IPv6 Basics

Share Boston Session 13229

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What is IPv6

Updated version of the Internet Protocol (IPv4)

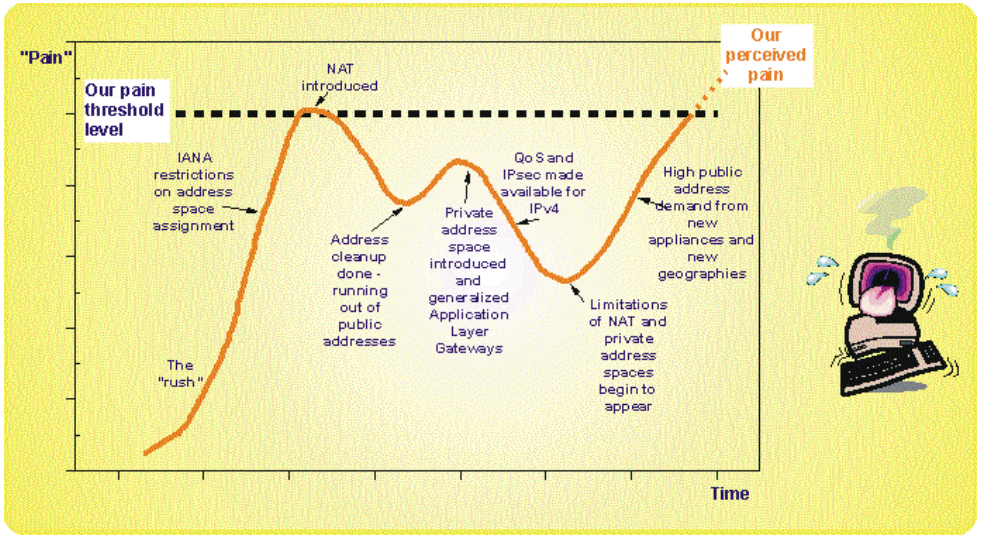
Defined in RFC 1752

New features

- **Larger address space**
- **Encapsulation**
- **Class of service for audio, video, etc.**
- **Multicast support**
- **Authentication**
- **Encryption**
- **Automatic configuration/reconfiguration**
- **Support for non-IP protocols**

Coexist with IPv4

Why Do We Need More Address Spaces?

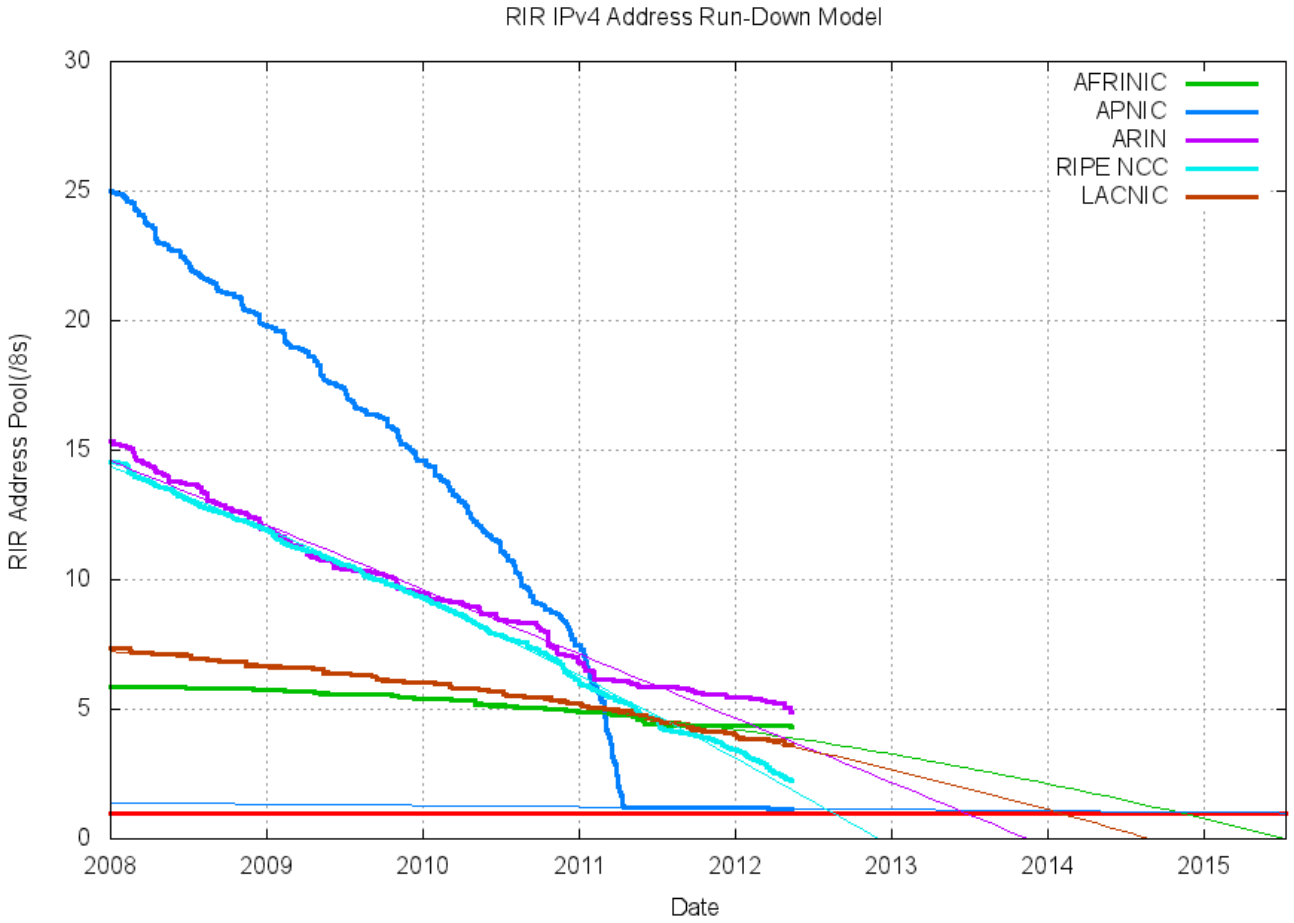


February 2011 – NRO (Number Resource Organization of the IANA) allocated the last IPv4 addresses to RIR

Microsoft paid $7.5M for Nortels 666,624 IPv4 addresses

Trading sites like Tradipv4.com have emerged

IPv4 address allocation by /8



Applications are Changing

IPv6 Technology Scope

IP Service	*IPv4 Solution*	*IPv6 Solution*
Addressing Range	32-bit, Network Address Translation	128-bit, Multiple Scopes
Autoconfiguration	DHCP	Serverless, Reconfiguration, DHCP
Security	IPSec	IPSec Mandated, works End-to-End
Mobility	Mobile IP	Mobile IP with Direct Routing
Quality-of-Service	Differentiated Service, Integrated Service	Differentiated Service, Integrated Service
IP Multicast	IGMP/PIM/Multicast BGP	MLD/PIM/Multicast BGP,Scope Identifier

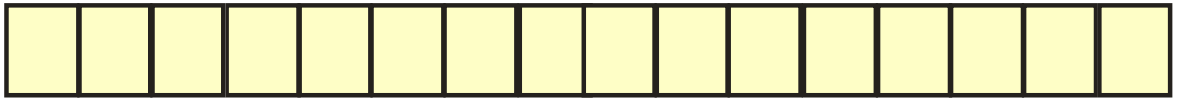
IPv6 Address Size

207.217.125.50/24

IPv4
(4 bytes - 32 bits)

2001:0DB8::15:219:D1FF:FE10:74EE/64

C L



IPv6
(16 bytes - 128 bits)

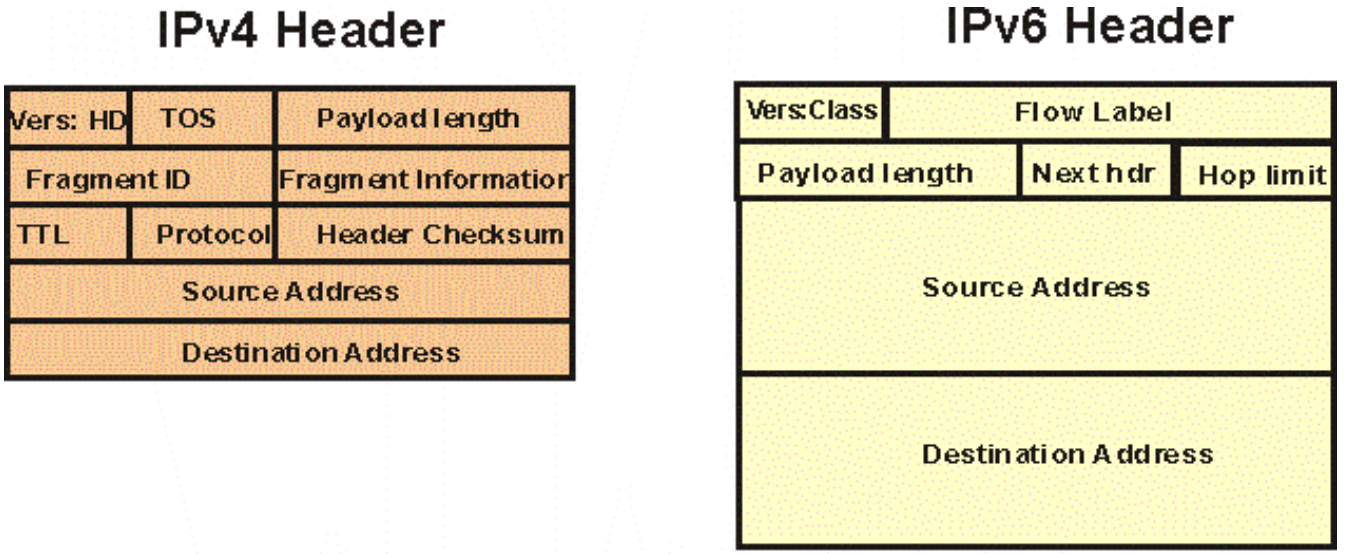
Asia feeling address squeeze fastest due to receiving addresses last

Mobil digital telephony pressuring existing IPv4 network

ICANN continues to handle overall addressing issues

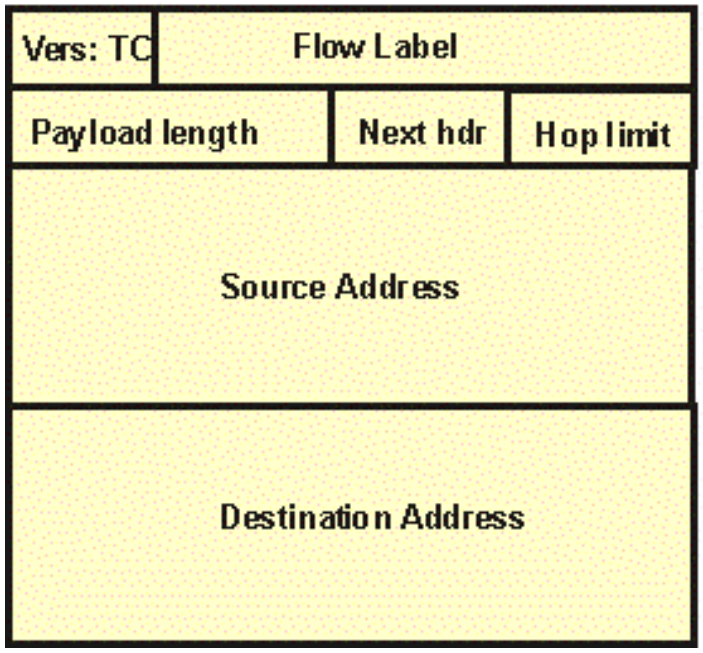
Shortcuts like dropping Leading zeros or Contiguous zeros permitted

IPv6 Header



IPv4 header is 20 bytes : IPv6 header is 40 bytes
Address increased from 32 to 128 bits
Fragmentation fields moved out of base header
Header checksum
Time to Live replaced with 'Hop Limit'
Protocol replaced with 'Next Header'
TOS replaced with 'Flow Label'
Alignment changed from 32 to 64 bits

IPv6 Flow Label



Identifies datagrams that require special quality of service

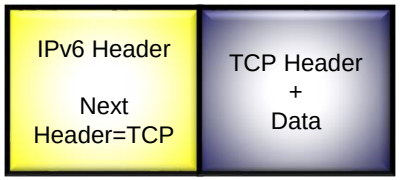
May be used to tie particular traffic to pre-allocated network resources

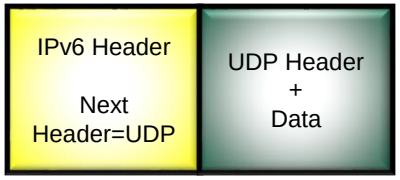
Zero value indicates no flow label

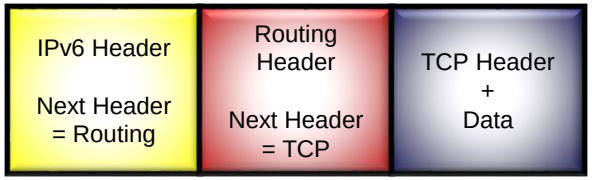
Other protocols like RSVP may provide information for the Flow Label

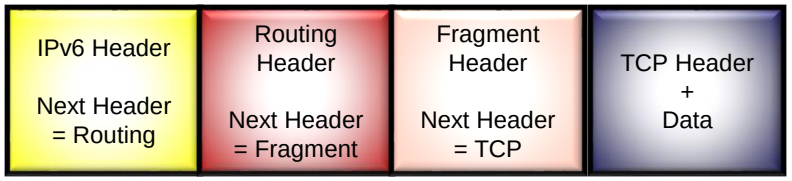
TC class identifies delivery of priority packets
- Values 0-7 : TCP flow controlled packets
- Values 8-15 : real time packets

IPv6 Extension Headers









Hop by hop options = 0
Information for all devices in the path

Destination options = 60
Destination information for all devices

Routing = 43
Specify route for a datagram

Fragment = 44
Breaks datagram if MTU exceeded

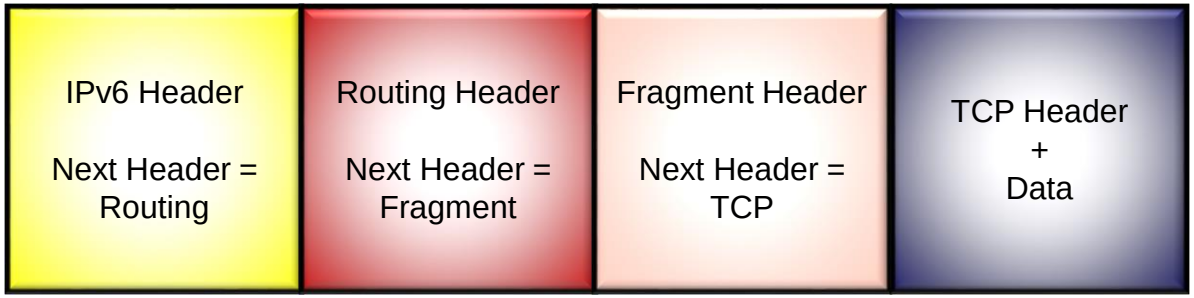
Encapsulating Security Payload = 50
Encryption type and parameters

Authentication = 51
Hash type and parameters

Destination options = 60
Information only for destination host

Protocols
TCP = 6, UDP = 17, RSVP = 46, ICMP = 58

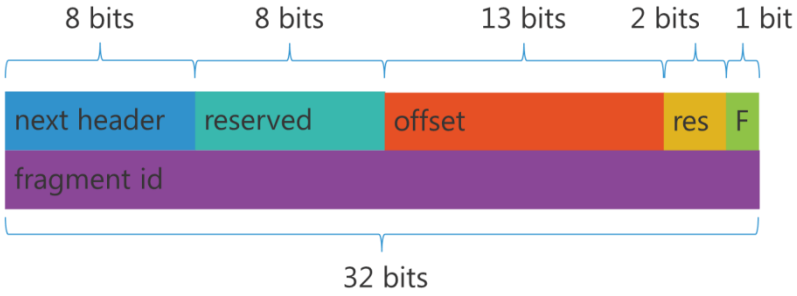
IPv6 Fragmentation Header



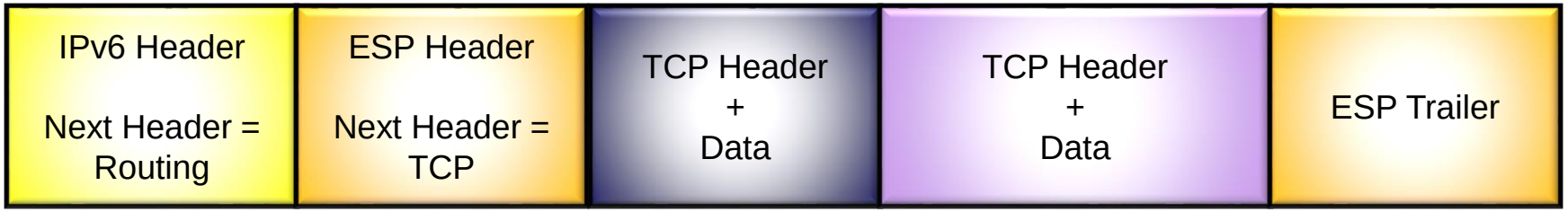
In IPv4 Routers handled fragmenting frames

If needed, IPv6 hosts fragment frames:

- Increased guaranteed minimum MTU of 1280
- Pat MTU discovery to find maximum fragment size for a path



IPv6 Security



Authentication Header (AH)

- Packet authentication and integrity without confidentiality
- Algorithm independent (MD5) (SHA1)

Data Privacy Header (ESP)

- Message including next headers encrypted
- Mandatory support of DES-CBC
- May also include AH with no separate header

IPv6 Address Types

unicast:

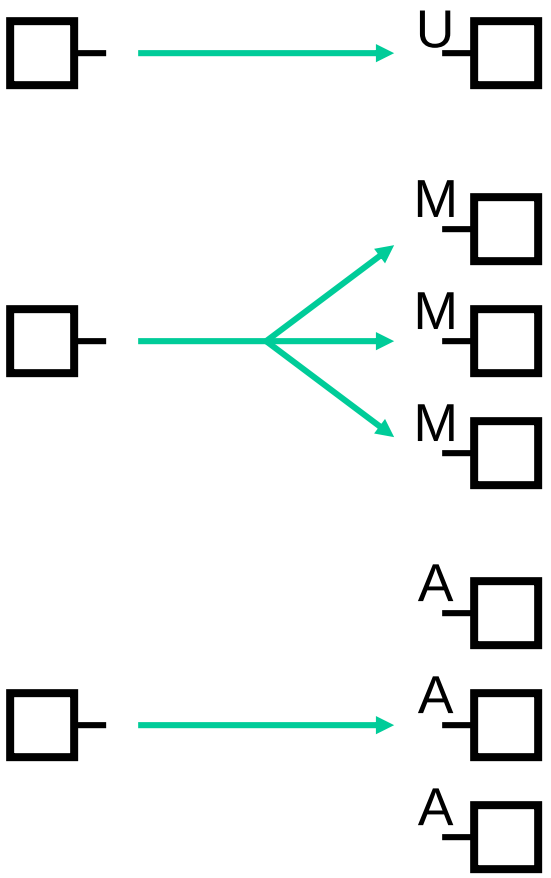
for one-to-one communication

multicast:

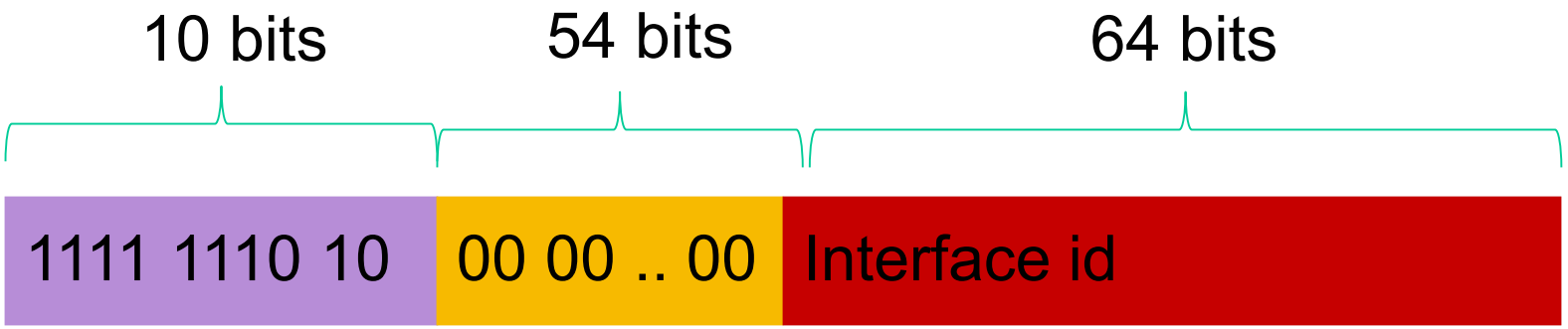
for one-to-many communication

anycast:

for one-to-nearest communication

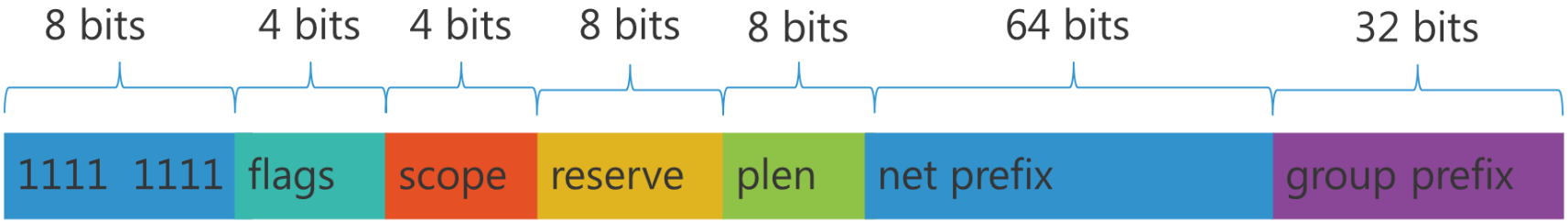


Link Local Address



- FE80 prefix
- Similar to IPv4 APIPA (169.254.0.0/16)
- Only for on-link communication, not routable
- Used for
  - Auto configured addresses
  - Neighbor discovery process

Multicast Address



Flags

0: well known address, 1: transient address

Scope

1: Node Local (FF01::1), 2: Link Local (FF02::1)

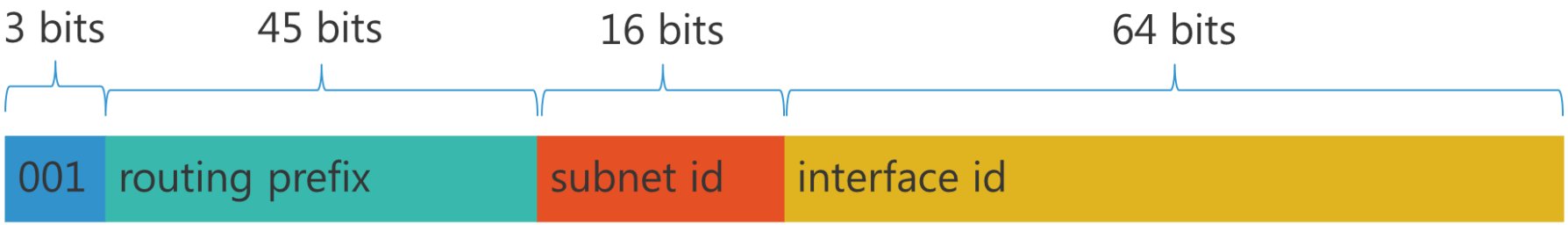
All routers group: FF02::2)

Group ID

1: All nodes, 2: All routers, 101: all NTP servers

- Multicast replaces Broadcast
- All IPv6 nodes must support multicast
- You must enable IGMP snooping

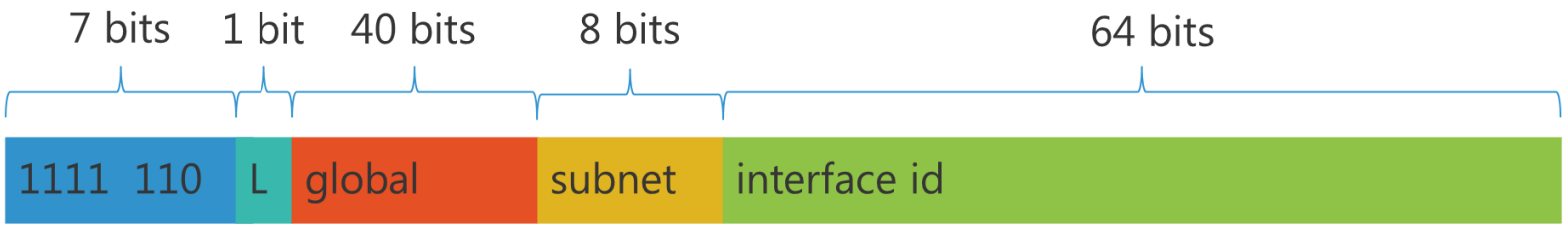
Global Unicast Address



Address Type	Binary Prefix	Prefix
Unspecified	000…0	::/128
Loopback	0000…01	::1/128
ULA	1111 110	FC00::/7
Assigned to RIRs	001	2003:/3
Global Unicast	Everything else!!	

Korea: 2001:0200 – 099F
ATT: 2001:0408/32
Verizon: 2001:0506:0000/48

Unique Local Address (ULA)



- L=1
- FC00::/7 prefix
- Local or site local communications
- Most likely will be unique and not expected to be routable
- Well known, somewhat like the RFC1918

Windows and IPv6

IPv6 is preferred

Nameserver query

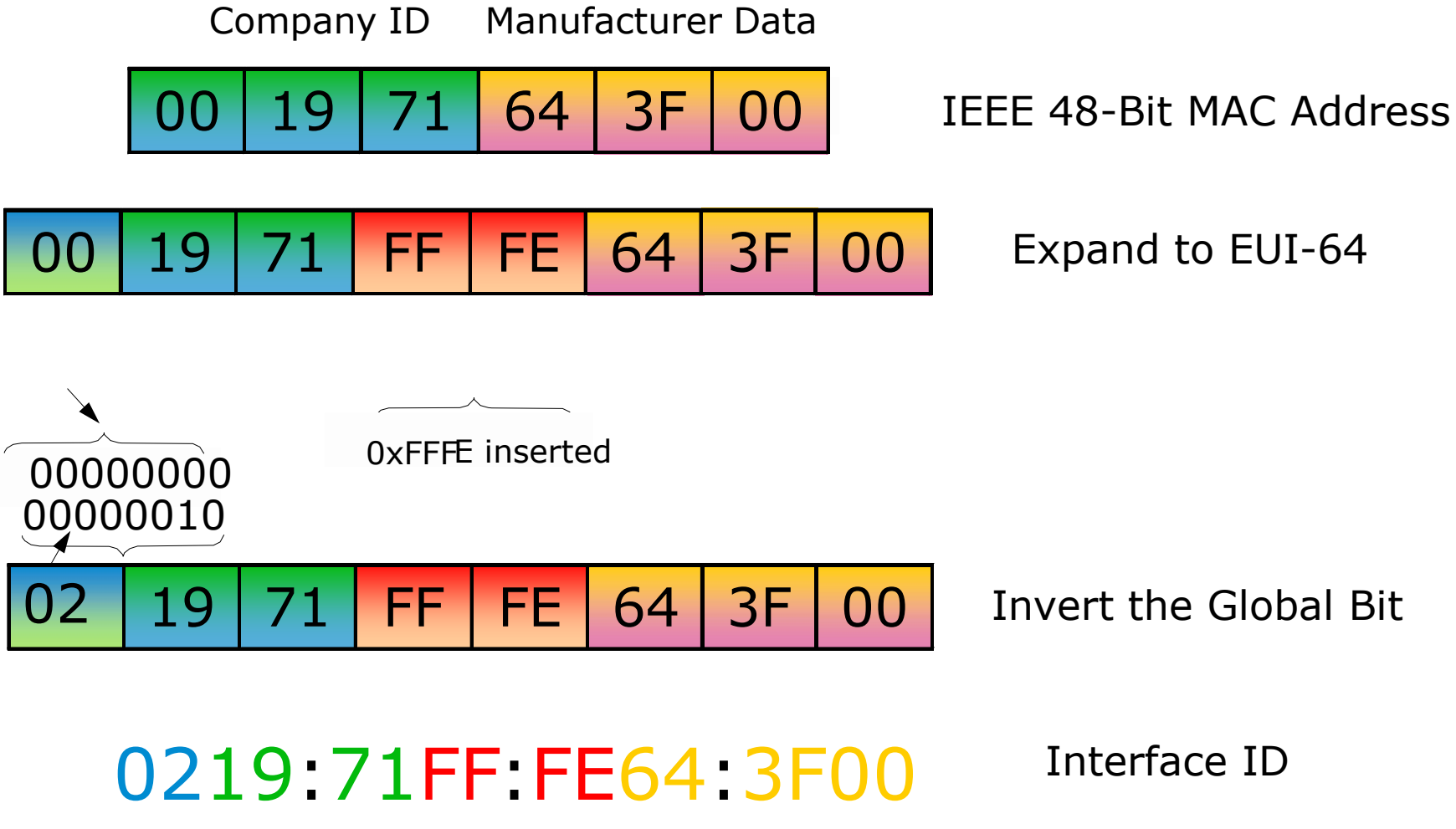
Try to reach IPv6

Try to reach IPv4

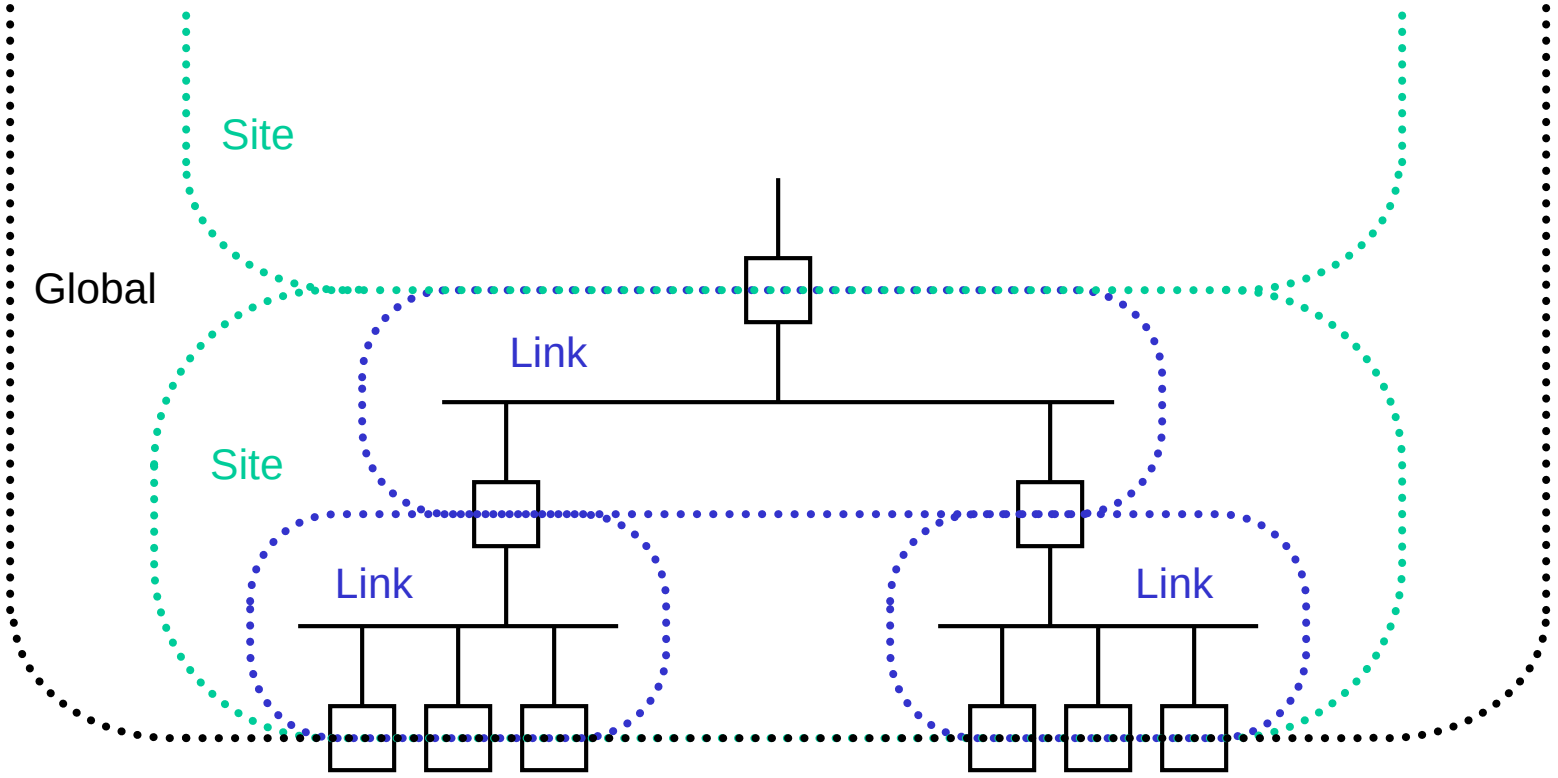
Timeout

```
Wireless LAN adapter Wireless Network Connection 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Wireless Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . : hawaii.rr.com
   Link-local IPv6 Address . . . . . : fe80::6947:83b1:88e2:73d4%13
   IPv4 Address. . . . . . . . . . . : 192.168.1.146
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.1.1

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Tunnel adapter Teredo Tunneling Pseudo-Interface:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2001:0:4137:9e76:10f7:1e4b:9d69:43f8
   Link-local IPv6 Address . . . . . : fe80::10f7:1e4b:9d69:43f8%15
   Default Gateway . . . . . . . . . : ::

Tunnel adapter isatap.hawaii.rr.com:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . : hawaii.rr.com
```

Interface ID from MAC



Boundaries



IPv6: Autoconfiguration

Combination

ARP : ICMP router discovery : ICMP redirect

Neighbor discovery

Multicast and unicast datagrams

Establishes MAC address on same network

ICMPv6 router solicitation

ICMPv6 router advertisement

ICMPv6 neighbor solicitation

ICMPv6 redirect

ICMPv6 includes IGMP protocol for Multicast IP

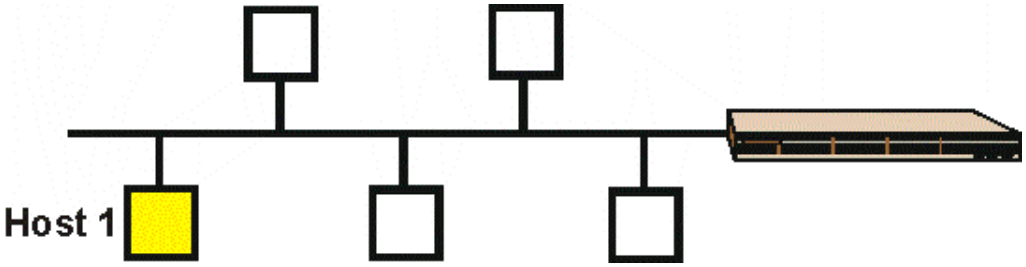
Reduces impact of finding hosts

Stateless: router configures a host with IPv6 address

Stateful: DHCP for IPv6

Link Local Address: IPv6 connectivity on isolated LANs

IPv6 Auto-configuration



Host 1 comes on line and generates a link local address

Host 1 sends out a query called neighbor discovery to the same address to verify uniqueness. If there is a positive response a random number generator is used to generate a new address

Host 1 multicasts a router solicitation message to all routers

Routers respond with a router advertisement that contains an aggregatable global address (AGA) prefix and other information

Host 1 automatically configures its global address by appending its interface ID to the AGA

Host 1 can now communicate

Changes Needed to Implement IPv6

Hosts

- Implement IPv6 code in operating system
- TCP/UDP aware of IPv6
- Sockets/Winsock library updates for IPv6
- Domain Name Server updates for IPv6

Domain Name Server (DNS)

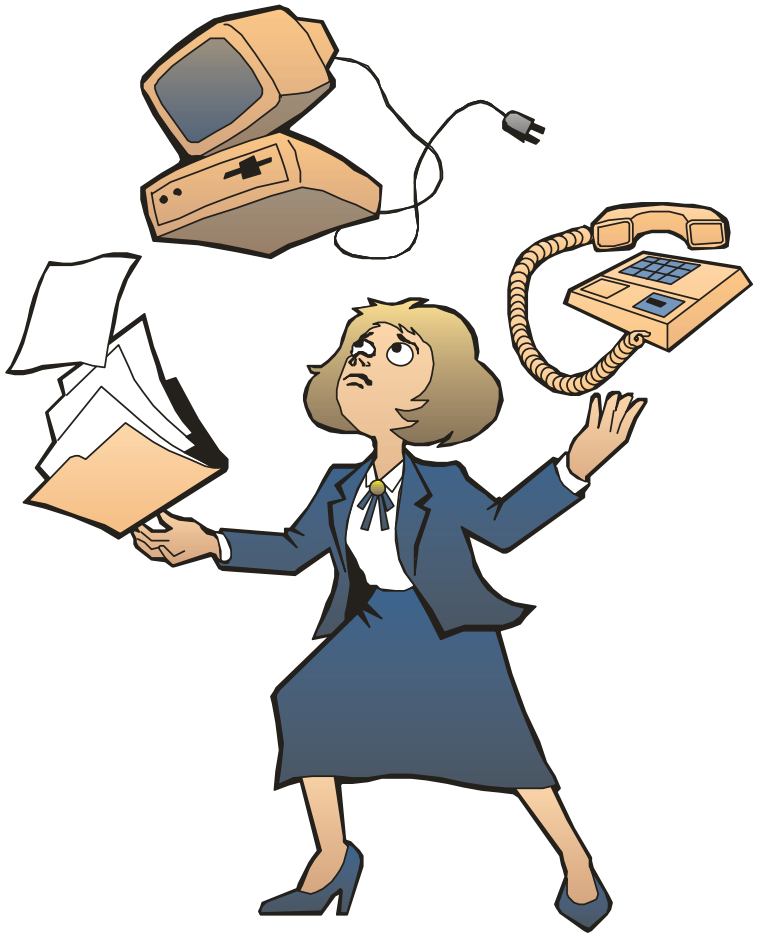
- Many products already support 128 bit addresses
- Uses ‘AAAA’ records for IPv6
- IP6.INT (in_addr_arpa in IPv4)

Routers

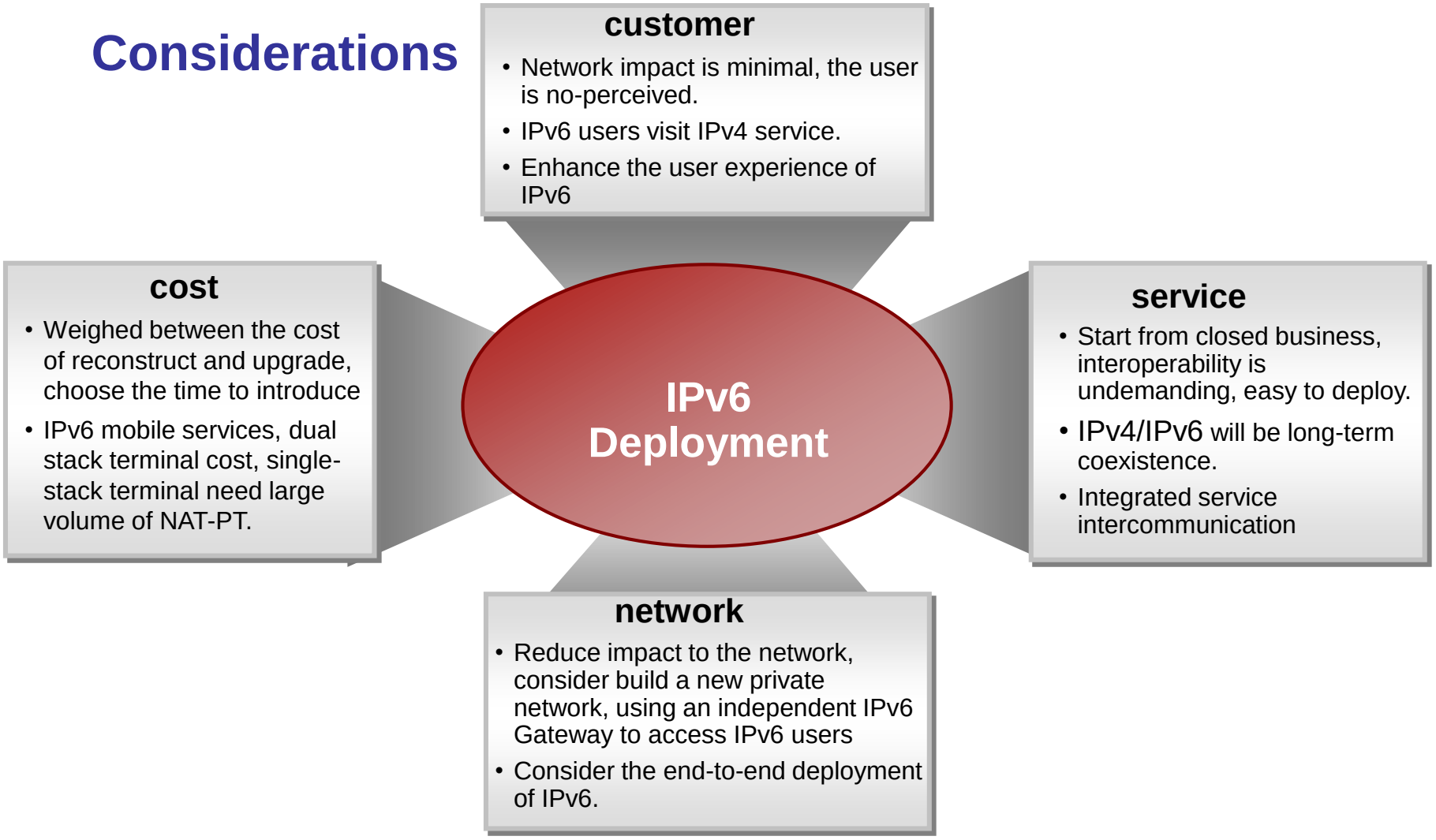
- IPv6 forwarding protocols
- Routing protocols updated to support IPv6
- Management needs to support ICMPv6
- Implement transition mechanisms

IPv6 Protocol Status

- RIPv6 - Same as RIPv2
- OSPFv6 - Updated for IPv6
- EIGRP - Extensions implemented
- IDRP - Recommended for exterior protocol over BGP4
- BGP4+ - Preferred implementation in IPv6 today



Considerations



Applications

- NTT ‘Earthquake Alert Service
  - On detecting P-wave an S-wave alert is delivered
  - IPv6 Multicast is adopted
    - Low delay delivery is achieved
    - IPv4 is not suitable for a push-type service due to NAT
- Sensor Arrays
  - 6LoWPAN (RFC 4919and 4944) based networks
  - Routing over low poer and Lossy Networks
    - Sensors on aging infrastructure
    - Fire sensors
- Chinese Academy of Sciences
  - Integrated wireless, control and precision agriculture technologies linked
    - Accurate watering of farmland
    - Water/soil pollution monitoring

IPv6 Deployment

China Telecom	2009 deploy Experimental IPv6 network, in 2010 commercialized. **T**he Telecommunications Research Institute draft guidance of large-scale IPv6 introduction, Hunan Telecom starts IPv6 test point. In 2010 Shanghai World Expo and Guangzhou Asian Games displayed IPv6.
China mobile	3G mobile broadband deploy IPV6, to resolve the limitation of private network address space. The original IPv4 reserve is very limited, the mobile broadband has more requirements. 2010, China mobile deployed 3G IPv6 commercial services.
China Unicom	2010 commercial-scale test users reached 20,000, China Unicom built a new type IPv6 access network
France Telecom	2009 Q2-Q3 FT deployed Enterprise IPV6, in 2010 deployed the family IPv6 Livebox, the Core network maintains IPv4 temporarily. Poland subnet has strong interest, actively discusses the deployment of IPv6 solution, requests the current network equipment support dual-stack.
Japan	IPv6 large-scale commercial from 2005, package the new concept of next-generation network, provide high-speed network services based on IPv6, leveraging next-generation network evolution, and promote various IPV6 new technologies and new services.
America	The U.S. government required government and Defense departments migrate telecommunication network into IPv6 platform before the summer of 2008. It led that the United States new applied IPv6 addresses reached 14,729 pieces, the world's ranking jumped from No. 11 to No. 1.

NTT and IPv6

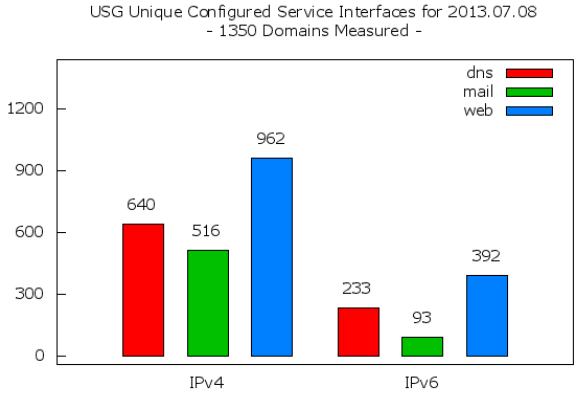
1.Latency Statistics(ms)

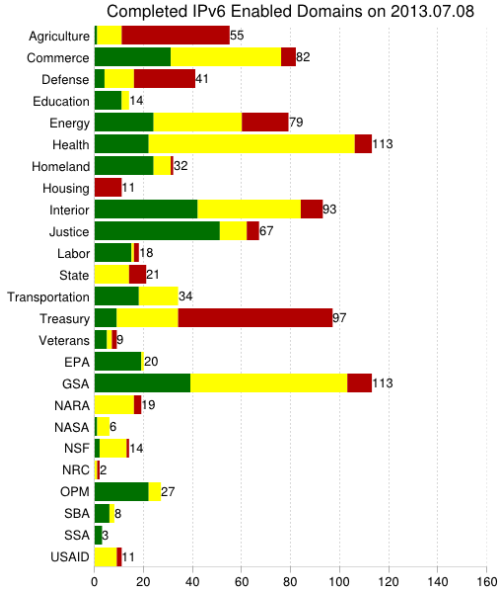
Month	Intra-Japan (25ms)	Intra-Asia (95ms)	Intra-US (60ms)	Intra-Europe (35ms)	Trans-Atlantic (90ms)	US-Japan (130ms)	Japan-Europe (300ms)
Oct 2012	10.39	51.17	44.30	23.26	72.31	105.49	262.25
Nov 2012	9.68	52.53	44.17	23.36	72.01	103.24	262.07
Dec 2012	10.18	57.55	43.88	23.39	71.99	93.63	224.09

2.Packet Loss Statistics(%)

Month	Intra-Japan	Intra-US	Trans-Atlantic	Japan-US	Intra-Asia	Intra-Europe	Japan-Europe
Oct 2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov 2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec 2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00

IPv6 and the US Government



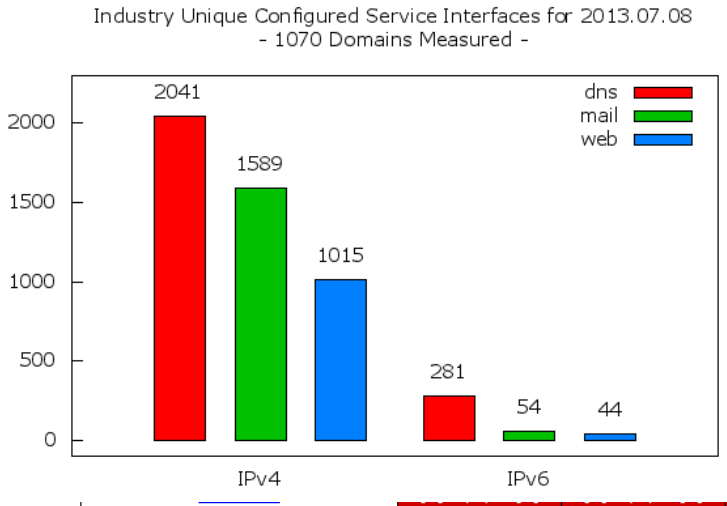


- Detailed IPv6 & DNSSEC Service Interface Statistics for 2013.07.08 -

Domain	Organization	DNS	Mail	Web	DNSSEC
gov.404.	Securities and Exchange Commission	[8] 3/2/2 [O]	[0] 0/0/0 [-]	[3] 0/0/0 [I]	S/V/C
gov.9-11commission.	National Archives and Records Administration	[2] 2/2/2 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	S/V/C
gov.911.	Department of Transportation	[3] 3/0/3 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	S/V/C
gov.911commission.	National Archives and Records Administration	[2] 2/2/2 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	S/V/C
gov.aapi.	Department of Education	[4] 4/0/4 [O]	[0] 0/0/0 [-]	[1] 1/0/1 [I]	S/V/C
gov.abandonedmines.	Department of the Interior	[6] 4/4/4 [O]	[1] 0/0/0 [O]	[1] 0/0/0 [I]	S/V/C
gov.abilityone.	Comm for People Who Are Blind/Severly Disabled	[2] 2/2/2 [O]	[1] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
gov.abmc.	American Battle Monuments Commission	[2] 0/0/0 [O]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
gov.access-board-members.	U. S. Access Board	[4] 4/4/4 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	U/-/-
gov.access-board.	U. S. Access Board	[2] 0/0/0 [O]	[2] 0/0/0 [O]	[1] 1/0/0 [I]	U/-/-
gov.acf.	Department of Health And Human Services	[4] 4/4/4 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [O]	S/V/C
gov.achp.	Advisory Council on Historic Preservation	[4] 2/0/2 [O]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	S/V/C
gov.acquisition.	General Services Administration	[6] 2/0/2 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	S/V/C
gov.acus.	Administrative Conference of the United States	[6] 2/0/2 [O]	[2] 0/0/0 [O]	[1] 0/0/0 [I]	S/V/C
gov.acwi.	Department of the Interior	[6] 6/0/6 [O]	[2] 0/0/0 [O]	[6] 6/4/4 [O]	S/V/C

http://usgv6-deploymon.antd.nist.gov/cgi-bin/generate-gov

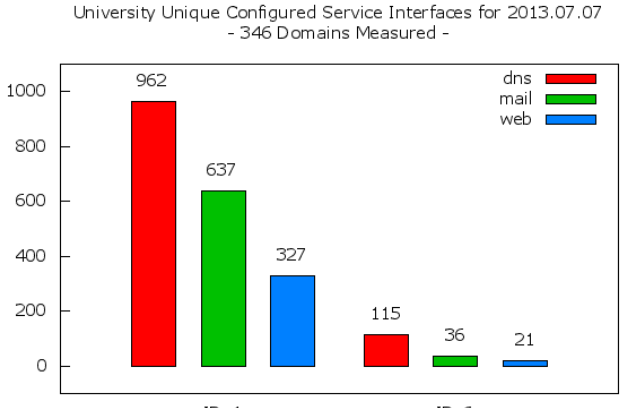
IPv6 and Industry



com.yahoo.	Yahoo!	[7] 0/0/0 [I]	[3] 0/0/0 [O]	[2] 4/4/4 [I]	U/-/-
com.youtube.	YouTube	[4] 0/0/0 [O]	[5] 5/5/5 [O]	[11] 1/1/1 [O]	U/-/-
com.yrcw.	YRC Worldwide	[2] 2/2/2 [O]	[4] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
com.yum.	Yum Brands	[2] 0/0/0 [O]	[2] 0/0/0 [O]	[2] 0/0/0 [O]	U/-/-
com.zalecorp.	Zale	[4] 0/0/0 [O]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
com.zedo.	ZEDO	[5] 5/3/5 [O]	[7] 6/6/6 [O]	[1] 0/0/0 [I]	U/-/-
com.zimmer.	Zimmer Holdings	[3] 0/0/0 [I]	[1] 0/0/0 [I]	[2] 0/0/0 [O]	U/-/-
com.zionsbancorporation.	Zions Bancorp.	[6] 6/0/6 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	U/-/-
edu.apollogrp.	Apollo Group	[4] 0/0/0 [I]	[1] 0/0/0 [O]	[2] 0/0/0 [O]	U/-/-
net.arin.	ARIN	[4] 4/4/4 [I]	[2] 2/2/2 [I]	[2] 2/2/2 [I]	U/-/-
net.att.	AT&T	[4] 4/4/4 [I]	[3] 0/0/0 [I]	[1] 1/1/1 [I]	U/-/-
net.att.ipv6.	AT&T	[3] 3/3/3 [P]	[0] 0/0/0 [-]	[0] 0/0/0 [-]	U/-/-
net.chs.	Community Health Systems	[4] 2/0/2 [O]	[4] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
net.comcast.	Comcast	[5] 5/3/5 [I]	[2] 2/2/2 [I]	[2] 2/2/2 [O]	S/V/C
net.cox	Cox	[3] 0/0/0 [I]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-

http://usgv6-deploymon.antd.nist.gov/cgi-bin/generate-gov

IPv6 and University

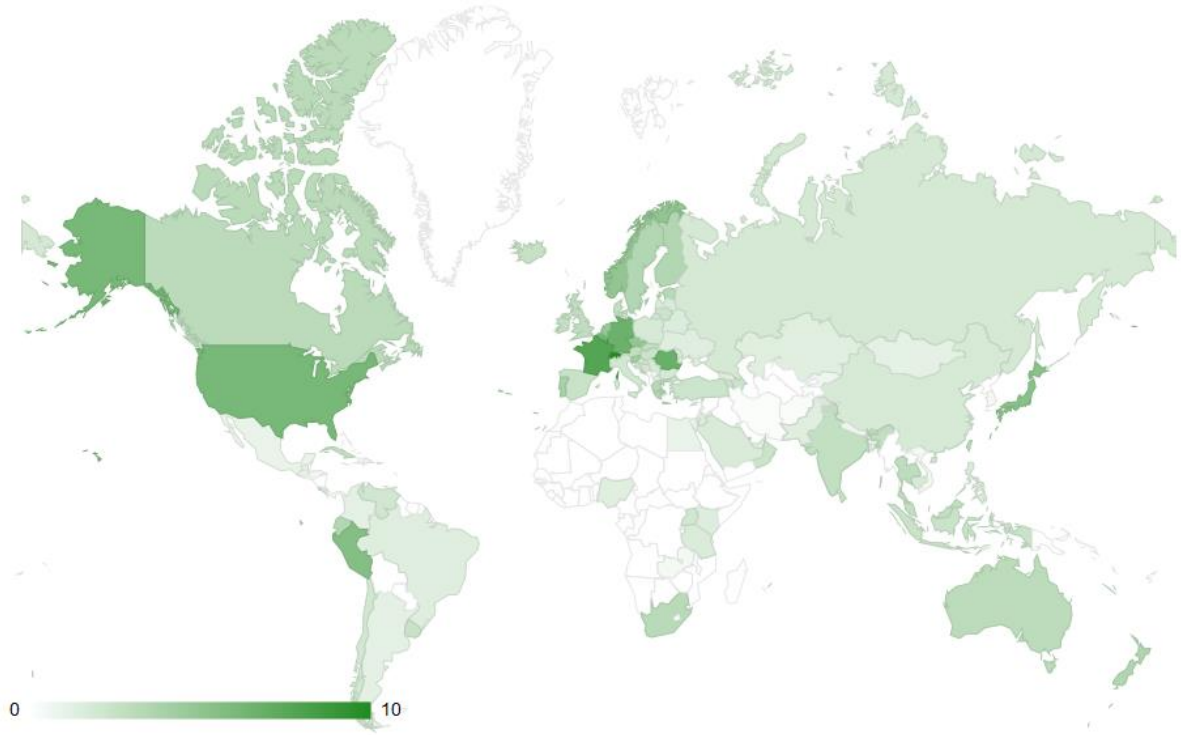


- Detailed IPv6 & DNSSEC Service Interface Statistics for 2013.07.07 -

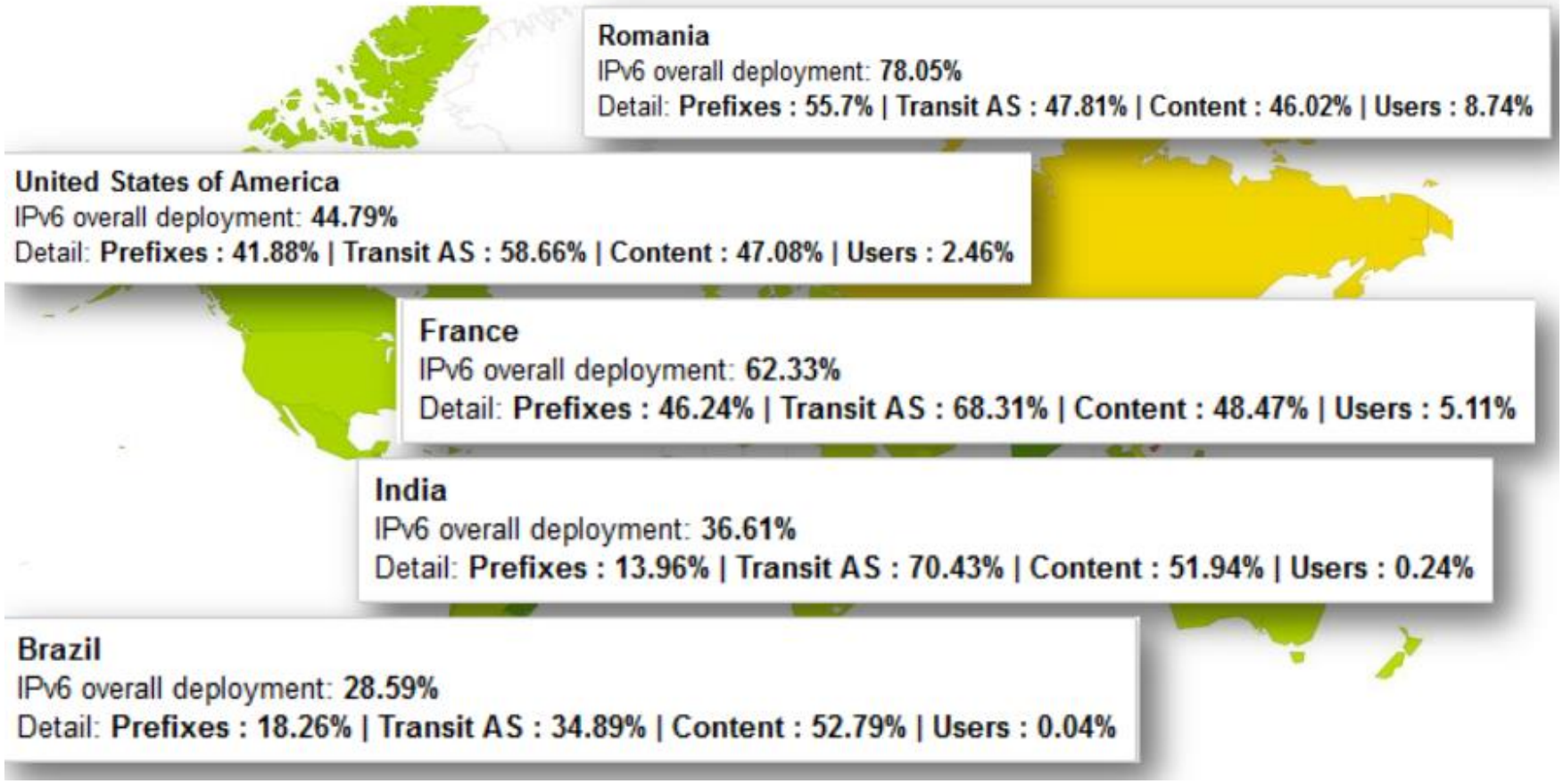
Domain	Organization	DNS	Mail	Web	DNSSEC
edu.uakron.	University of Akron	[2] 0/0/0 [I]	[2] 0/0/0 [O]	[1] 0/0/0 [I]	U/-/-
edu.aamu.	Alabama A&M University	[4] 0/0/0 [M]	[1] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.alasu.	Alabama State University	[5] 0/0/0 [O]	[5] 0/0/0 [M]	[1] 0/0/0 [I]	U/-/-
edu.uab.	University of Alabama at Birmingham	[5] 2/2/2 [M]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.ua.	University of Alabama Tuscaloosa	[3] 0/0/0 [M]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.albany.	University at Albany	[5] 2/2/2 [M]	[1] 0/0/0 [O]	[1] 1/1/1 [I]	U/-/-
edu.alcorn.	Alcorn State University	[2] 0/0/0 [I]	[1] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.american.	American University	[4] 0/0/0 [I]	[3] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.appstate.	Appalachian State University	[2] 0/0/0 [I]	[1] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.arizona.	University of Arizona	[5] 0/0/0 [M]	[1] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.asu.	Arizona State University	[4] 0/0/0 [I]	[4] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.astate.	Arkansas State University	[4] 1/0/0 [M]	[1] 0/0/0 [I]	[1] 0/0/0 [I]	U/-/-
edu.uark.	University of Arkansas Fayetteville	[2] 0/0/0 [I]	[3] 2/0/0 [I]	[1] 0/0/0 [I]	U/-/-

http://usgv6-deploymon.antd.nist.gov/cgi-bin/generate-gov

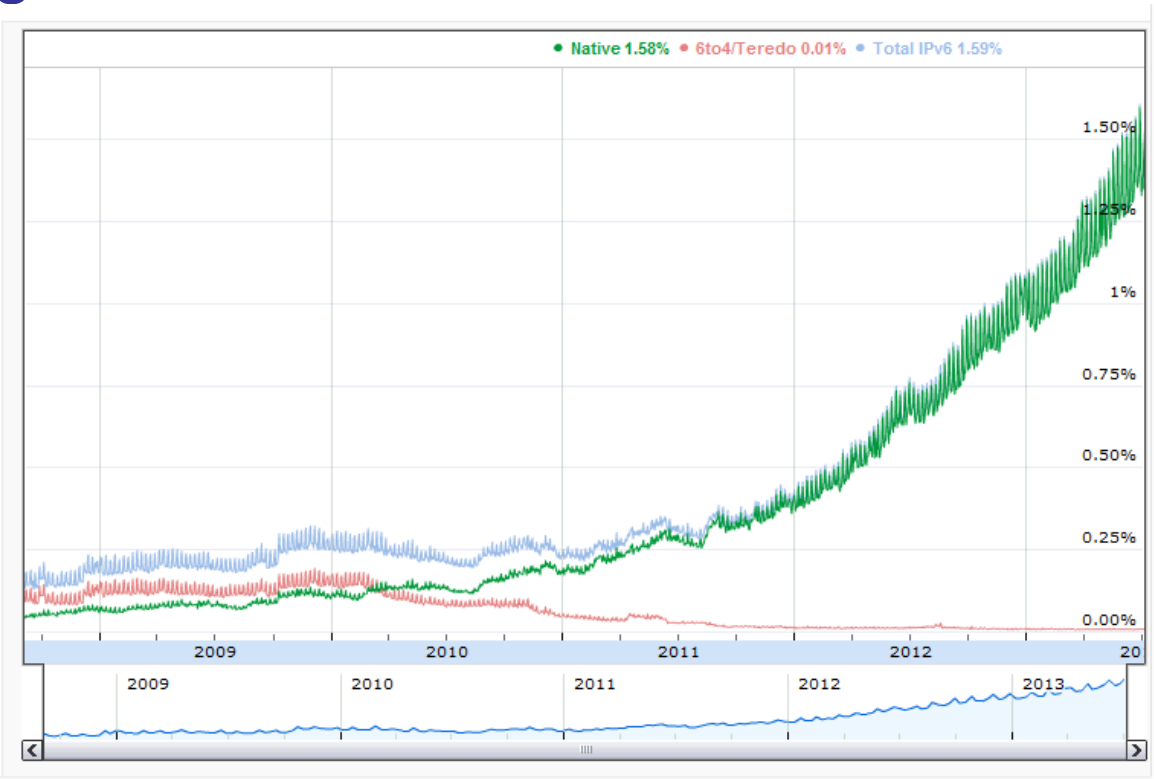
6lab.cisco.com



IPv6 Statistics
6lab.cisco.com/stat

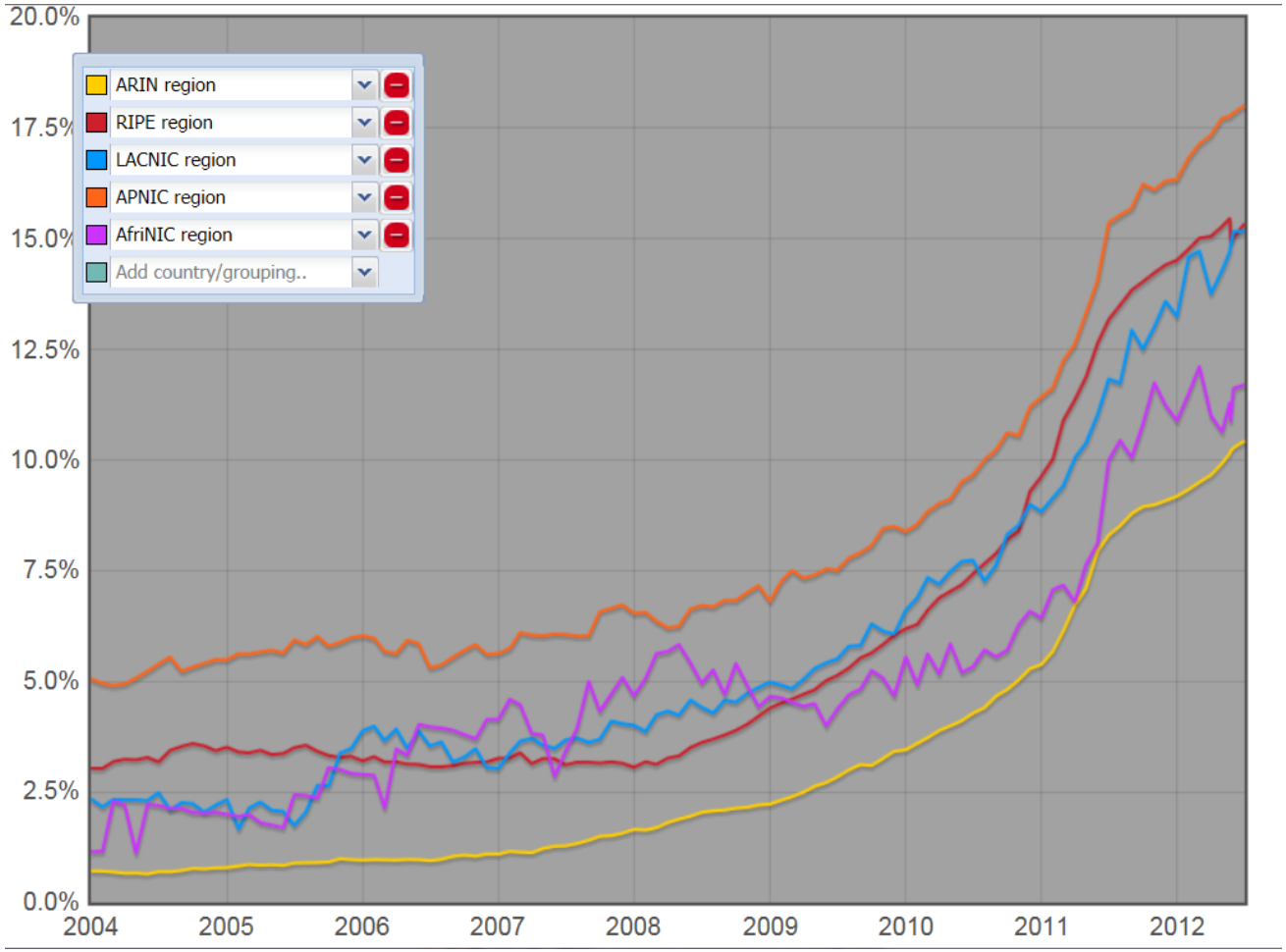


Google IPv6 Statistics



Google Statistics on IPv6 continuous usage
http://www.google.com/ipv6/statistics.html#

IPv6 Networks Advertised



IPv6 Transition Methods

Tunneling

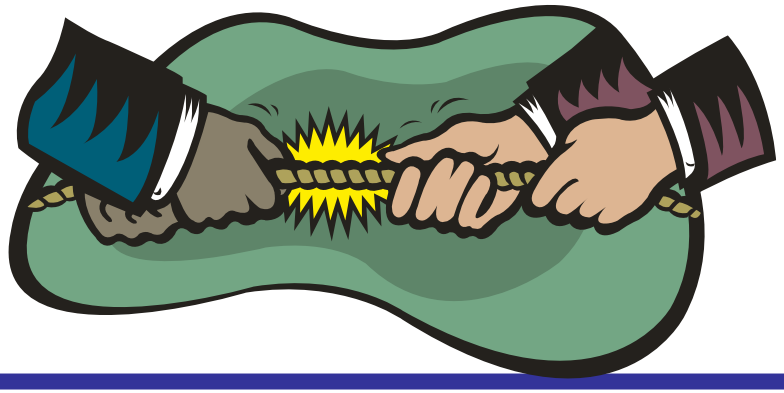
IPv6 only systems communicate across an IPv4 network

Header translation

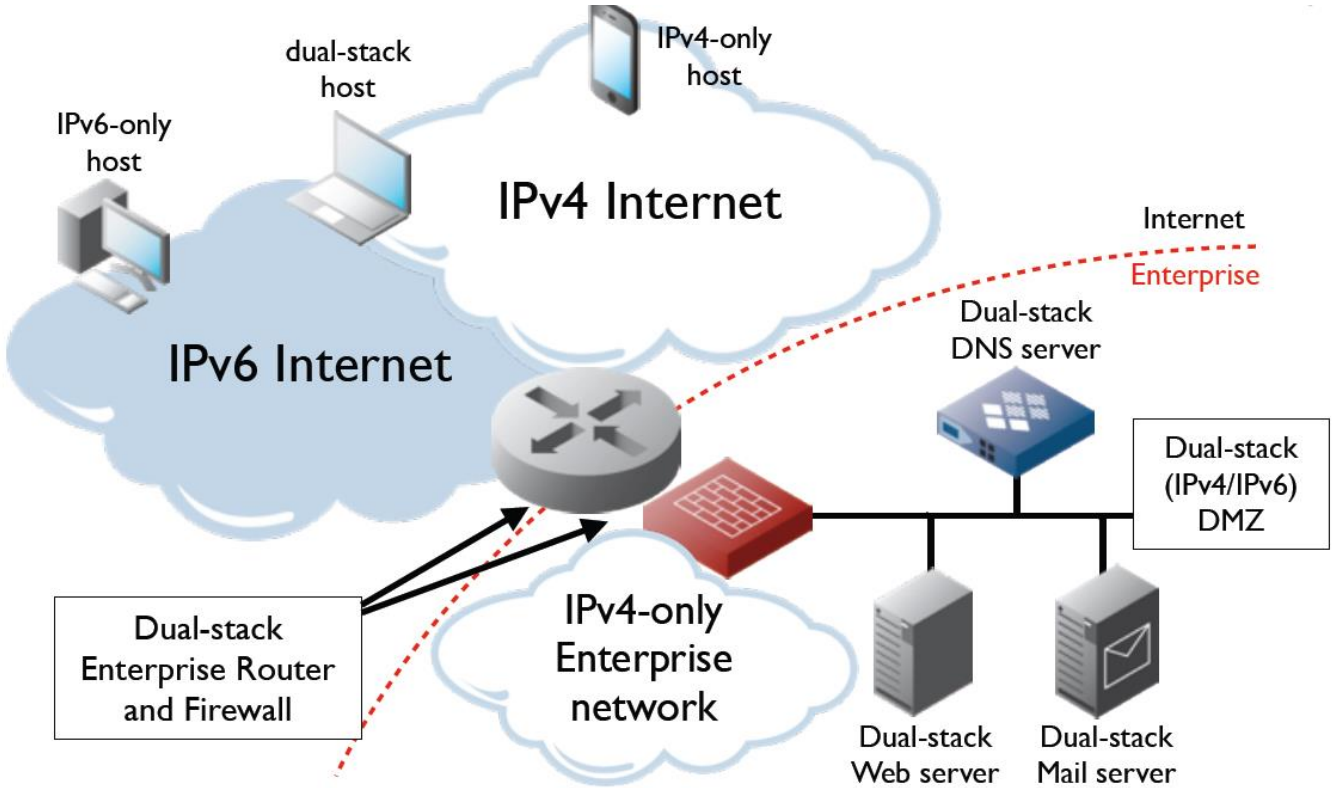
IPv6 system communicates with an IPv4 system

(header conversion, transport relay, application proxy)

Dual Stack

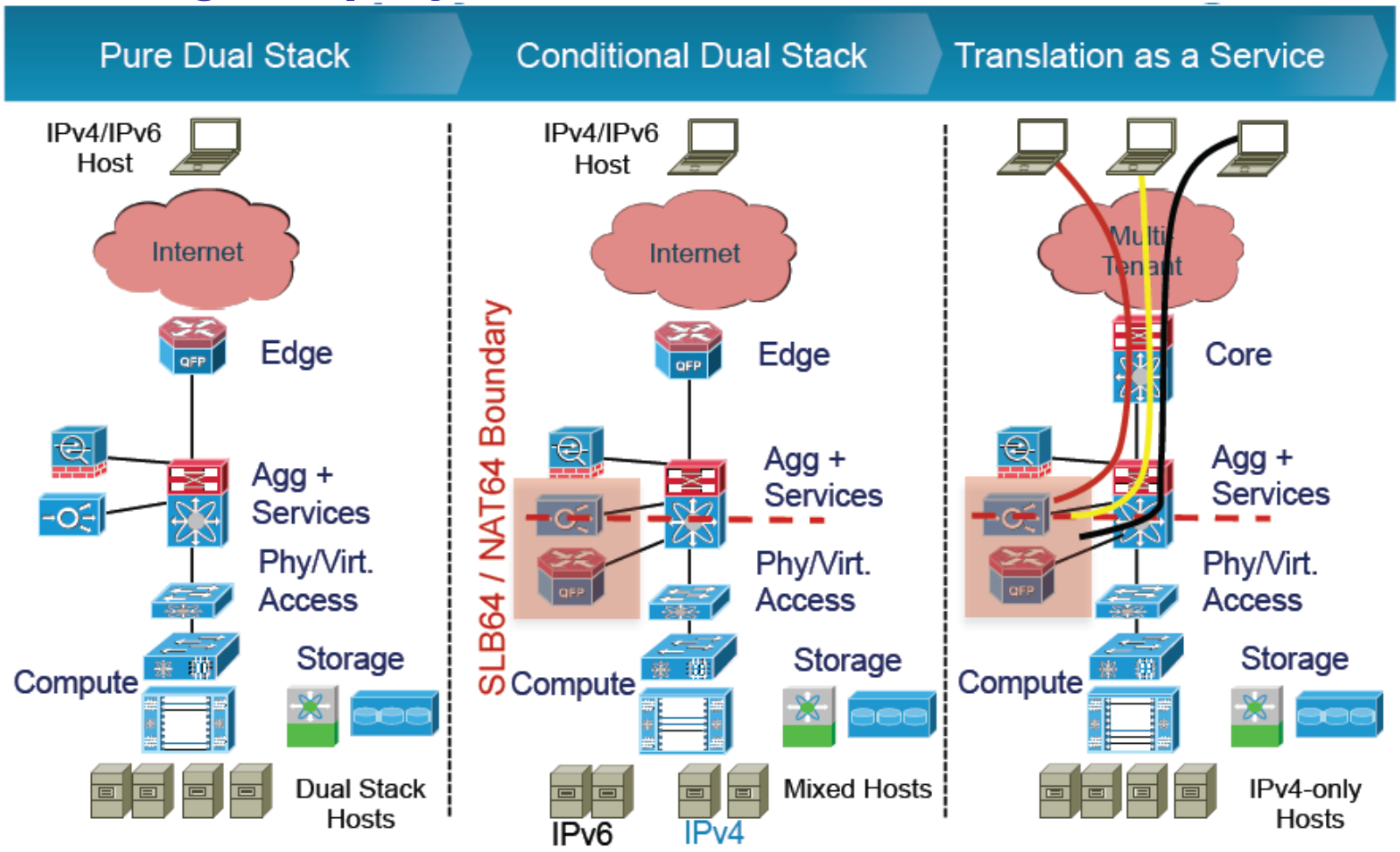


Enterprise Content



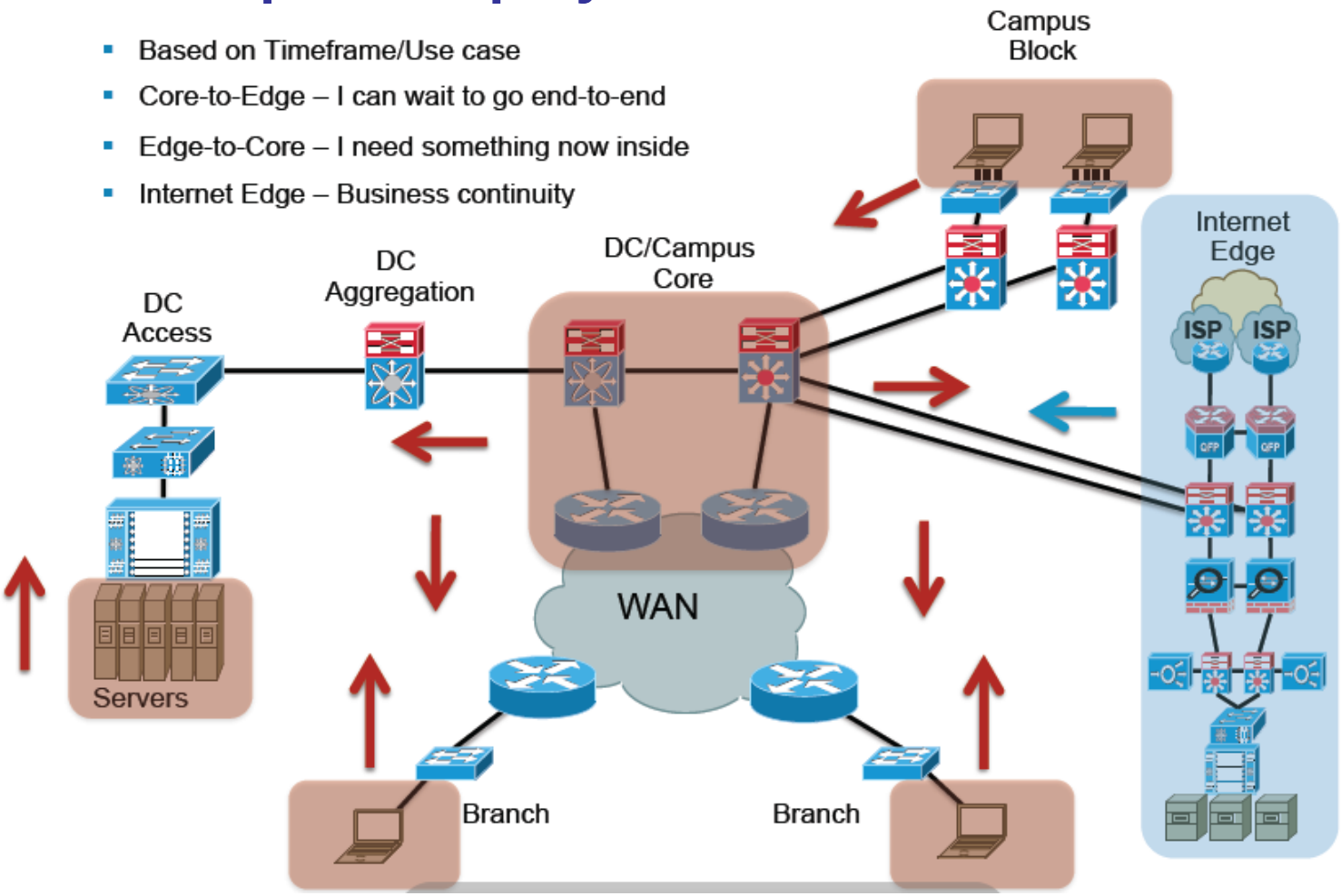
Availability of enterprise content over IPv6

IPv6 Edge Deployment



IPv6 Enterprise Deployment

- Based on Timeframe/Use case
- Core-to-Edge – I can wait to go end-to-end
- Edge-to-Core – I need something now inside
- Internet Edge – Business continuity



Why IPv6 in Korea?

Prepare IPv4 Address Depletion

- Usage ratio of assigned IP addresses : 96.2% (Mar. 2006)
- More IP addresses to be needed for the future IT839 Strategy

Promoting New Services

- IPv6 based Home Network Service
- IPv6 Service over 2.3 GHz based WiBro
- IPv6 based VoIP Service
- IPv6 based Telematics Service, and many others

IT839 New Growth Engine

- A master plan for the IT industry
- Effort to gain more growth momentum from the IT sectors

6to4 Tunneling

IPv6 traffic tunneled to go through an IPv4 network
- www.sixxs.net – Worldwide tunnel broker

Address - 2002:wwxx:yyzz::/48
- wwxx:yyzz is both the NLA and the colon-hexadecimal representation of an IPv4 address assigned to the site or host

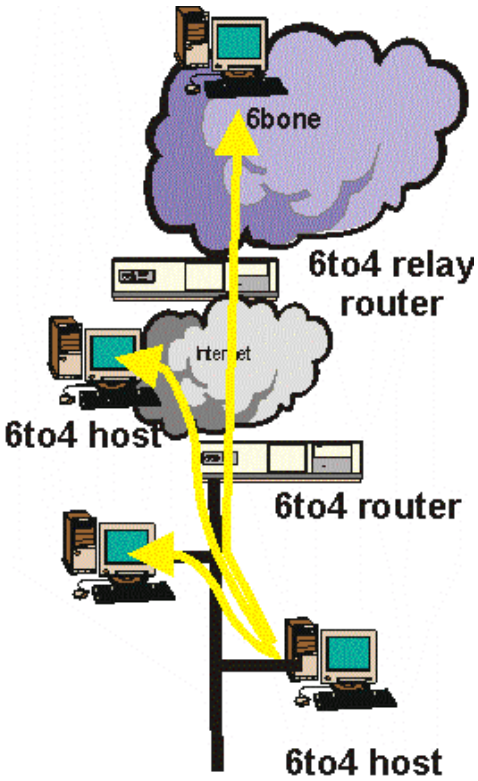
2002:wwxx:yyzz:[Subnet]:{Interface ID}

6to4 host - an IPv6 host that is configured with at least one 6to4 address

6to4 router - an IPv4/IPv6 router that forwards 6to4 traffic between 6to4 hosts within a site or 6to4 relay routers on the IPv4 Internet

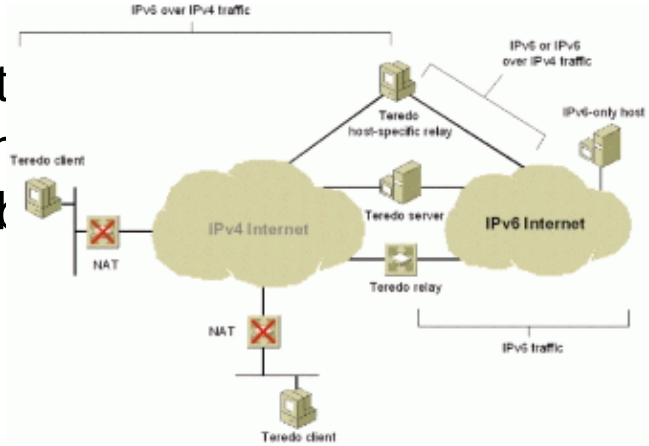
6to4 relay router - an IPv4/IPv6 router that forwards 6to4 addressed traffic between 6to4 routers on the IPv4 Internet and hosts on IPv6 networks

Anycast
2002:C058:6301::



Teredo

- 6to4 tunnels requires the tunnel end point public IPv4 address…..so for many that r NAT device…Many NAT devices cannot b upgraded
- Teredo encapsulates IPv6 in UDP/IPv4 datagrams.
  - Diagnoses UDP over IPv4 (UDPv4) connectivity and discovers the kind of NAT
  - assigns a globally-routable unique IPv6 address to each host using it;
  - encapsulates IPv6 packets inside UDPv4 datagrams for transmission over an IPv4 network (this includes NAT traversal);
  - routes traffic between Teredo hosts and native (or otherwise non-Teredo) IPv6 hosts.



IPv6 Translations

NAT-PT (Network Address Translation and Protocol Translation)

Translates by mapping each IPv6 address onto one from a pool of IPv4 addresses

Upside: easy to implement and understand

Downside: Limits simultaneous access to multiple services with a network

Breaks end-end networking

Single point of failure

NAPT-PT (Network Address Translation plus Port Translation)

Protocol gateway translates the IPv4/IPv6 network addresses and also maps port across boundaries

Upside: Easy to implement, adds support for more simultaneous sessions

Downside: Breaks end-end networking, single point of failure

SIIT (Stateless IP/ICMP Translation)

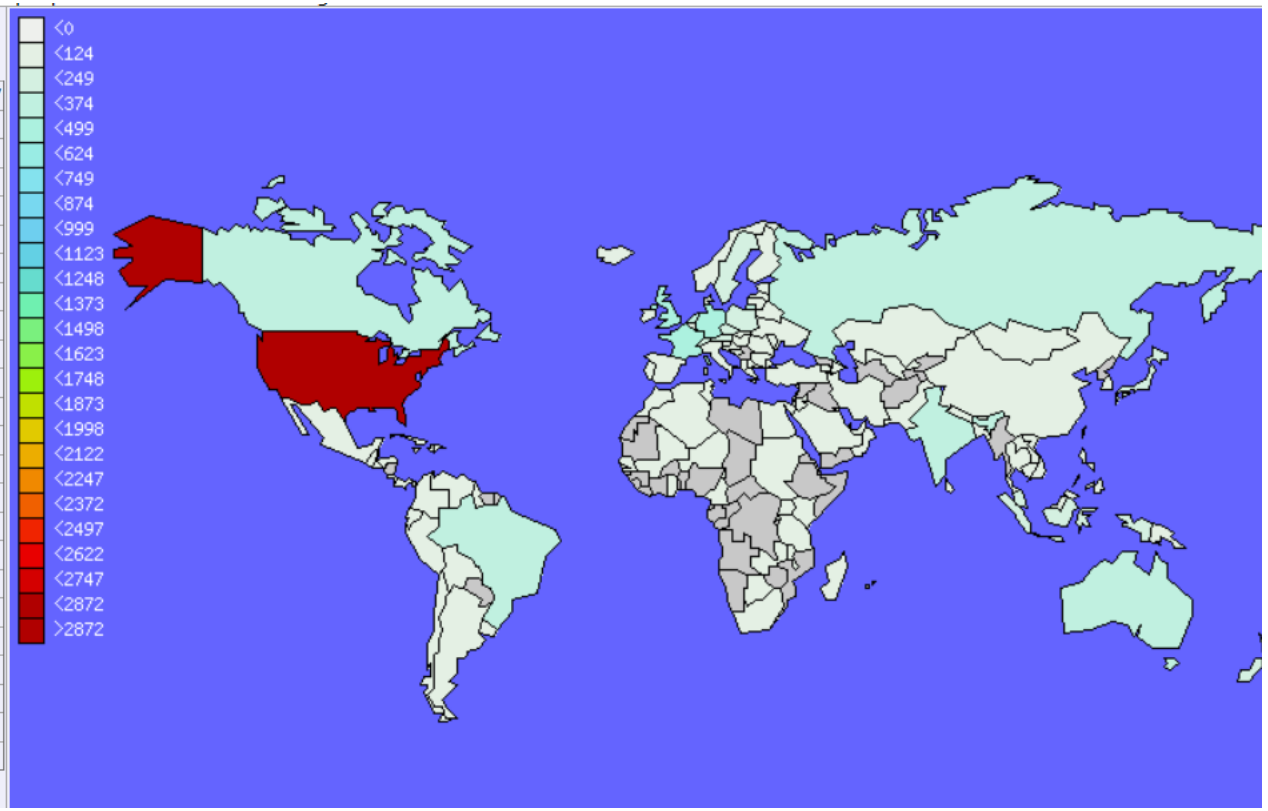
IP packets and ICMP messages are translated between IPv4 and IPv6 with temporary assignments of IPv4 addresses creating a one-one mapping

Upside: Does not require state detail to be maintained

Downside: Does not save on IP addresses, single point of failure

IPv6 BGP Weathermap – Prefixes per Country

1	United States	3067
2	Germany	477
3	France	402
4	United Kingdom	399
5	Australia	388
6	EU	375
7	Brazil	349
8	Russian Federation	341
9	India	333
10	Netherlands	328
11	Canada	304
12	Indonesia	259
13	Japan	240
14	Sweden	239
15	Czech Republic	171
16	Poland	170
17	Switzerland	162
18	New Zealand	144
19	Singapore	137
20	Austria	131
21	Hong Kong	129
22	Korea, Republic of	110
23	Ukraine	110
24	Norway	106



IPv6 Migration Plans

- **Define topology and functions on hosts, routers, and service machines**
- **Upgrade DNS, DHCP, ARP servers to handle IPv6 addresses**
- **Introduce dual stack systems that support IPv4 and IPv6**
- **Configure to Internet using IPv6**
- **Rely on tunnels to connect IPv6 islands separated by IPv4 networks**
- **Gradually remove IPv4 from systems**
- **Work closely with ISP for connections to the Internet**

IPv6 References

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IPNG and the TCP/IP Protocols - John Wiley and Sons - ISBN-0-471-13088-5

IPv6 The New Internet Protocol - ISBN-0-13-24-241936

IPNG Internet Protocol Next Generation - ISBN-0-201-63395-7

Internetworking IPv6 with Cisco Routers - ISBN 0-07-022831-1

AES Sessions

Session	Title	Day	Time	Room
12152	IPv6 Basics	Tuesday February 5	1:30 PM	Golden Gate 4
12777	Network Problem Diagnosis with Packet Traces	Wednesday February 6	9:30 AM	Golden Gate 3
12778	Performance Factors in Cloud Computing	Wednesday February 6	11:00 AM	Golden Gate 4
12150	I'm Running IPv6 How Do I Access?	Wednesday February 6	3:00 PM	Golden Gate 4
12158	Managing an IPv6 Network	Thursday February 7	11:00 AM	Golden Gate 4
12149	Kick Start your IPv6 Skills using your home network	Friday February 8	8:00 AM	Golden Gate 4
12153	IPv6 Deep Dive	Friday February 8	9:30 AM	Golden Gate 4

ありがとうございました

Grazie

Danke

Merci

ขอบคุณ

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Gracias

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감사합니다

நன்றி
Tamil

Obrigado

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