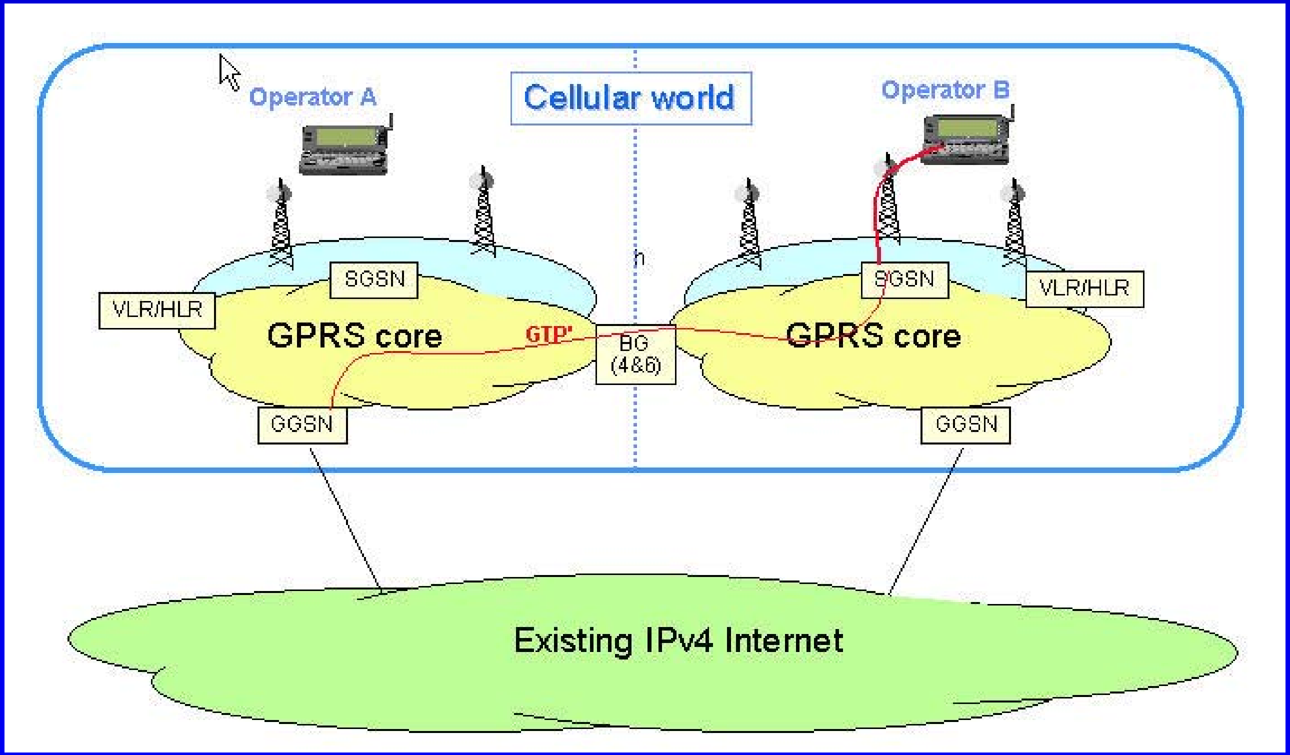
- **Operating-System supports IPv6**
- **MacOS-X, SunOS, Microsoft Win2K, Linux, AIX, True64, freeBSD, openBSD…**

- **Routers and Switches**
- **3Com, Cisco, Ericsson, Nokia, Extreme Networks, Hitatchi, NorTel.**

Reflections from the net

- What will it costs to implement
  - New hardware and software.
  - The major problem today is traffic and traffic engineering.
  - New applications.
  - Learning periodIPv6 definitely needs some studies.
  - Politics and company standards-
- Words from Cisco (Steve Deering)
  - High costs of a slow rollout of IPv6 .
  - NAT's not working.
  - No room for new services.
  - IPv4 has scaling limits we need IPv6 to keep going.

IPv6 over GPRS

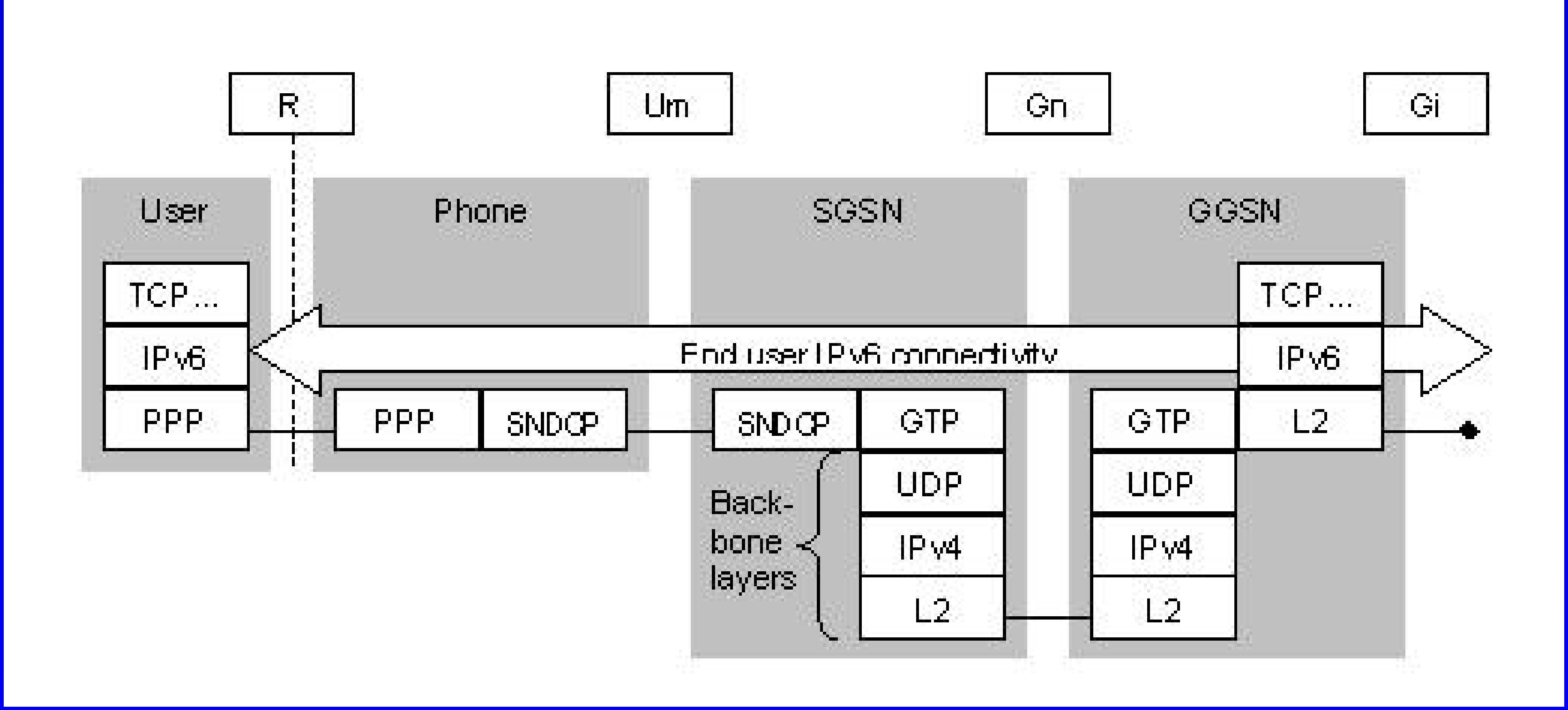


MipV6 (Mobile IP version 6)

INTERNET-DRAFT: Mobility Support in IPv6

INTERNET-DRAFT Hierarchical MIPv6 mobility management (HMIPv6)

IPv6 over GPRS protocol stack



IPv6 addresses

- fe80:0000:0000:0000:0000:0250:56ff:febc
- fe80:0:0:0:250:56ff:febc
- fe80::250:5ff:febc
- ::192.168.3.204

Address Types

- Unicast (one-to-one)
  - global
  - link-local
  - site-local
  - compatible (IPv4,IPX)
- Multicast (one-to-many)
- Anycast (one-to-nearest)

Address Type Prefixes

Address types	Binary prefix	Hex prefix
IPv4 compatible	00..(64 zero bits)	0:0:0:0
Global unicast	001(0)	2
Link-local	1111 1110 10(00)	fe8
Site-local	1111 1110 11(00)	fec
Multicast	1111 1111	ff

Global Unicast Addresses

001	TLA	NLA*	SLA*	Interface ID
	45 bits		16 bits	64 bits

- TLA=Top-Level Aggregator (nordu.net)
  NLA*=Next-Level Aggregator (sunet.se)
  SLA*=Site-Level Aggregator (kth.se)
- All subfields variable-length non-self-encoding (like CIDR)

Link-Local & Site-Local Addresses

- Link-local addresses for use during auto-configuration and where no routers are present

1111 1110 10	0	Interface ID

- Site-local adresses for independence from changes of TLA/NLA*

1111 1110 11	0	SLA*	Interface ID

Multicast Addresses

1111 1111	Flags	Scope	Group ID

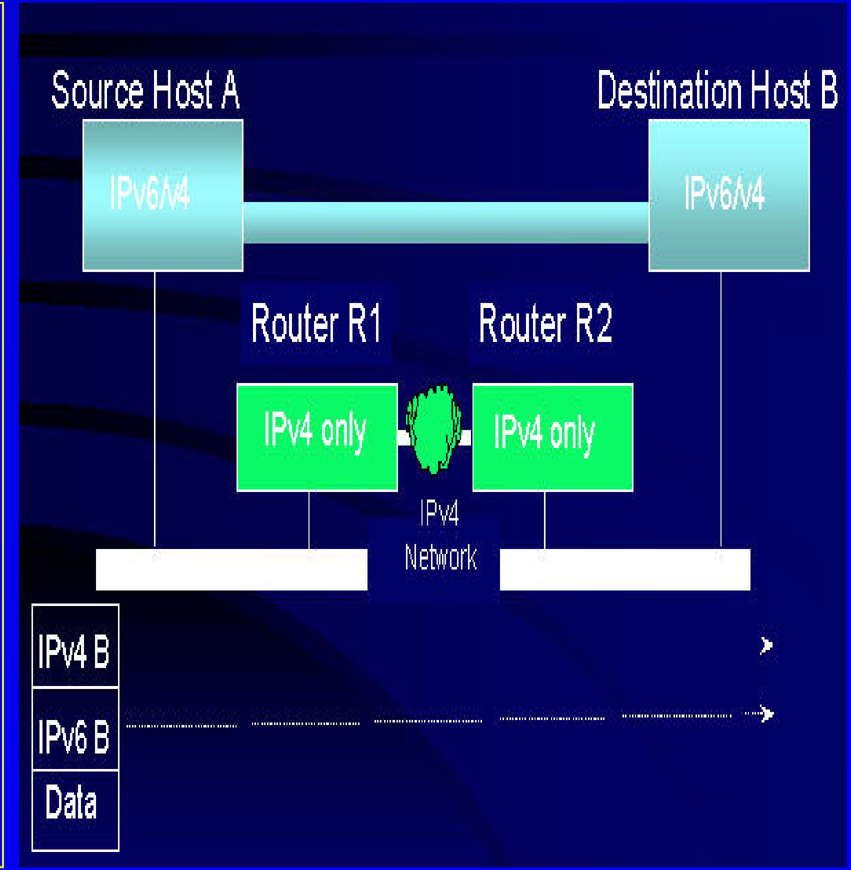
- 4 bit scope
  - 1 - node-local
  - 2 - link-local
  - 5 - site-local
  - 8 - organization-local
  - B - community-local
  - E - global

- last bits of group id
  - 1 - All Nodes Addresses
  - 2 - All Router Addresses
  - 9 - RIP Routers

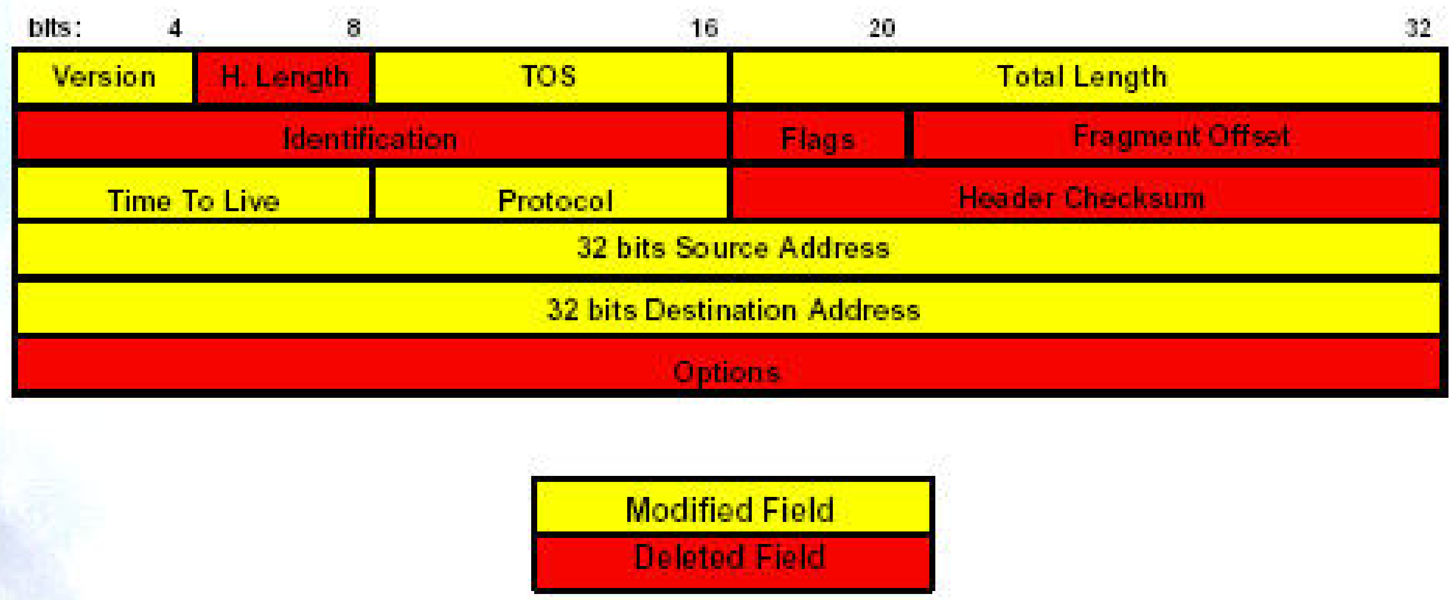
ff05::9=site-local rip router multicast

Transition between IPv4 & IPv6

- In the bindery we need a new DNS record: AAAA or A6
- Tunnelling
  - Configured
  - Automatic
- Dual Stacks
- Mapped addresses
- Address translations/header
  - SIIT (Stateless translation)
  - NAT-PT (Statefull translation)



IPv4 & IPv6 Packet



IPv6 Header


0
4
8
16
24
32
Version
Priority
Flow Label
Payload Length
Next Header
Hop Limit
Source Address
Destination Address
10 x 32 bits = 40 octets

IPv6 headers

Extension header	Description
Hop-by-hop options	Miscellaneous information for routers
Destination options -1	Information for 1st destination
Routing	Full or partial route to follow
Fragmentation	Management of datagram fragments
Authentication	Verification of the sender's identity
Encrypted security payload	Information about the encrypted contents
Destination options -2	Additional information for the final destination only

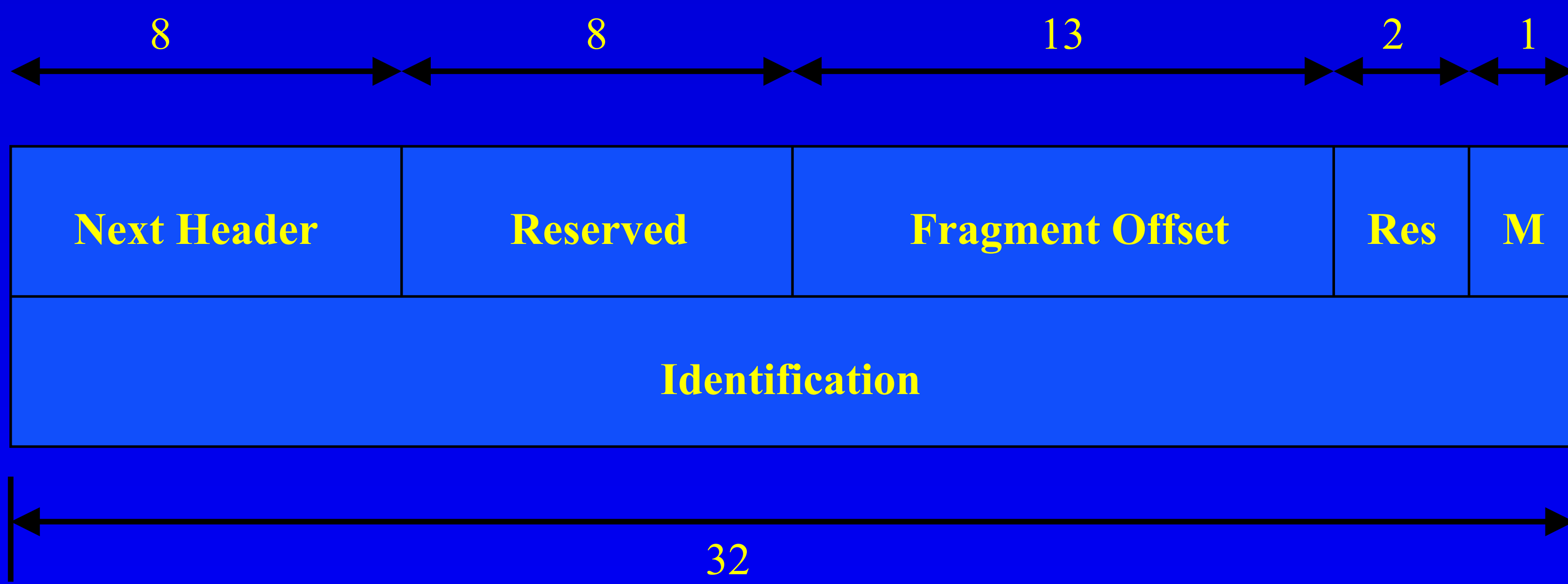
IPv6 Headers order

- IPv6 header
- Hop-by-Hop Options header
- Destination Options header
- Routing header
- Fragment header
- Authentication header
- Encapsulating Security Payload header
- Destination Options header
- Upper-layer header

IPv6 Routing header

Next Header	Type	Number of Addresses	Next address
Reserved	Strict/loose Bit Map		
1 - 24 Addresses			

IPv6 Fragment header

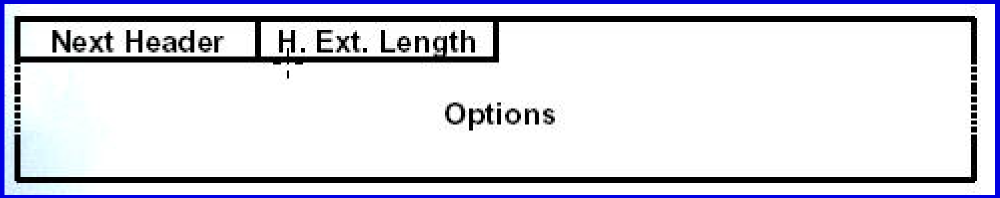


IPv6 Encapsulating Security Payload header

Transport mode

Tunnel Mode

IPv6 Hop by hop option



IPv6 minimum packet size

- Link MTU and Path MTU
- Minimum link MTU is 1280 bytes for IPv6, in IPv4 it was 68 bytes.
- On links where MTU is less than 1280, a special fragmentation and reassembly algorithm must be used.
- The recommendation is to use 1500 byte MTU wherever possible (Ethernet framesize).

- Path MTU discovery, RFC 1981 describes how to send packages larger than 1280 bytes.

- BootRom situations can omit RFC 1981 as long as packet size is =<1280 bytes.

IPv6 Maximum packet size

- The opposite situation to the one above is the maximum packet size.
- Base IPv6 packets supports data payloads up to 65535 bytes. Header of 40 byte excluded.
- Bigger packets can be carried by setting the IPv6 payload length to zero, and adding the jumbogram hop by hop option.
- Cant use fragment's with jumbograms (RFC 2675).

IPv6 & QoS

Flow Label 24 bit traffic ID tags

Routing options, strict and loose

Packet priority

Flag-Value	Defined as
0-7	Congestion controlled traffic:
8-15	**Non congestion-controlled traffic.**

0	**No traffic defined**
1	**Filler Traffic - Netnews**
2	**Data transfer**
3	**Reserved**
4	**Transfer - FTP, NFS**
5	**Reserved**
6	**Interactive traffic - Telnet**
7	**Internet control traffic – SNMP.**

Open discussion.

By

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