



IPv6 Enterprise Transition Strategy



Eric Vyncke
Distinguished Engineer
CTO/Consulting Engineering
Cisco Systems

Agenda



- Impact of IPv4-address exhaustion
- IPv6 for Internet Presence
- IPv6 in Singapore
- IPv6 access to the Internet
- IPv6 in the intranet
- Conclusion

Impact on Internet Connectivity

- 3 approaches currently worked on by SP

 - Dual-stack: SP allocates both IPv4 and IPv6 global addresses to his subscribers

 - Shared IPv4 address: SP relies on NAT in his network to share a couple of global IPv4 addresses and allocates private IPv4 addresses to his subscriber

 - IPv6 only

- It is expected that SP will deploy a combined and phased approach

 - Sharing IPv4 global address is part of the solution

 - IPv6-only as ultimate the goal, there is no alternative plan

Impact of the Enterprises

- Enterprises should expect their customers, partners, and remote employees to have a **mix of connectivity**

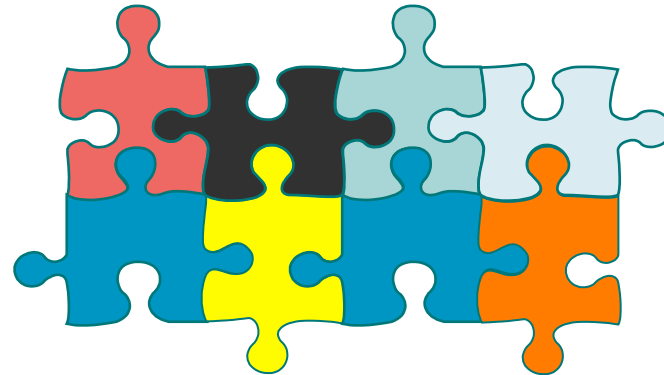
Public IPv4-only

Public IPv4 and IPv6

Shared IPv4-only

Shared IPv4 and IPv6

IPv6 only



Enterprises must be ready for this mix
(they cannot select the SP of their users).

The days of one public IPv4 for each Internet user are over.

Impact of Shared IPv4 Address on Applications

- Applications which could **work poorly or even not at all** when one side uses a shared IPv4 address

Multiple TCP connections (like AJAX) in parallel

Assuming that one IPv4 address = one user (for logging, for load balancing, for access control...)

Expecting inbound connections (like active FTP)

Using an application not yet supported by the NAT devices

Enterprises should:

- Be conservative for their IPv4 users
- Be aggressive for their IPv6 plan

- Be aggressive for their IPv6 plan
- Be conservative for their IPv4 users

IPv6 for Internet Presence



How to offer services on the IPv6 Internet?

What is Internet Presence

- The set of services offered by the enterprises/
Governments/Hospitals/Schools to their
customers/citizens/patients/students

Web applications

VPN access

E-mail

Instant messaging

....



Why Should an Enterprise Add an IPv6 Internet Presence?

- To be ready for IPv6
 - Or show technical leadership
- Regulations or incentives
- To keep applications running
- Unique IP address per user
- Customers having/requesting only IPv6 connectivity



Multiple Ways to Add IPv6 to Web Servers

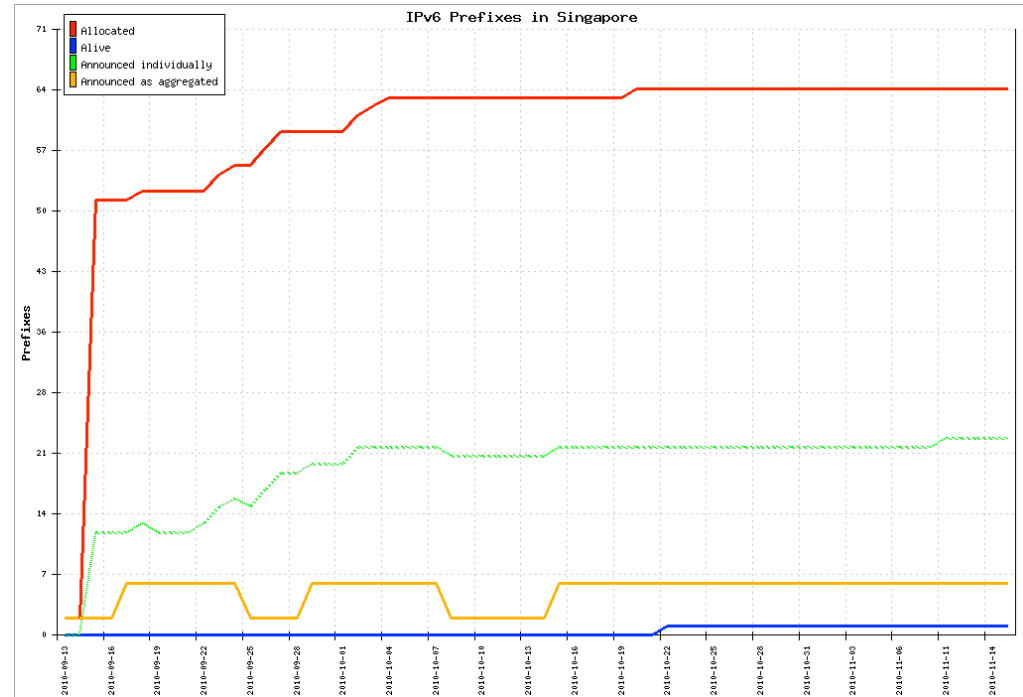
- Add native IPv6 to existing web servers:
 - could require some changes in application scripts & logging
- **Add a set of IPv6-only web servers**
 - More flexibility and independence of IPv4 & IPv6**
- Address Family Translator (AFT) in load balancer
 - Accept IPv6 connection from browser
 - Load balance and connect to server with IPv4
- **AFT in reverse web proxies**
 - Quite often reverse proxies are used for security anyway**
 - Same as load balancers**
- AFT in network devices
 - Currently in NAT-PT but scalability issue and deprecated by IETF
 - Being worked on at the IETF Behave WG

IPv6 in Singapore



Who does IPv6 in Singapore?

| Country | Allocated IPv6 prefixes |
|-----------|-------------------------|
| Singapore | 64 |
| Hong Kong | 77 |
| Thailand | 41 |
| Indonesia | 160 |
| Malaysia | 59 |
| Belgium | 448 |



| | |
|--------------------------------|-----------|
| Allocated IPv6 prefixes | 64 |
| Announced in BGP as aggregated | 6 |
| Announced in BGP | 23 |

Source: <http://www.vyncke.org/ipv6status/detailed.php?country=sg#prefixes>

IPv6 Access to Internet



How can enterprise internal users access services on the IPv6 Internet?

Why Getting IPv6 Access to the Internet?

- Get end-to-end connectivity for all users
- Avoid being placed behind a NAT
- Facilitate merging & acquisition (avoiding NAT conflicts)
- Be ready to merge/acquire with a IPv6-enabled organization
- Customer or partner requiring IPv6
- Getting know-how and expertise on IPv6
- Later when IPv4 connectivity becomes too expensive

Adding IPv6 Access for Internal Users

- Choice of deployment models

Application proxies at the perimeter:

Internal browser connects over IPv4 to proxies

Proxies connects to IPv6 server

Dual-stack:

add IPv6 to all hosts and network devices

recommended approach

Tunneling

add IPv6 only to some hosts and network devices

could be used for pilot phase or in case of legacy devices

Adding IPv6 Access for Internal Users (Cont.)

- Upgrade

 - perimeter functions: firewall, proxies, content filtering

 - Operational procedures

 - DNS servers which should also reply with IPv6 content

IPv6 in the Intranet



How can enterprise internal users
use IPv6 for internal services?

Why Adding IPv6 to all hosts in the intranet?

Even if RFC 1918 is enough for enterprise

- Visibility of tunneled IPv6 traffic

To enforce a security policy

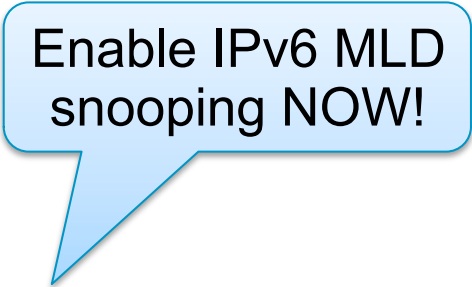
- Enable IPv6-only application

Windows 7 DirectAccess transport IPv6 only

Windows 2008 Cluster uses IPv6 link-local address

Apple Airport management uses IPv6 link-local address

- Simpler network management without any NAT
- Ease of deployment and mobility
- Easier merge & acquisition



Enable IPv6 MLD
snooping NOW!

Why Adding IPv6 to all Hosts in the intranet?

Because RFC 1918 may not be enough...

- Addressing plan not always optimum...
- Adding too many IP phones
- Adding too many wireless stations
- More critical in the Data Center

More and more mobile Virtual Machines

Layer-2 domain is limited to IPv4 ARP broadcasts

Layer-2 domain is much larger thanks to IPv6 Neighbor Discovery multicast

Building an IPv6 intranet

- Well-known and proven designs (dual-stack, hybrid, ...)
- All OS (Microsoft, Apple, *ix) support IPv6 for years
- Some 'hidden' costs

Training of operational staff

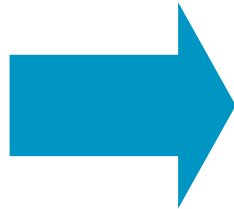
Test all applications for IPv6 readiness

While IPv4 will probably disappear from the Internet,
It can be expected that IPv4 will stay longer in the enterprise
(think SNA or DECnet)

(think SNA or DECnet)
It can be expected that IPv4 will stay longer in the enterprise

Cisco Licensing Feature Parity for IPv4 and IPv6

Catalyst 6500 Advanced IP Services - IPv6 Feature Set



IP Services image – IPv6 feature parity with IPv4. Key ones include:
Routing IPv6 Features - EIGRPv6,
IPv6 multicast,
IPv6 tunneling

IP Base image - IPv6 Host features include:
IPv6 addressing
ICMPv6 & redirect
IPv6 MTU path discovery
IPv6 Neighbor discovery
Syslog, SNMP, Telnet, SSH over IPv6

Which IPv6
Address?



Which Kind of IPv6 Address to use ?

Which IPv6 Address?

- **Provider Assigned (PA):** like in IPv4
 - Free
 - Bound to on SP (so changing SP means renumbering)
- **Provider Independent (PI)**
 - Expensive (often includes a recurring cost)
 - Makes multi-homing possible for international presence or resiliency
- **Universal Local Addresses (ULA)**
 - Free (locally generated)
 - No global Internet connectivity (but private links to other enterprises are possible) => requires application proxies at the edge

Where and When to Use Them?

- Internet Presence

 - PI for enterprises with multiple Internet Presence connections or where multi-homing is required for resiliency

 - Else PA

- Access to the Internet & intranet

 - PI for enterprises wanting multi-homing (resiliency or geographical distribution)

 - ULA is possible when applications proxies are used at the perimeter and no end-to-end connections are required

 - PA when there is no applications proxies or when end-to-end connections are required but beware about renumbering in case of SP change.

Conclusion



Summary

Google for *What Enterprises Should Do About IPv6 In 2010*

- IPv6 Internet Presence

 - Probably the most important (customer facing)

 - The easiest

- Access to the IPv6 Internet

 - Could be required by partners or to facilitate mergers & cooperation

 - Several approaches: dual-stack, proxies, tunnels

- IPv6 in the intranet

 - For IPv6-only application, to get visibility on IPv6 traffic, to get a clean and easy-to-manage intranet

 - Easy on the network, more longer on application

Key Points

- IPv4-address exhaustion has less direct impact on enterprises than on ISP
 - But, real impact on their customers & partners
- IPv6 also brings other benefits from simpler network operation to modern applications support
- Enterprises SHOULD assess their situation and requirements 1 or 2 years before IPv4 address pool is exhausted

This is start late 2010 at the latest





CISCO