IPv6 Business Case

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Agenda

• Market Drivers
• Why Now?
• Security Perspectives
• Service Provider and Enterprise Issues
• Cisco R&D – Shanghai
• Wrap-up
• Most Network Managers will not ask for IPv6 until they run into a problem getting IPv4 space. It is simple human nature to ignore a problem until it becomes a crisis.
Market Drivers
Wide access to information

- Improved crop yields through access to current farming research & weather information.
- Distribution to more markets through wide advertising at low cost.
• 7/06 – Matsushita Electric comprehensive security service using an IPv6-enabled TV, circuit breaker box, and home LAN system.

• 6/06 – Freebit IP Business Phone service utilizing IPv6

• 1/06 – Panasonic HD-PLC chip which provides 190Mbps broadband connectivity with electric outlets ... AES 128-bit encryption ...

• 10/05 – IPv6 Enabled Digital HDTV LCD from Toshiba
Appliances improve productivity & IT’s role is to maximize worker productivity...
ISP’s waiting for a leader?

• Narelle Clark (Optus)

“Perhaps the carriers are reacting to IPv6 like the Penguins on Phillip Island. They stand around looking at each other waiting for one to break rank and run across the beach. Once one or two have made it to the other side the rest will parade across together”.

Perhaps...

Or maybe they just believed the prior projections of 15-20 more years and figured they had plenty of time to deal with it later.
Why Now?
Distribution of IPv4 addresses by /8

Jan. 16, 2007

<table>
<thead>
<tr>
<th>Organization</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>93%</td>
</tr>
<tr>
<td>ARIN</td>
<td>27%</td>
</tr>
<tr>
<td>RIPE NCC</td>
<td>22%</td>
</tr>
<tr>
<td>APNIC</td>
<td>24%</td>
</tr>
<tr>
<td>LACNIC</td>
<td>4%</td>
</tr>
<tr>
<td>AfriNIC</td>
<td>1%</td>
</tr>
<tr>
<td>Defined</td>
<td>4%</td>
</tr>
<tr>
<td>Multicast</td>
<td>16%</td>
</tr>
<tr>
<td>Experimental</td>
<td>16%</td>
</tr>
<tr>
<td>IANA - Pool</td>
<td>49%</td>
</tr>
</tbody>
</table>

19.1% remaining
Consumption is accelerating despite increasingly intense conservation efforts.

- PPP / DHCP (temporal address sharing)
- CIDR (classless inter-domain routing)
- NAT (network address translation)
- plus some address reclamation

Growth is occurring in all regions.

While growth as seen in the routing system is strongest in Asia, the allocation growth is strongest in Europe.
Exhaustion of the central IANA pool - orange
Exhaustion of the collective RIR pools - magenta
Relative distribution rates between the RIRs
Time depth of collective RIR pools on pub date - white
Time depth between exhaustion events - diff between orange & magenta

Tony Hain
Implications

• Despite the wide-scale deployment of NAT, the consumption of the IPv4 pool continues at an accelerating rate.

• When IANA runs out, existing IPv4 networks still work. The only ones that will be immediately impacted are the RIRs when they come back for more space.

• When any RIR runs out, existing IPv4 networks still work. The only ones that will be immediately impacted are the LIR/ISP/Enterprise’s when they come back for more space.

• When the LIR/ISP runs out, existing IPv4 networks still work. The only ones that will be immediately impacted are the people looking for more or new space.

• Any specific network will only need IPv6 when they attempt to talk to someone that was unable to acquire enough IPv4 space, or attempt to expand or add new applications and find themselves unable to get enough IPv4 space.
Business Challenges

- Less complex, easier to manage, implementation and operations
  Enables greater ROI from emerging and new business apps

- Natural evolution to improve operations, productivity, and service
  Could just replace 1:1, but ask:

‘Where does the network need to be in 3-5 years?’

‘Which applications and services will be expected?’

(mobility, virtual presence, …)
The Internet evolution

• 20 years ago ---
  – Modest capacity
  – 1.2 kbps ® 45 Mbps
  – Moderate latency
  – Moderate loss rate
  – Periodic attachment
  – Primarily text based applications

• Today ---
  – Vast range of capacities
    10’s kbps → 40 Gbps
  – Fixed and nomadic attachment
  – Basic multimedia
  – Foundation for global e-commerce

• Tomorrow ---
  – IPv6 based mobile e-commerce

Author/Editor: Merike Kaeo - DoubleShot Security
This design can be augmented with IDS, application proxies, and a range of host security controls.

The 3-interface FW design as shown here is in use at thousands of locations worldwide.

Firewall policies are generally permissive outbound and restrictive inbound.

As organizations expand in size the number of “edges” and the ability to clearly identify them becomes more difficult.
IPv6 Local Network Protection

LNP – A set of IPv6 techniques that may be combined on an IPv6 site to simplify and protect the integrity of its network architecture, without the need for Address Translation

http://www.ietf.org/internet-drafts/draft-ietf-v6ops-nap-06.txt
## Market perceived benefits of IPv4 NAT

http://www.ietf.org/internet-drafts/draft-ietf-v6ops-nap-06.txt

<table>
<thead>
<tr>
<th>Function</th>
<th>IPv4</th>
<th>IPv6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Gateway</td>
<td>DHCP – single address upstream</td>
<td>DHCP-PD – arbitrary length customer prefix upstream</td>
</tr>
<tr>
<td></td>
<td>DHCP – limited number of individual devices downstream</td>
<td>SLAAC via RA downstream</td>
</tr>
<tr>
<td>Simple Security</td>
<td>Filtering side effect due to lack of translation state</td>
<td>Explicit Context Based Access Control (Reflexive ACL)</td>
</tr>
<tr>
<td>Local usage tracking</td>
<td>NAT state table</td>
<td>Address uniqueness</td>
</tr>
<tr>
<td>End system privacy</td>
<td>NAT transforms device ID bits in the address</td>
<td>Temporary use privacy addresses</td>
</tr>
<tr>
<td>Topology hiding</td>
<td>NAT transforms subnet bits in the address</td>
<td>Untraceable addresses using IGP host routes /or MIPv6 tunnels for stationary</td>
</tr>
<tr>
<td>Addressing Autonomy</td>
<td>RFC 1918</td>
<td>RFC 3177 &amp; 4193 (ULA)</td>
</tr>
<tr>
<td>Global Address Pool Conservation</td>
<td>RFC 1918</td>
<td>340,282,366,920,938,463,463,374,607,431,768,211,456 addresses (3.4*10^38)</td>
</tr>
<tr>
<td>Renumbering and Multi-homing</td>
<td>Address translation at border</td>
<td>Preferred lifetime per prefix &amp; Multiple addresses per interface</td>
</tr>
</tbody>
</table>
Service Provider and Enterprise Issues
The Solution: A Lifecycle Approach

Advanced Service Offerings

- Device Audit: IPv6 Posture Assessment
- Migration Strategy
- Software Strategy
- Network Architecture Strategy

Detailed Design Development
- IPv6
- Design Validation
- Proof of Concept
- Detail
- Design Review
- SW Release Recommendations

Implementation
- Plan Development
- IPv6
- Plan Review
- Remote Deployment Support
- Acceptance Test
- Plan Review
- Implementation Plan Assistance
- Remote SW Upgrade Support

Ongoing SW Release Assessment
- Performance Engineering Audit
- Knowledge Transfer
- Design Support
- Network Application Perf and Optimization
- Performance and Optimization Engineering
- Focused Engineering Support
- Operations Management

Software Support
- Cisco.com, e-Learning, IPv6 training
- TAC Support, Cisco Press
- HW Replacement

Prepare, Plan, Design, Implement, Operate, Optimize
Dual-Stack de-mystified

- Dual-stack infrastructure simplifies the network design by allowing IPv4 to persist until it is no longer in use.
- Layer 3 infrastructure integrates IPv6 connectivity while retaining IPv4.
- All recent operating systems support dual-stack, where hosts use either IPv4 or IPv6 based on the capability and name service record of the correspondent.
- NAT-PT should be restricted for use as a front-end to servers that could not be dual-stacked, but need to provide service to eventual IPv6-only clients.

(Translation is only required between mismatched versions, but is often promoted for general use by those who rely on masquerading behind unnecessary complexity.)
Issues facing the network manager

• **Staff training** – reducing perceived service level

  Awareness – OS stack will tunnel unless there is native service

• Network management **tools** – scripts and commercial products ignoring the IPv6 deployment

• Traffic patterns – old wan **traffic models** dominated by client/server apps, new by peer-to-peer collaboration tools

  Multi-homing – Global address allocation policy for enterprise deployments

• **Timing** – deployment being forced in short order by a partner interaction rather than planned and orderly over time

Applications – not providing IPv6 support before IPv4 is...
Cisco Research & Development Center

Cisco Systems (China) R&D Co. Ltd.
aka CRDC - Cisco (China) R&D Center
Wholly Owned Foreign Enterprise (WOFE)

Address: 11 - 16 F, Block C of Keji Building
900 Yishan Lu, Caohejing Hi-Tech Park,
Shanghai, P.R.C. 200233
CRDC History

- Jan'04 – Initial proposals
- May’04 – Project approved - J. Chambers
- July'04 – Site director appointed
- Oct'04 – Temp. office opened
- Jan'05 – Est. 2nd Shanghai Branch of Cisco Systems (China) Networking Technology Co, Ltd
- Jan'05 – First local staff hired
- Aug’05 – Move to Shanghai Caohejing Hi-Tech Park
- **Oct 12, 2005 - Official Opening**
- Nov’06 – CRDC reaches 360 employee mark, 9 Business units
- Jan'07 – Space expansion lease signed
The Mission for the CRDC

Create a center of engineering excellence for key technologies, products, and solutions to support China, APAC, and Cisco global customers.

Build, maintain, and grow a Cisco development partner ecosystem for cost-effectiveness and flexibility to scale

Architect, design, develop, test and support products, product extensions and solutions for delivery to Cisco customers all over the world.

Drive business in cooperation with business units and technology groups
The Mission, cont.

Maintain close relationship with the government, academia and the community

Contribute to the community and the country by direct corporate engagement and by encouraging our staff to be involved.

Work hard and have fun!
CRDC People

Management

Staffing

CRDC People

Management

Staffing

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Wrap up
Summary

• Application opportunities abound once the developer is freed from the shackles of the client/server model where the server has restricted deployment options.

• The IPv4 resource consumption continues globally, and despite perceptions propagated by the North American press the exhaustion of the pool will impact everyone.

• Governments around the world perceive that leadership in developing the next generation of Internet technologies will be key to their national prosperity.

• As always-on Internet services become ubiquitous and permeate everyday life, consumer expectations will be that applications ‘just work’ without awareness of the active access technology.
Q and A
Cisco Press Books

Deploying IPv6 Networks

An essential, comprehensive, and practical guide to IPv6 concepts, service implementation, and interoperability in existing IPv4 environments.

Ciprian Popoviciu, CDCT fo. 4499
Eric Levy-Abegnoli
Patrick Grossetete

ciscopress.com

Cisco Self-Study:
Implementing Cisco IPv6 Networks (IPV6)

Design, build, configure, and support networks based on Version 6 of the Internet Protocol

Edited by: Régis Desmeules

ciscopress.com
More Information

- CCO IPv6 - [http://www.cisco.com/ipv6](http://www.cisco.com/ipv6)
- The ABC of IPv6
- IPv6 Application Notes
- ICMPv6 Packet Types and Codes TechNote:
- Cisco IOS IPv6 Product Manager – [pgrosset@cisco.com](mailto:pgrosset@cisco.com)