IPv6 Implementation Update
DREN and SPAWAR

VA Inter Agency IPv6 Meeting
2 Feb, 2011
Crystal City, VA

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The DREN IPv6 Initiative

- Aggressive deployment of IPv6 to DoD's R&E WAN (DREN) and to all campuses of one major customer (SPAWAR)
- These are production networks with 10's of thousands of users and systems.
  - i.e., not just a testbed
- Goals
  - See what works and what's broken
  - See what's missing
  - Share lessons learned

IPv6 deployment progress

- ✔ WAN – dual stack everywhere, peering (unicast+multicast)
- ✔ LANs, WLAN – all subnets fully support v6, renumber v4
- ✔ Infrastructure services – recursive DNS, NTP, SMTP, XMPP
- ✔ Support services – RADIUS, LDAP, Kerberos
- ✔ Public facing services – authoritative DNS, MX's, www, NTP
- ✔ "Security stack" – firewall, IDS, IPS, etc.
- ✔ Security services – WSUS, McAfee ePO (aka DoD HBSS)
- ✔ Servers, desktops, laptops – 100% dual stack
- ✔ Storage (NFS, CIFS)
- ✔ Network management

Defense Research and Engineering Network (dren.net)	SUCCESS	SUCCESS	0/0 3/3	Stratum 1	SUCCESS
SPAWAR (spawar.navy.mil)	SUCCESS	SUCCESS	0/0 3/3	Stratum 1	SUCCESS

Previously discussed…

- Reported at previous meetings:
  - New approach to training, and bootstrapping sites, and BCPs
  - All DREN on Google-IPv6, very successfully
  - Some customer sites see 10% of traffic now over IPv6
  - Auto-sync for DNS tool
  - Rogue RAs – mostly from Windows with ICS – fix with router-priority
  - Semantec Endpoint Protection (SEP) breaks IPv6
  - vmware ESX 3.x
  - Blackberry Enterprise Services (BES) on IPv6-enabled Windows server will crash
  - WSUS (windows patching) all over IPv6 successfully
  - Serious problems with randomized identifiers in Windows (RFC 4941)
  - Problems with Mac OSX 10.6 (Snow Leopard)
    - DNS (mDNSresponder bug), java can't be made to use IPv6, talking to IPv6 printers
  - IPv6 support in FreeRadius (how to)
  - Goal: ALL servers, desktops, laptops running dual stack (at SPAWAR)

Previously discussed…

- Reported at previous meetings:
  - java applets won't use IPv6 without special tuning
  - Continued additional support for network management over IPv6
  - DREN-wide updates to resolve JunOS bugs
  - Remaining issues with IPv6 on management LAN
  - managing UPSs over IPv6
  - NFS and CIFS (via NetApp) over IPv6

Mgmt LAN over IPv6 - update

- Goal – Management LAN IPv6-only (see previous talks)
  - replaced remaining old Foundry switches that had lingering IPv6 issues
  - Brocade TCP bug fixed (had been a showstopper)
  - APC units all replaced by manufacturer
    - first version had flaws, was unstable
- Success:
  - removed IPv4 from switch mgmt LAN at one campus (supporting over 500 switches)
  - removed lingering IPv4 config lines from all switches
- Problem:
  - Server ops group uses Zenoss, and lost all visibility to switches
    - too bad, they should not have purchased it if it didn't support IPv6
    - Recently added ping6 support, so some visibility restored

Mgmt LAN over IPv6 - update

- Remaining issues
  - Lack of unified IP MIB support (RFC 4293) in most products
  - A few devices still need upgrade or replacement in our infrastructure
    - Aruba WLAN controller
    - Cisco 3000 series VPN
    - ServerIrons
    - Bluecoat Proxy
- DREN3 RFP (Jan 2011)
  - "DREN is identified as an IPv6 network with IPv4 legacy support"
  - "Additionally, all network management will be enabled using IPv6"

Other updates

- Symantec Endpoint Protection (SEP)
  - broke IPv6, so outlawed on our net
  - workaround (config change) identified
  - Symantec now committed to full IPv6 support in all products
- MacOSX 10.6
  - broke address selection (didn't prefer AAAA)
  - caused Internet brokenness (6to4 preferred over native v4 if on private address space)
  - 10.6.5 starts to fix these issues
  - but see http://arstechnica.com/apple/news/2010/11/apple-fixes-broken-ipv6-by-breaking-it-some-more.ars?comments=1&p=21007430#comment-21007430
- Much NFS and CIFS still using IPv4
  - no client support in XP, RedHat up through RHEL5, Solaris 8.
- Juniper SRX testing
  - lacking many IPv6 features (management, tunnels, IPSEC, etc.)

Other updates

- Privacy Addresses (RFC 4941) – we still hate it
  - Default enabled in Windows
  - Incompatible with many Enterprise environments
  - Ubuntu thinking about making it default
    - PLEASE DON'T!!!
  - Work underway on I-D to address this issue
    - new flag in RA prefix information option.
- Some vendors eating own dogfood, finally

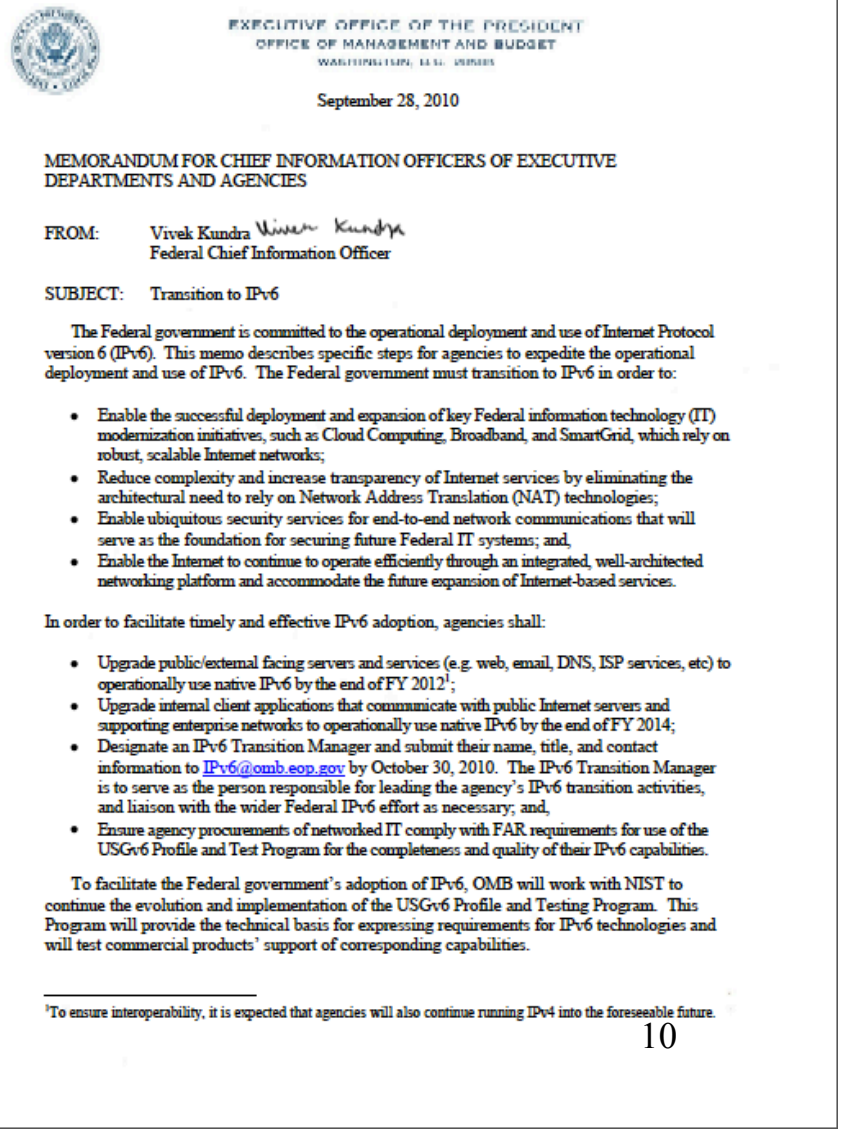
Brocade (brocade.com)	SUCCESS	SUCCESS	4/4 4/4

  - Others just starting to:

Cisco Systems (cisco.com)	www.ipv6	FAIL	0/2 0/2
Juniper Networks (juniper.net)	ipv6	FAIL (P)	0/3 0/5
Force10 Networks (force10networks.com)	FAIL	FAIL	0/0 0/4

New OMB mandate

- Sept 28, 2010
- IPv6-enable all public services by 2012
- Everything else by 2014
- All agencies deliver transitic plans by April 2011



EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

September 28, 2010

MEMORANDUM FOR CHIEF INFORMATION OFFICERS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Vivek Kundra
Federal Chief Information Officer

SUBJECT: Transition to IPv6

The Federal government is committed to the operational deployment and use of Internet Protocol version 6 (IPv6). This memo describes specific steps for agencies to expedite the operational deployment and use of IPv6. The Federal government must transition to IPv6 in order to:

- Enable the successful deployment and expansion of key Federal information technology (IT) modernization initiatives, such as Cloud Computing, Broadband, and SmartGrid, which rely on robust, scalable Internet networks;
- Reduce complexity and increase transparency of Internet services by eliminating the architectural need to rely on Network Address Translation (NAT) technologies;
- Enable ubiquitous security services for end-to-end network communications that will serve as the foundation for securing future Federal IT systems; and,
- Enable the Internet to continue to operate efficiently through an integrated, well-architected networking platform and accommodate the future expansion of Internet-based services.

In order to facilitate timely and effective IPv6 adoption, agencies shall:

- Upgrade public/external facing servers and services (e.g. web, email, DNS, ISP services, etc) to operationally use native IPv6 by the end of FY 2012[1];
- Upgrade internal client applications that communicate with public Internet servers and supporting enterprise networks to operationally use native IPv6 by the end of FY 2014;
- Designate an IPv6 Transition Manager and submit their name, title, and contact information to IPv6@omb.eop.gov by October 30, 2010. The IPv6 Transition Manager is to serve as the person responsible for leading the agency's IPv6 transition activities, and liaison with the wider Federal IPv6 effort as necessary; and,
- Ensure agency procurements of networked IT comply with FAR requirements for use of the USGv6 Profile and Test Program for the completeness and quality of their IPv6 capabilities.

To facilitate the Federal government's adoption of IPv6, OMB will work with NIST to continue the evolution and implementation of the USGv6 Profile and Testing Program. This Program will provide the technical basis for expressing requirements for IPv6 technologies and will test commercial products' support of corresponding capabilities.

[1]To ensure interoperability, it is expected that agencies will also continue running IPv4 into the foreseeable future.

New OMB Mandate

- Federal IPv6 Task Force coordinating efforts
- All agencies made initial presentations
  - situation is not good
- Major issues for most Agencies
  - TIC doesn't support IPv6 yet
  - Carriers on Networx contract don't seem to support IPv6 yet
  - Akamai
  - Load Balancers
- Agencies have done very little real work
  - some have generated lots of paper
  - almost no evidence of actually passing any IPv6 traffic

New guidance

- Updated FAQ coming soon
  - clarifying things like "public facing services"
- Checklists and Transition Plan templates
- Do something NOW, don't wait until 2012
  - "don't be afraid to break some glass"
  - identify primary agency web site and IPv6-enable it within next 4 months
    - establish internal tiger-team, will full support and authorization by management.
  - Participate in World IPv6 day
    - will help gain much needed operational experience
    - will create demand signal for suppliers
- Will define milestones and measures of success
  - status reported weekly to Federal CIO

Sample Transition Plan

- Example of the type of phased plan one would need to successfully meet the 2012 deadline.
- Includes early successes, necessary to gain operational experience needed to feed later phases.
- Milestones along the way.

Phase 1 (pilot, just do something)

- March 2011
  - internal tiger team established and authorized to make something happen (support from CIO on down)
  - agency has an IPv6 address assignment, and an initial addressing plan
    - addressing plan will be wrong the first time, so don't worry about it.
  - a public web site is identified for ipv6-enablement (e.g. www.agency.gov)
  - IPv6 service requested of ISP
  - if agency uses Akamai, ask to participate in beta program
- June 2011
  - IPv6 path established to public web site, by whatever means possible, even if it can't be done natively
  - first public web site ipv6-enabled (even if a native clone of the real site)
  - at least one authoritative DNS server has AAAA record
  - start looking at agency MXs
  - participate in World IPv6-day
    - ... and leave it enabled if no problems identified
    - ... and enjoy a moment of publicity, which will energize the team for the next phase
- If the above is successful, that would be the first milestone
  - measure of success is an IPv6-only client able to reach agency's public web site

Phase 2 - (bridge the gaps, infrastructure and support built up correctly)

- Sept 2011
  - problems identified in phase 1 being worked aggressively (ISP, Akamai, load balancers, ipv4 literals, etc.)
    - including procurements for replacing critical components lacking ipv6 support
    - including vendor requests to fix bugs and provide feature parity (may take 6 to 18 months!!)
  - addressing plan revised (if this is rev2, you will probably still get it wrong, but that's OK)
  - transition plan flushed out in more detail based on phase 1 lessons learned
  - additional key public web servers identified, especially for large organizations with sub-agencies (DHS, DoD, etc.)
  - finalize plan for DNS (IPv6 transport, verify DNSSEC capability)
  - plan for upgrade of MXs, working with vendors if necessary
  - training of staff is underway
  - internal publicity program is underway, building an "ipv6 culture" across all IT components in the organization

Phase 2, continued

- Dec 2011
  - ISP, TIC, load balancer, and other major components now fully support IPv6
  - next few public web sites ipv6-enabled
  - authoritative DNS servers have IPv6 transport
  - initial solutions implemented to get IPv6 to the MXs
  - help desk staff trained, network operations support trained
  - continued pressure on vendors, suppliers, to provide IPv6 capabilities where previously missing

- Somewhere in here is milestone 2, when the infrastructure fully supports IPv6 transport (ISP, TIC, Akamai, agency border router(s), etc.) natively to where the key services (authoritative DNS, public web server, mail exchanger) are hosted, and some of the public services are using this natively.

Phase 3 – final big push

- March 2012
  - Akamai should be fully supporting IPv6 by now
  - continued progress on enabling public facing services (web, DNS, MX)
    - should be 10% complete by now
  - continued work on going through web content to expunge ipv4 literals
  - operations and management tools made IPv6-aware
- June 2012
  - vendor fixes and updates should be arriving by now, so earlier workarounds can be eliminated
  - participate in next IPv6-day event, if there is one (this has been discussed)
  - continued progress on enabling public facing services (web, DNS, MX)
    - should be 50% complete by now
- Sept 2012
  - public services (DNS, web, MX) 100% IPv6-enabled

- Milestone 3 is when an agency meets that 100% goal.
- Intermixed with all that should include some preparations for meeting the 2014 deadline.

Along the way…

- Go native
  - avoid tunneling
  - avoid translation techniques
  - native dual-stack is the goal
- Use a phased (or spiral) approach
  - start small, go for low hanging fruit
  - gain operational experience
  - don't waste time on massive comprehensive transition plans
    - usually wrong because not based on operational experience
- Develop an IPv6 corporate culture, permeating both technical and management parts of the organization.

Soapbox

- Enabling IPv6 throughout your environment needs to be a cultural thing.
  - Get everyone involved and on-board
  - Include it as part of tech refresh.
- It may seem overwhelming in the beginning, but its really not that hard to get started.
- Don't be afraid to break some glass
- Very important that we focus on making our public facing services dual-stack as soon as possible.
  - otherwise we'll be in translator-hell, breaking various applications
  - eventually some clients won't be able to reach you
- IPv6 is an "unfunded mandate", and everyone needs to do their part.
- Need v4/v6 feature parity in products
- Avoid vendors that don't have a good IPv6 story