Seminar Presentation

IPv6

Next generation IP

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Network Problems

- Communication Problem
- Identification Problem
  - Identification of Networks
    - ✓*Logical Addressing system*
  - Identification of system with in the network
    - ✓*Physical Addressing system*
  - Identification of the process with in the system
    - ✓*Service point addressing system*
- Connection Problem

IPv6 Myths

- IPv6 is a patch to IPv4 with more addresses
- Flag Day for IPv6 activation to be announced
- The drive for IPv6 starts in the backbone/Telco
- IPv6 is too complex, it can break IPv4 networks

New Features

- New header format

- Large address space – 2^{128} vs. 2^{32}
- Efficient and hierarchical addressing and routing

IPv6 Changes

	IPv4	IPv6
Source and destination addresses	32 bits (4 bytes)	128 bits (16 bytes)
IPsec support	Optional	Standard
Identification of packet flow for QoS handling by routers	None in header	Included in header
Fragmentation	By both routers and sending host	Only by sending host
Header checksum	Included	Not included
Header optional data	Included	Moved to extension headers

IPv6 Changes

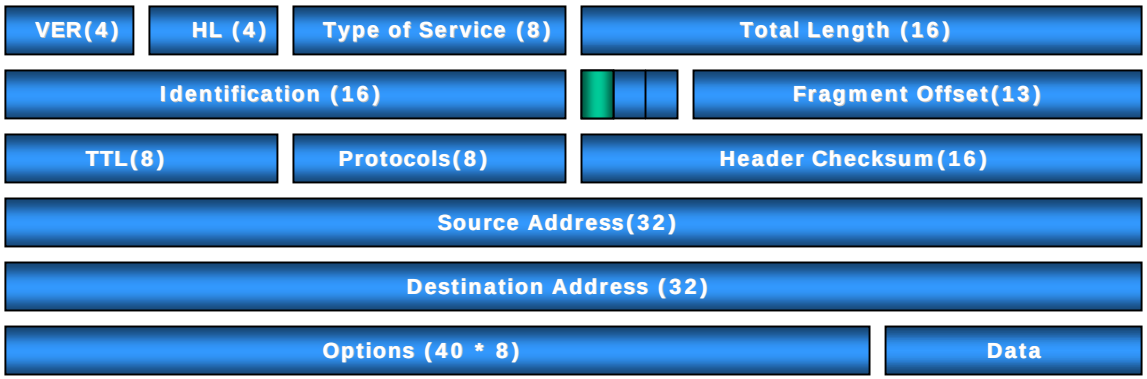
	IPv4	IPv6
IP address resolution method	Broadcast ARP request frames	Multicast Neighborhood. Solicitation messages
Managing local subnet group membership	IGMP	Multicast Listener Discovery (MLD)
Determine best default gateway	ICMP Router Discovery (opt.)	ICMPv6 Router Solicitation & Adv. messages (req.)
Sending traffic to all nodes on subnet	Broadcast addresses	Multicast address

IPv6 Changes

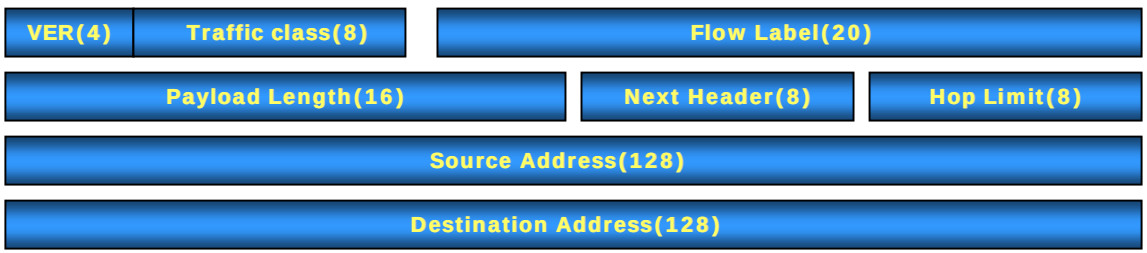
	IPv4	IPv6
Configuration	Manually or through DHCP	Automatic
Packet size support	576-byte (possibly fragmented)	1280 byte (no fragmentation)

Internet Protocol Headers

IPv4



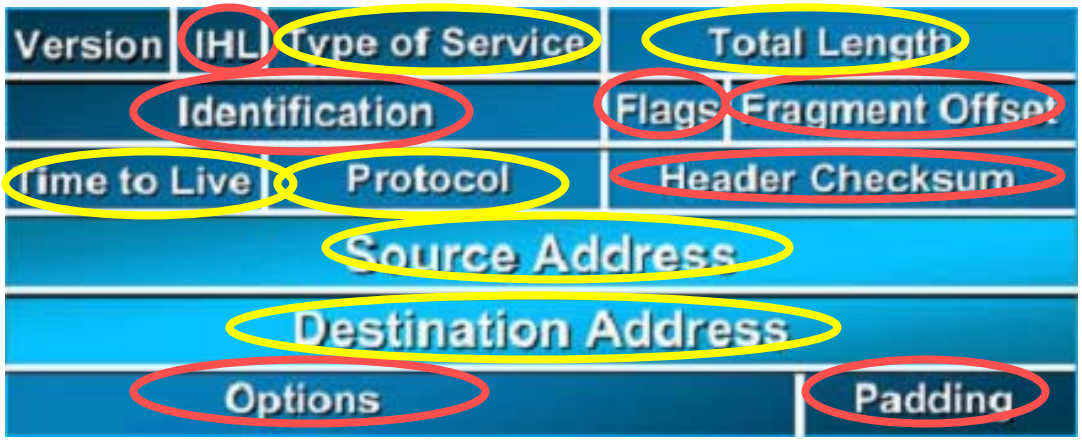
IPv6



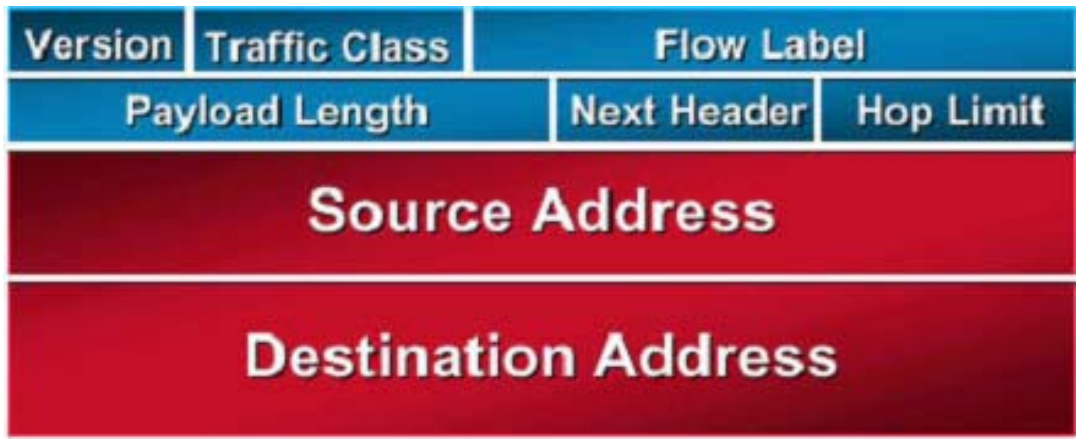
Header Changes

Removed

Changed



- 20 octets
- 12 fields, including 3 flag bits
- Fixed max number of options

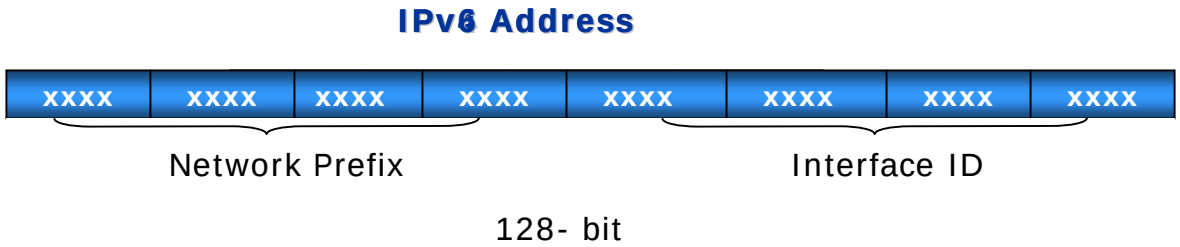


- Fixed 40 octets
- 8 fields
- Unlimited chained extension (options) header

Extension Headers

- Hop-by-Hop header
- Destination header
- Routing header
- Fragmentation header
- Authentication and Encapsulating Security Payload headers

IP Address Format



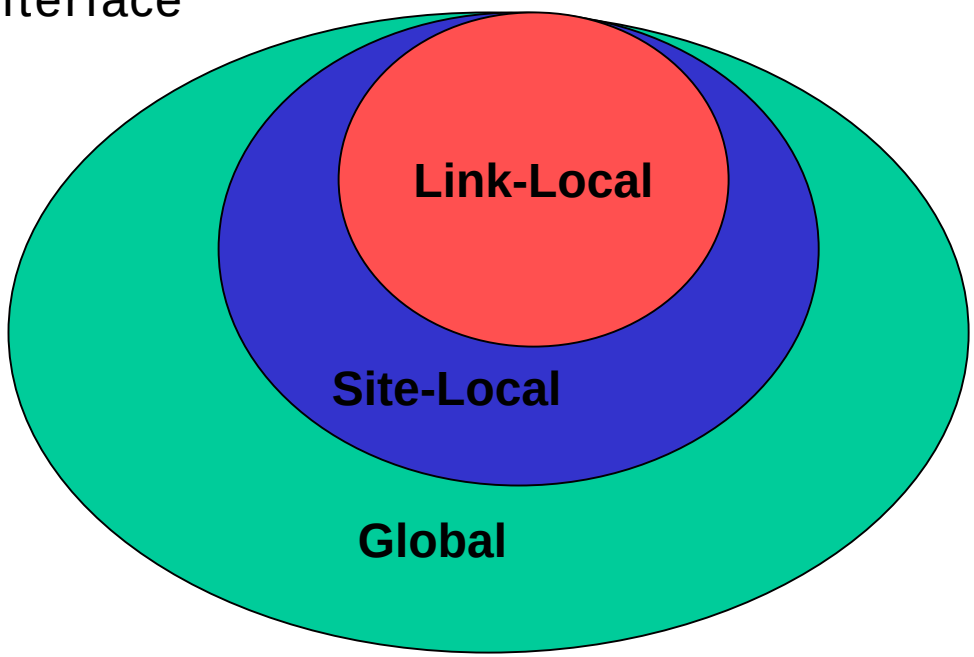
- a Unicast address
  - 1080:0:0:0:8:800:200C:417A
  - 1080::8:800:200C:417A
- A multicast address
  - FF01:0:0:0:0:0:0:43
  - FF01::43
- A loopback address
  - 0:0:0:0:0:0:0:1
  - ::1
- A unspecified address
  - 0:0:0:0:0:0:0:0
  - ::

IPv6 Address Structure

- Interface ID
  - Unique identifier for each host (48-bit MAC address + some padding)
  - Structure of a ‘Provider Based Unicast’ (like IPv4 with CIDR)
  - No more ‘classes’ (A,B,C,D,E)
  - More ‘granularity’ than IPv4 or IPv4 CIDR
  - No need to specify subnet mask

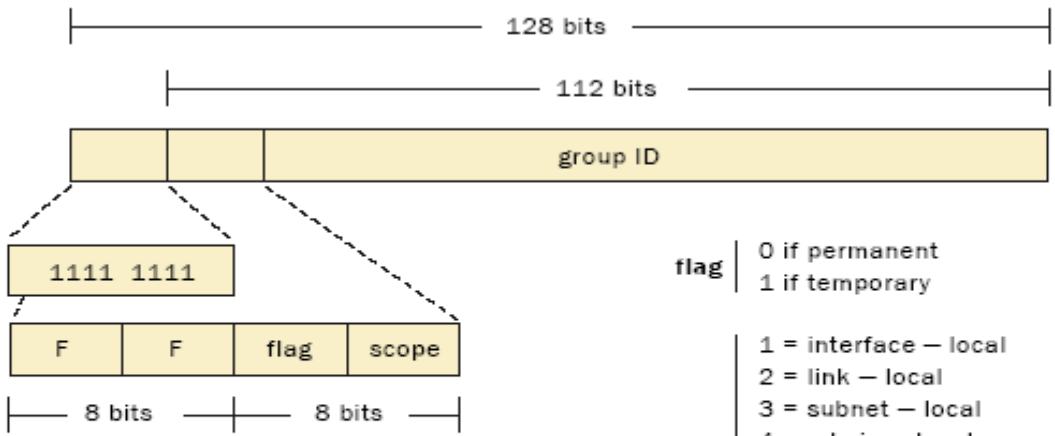
Addressing Considerations

- Assigned to interfaces
- Multiple addresses per interface
- Scope
  - Link-local
  - Site-local
  - Global
- Lifetime



IPv6 Addressing

- Unicast
  - Global unicasat address
  - Site-local unicast address
  - Link-local unicast address
- Anycast
- Multi Cast



Multicast address format.

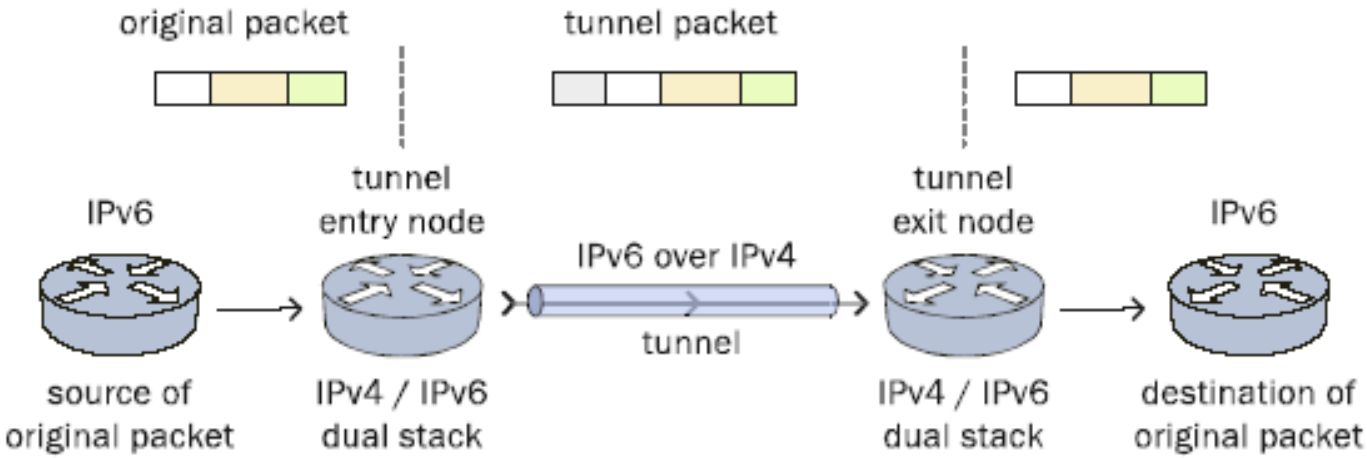
IPv6 Operations

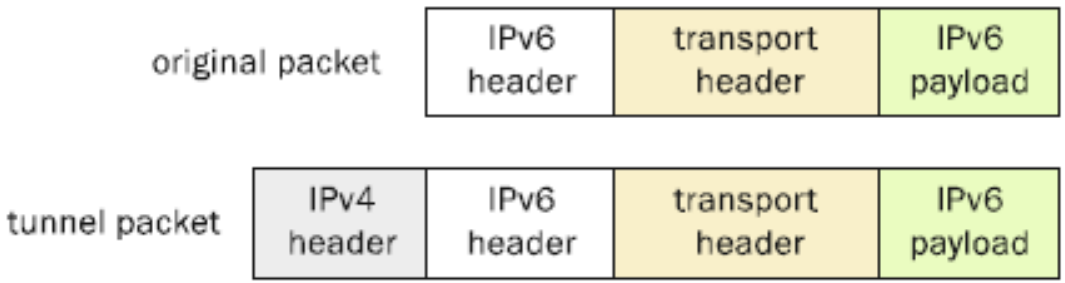
- Neighbor discovery
- Router discovery
- Stateless autoconfiguration and renumbering of IPv6 address
- Path Maximum Transfer Unit(MTU)
- DHCPv6 and Domain Name Server(DNS)

IPv6 Deployment

- Dual-stack backbone
- IPv6 over IPv4 tunnelling
- Manually configured tunnels
- GRE(Generic Routing Encapsulation)
- IPv4-compatible tunnels or 6over4 tunnels
- 6to4 tunnels

IPv6 over IPv4 Tunneling





Deployment Benefits

- Plug and play autoconfiguration for nodes
- Always-on solutions (3G requirement) enable self-provisioned “push services” to customers
- Peer-to-peer apps (e.g., video-conferencing) better supported by QoS built-in flow specs
- IPsec specs built-in for greater efficiency
- Unique addresses for all network devices

Transition Concerns and Issues

- Product support for both IPv6 and IPv4
- Selection of transition mechanisms
- Cost
- Asia and Europe migrate ahead of U.S.

Transition Goals

- **Incremental upgrade**: upgrade IPv4 devices to IPv6 any time without dependencies on other devices
- **Incremental deployment**: new IPv6 devices installed any time without prerequisites (except upgrading DNS)
- **Easy addressing**: existing addressing used for upgraded devices
- **Low start-up costs**: little prep work needed

Market Impact

- New applications tailored to target customers
- Secure session a boon to e-commerce
- Enable growth of 3G devices
  (PDAs, phones, vehicles, home appliances, etc.)
- Autoconfiguration facilities will accelerate adoption
- Multicast will drive more “ push” and interactive apps,
  e.g., on-line gaming

IPv6 Barriers

- No date when IPv4 addresses will dry up
- No killer app
- Reluctance to upgrade
  - Class A & B address owners are satisfied
  - What is really broken?
  - Cost to train IT staff
  - Nobody wants to be first

What it Means

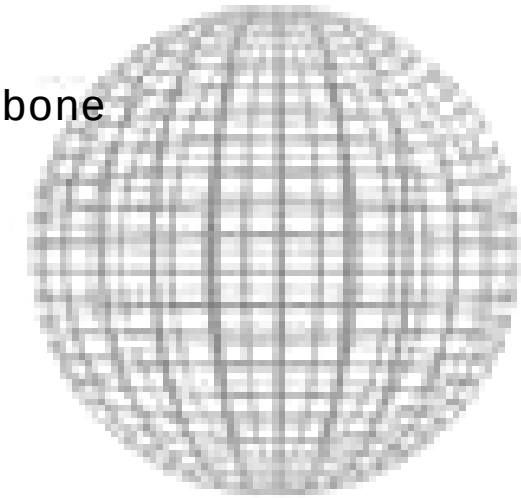
- Simplified header
  - Faster router processing
  - Less overhead
- Efficient option processing
- No fragmentation
  - Reduced load on routers
  - Easier to implement in hardware
  - Easy Layer 3 switching of IP
- Minimum link MTU is 1280 bytes

Impact of New Address Structure

- Separation of “who you are” from “where you are connected to”
  - Prefix depends on routing topology
  - Interface ID identifies a node
- Anycast is ready
- Broadcast disappears

Global Deployment Status

- European Commission for Enterprise and Information Society endorses IPv6 native deployment
  - 6NET
  - Euro6IX – Pan-European IPv6 Exchanges Backbone
  - 6Link – IPv6 Projects United
- Japan
  - Commercialized operations
  - New applications
- National deployment in Korea
- India – development & deployment strategies started



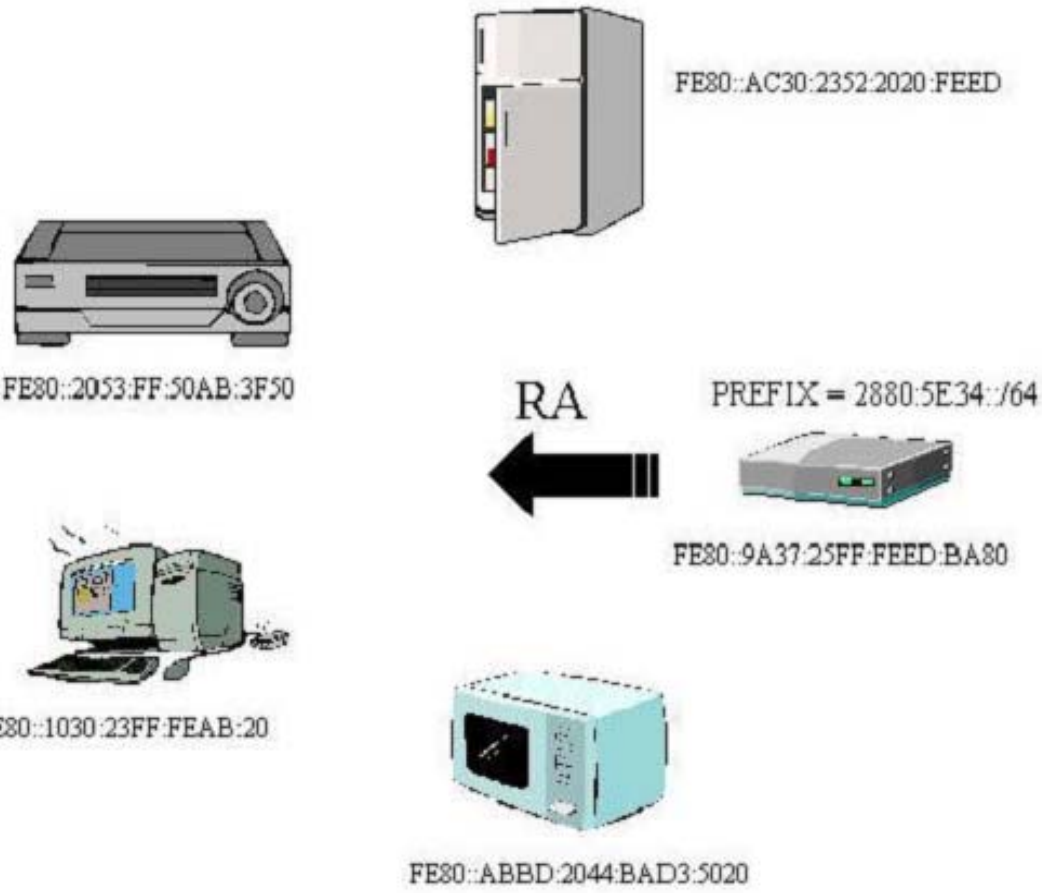
Is IPv6 Finally gained Ground

- Low adoption level
- Early Vendor support
- Lack of user support
- Factors Holding back Adoption
  - Cost and effort
  - IPv6 shortcomings
  - Who needs IPv6
- Future
  - Wireless : IPv6's killers app?

Vendor and Operator Position

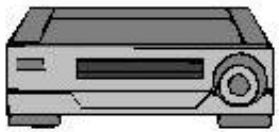
- Operator support: BT, DT, Telia, NTT
- Government support: Japan, Korea, European Union, Canada
- Many vendors have IPv6 product road map
- Support in current software releases
  - Microsoft XP
  - Cisco 12.0xT
  - Sun Solaris 8 and 9
  - Linux
  - Others

Example : Home Networking



Example : Home Networking

FE80::AC30:2352:2020:FEED
2880:5E34::AC30:2352:2020:FEED



FE80::2053:FF:50AB:3F50
2880:5E34::2053:FF:50AB:3F50

PREFIX = 2880:5E34::/64

FE80::9A37:25FF:FEED:BA80

FE80::1030:23FF:FEAB:20
2880:5E34::23FF:FEAB:20

FE80::ABBD:2044:BAD3:5020
2880:5E34::ABBD:2044:BAD3:5020

THANK YOU

Queries …?