

# **Meeting the OMB FY2012 Objective: Experiences, Observations, Lessons-Learned, and Other Thoughts**

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# Introduction

- Experiences, lessons-learned, and perspectives from 13 years of active Internet Protocol version 6 (IPv6) deployment in United States (US) Government networks
- The US Government has tried various incentives and mandates (2008, 2012, and 2014)
  - Some fail, some do help. Why?
  - What are some good incentives and mandates?
- What are the keys to making progress on IPv6 deployment?
  - What works?

# Key Factors to Success

- Have the right mindset or worldview, and the correct paradigms
- Have a corporate IPv6 culture with proper vision and leadership
- Keep it simple
- Employ good mandates and incentives
- Measure and share progress

# Incorrect Mindset or Worldview

- Experience has shown that most organizations that plan to deploy IPv6, or IPv6-enable their products, initially have an incorrect mindset on how to get there
- Typical errors in thinking:
  - “What’s the business case or Return on Investment (ROI) if I spend money and effort on deploying IPv6 now?”
  - “How can I charge more money for IPv6, since it is a feature?”
  - “I can’t do IPv6, because things will break when I turn off IPv4”
  - “I can’t do IPv6, because it costs too much. It is not a high-priority”
  - Thinking that you need to be conservative with IPv6 addresses, like we have been with IPv4

# Proper Mindset, Worldview

- What is it you are trying to do?
  - Add full support for IPv6 everywhere in your network and your products and services, wherever you have IPv4 today, and continue to support IPv4 in parallel for the next decade or more. You will know when and where to shut off IPv4, so don't worry about it now
- Why are you doing this?
  - The future of the Internet is at stake. It cannot grow without ubiquitous IPv6. You are part of the “ubiquitous”
  - If we don't get on with it, bad things will happen, Carrier-Grade Network Address Translation (NAT) (CGN), for example

# Proper Mindset, Worldview (continued)

- What is the business case for IPv6?
  - There is no early return on investment
  - The benefit is long-term
  - If you don't deploy IPv6, you will eventually lose business, or go out of business

# Proper Mindset, Worldview (continued)

- What will it take in time and resources?
  - You have a choice:
    - Use normal technical refresh cycles to roll-out IPv6, over 5+ years at almost no extra cost
    - Wait until it is really necessary or mandated, then do it quickly at very high-cost (think “forklift upgrades”)
  - **Lesson:** If you haven’t started yet, you are probably too late to take the inexpensive path. Delaying any longer will just make it worse

# Culture, Vision, Goals

- Successful enterprise IPv6 deployments require:
  - Clear vision and goals, set and communicated from the top (CIO/CEO)
  - One or a few individuals leading the charge, in a full-time role
  - Information Technology (IT) staff must be enabled (given authority) to make it happen
  - Whole organization (everyone involved in IT) must embrace an IPv6 culture
  - Status and progress must be measured and published
- It is much more than just an Internet Protocol (IP) networking issue

# Keep it simple

- Common problem:
  - Agencies can get bogged down in years of planning, before passing a single IPv6 packet
    - It is mostly a waste, because they have the wrong mindset and worldview and are thinking IPv4 paradigms (address conservation, for example)
  - Agencies can be overwhelmed by not knowing what to do or where to start
- A simpler approach:
  - (for FY2012 objective): Can you get to my website via IPv6? If not, fix that
  - (for FY2014 objective): Can my users get a good score at <http://test-ipv6.com>? If not, fix that

# A problem with addressing plans

- Everyone makes the same common mistakes
- It comes from “IPv4 thinking”
  - It is pretty much guaranteed to take at least 3 major iterations to get it right
- Agencies have acquired Provider-Independent (PI) address allocations, and have assumed Local Internet Registry (LIR) responsibilities for their smaller bureaus
  - Who is validating their respective IPv6 addressing plans regarding the FY2012 objective, and impact to their FY2014 efforts?

# Dealing with your suppliers

- Profiles like the National Institute for Standards and Technology United States Government version 6 (USGv6) and Réseaux IP Européens (RIPE)-554 documents are important, but not necessarily sufficient. HPCMP also does the following:
  - Before considering products and services from any provider, ensure their corporate website is IPv6-enabled
  - If website is not IPv6-enabled, it is an indication that there is no corporate commitment to IPv6, and we probably don't want their products, so stop considering them until they fix this
  - Avoid products where the provider does not “eat their own dog food”
  - Evaluate (Test) all products in a production scenario
  - Include full IPv6 support in all contracts
- There are many examples where this really works

# Deploy “Native” IPv6

- It is a common misunderstanding that native IPv6 implies IPv6-only (turning off IPv4)
  - We can’t turn off IPv4, yet
- When we say “native”, we mean:
  - Not translated
  - Not tunneled
- “Native” is really short for “native end-to-end”
  - The goal is to have communications paths where IPv6 packets are transported “natively” from client to server (end-to-end), without going through translators (like today’s NAT devices), and without being “tunneled” inside IPv4 networks

Saltzer, J. H., D. P. Reed, and D. D. Clark (1981) "End-to-End Arguments in System Design"

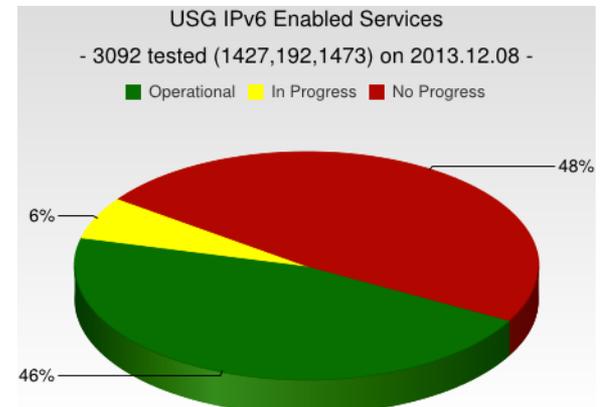
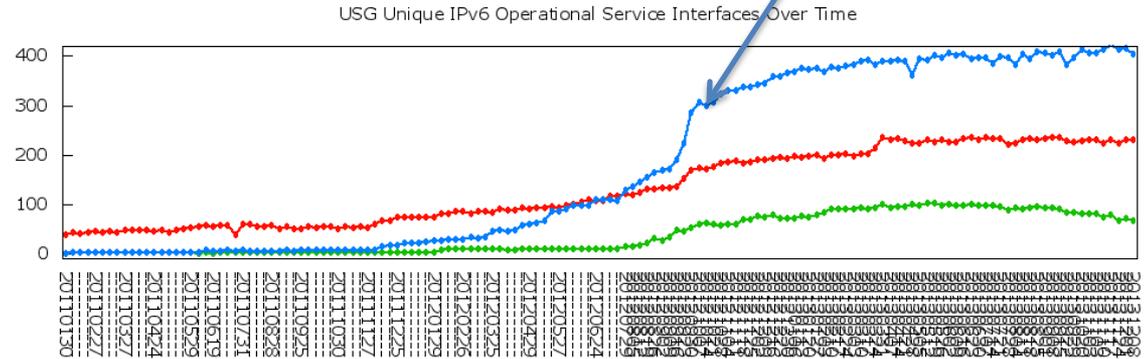
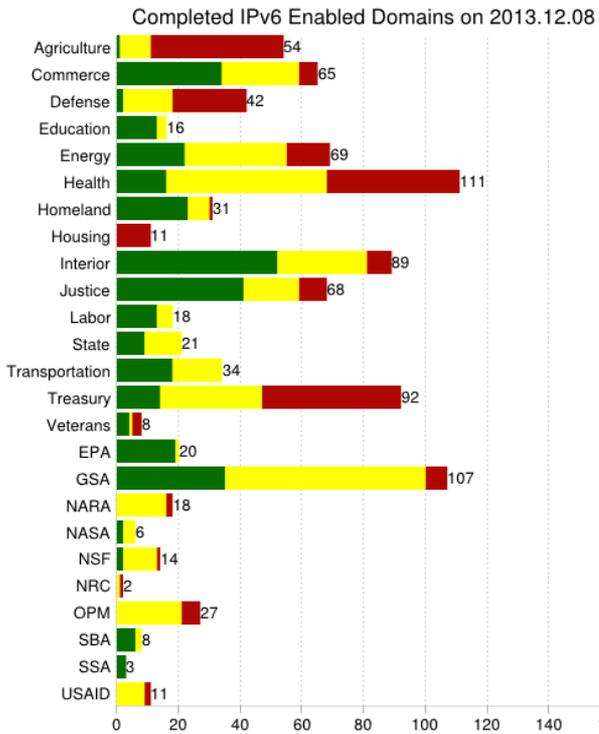
# Do mandates help?

- Yes, sometimes, to some degree
- US Government experience:
  - FY2008 mandate – failed (due to lack of follow-through)
  - FY2012 mandate – 38% successful to date
  - FY2014 mandate – little progress to date – more challenging to measure success
- World efforts – highly successful
  - World IPv6 Day on June 8, 2011
  - World IPv6 Launch on June 6, 2012

# US Government IPv6 Status

- NIST IPv6 Deployment Monitor

**FY2012 objective**



# Observations and Questions

- Why did much of the change come right before the deadline?
  - Incentives work
- If these metrics show only 46% completion, does this indicate a failure to meet the goal?
  - No
- After the FY2012 objective, what incentive is there to...
  - Leave things turned on?
  - Continue making progress on the other 54%?

# Interpreting the results

- “Red” doesn’t mean “no progress”
  - To get to “green”, you had to plan, procure, contract, train, test, install, and configure for IPv6 deployment
- By the FY2012 deadline:
  - ~800 domains made some progress
  - ~1200 unique public .gov services are IPv6-enabled
  - ~30% of public web .gov sites monitored are IPv6-enabled

# Success?

- Yes, this was a huge success:
  - A significant increase in demand signal from the US Government to industry, to deliver IPv6 services
    - Much harder to ignore or give low-priority to IPv6-customer requirements
    - Explodes the myth that “nobody is asking for IPv6”
  - A huge increase in IPv6 awareness in the US Government agencies
    - People holding workshops, getting training, working with their providers, etc.

## Success? (continued)

- Numerous commercial products have been conformance and interoperability tested
  - <http://www-x.antd.nist.gov/usgv6/products.html>
- A lot of public US Government content is becoming IPv6-enabled
  - Being part of the solution, rather than the problem
  - Setting an example and paving the way for the rest of the public sector
- But we MUST keep pressing forward on the remaining 49% where there is no progress
  - What are you doing to incentivize your own organization?
    - DREN as an example

# Concerns about security

- Most IPv6 security issues are no worse than IPv4
- One real IPv6 security concern has been lack of implementation maturity
  - The code is very new and we haven't found all the bugs yet
  - But this is improving quickly
- Example: (a total network failure)

# Role of Government

- US Government organizations can make a difference
  - Large consumers of information technology and services, and large enough to influence industry to make products and services fully IPv6-capable
  - Can set a good example for others to follow
  - If they are not part of the solution, they are part of the problem

**END**

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