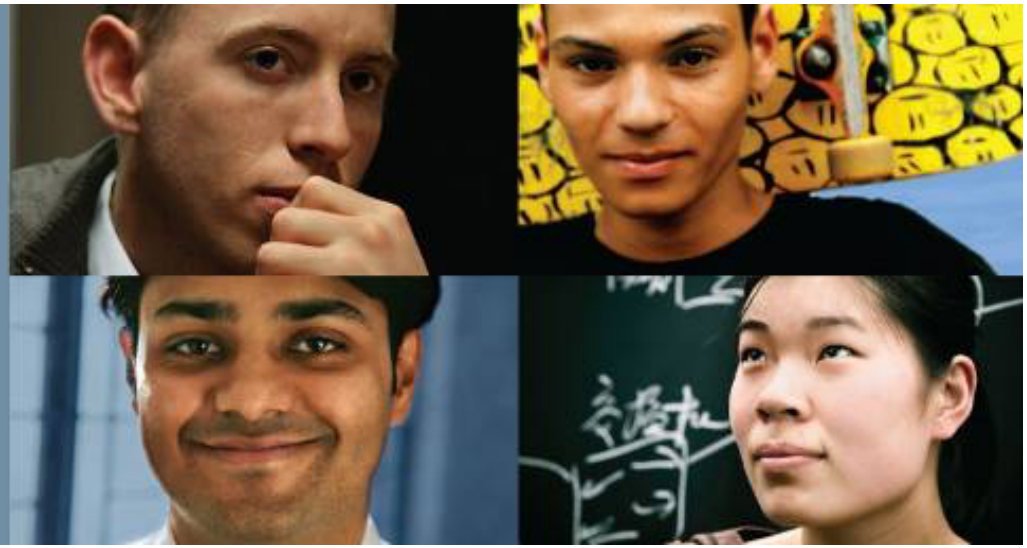
TNE10006/TNE60006: Networks and Switching



IPv6 Introduction

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Outline

- IPv4 Problems
- IPv6 Introduction
- IPv6 Addresses
- IPv6 Prefix Lengths

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IPv4 Issues

Future Problems

- Population Growth:

  The Internet population is growing, users stay connected longer

- Mobile Users:

  Mobile phones, Mobile devices (tablets, iPads, laptops)

- Transportation:

  There will be more than one billion automobiles

- Consumer Electronics:

  Remote monitoring of home appliances

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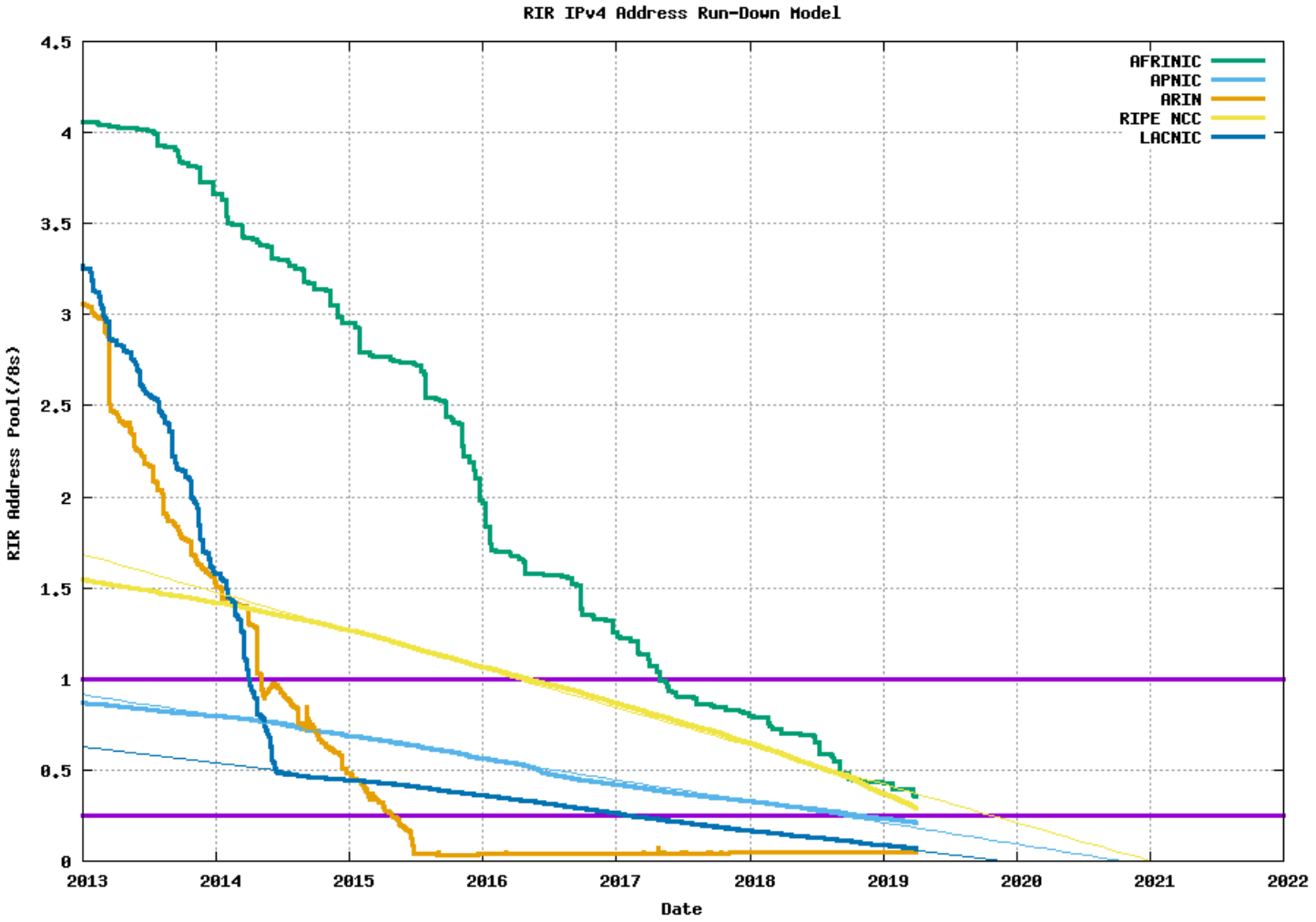
Address Usage

- Running out of addresses

  Source: www.potaroo.net/tools/ipv4



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IP The Next Generation

- What happened to IPv5
- Much larger address space
- IPv6 address = 16 bytes = 128 bits

  2^{128} = 340,282,366,920,938,463,463,374,607,431,768,211,456

- Or

  665,570,793,348,866,943,898,599 addresses for each m^2 of the planet

- So where is IPv6 ???

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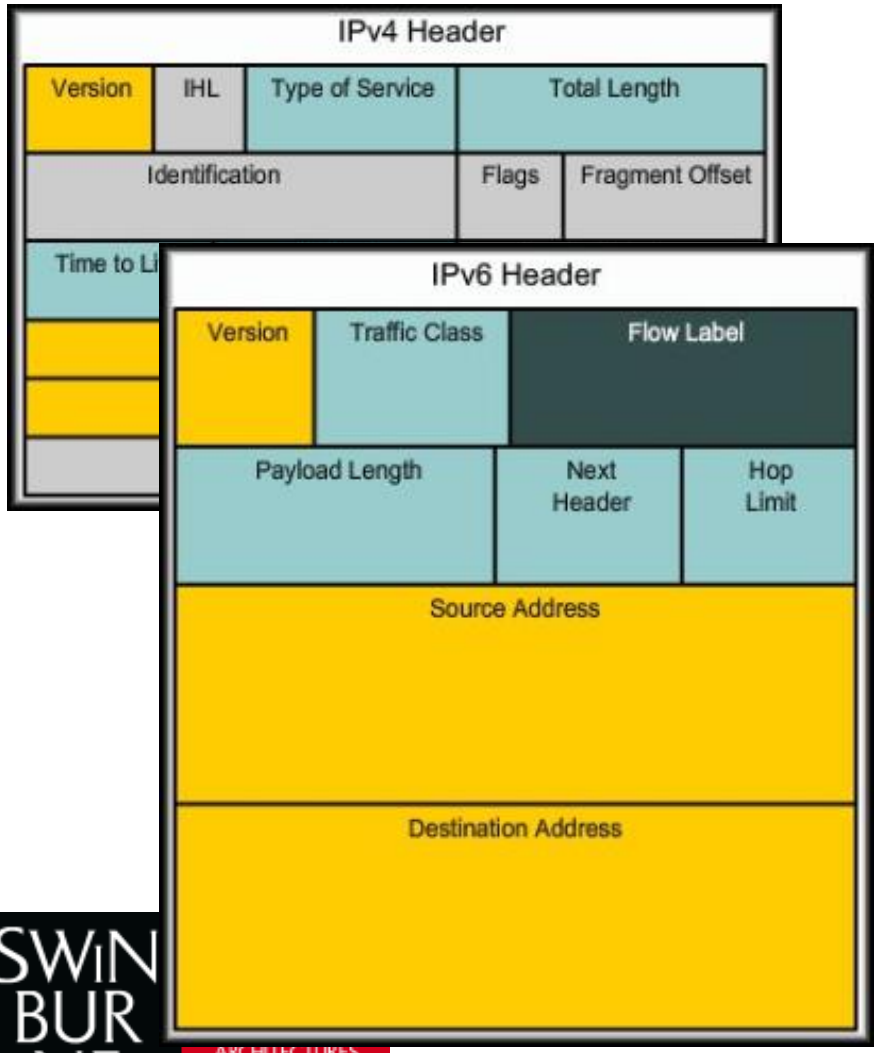
IP The Next Generatio



Enhanced IP addressing:

- Global reachability and flexibility
- Aggregation
- Multihoming
- Autoconfiguration
- Plug-and-play
- End-to-end without NAT
- Renumbering

Mobility and security:

- Mobile IP RFC-compliant
- IPsec mandatory (or native) for IPv6

Simple header:

- Routing efficiency
- Performance and forwarding rate scalability
- No broadcasts
- No checksums
- Extension headers
- Flow labels

Transition richness:

- Dual-stack
- 6to4 and manual tunnels
- Translation

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ARCHITECTURES

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IPv6 Address Representation

- 128 bits in length and written as a string of hexadecimal values
- In IPv6, 4 bits represents a single hexadecimal digit, 32 hexadecimal value = IPv6 address

```
2001:0DB8:0000:1111:0000:0000:0000:0200
FE80:0000:0000:0000:0123:4567:89AB:CDEF
```

- Hextet used to refer to a segment of 16 bits or four hexadecimals
- Can be written in either lowercase or uppercase

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Rule 1- Omitting Leading 0s

- The first rule to help reduce the notation of IPv6 addresses is any leading 0s (zeros) in any 16-bit section or hextet can be omitted.
- 01AB can be represented as 1AB.
- 09F0 can be represented as 9F0.
- 0A00 can be represented as A00.
- 00AB can be represented as AB.

Preferred	2001:0DB8:000A:1000:0000:0000:0000:0100
No leading 0s	2001: DB8: A:1000: 0: 0: 0: 100
Compressed	2001:DB8:A:1000:0:0:0:100

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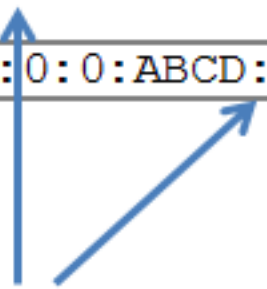
Rule 2 - Omitting All 0 Segments

- Replace any single, contiguous string of one or more 16-bit segments (hextets) consisting of all 0's with a double colon (::)
- Double colon (::) can only be used once within an address
- Known as the *compressed format*

Example #1

Preferred	2001:0DB8:0000:0000:ABCD:0000:0000:0100
Omit leading 0s	2001: DB8: 0: 0:ABCD: 0: 0: 100
Compressed	2001:DB8::ABCD:0:0:100
OR	
Compressed	2001:DB8:0:0:ABCD::100



Only one : : may be used.

Example #2

Preferred	FE80:0000:0000:0000:0123:4567:89AB:CDEF
Omit leading 0s	FE80: 0: 0: 0: 123:4567:89AB:CDEF
Compressed	FE80::123:4567:89AB:CDEF

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Examples

- E3D7:0000:0000:0000:01F4:00C8:C0A8:0420
- 3FFE:0501:2008:0000:0260:07FF:FE40:EFAB
- 6134:00F5:0000:0000:0145:0000:0000:00AB

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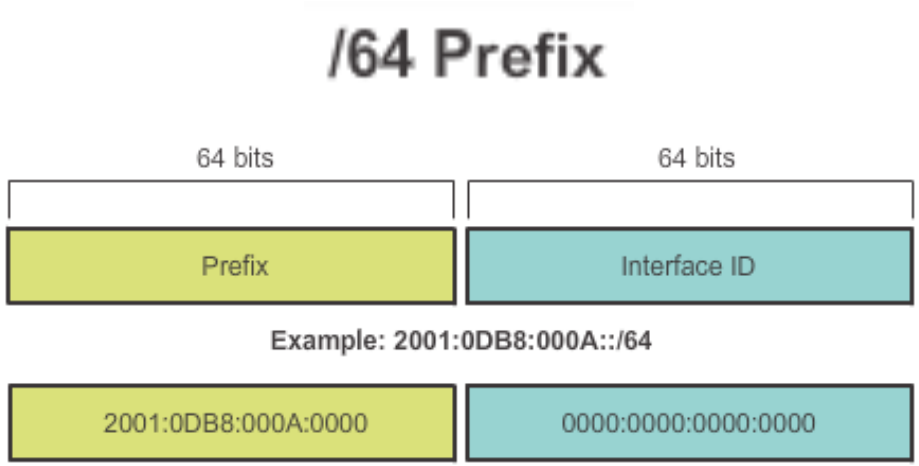
IPv6 Subnet Mask – Prefix Length

- IPv6 only uses slash notation for prefix length
  - Prefix length can range from 0 to 128
  - Typical prefix length is /64



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Summary

In this lecture, we covered:

- IPv4 Problems
- IPv6 Introduction
- IPv6 Addresses
- IPv6 Prefix Lengths

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