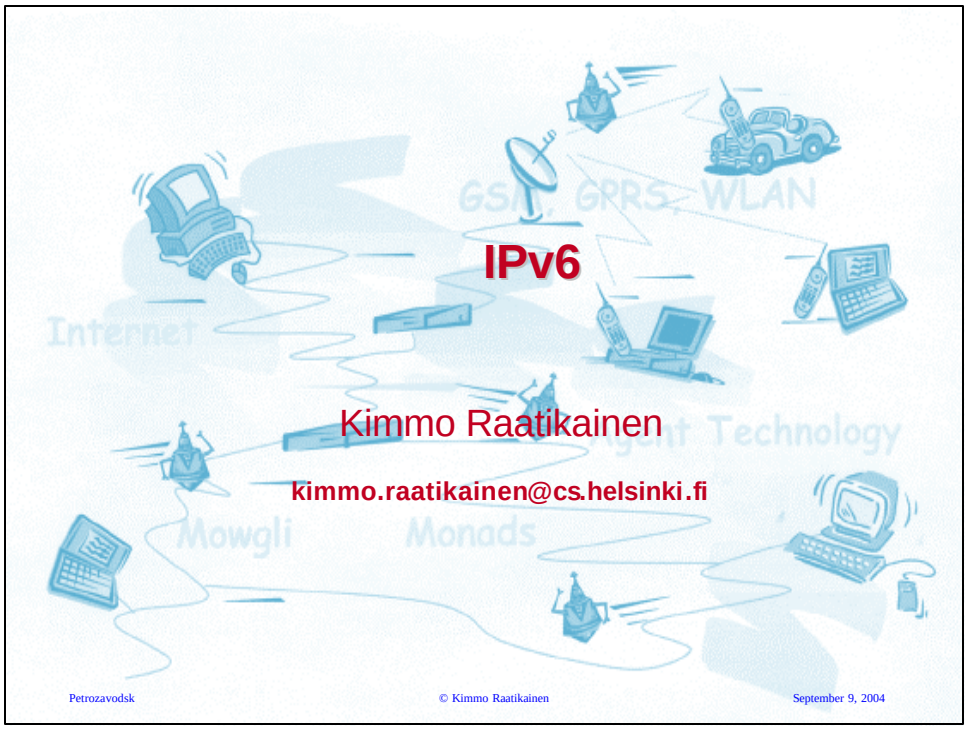

IPv6

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Lession Outline

- Objectives
- Requirements for routers
- Addressing
- IPv6 headers
- Summary

- W. Stallings: ”IPv6”, IEEE Comm. Mag. 34,7 (July 1996)

Objectives

- Support billions of hosts
- Reduction of routing tables
- Simple packet processing at routers
- Better security
- Multicasting support
- IPv4 support

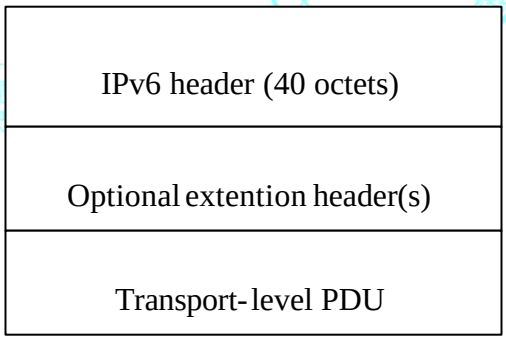
Requirements for routers

- Various addressing schemes
  - e.g. LAN, X.25
- Fragmentation
  - max packet size varies
- Various hardware/software interfaces
- Different reliablity requirements
  - c.f. TCP and real-time audio/video

Addressing

- 128-bit address (32-bit in IPv4) [interface addr.]
  - 7x10^23 IP addresses per square meter!
- Most of address space currently unassigned
- Formats:
  - provider-based global unicast
  - link-local address
  - site-local address
  - IPv4-compatible IPv6 address
  - subnet.router anycast address
  - multicast address

IPv6 PDU Format



IPv6 Header

- Version (4 bits)
- Priority (4 bits)
- Flow label (24 bits)
- Playload length (16 bits)
- Next header (8 bits)
- Hop limit (8 bits)
- Source address (128 bits)
- Destination address (128 bits)

IPv6 Extension Headers

- Order specified
  - Hop-by-hop options header
  - Destination options header (first destination) *(the one in IPv6 header and those in routing header)*
  - Routing header
  - Fragment header
  - Authentication header
  - Encapsulating security playload header
  - Destination options header (final destination)

Priority Field

- CC or RT traffic
- 8 priority levels (relative) in each
- CC-traffic:
  - **internet control traffic (OSPF, BGP, SNMP)**
  - **interactive traffic (telnet)**
  - **attended bulk traffic (ftp, http)**
  - **unattended data transfer (email)**
  - **filler traffic (usenet messages)**
  - **uncharacterized traffic**

Flow Label

- 24-bits
- flow identified by <source,destination,flow label>
- flow (router view): sequence of packets that share attributes (path, resource allocation, discrad requirements, accounting, security)
- special treament of packets need to be negotiated

Unicast Addresses

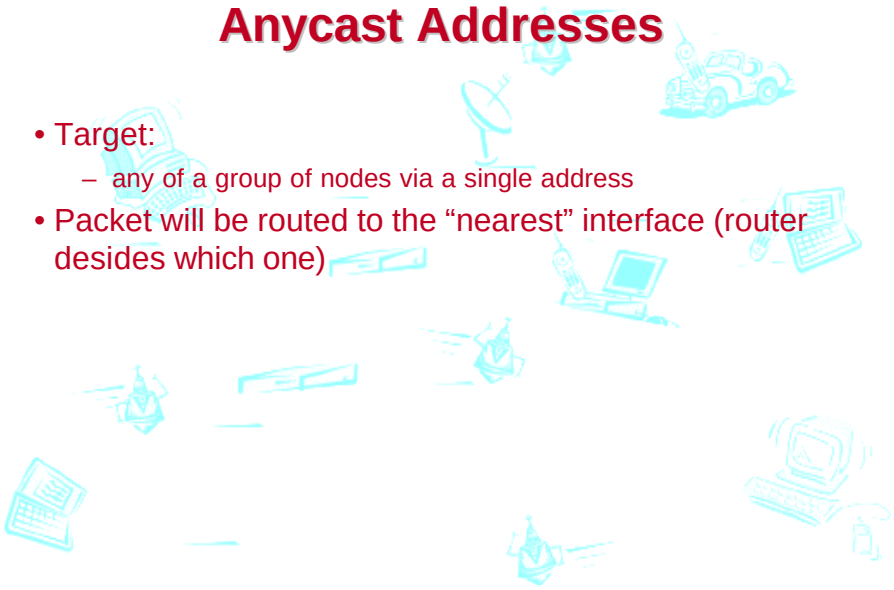
- Provider-based Global Unicast Address
  - Registery ID
  - Provider ID
  - Subscriber ID
  - Subnet ID
  - Interface ID

Local Addresses

- Link:
  - A single link or subnetwork
  - Usage
    - auto-address configuration
    - neighbor discovery
- Site:
  - Local use
  - Possible to integrate later into the global scheme

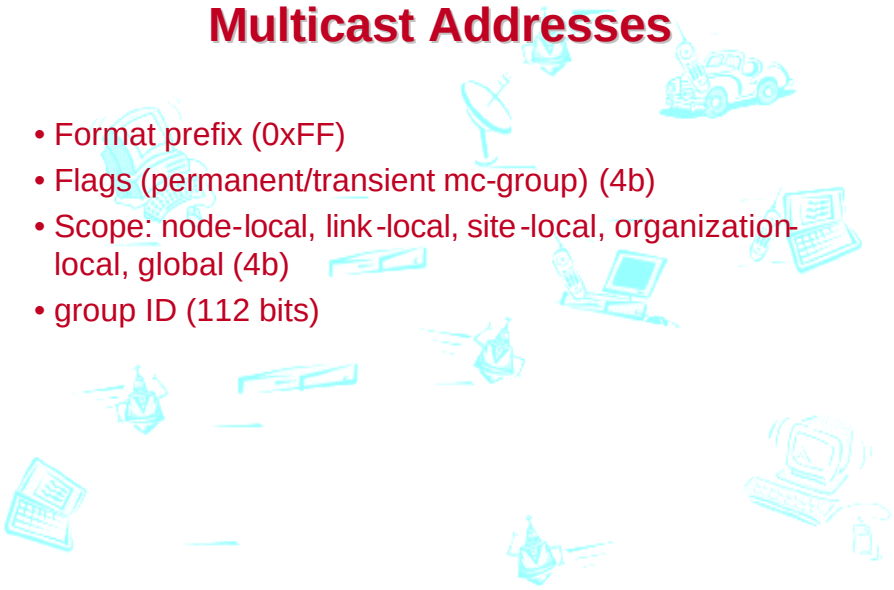
Anycast Addresses

- Target:
  - any of a group of nodes via a single address
- Packet will be routed to the “nearest” interface (router desides which one)



Multicast Addresses

- Format prefix (0xFF)
- Flags (permanent/transient mc-group) (4b)
- Scope: node-local, link-local, site-local, organization-local, global (4b)
- group ID (112 bits)



Hop-by-hop Options Header

- Next header (8 bits)
- Header extension length (8 bits) [unit=64 bits]
- Options:
  - option type (8 bits)
  - option length (8 bits) [in octets]
  - option data
- Only jumbo playload option defined
  - for playload over 64 Koctets

Fragment Header

- Only source can perform fragmentation
- Routers discrad packets longer than MTU
- Path smallest MTU discovery needed
- minimum MTU is 576 octets
- zero config requires 1500 octets

Summary

- A rich set of Security features
- Objectives quite well met
  - router load per packet significantly reduced
    - No checksum calculations/re-calculations
- IPv4 hosts/routers need to be supported (at least) for the next 10 years