

An Industry view of IPv6 Advantages

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Imagine what IPv6 can do for you!

Where we are Today

- IPv4 a victim of its own success
- IPv4 addresses consumed at an alarming rate
 - Interim measures in place have helped
 - Eased the routing table growth (CIDR)
 - Reduced the pressure on address space (NAT)
 - But at the cost of lost transparency (End-to-End) model
- IPv4 System administration is Labor intensive, complex, slow, and error prone
- Security is optional; no single standard

But ...

- Accelerating growth of existing Internet usage
 - 1B Internet users by 2005
- New Internet usages
 - Always-on devices
 - Internet appliances devices
 - 1B mobile users by 2005
- ➔ Sub-optimal conditions for continued evolution of the Internet

Where we want to be

- Solve many of the problems caused by the IPv4 success and more...
- “Everything to the Internet”
 - Pervasive Internet
- IPv6 deployment
 - For the continued growth and success of the Internet
 - A natural evolution from IPv4
 - Designed with extensibility and scalability in mind

IPv6 Immediate Benefits

- Increased Address Space
 - 128 bits
 - 2^{128} is a really big number
 - Enough unique addresses for all devices
 - Efficient addressing and routing topology
 - Restoration of End-to-End model
- And while we're at it, we might as well make a few other improvements...

Impact on the Communications Industry

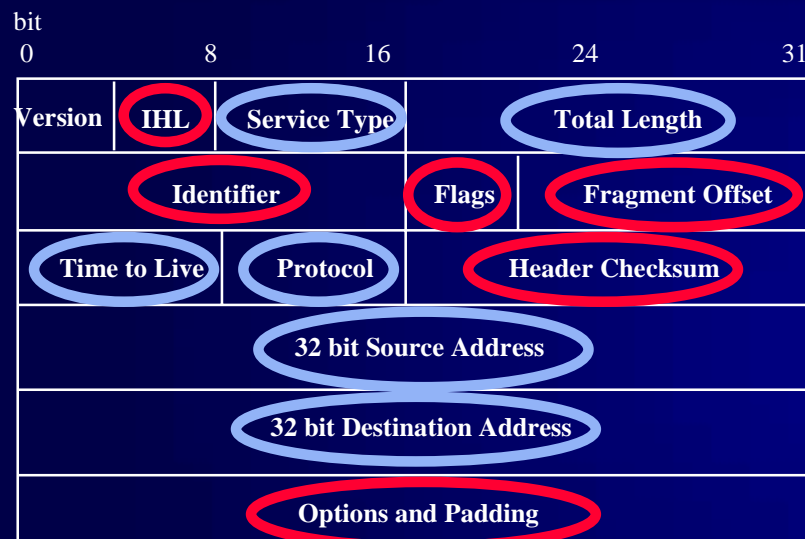
- Complexity is reduced
- Optimal conditions for continued evolution of the Internet
 - Wireline, Wireless, and Telephone System are integrated as a single network domain
- ➔ New End-to-End Applications can now evolve again

Internet End-to-End
+ Pervasive Services
+ New Applications
+ Reduced Cost
= Profit

IPv6 Base Technology

Wins

IPv6 Header – Comparison with IPv4

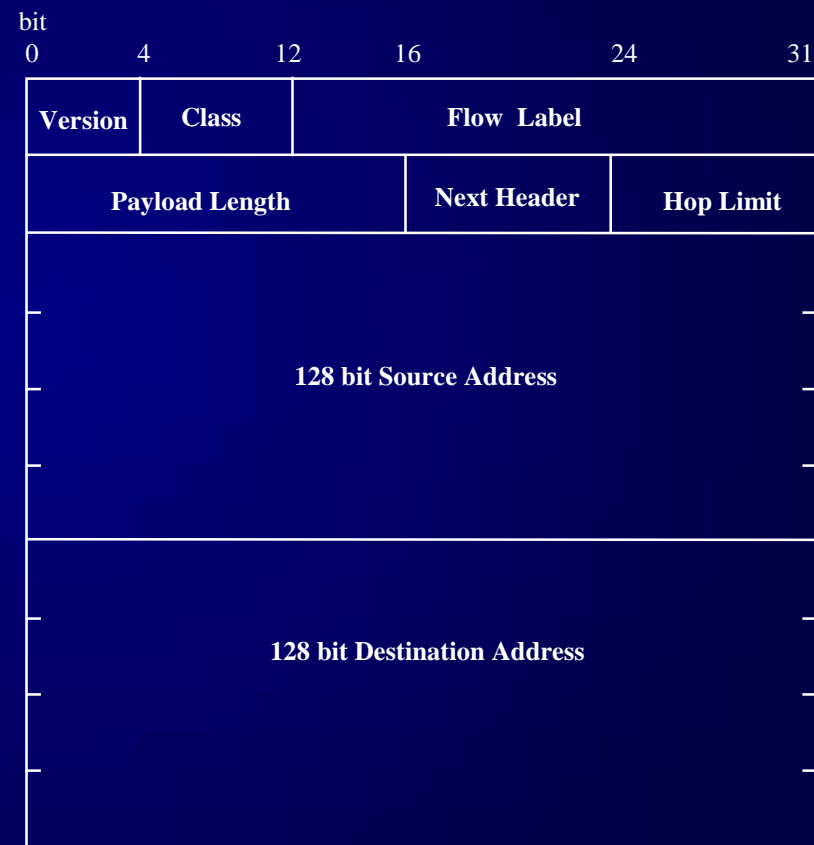


IPv4 Header

20 octets, 12 fields, including 3 flag bits
+ fixed max number of options

Changed

Removed



IPv6 Header

40 octets, 8 fields
+ Unlimited Chained Extension (options) Header

8

Design Philosophy

- Recognizable yet simplified header format
- Reduce common-case processing cost of packet handling
- Keep bandwidth overhead low in spite of increased size of the address
- Flexible and extensible support for option headers
 - IP options have been moved to a set of optional Extension Headers
 - Extension Headers are chained together

IPv6 Header Performance Wins Layout

- Fixed Size IPv6 Header
- Fewer fields in basic header
 - faster processing of basic packets
- 64 Bit Alignment Header/Options
- Efficient option processing
 - Option fields processed only when present
 - Options not limited at 40 bytes
 - Processing of most options limited performed only at destination

IPv6 Header Performance Wins Processing

- Remove checksum from Network Layer
 - Datalinks are more reliable these days
 - Upper Layer checksums are now mandatory (for example, TCP, UDP, ICMPv6)
- No fragmentation in the network
 - Reduce load on routers
 - Easier to implement in hardware
 - Easy for Layer 3 switching of IP
- Minimum link MTU is 1280 bytes
 - From 68 in IPv4

The power of IPv6

Addressing
Management
Security and QoS

Addressing Model (RFC 2373)

- Many kinds of Address
 - No change from IPv4 model
 - Addresses assigned to interfaces
 - Interfaces have multiple addresses
- IPv6 addresses have scope and lifetime

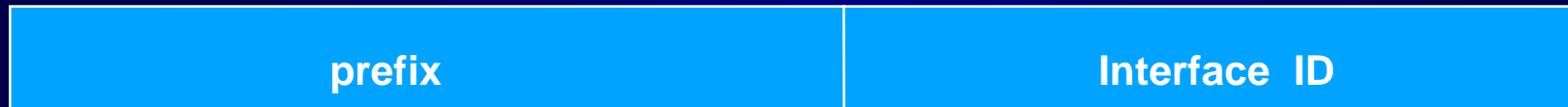


IPv6 Unicast Address

- Address = prefix of n bits + interface ID of $128-n$ bits
 - Separate “who you are” from “where you are connected to”

n bits

$128-n$ bits



Prefix Representation <prefix>::/<n-bits>

- Aggregatable Global Unicast Address format

3FFE:0301:DEC1:: 0A00:2BFF:FE36:701E

Simplified Network Administration

- Provides “Plug-and-Play” capability
 - Address Autoconfiguration
 - Link Local Address (No router or server required)
 - Stateless mechanism
 - Router advertisements provide prefix
 - Stateful mechanism
 - Server provides address (DHCP)
- Built-in renumbering
 - An end of ISP “lock in”!
- ➔ Lower network maintenance

Improved Mobile IP support

- IPv6 Mobility is based on core features of IPv6
 - IPv6 is designed to support Mobility
 - Mobility is not an “Add-on” features
 - IPv6 Neighbor Discovery and Address Autoconfiguration allow hosts to operate in any location without any special support
- No single point of failure
- More Scalable : Better Performance
 - Less traffic through Home Link
 - Less redirection / re-routing
 - Traffic Optimisation

IPv6 Mandates IP Security

- Security features are standardized and mandated
 - All implementations must offer them
- Extensions to the IP protocol suite (RFC 2401)
 - Authentication (Packet signing)
 - Encryption (Data Confidentiality)
- Operates at the IP layer
 - Invisible to applications
- Protects all upper layer protocols

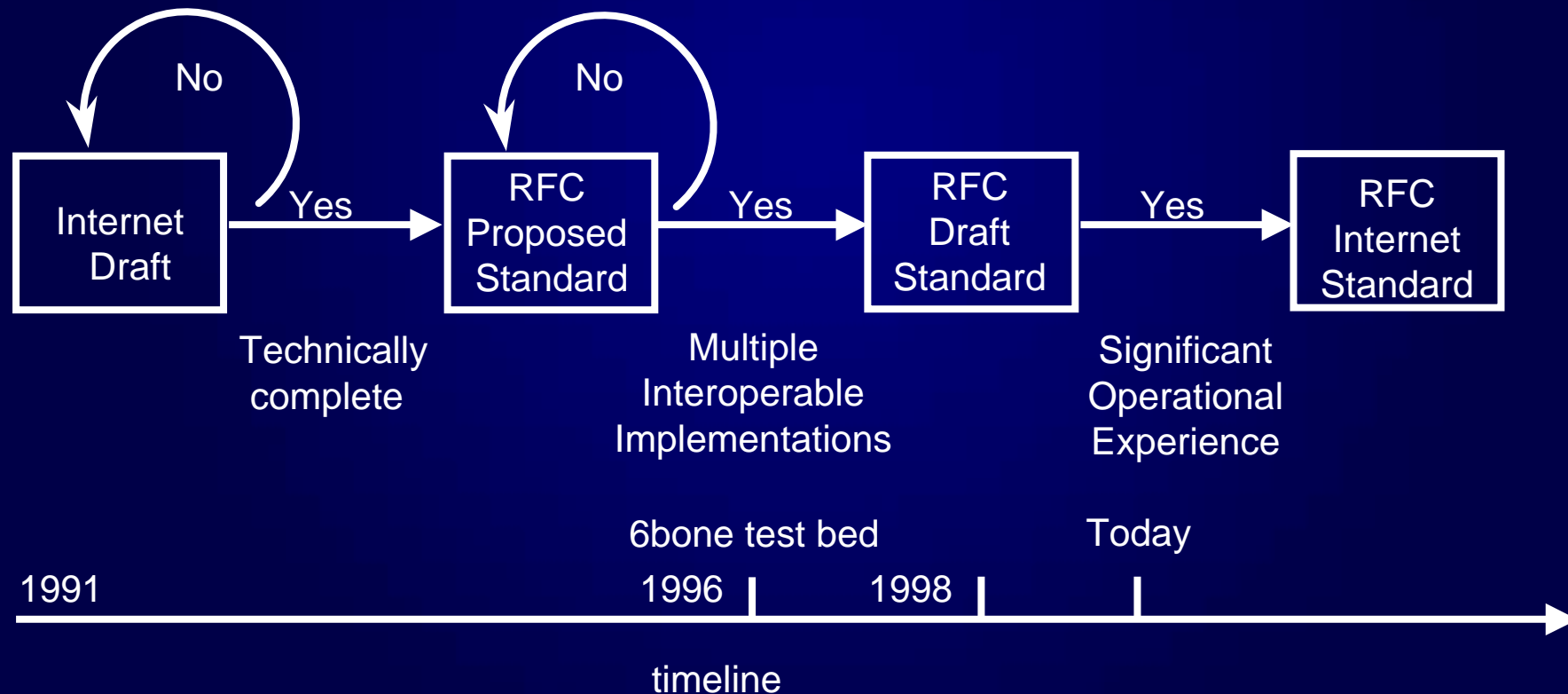
Quality of Service potential

- Support for diffserv (Differentiated Service)
 - Class field enables a source to identify desired class of service / delivery priority of its packets
 - Correspond to Type-Of-Service in IPv4
- Support for Intserv (Integrated Service)
 - Enable a source to identify flows needing special QoS
 - Flow is a sequence of packets which need special handling
 - Not fully defined yet

Summary

A decade of design and testing

- Core IETF specs have reached Draft Standard status



IPv6 Offer Superior Services to Customers

- Virtually unlimited addresses
- Efficient and extensible IP datagram
- Plug and Play and Lower network maintenance
- Improved host and router discovery Improved Mobile IP support
- End-to-End security - IPsec mandated
- Coexistence with IPv4

Deploy today with commercially available products

Questions?