

National Aeronautics and Space Administration



NASA IPv6 Case Study

gogoNET Live! 4

Office of the Chief Information Officer

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September 28, 2010 OMB Memo

1. Designate an IPv6 Transition Manager by 10/30/2010
2. Ensure agency procurements of networked IT comply with the FAR requirements for use of the USGv6 Profile and Test Program for the completeness and quality of their IPv6 capabilities
3. (**Goal # 1**) Upgrade public/external facing servers and services (e.g. web, email, DNS, IP services, etc.) to operationally use native IPv6 by the end of FY 2012
4. (**Goal # 2**) 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

<http://www.cio.gov/documents/IPv6MemoFINAL.pdf>



August 2005 OMB Memo

- August 2005: OMB memo M-05-22: Transition Planning for IPv6 was sent to Agency CIOs
 - » Nov 2005 – assign an agency lead and inventory equipment
 - » Feb 2006 – develop a transition plan & progress report
 - » June 2006 – complete inventory & analysis
 - » June 2008 – demonstrate IPv6 across backbone
- In 2005, some were still in denial about the need or perhaps the urgency to implement IPv6
 - » “We have plenty of IPv4 addresses...”



2010 IPv6 Status

- So even though NASA was compliant to with meeting the 2008 demonstration, extensive progress halted
- NASA already had a /32 allocation
- NASA's Network Research Engineering Network (NREN) continued to work with IPv6
 - » Continued usage across its backbone
 - » Started to establish v6 peering: Internet2, ESnet, DREN
- At least one other center had previously investigated IPv6 based on the first memo
- DRAFT planning documents created



What's different this time?

- Depletion of IPv4 addresses now a reality
- IPv6 implementation goals go much further...
 - » Once you have implemented IPv6 on public websites, you are not likely to disable
 - » Goals have impact beyond OCIO office: website owners, end host systems, etc.
- US Federal government IPv6 initiative being watched by the world
- Did not have to convince NASA of the importance of the IPv6 initiative
- But, it is still an...



Unfunded Mandate

- While NASA IT community by and large accepted and was ready to prepare to implement IPv6, no new funding was being allocated to support this effort
- As a result this meant:
 - » Adding responsibilities to an extremely busy NASA IT community
 - » No funding was allocated to solve problems like replacing legacy equipment not capable of supporting IPv6
 - Instead the plan is to leverage scheduled upgrades and insure IPv6 compliance is insured with all new IT purchases



Insuring IPv6 Compliance

- NIST Developed the USGv6 Profile
 - » Vendors of test their products in certified IPv6 labs
 - » Customers can request a Standards Declaration of Conformance (SDOC) to obtain results of testing
- IPv6 Checkpoints
 - » Contracts – adding IPv6 requirements into contracts
 - » Enterprise Architecture Planning
 - » Project Planning early stages
- Anyone with the ability to purchase IT products should be insuring they are IPv6 capable
 - » More specifically, in live operational dual-stack networks with a high volume of traffic



OCIO Churn

- Launch of several agency IT contracts:
 - » Networking
 - » End user support
 - » Agency Help Desk
 - » Web Services
- New Leadership: CIOs, Program/Service Execs, etc.
- New Governance – new and disbanded working groups and boards
- Networking Transformation – shifting to a more centralized way of doing all aspects of networking under one agency enterprise wide networking contract



Getting the Word Out

- Excellent support from OCIO
- CIO Board committed to provide a center representative to form a NASA IPv6 Working Group.
 - » Active Sub Teams: Routing, Security, and Web & Applications
- Targeted Communications
 - » Decided against an agency wide memo
 - » Presentations to various working groups: network architecture, security, communication SMEs, web SMEs, etc. as required
- Regular updates have been given to the CIO Board

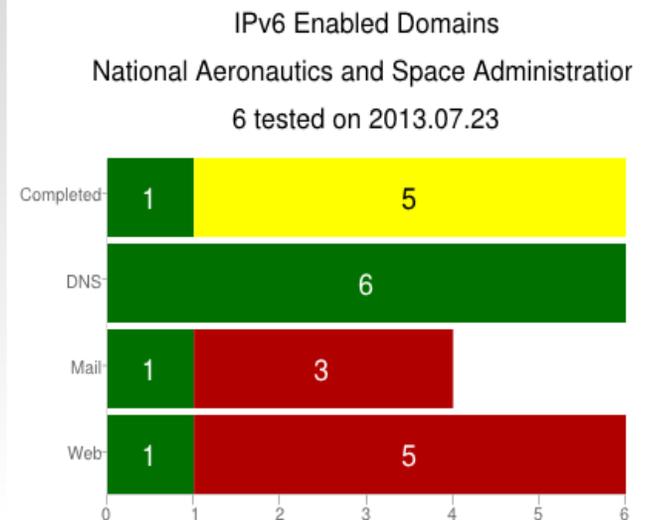
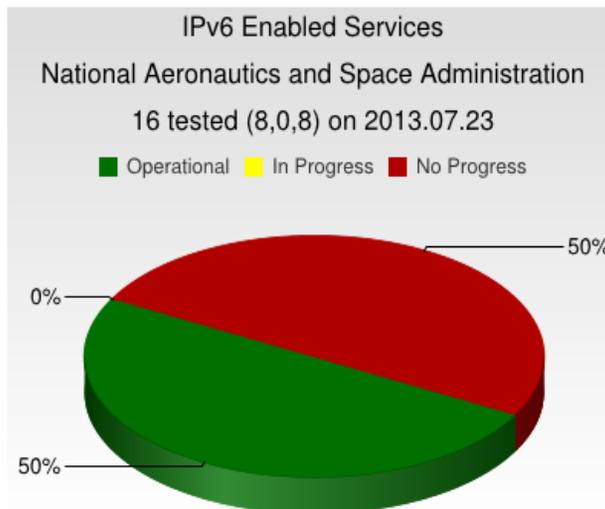
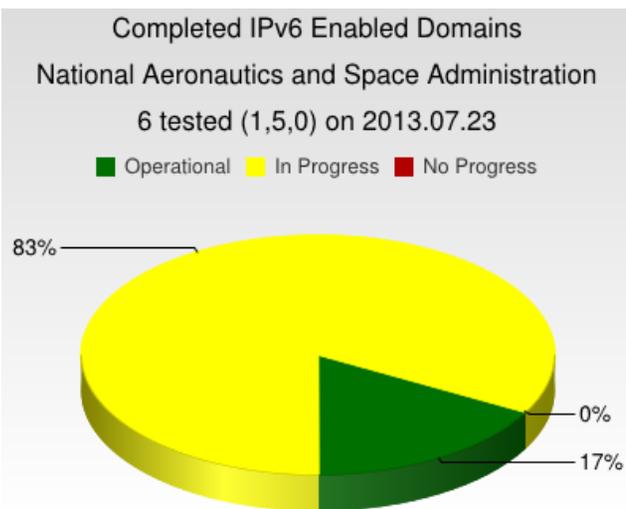


NIST Deployment Monitor

■ NIST Fev6 Deployment Monitor – NASA Status

<http://usgv6-deploymon.antd.nist.gov/cgi-bin/cfo?agency=nasa>

Domain	Organization	DNS	Mail	Web	DNSSEC
gov.globe.	National Aeronautics and Space Administration	[4] 2/0/2 [0]	[1] 0/0/0 [0]	[1] 0/0/0 [I]	S/V/C
gov.km.	National Aeronautics and Space Administration	[3] 3/0/3 [0]	[0] 0/0/0 [-]	[2] 2/2/2 [0]	S/V/C
gov.nasa.	National Aeronautics and Space Administration	[3] 3/0/3 [I]	[6] 6/0/6 [I]	[8] 0/0/0 [0]	S/V/C
gov.nswp.	National Aeronautics and Space Administration	[3] 3/0/3 [0]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	S/V/C
gov.scijinks.	National Aeronautics and Space Administration	[3] 3/0/3 [0]	[3] 0/0/0 [0]	[1] 0/0/0 [0]	S/V/C
gov.usgeo.	National Aeronautics and Space Administration	[3] 3/0/3 [0]	[1] 0/0/0 [I]	[1] 0/0/0 [I]	S/V/C





NASA Public Websites

- What is a public website?
 - » A website whose audience is intended for the general public
- NASA has a database of websites and applications
 - » Attempted to validate data integrity of database
 - » Best source of public websites
- Used the public website database information to create the IPv6 Tracker
 - » A sharepoint site that has list of public websites per center
 - » A mirror excel spreadsheet enables us to report status
 - » An automated approach would have been much better



FY2012 Mandate Status

- NASA has about 1000 public websites to be implemented as part of the FY2012 mandate
 - » Multiple centers are complete and some are near completion
 - » NASA, however, is less than 30% complete overall

												Agency Totals	
116	2	127	382	95	58	52	100	31	15	12	42	1032	Total # Identified Sites
9	2	0	47	95	1	5	47	31	14	12	35	298	Total # Dual Stack
107	0	127	335	0	57	47	53	0	1	0	7	734	Total # IPv4 Only

8%	100%	0%	12%	100%	2%	10%	47%	100%	93%	100%	83%	29%	Total Percentage Completed
TBD	Complete	TBD	9/30/14	Complete	1/31/14	TBD	TBD	Complete	TBD	Complete	TBD	9/30/14	



Training

- NASA IT community needed IPv6 training but there were limited training funds
- Conducted Agency IPv6 Training sessions and webinars
- Shared information about IPv6 conferences, webinars, Fedv6 Working Group/Sub Team presentations
- Training is very important, but it is also critical to have IPv6 labs or environments to test and verify concepts
 - » NASA has a lab that is available to the centers to test IPv6
- Utilize “best value” instead of “lowest bidder” and check certifications, trainer history, etc



Security Operation Center

- NASA has a Security Operations Center (SOC) and even though they communicated IPv6 requirements well in advance of the FY2012 mandate, vendors were still struggling to enable IPv6 at the deadline
- Agency made a decision that we would not go forward with implementing IPv6 until the SOC was capable of monitoring IPv6
- Updates were only made to latest version of the IDS equipment
 - » At the time, only two centers had the latest version of IDS
 - » Workaround: Re-route backbone IPv6 traffic to the two centers capable of monitoring IPv6
- So as we were supposed to be wrapping up with the 2012 mandate, we were really just getting started



Vendor Issues

- Some vendors promised implementation by September 30, 2012 ... NOT prior!
- Formally request IPv6 requirements in writing!
- Often were told we were the only ones requesting IPv6
- Vendors pointing the finger at each other
- Release dates for fixes continued to slip
- Vendors trying to develop an internal business case to implement IPv6
- No estimated completion date on when they will support IPv6
- Vendors offering IPv6 OR something...



IPv6 Address Assignments

- We spent an enormous amount of time planning the IPv6 address assignments
 - » Discussions went on so long we ultimately only distributed the public IPv6 addresses
 - » Intranet address space allocations are still in the works
- During this time the team managing this effort was in the process of evaluating products for an enterprise DHCP/DNS/IPAM (DDI) upgrade
 - » DDI upgrade is nearly complete
 - » New product will provide additional IPv6 capabilities
 - » Centers that have transitioned are still getting used to the new product



Other Challenges

- Equipment Replacements: Firewalls, Load Balancers, etc
- OS updates: Routers, Servers, etc.
- Public Servers Issues:
 - » Relocating Public Servers
 - Moving them into DMZ or datacenters
 - Moving them onto the new agency Web Services contract
 - Re-architecture of web solution
 - » Servers supporting both public & internal services (e.g. Virtual Desktop Infrastructure (VDI))
- Data center/cloud service providers



FY2014 Goal Planning

- Working through issues that are not inherently IPv6 issues, but that are going to have major impact to IPv6 implementation
 - » D-DHCP
 - » Security Zones



D-DHCP

- While the “D” in DHCP stands for “dynamic,” many current implementations use manual reservations and MAC pools
- IPv6: Automation is needed due to increased complexity
 - » NASA clients to be IPv6-enabled by 30 SEP 2014
 - » Implementations to begin as early as 01 JAN 2014
- Standardize to increase operational efficiencies, reduce costs, increase security
 - » Wide range in implementation approaches – every center is different
 - » Reduce reliance on manual processes, which are labor-intensive, error-prone, and can be defeated by stealthy tactics
 - » Improve time to service for end users (new seats, refreshes)
 - » Streamline implementation of new services (e.g., BYOD, VoIP)



D-DHCP Status

- All centers running D-DHCP for wireless
- For wired
 - » Three centers with D-DHCP
 - » Two with M-DHCP, with one planning to migrate to D-DHCP
 - » Rest have no DHCP implemented for wired
- Significant effort and planning still ahead to implement D-DHCP for IPv4, not to mention for IPv6
- Initial presentation was made to Center Security Officers, but next steps are still in the works
- Security officers appear to be most concerned with tracking of hosts



TIC & Security Zones

- Trusted Internet Connection (TIC) – a Federal security initiative with the goal of consolidating external connections into specified TIC locations and establishing standard monitoring requirements across the Federal government
 - » NASA manages five TIC locations
 - » Enabling IPv6 in TIC locations
- Security Zone Definitions – An attempt to define security definitions that can be applied enterprise wide
 - » Public & Science – defined & allocated
 - » Intranet – defined & allocation will occur soon
 - » Extranet – undefined



Next Steps

- Continue to work on completing the FY2012 mandate
 - » Sites that are on the NIST Deployment Monitor
 - » ~1000 public websites
 - » Target completion date is September 30, 2014
- Planning for implementation of FY2014 mandate
 - » Assigning intranet IPv6 address space to centers
 - » Enabling D-DHCP across the centers
 - » Establishing new security monitor techniques where necessary
 - » Tracking applications



Questions?





Reference Materials

- OMB September 28, 2010 Memo

<http://www.cio.gov/documents/IPv6MemoFINAL.pdf>

- OMB August 2, 2005 Memo

<http://www.whitehouse.gov/sites/default/files/omb/memoranda/fy2005/m05-22.pdf>

- USGv6 Profile:

<http://www-x.antd.nist.gov/usgv6/index.html>

- IPv6 Ready:

<https://www.ipv6ready.org/>

- NIST Fedv6 Deployment Monitor

<http://fedv6-deployment.antd.nist.gov/>

- Trusted Internet Connection (TIC):

<https://www.dhs.gov/trusted-internet-connections>



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