Putting IPv6 to work

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Rocky Mountain IPv6 Task Force
IPv6 and Microsoft Challenges in implementing IPv6

Dawn Bedard
Microsoft
Agenda

- In the Beginning
- What we have learned
- Microsoft Clients
In the Beginning

**World IPv6 Day** June 8, 2011

Corporate wide interest and excitement leading up to IPv6 world launch day!!

A leader in IPv6 support

Since Vista, Microsoft solutions have IPv6 support turned on by default/natively

**World IPv6 Launch** June 6, 2012.....YAY!
Need an infrastructure that can support IPv6

Need to be able to manage our IPv6 address space

It’s going to take awhile to get fully enabled

Working together – Cloud & Enterprise – we can accomplish a lot
Teams need to collaborate
Enterprise had one strategy,
Cloud had its own strategy

Our initial IPv6 addressing plan had issues
Learned lessons around paper vs implementation

No master plan for implementation.
Our infrastructure had gaps - what had it implemented where?

Did IPv6 Day really make a difference in customer needs?
Teams need to collaborate
Enterprise had one strategy,
Cloud had its own strategy

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• Biggest challenge by far!
  – Both Enterprise and Cloud have the same challenge
• How do you balance the demands of the customer vs where technology wants to go
  – Customer demand for IPv6 has been low
  – Risks vs value

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http://fedv6-deployment.antd.nist.gov/snap-all.html
IPv6 IS Important

- Support from upper management is necessary

- Developed a whole new addressing plan
  - Work with each business to identify their business requirements and security requirements
  - Keep in mind the basics
    - Route aggregation
    - ACLs – where are they defined?
      - Who talks to who?
  - Standardization in implementations and definitions
    - /127 for point-to-point
    - /64 for a “subnet”
    - /40 for a region
What surprised us

- Memory available on common chipsets in the switches impacted our IPv6 address plans
- For example, one set of tests:

<table>
<thead>
<tr>
<th>Test#</th>
<th>%IPv4 (/24-/29)</th>
<th>%IPv6 (all /64s)</th>
<th>IPv4/IPv6 % split</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200k</td>
<td>0</td>
<td>100/0</td>
</tr>
<tr>
<td>2</td>
<td>160k</td>
<td>15k</td>
<td>80/20</td>
</tr>
<tr>
<td>3</td>
<td>120k</td>
<td>31k</td>
<td>60/40</td>
</tr>
<tr>
<td>4</td>
<td>80k</td>
<td>46k</td>
<td>40/60</td>
</tr>
<tr>
<td>5</td>
<td>40k</td>
<td>62k</td>
<td>20/80</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>77k</td>
<td>0/100</td>
</tr>
<tr>
<td>7</td>
<td>210k+ (all /32s)¹</td>
<td>0</td>
<td>100/0</td>
</tr>
</tbody>
</table>

This is why testing and experience with IPv6 is important!

¹: This refers to the IPv6 address block /32s.
Coordinating

- Begin tracking implementation across the corporation
  - Each business and their planning schedule
- Do not forget
  - security cameras
  - IP Phones
  - TV’s and Displays
  - lab environments
  - Re-evaluate projects already in progress
- Get on the roadmap for the applications
- Keep beating the drum
The Enterprise team has a goal of one building that is ipv6-only
- Desktops have been dual stacked for years
- Pilot v6-only using NAT64 (with DNS64)
  - Already have DNS64 with Direct Access
  - DHCPv6 already on corporate network in test for Stateful DHCPv6
- ISATAP deprecated in favor of dual-stack

Desktop testing
- 2 laptops, same OS, same hardware
- Switching from v6-only wired to dual-stacked wireless
- 1 gets a new address immediately, 1 waits 300 seconds (timeout on RA) (no "release6/renew6", used powershell “restart netadapter”)
- Only difference is the version of the NIC software
- Why?

Operations and Troubleshooting
- Issues when one troubleshooting step is to turn off IPv6
With SLAAC, the router advertises a network prefix as part of the Router Advertisement (RA).

Client will self-assign an IP based on the network prefix

- Hint: router lifetime must be > 0

Will the client use SLAAC?

- A: Routers advertisement (RA) contains Prefix Information and the client can use it to create an address
- O: Other configuration (SLAAC will get the DHCP options from the DHCP server even though it generates its own address)
Why Temporary Addresses

- A randomly generated IPv6 address that changes over time
- Generated for public address prefixes that use stateless address configuration
- If an interface identifier is always based on EUI-64, then the host could be tracked (regardless of the prefix)

...after a valid lifetime, a new interface identifier and temporary address is generated
If do not suppress RA AND broadcasting the network prefix AND are configured for Managed DHCP, then the client can have 4 IP addresses:

- Link local
- Managed DHCP address
- SLAAC address
- Temporary Preferred address

Note: These are the preferred addresses. Deprecated addresses may also exist such as expired temporary addresses.

Keep that in mind when determining policy.

ipv6 nd
managed-config-flag

ipv6 nd prefix
2001:DB8:CAFE:2
100::/64 300 300
no-autoconfig
Looking at a longer term solution for a dual-stack environment than Happy Eyeballs (RFC 6555) as more environments move beyond to native IPv6

Tests IPv6 when connecting to a network that advertises IPv6 routability and will only use IPv6 if IPv6 is functioning
  - IPv6 version of Network Connectivity Status Indicator (NCSI)
  - Windows 8 does a test to for network connectivity to ipv6.msftncsi.com
    - If this works then IPv6 is operational
    - If it fails then IPv4 is preferred (IPv6 is demoted)

Uses approach mentioned in RFC 6724
  - Default Address Selection for Internet Protocol Version 6 (IPv6)
  - Caches information for 30 days

Choice of v6 over v4 is application dependent

Scope, Preferred over Deprecated, Native over Transitional, Temporary over Public
Tools are available to help port applications

- **Check4.exe**
  - Part of the Microsoft Windows Software Development Kit
  - A utility that steps through your code base with you, identifies potential problems or highlights code that could benefit from IPv6-capable functions or structures, and makes recommendations.
QUESTIONS?

Dawn.Bedard@Microsoft.com