AUSPEX TECHNOLOGIES

DISCOVER THE TRUE VALUE OF TECHNOLOGY

Federal IPv6 Training Overview

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Dale Geesey
Chief Operating Officer
Auspex Technologies, LLC
Phone: 703.319.1925
Fax: 866.873.1277
E-mail: dgeesey@auspextech.com
Web: www.auspextech.com

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Agenda

- 1:00 – 1:50 **Introduction to IPv6**
  - » History
  - » IPv6 Protocol Overview
  - » World Deployment Status
- 1:50 – 2:00 **Break + Q&A**
- 2:00 – 2:50 **Federal IPv6 Transition**
  - » Federal IPv6 Transition History
  - » Federal IPv6 Transition Policy & Guidance
  - » IPv6 Requirements in the FAR
- 2:50 – 3:00 **Break + Q&A**
- 3:00 – 3:50 **NIST USGv6 Program**
  - » USGv6 Profile
  - » USGv6 Testing Program
  - » Federal IPv6 Transition Progress Measures
- 3:50 – 4:30 **Q&A**

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INTRODUCTION TO IPV6

Introduction to IPv6: Learning Objectives

- Identify issues that led to the creation of IPv6
- Explain steps taken to extend the life of IPv4
- Describe at least two difference between IPv4 and IPv6
- Explain the value of extension headers
- Identify three network operators with significant IPv6 deployments

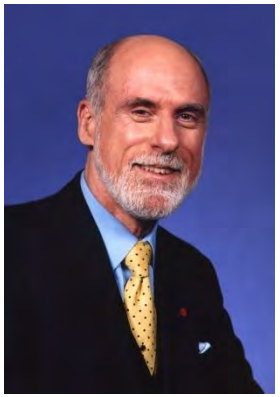
History

INTRODUCTION TO IPV6

The Internet Protocol: A Historical Perspective

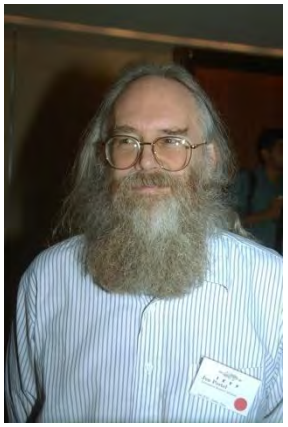
Len Kleinrock
"Packet Switching"
Theory

Larry Roberts
ARPANET



Vint Cerf
TCP/IP

Bob Kahn
TCP/IP



Jon Postel
DNS,
Addressing,
& Port Numbers

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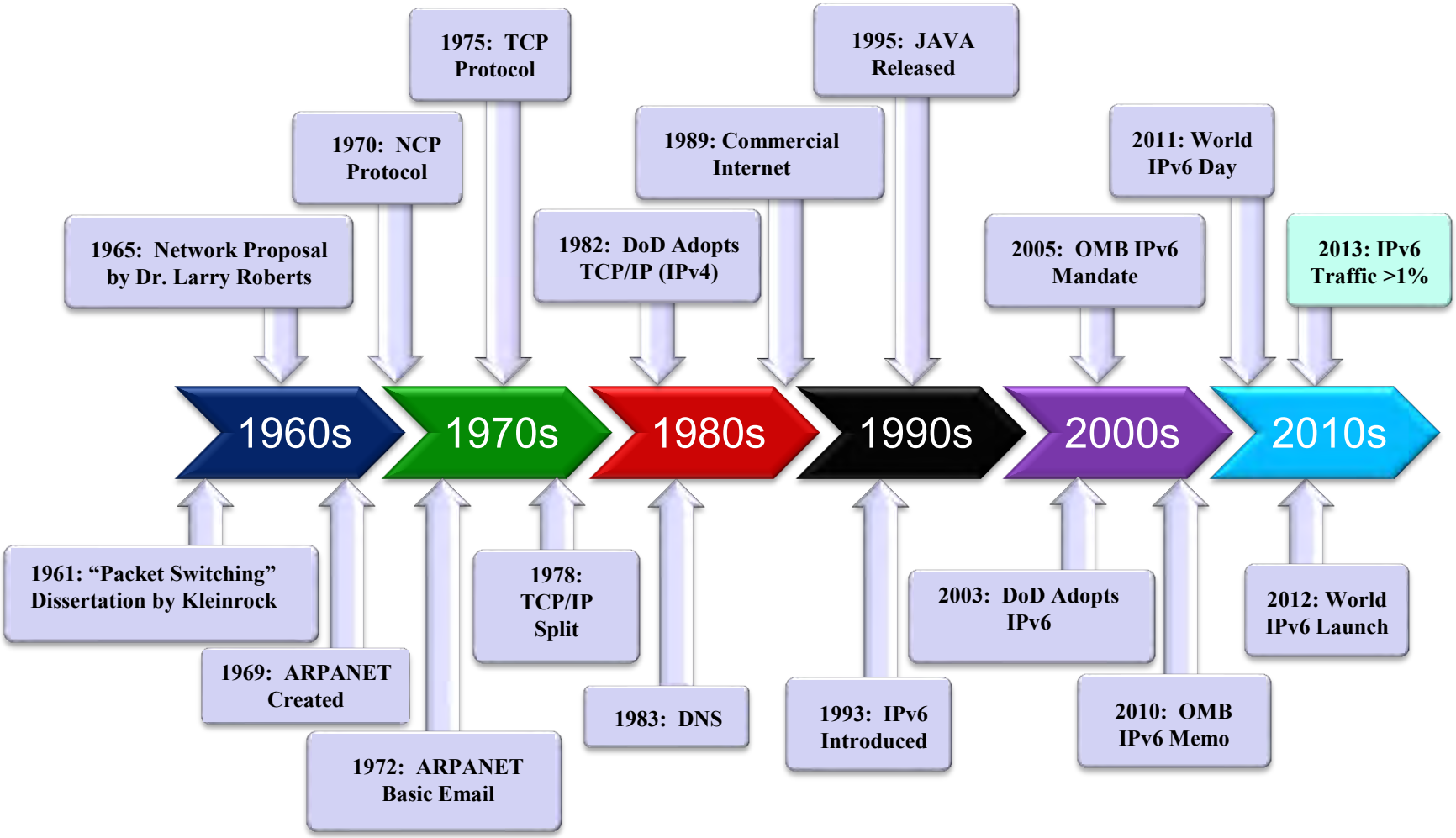
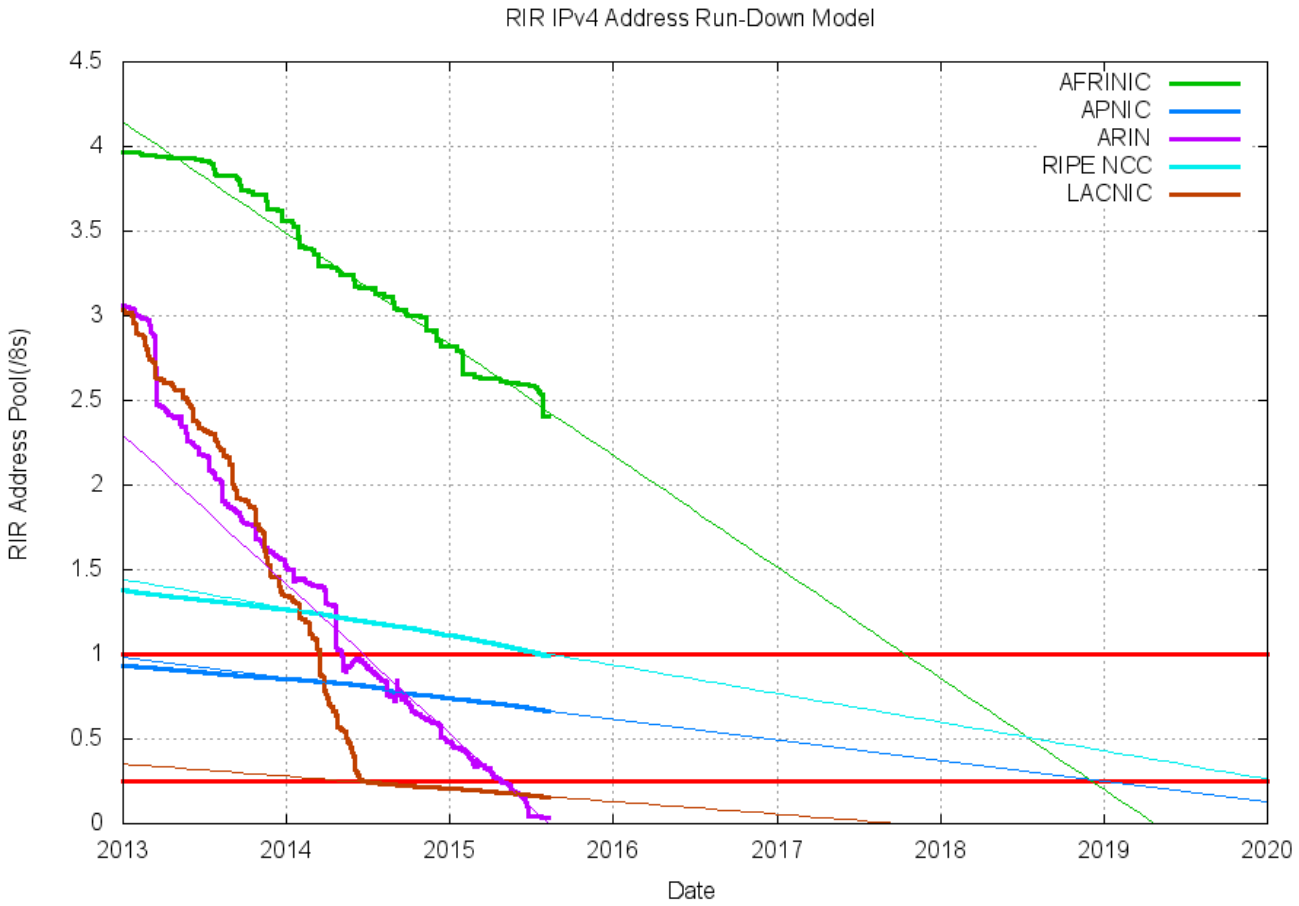
Packet Switching Timeline



IPv4 Degradation

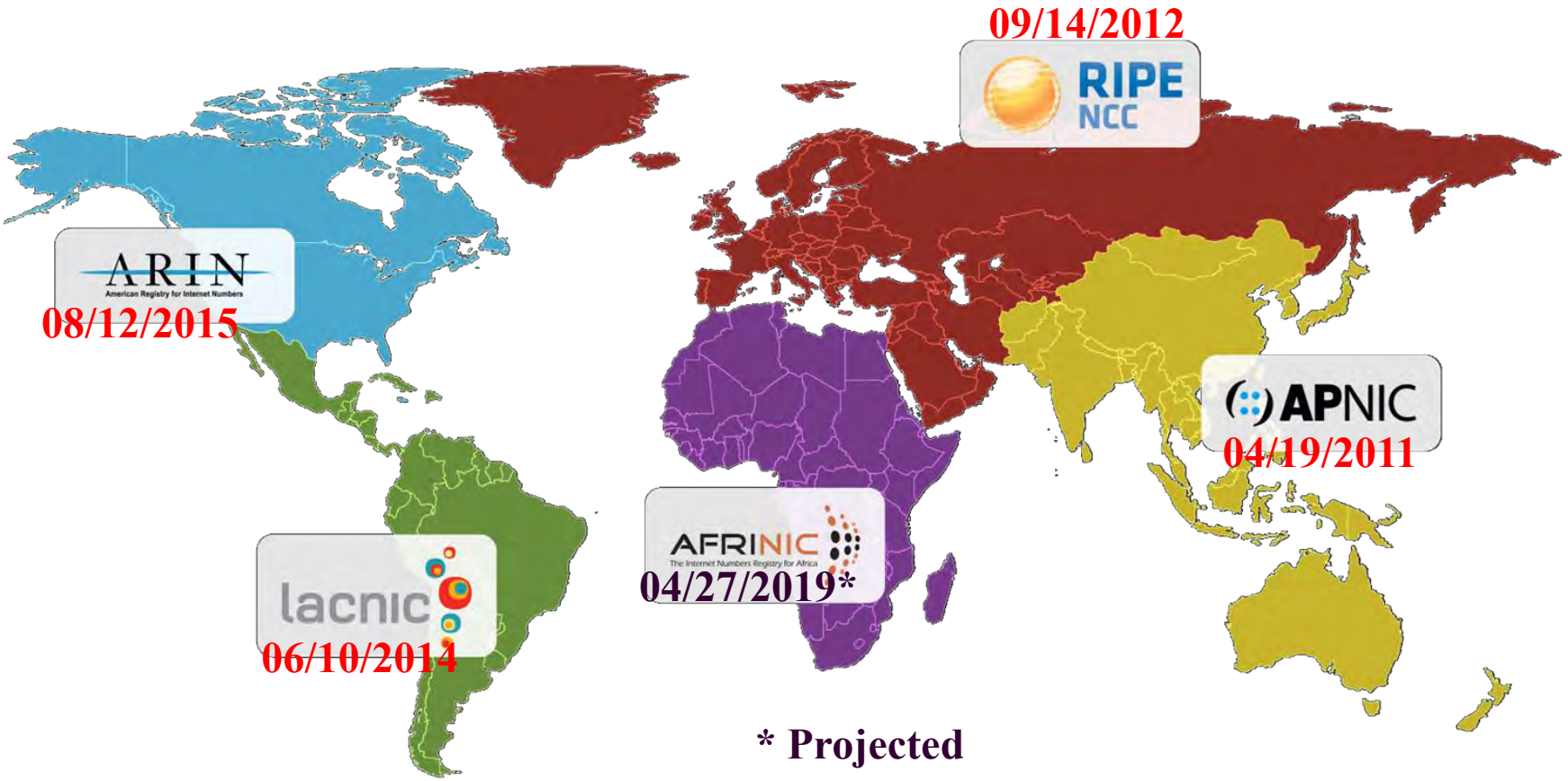
- IPv4 addresses have run out
  - 4.9 Billion devices currently on the Internet
  - 25+ Billion devices on the Internet by 2020 (Gartner)
  - Not enough addresses to support advanced applications
  - The U.S. is just now becoming a broadband society
- Many steps taken to alleviate the problem
  - Dynamic Addresses (DHCP)
  - Classless Addressing (CIDR)
  - Network Address Translation (NAT)
  - Strict addressing programs

Regional IPv4 Address Run-Down Model



*** Source: www.potaroo.net**

IPv4 Exhaustion Dates



Lost Promises of The Internet

- Ubiquity
- Peer-to-Peer Communication Model
- Transparency
- Dynamic Routing
- Unique & Stable Addresses
- Address Aggregation

IPng: Requirements

RFC 1550 - IP: Next Generation (IPng) White Paper Solicitation

- Scalability
- Timeframe
- Transition & Deployment
- Security
- Configuration, Administration, and Operation
- Mobile Hosts
- Flows & Resource Reservation
- Policy-Based Routing
- Topological Flexibility
- Support of Communication Media

IPng: Selection

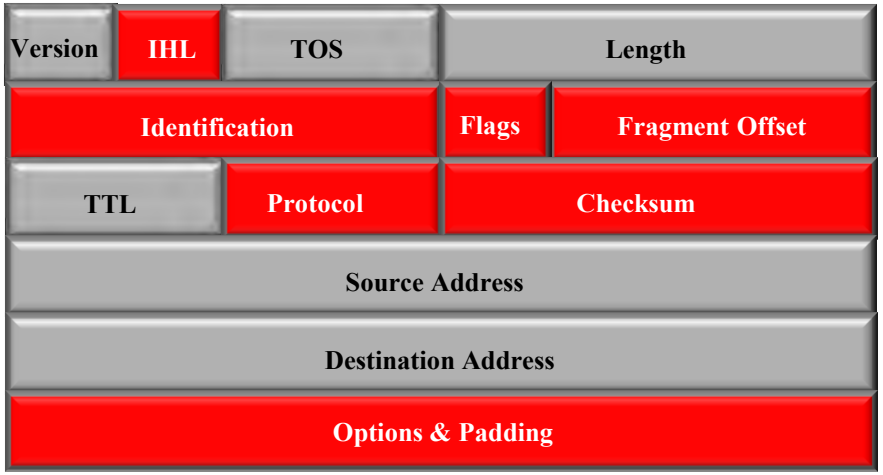
- SIPP Selected
  - RFC 1752 (1995)
  - Met Most Requirements
  - Similar To IPv4
  - Designated IPv6
    - Initial confusion resulted in first designating it "IPv7"
- IPv6 Base Protocol
  - RFC 1833 in 1995
  - RFC 2460 in 1998 (makes 1833 obsolete)

Criteria	CATNIP	SIPP	TUBA
Complete Specification	No	Yes	Mostly
Simplicity	No	No	No
Scale	Yes	Yes	Yes
Topological Flexibility	Yes	Yes	Yes
Performance	Mixed	Mixed	Mixed
Robust Service	Mixed	Mixed	Yes
Transition	Mixed	No*	Mixed
Media Independence	Yes	Yes	Yes
Datagram	Yes	Yes	Yes
Configuration Ease	Unknown	Mixed	Mixed
Security	Unknown	Mixed	Mixed
Unique Names	Mixed	Mixed	Mixed
Access to Standards	Yes	Yes	Mixed
Multicast	Unknown	Yes	Mixed
Extensibility	Unknown	Mixed	Mixed
Service Classes	Unknown	Yes	Mixed
Mobility	Unknown	Mixed	Mixed
Control Protocol	Unknown	Yes	Mixed
Tunneling	Unknown	Yes	Mixed

IPv6 Protocol Overview

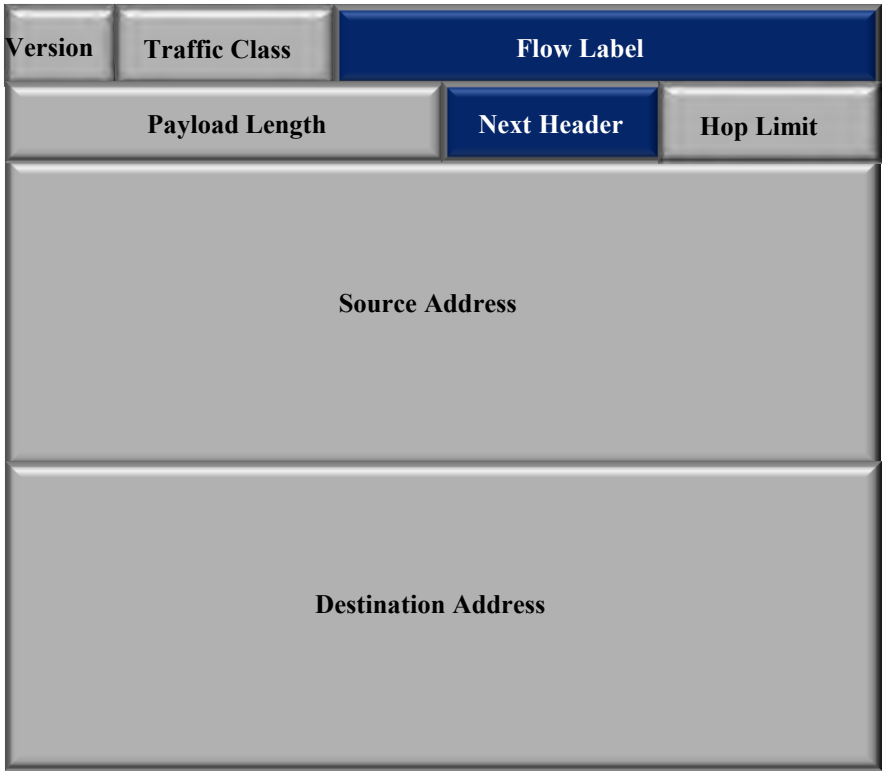
INTRODUCTION TO IPV6

IPv4 Header vs. IPv6 Header



~ 20 Bytes (No Extensions)

- Version (4)
- IHL – Header Length
- TOS – Type of Service
- Length – Size of Datagram
- Identification
- Flags – Fragmentation Flags
- Fragment Offset
- TTL – Time to Live (hops)
- Protocol – Transport Protocol
- Checksum – 16 bit Checksum
- Source Address
- Destination Address
- Options and Padding



40 Bytes
Extensions

IPv4 vs. IPv6: Functions & Features

Function / Feature	IPv4	IPv6
Address Space	32 Bit	128 Bit
Networks	Shared (32 Bit)	1.85 X 10^{19} (64 bits)
Hosts	Shared (32 Bit)	1.85 X 10^{19} (64 bits)
Header	~ 20 Bytes	40 Bytes
Extensible (Future Growth)	No	Yes
Host Auto-Configuration	Yes (DHCP)	Yes
Router Neighbor Discovery / Auto-Configuration	No	Yes
Security	IPSec Compatible	IPSec (Should)
Multicast	Yes	Yes
Anycast	No	Yes
Mobility	Possible w/ Routing Δ	Yes
Flow labels	No	Yes
Automatic Fragmentation	Yes	Only If Requested
DNS Record	A	AAAA

IPv4 vs. IPv6: Addressing

DISCOVER THE TRUE VALUE OF TECHNOLOGY

IPv4

- 32 Bit Address Field
  - 4.294 X 10^9 Addresses
  - Shared Net & Host Identifier
    - Subnet-able
  - Typical Allocation:
    - ISP: /24
    - Business: /30
    - Individual: /32

IPv6

- 128 Bit Address Field
  - 3.4 X 10^{38}
  - Net & Host Identifier (Each):
    - 64 Bits: 1.85 X 10^{19}
  - Typical Allocation
    - ISP: /32 or larger
    - Business: /48
    - Individual: /48 or /56
  - Micro-allocation:
    - /32 = 2^{32} or

      4.294 X 10^9 Nets (1 Internet)

Domain Name Service (DNS)

- An Internet service that translates domain names into IP addresses and vice versa
- Domain names are easier to remember, but Internet routing requires an IP address
- IPv4
  - A Record (IPv4 Address)
  - Associates a domain name with a 32-bit IPv4 address
- IPv6 DNS
  - AAAA or Quad-A Record (IPv6 Address)
  - Associates a domain name with a 128-bit IPv6 address
  - The four “A”s (“AAAA”) are a mnemonic to indicate that the IPv6 address is four times the size of the IPv4 address

* RFC 3596 is the DNS Standard

IPv6 Features & Functions: Potential Benefits

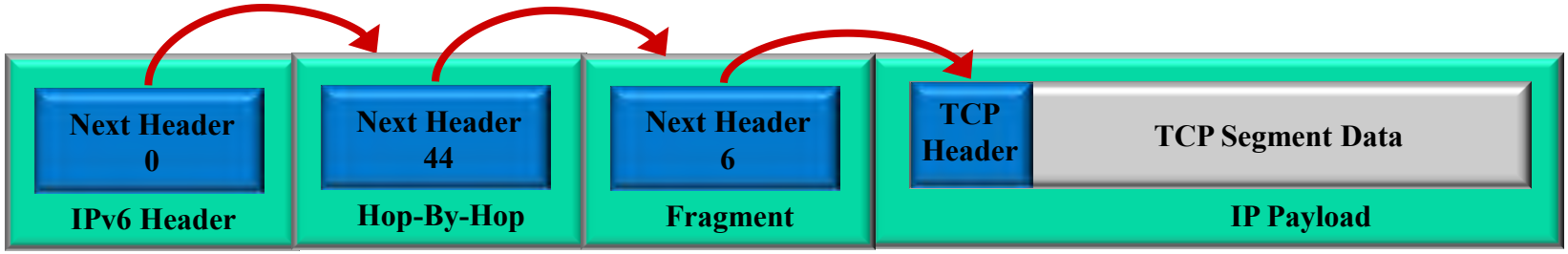
Core Feature / Function	Capability	Benefit
Expanded Address Space	3.4 X 10^{38} Addresses	- Everything uniquely addressable with virtually unlimited resources for everyone - A single enterprise can have multiple addressing plans
	Multiple Addresses Per Interface	- Multiple logical network topologies over common infrastructure - Multi-service platforms with unique IP addresses per service
Simplified Header	40 Byte Fixed Length	- Enhanced routing and switching performance - Improved "hardware-based" processing, e.g. encryption
Extension Headers	Extensible & Flexible Protocol	- Augmentation of the protocol and evolutionary enhancements
Authentication & Privacy	IPSec	- End-to-end information assurance, including authentication, security, and attribution

IPv6 Features & Functions: Potential Benefits

Core Feature / Function	Capability	Benefit
Auto-Configuration	Controlled Configuration	- Defined criteria for local address allocation with access limitations - Defined criteria for global access via a globally unique address
	Router Neighbor Discovery	- Router neighbor identification and configuration - Rapid, Dynamic Network Configuration
	Network Mobility	- Mobile and ad-hoc routing for translating networks and sensor-based networks
Optimized Routing	MTU Discovery	- Optimized packet sizing for data and multimedia - Streamlined utilization of infrastructure resources
	Multicast	- Improved multicast functionality and performance
	Anycast	- New anycast mechanism for data and resource identification and acquisition
Flow Labels	Header Labels	- Router, node, host, or application-based flow handing - Improved quality and priority

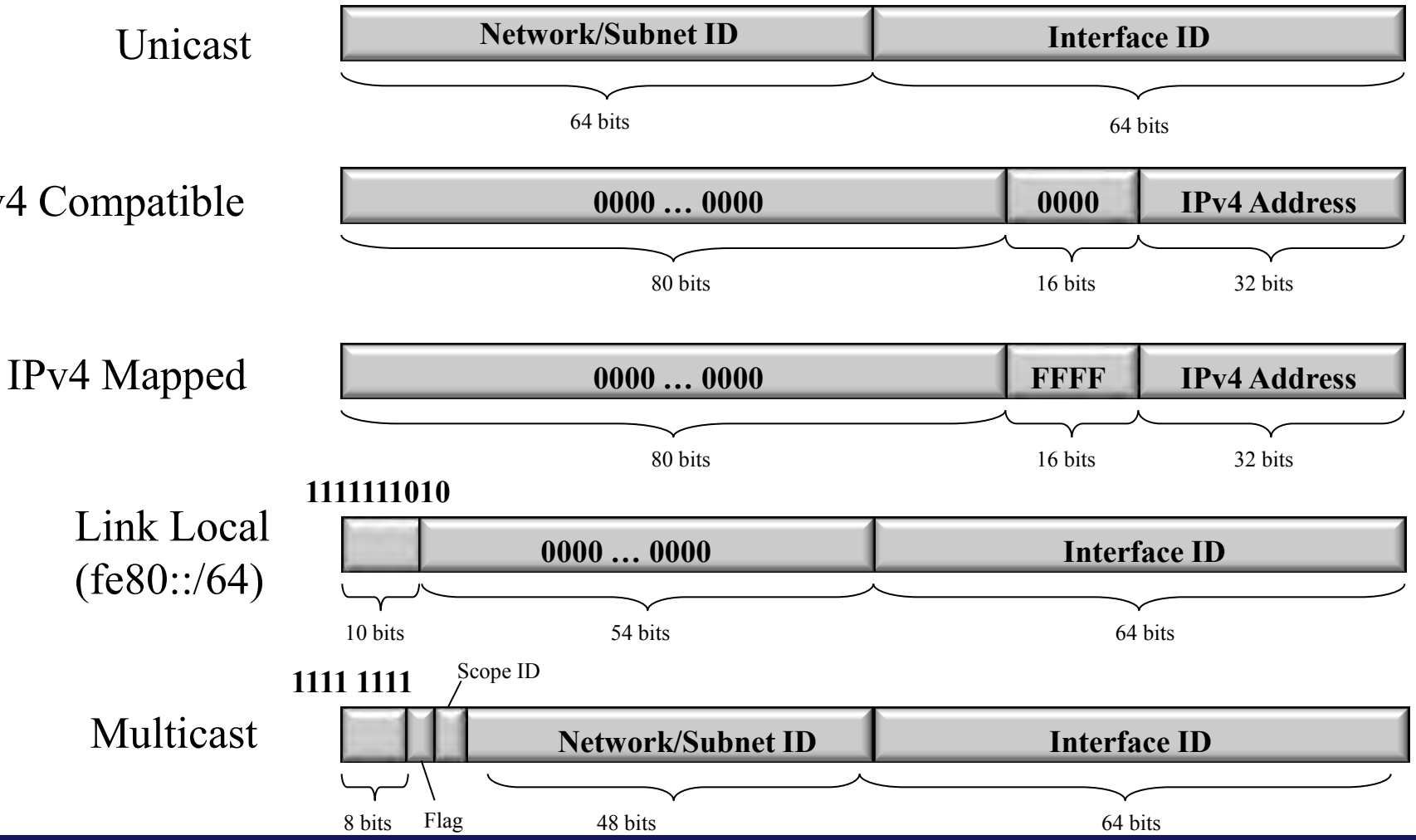
Extension Headers

IPv6 Packet With No Extension Headers (Next Header = 6)



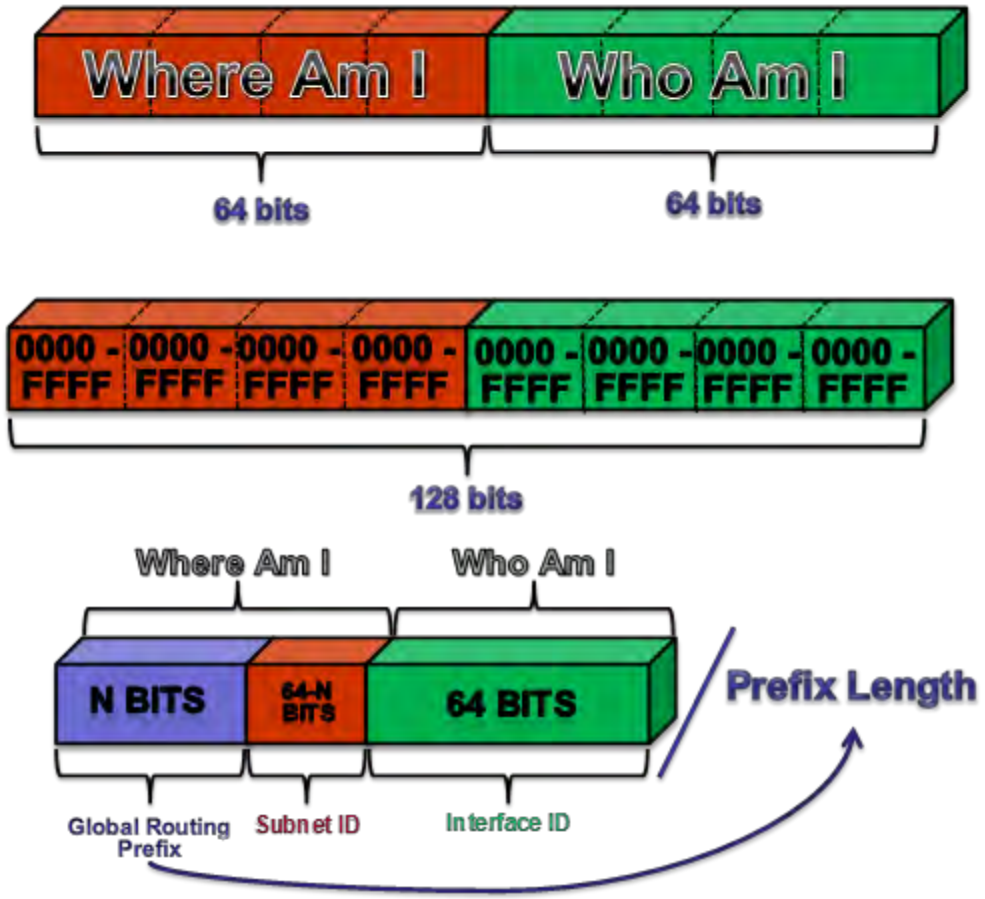
IPv6 Packet With Two Extension Headers

IPv6 Address Types



IPv6 Addressing Format

- Many ways to write the same IPv6 address
- "::" can be used once to compress consecutive 0's
- Same
  - 2001:0DB8:0000:0000:0000:0000:0000:0001
  - 2001:DB8:0:0:0:0:0:1
  - 2001:DB8::1
- Same
  - 2001:DB8:0:0:FFFF:0:0:1
  - 2001:DB8::FFFF:0:0:1



Auto-Configuration

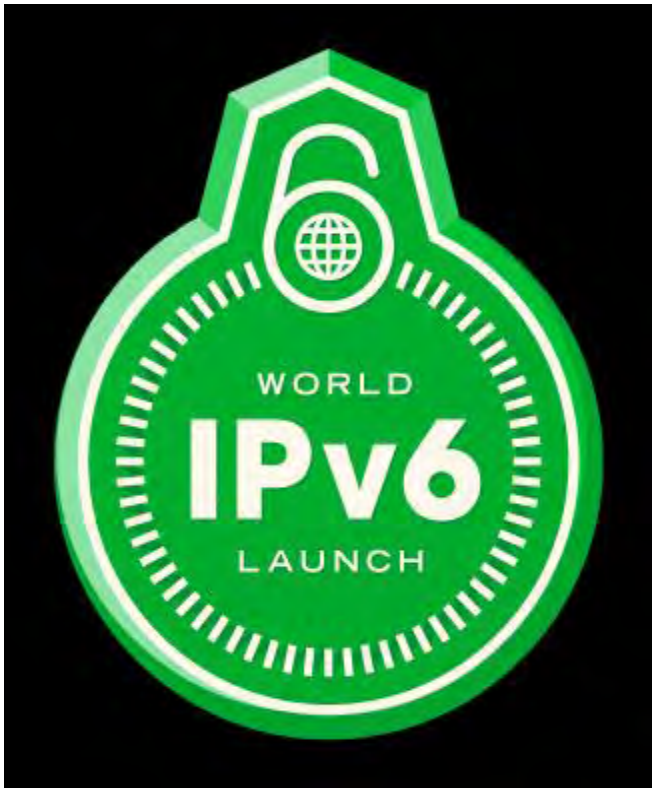
- Host Auto-configuration
  - Server Based (stateful/DHCPv6)
  - Non-Server Based (stateless)
- Network/Host Automatic Renumbering
- Stateless Auto-configuration
  1. Link-Local Address Generation
  2. Link-Local Address Uniqueness Test
  3. Link-Local Address Assignment
  4. Router Contact
  5. Router Direction
  6. Global Address Configuration

World Deployment Status

INTRODUCTION TO IPV6

World IPv6 Launch June 6, 2012

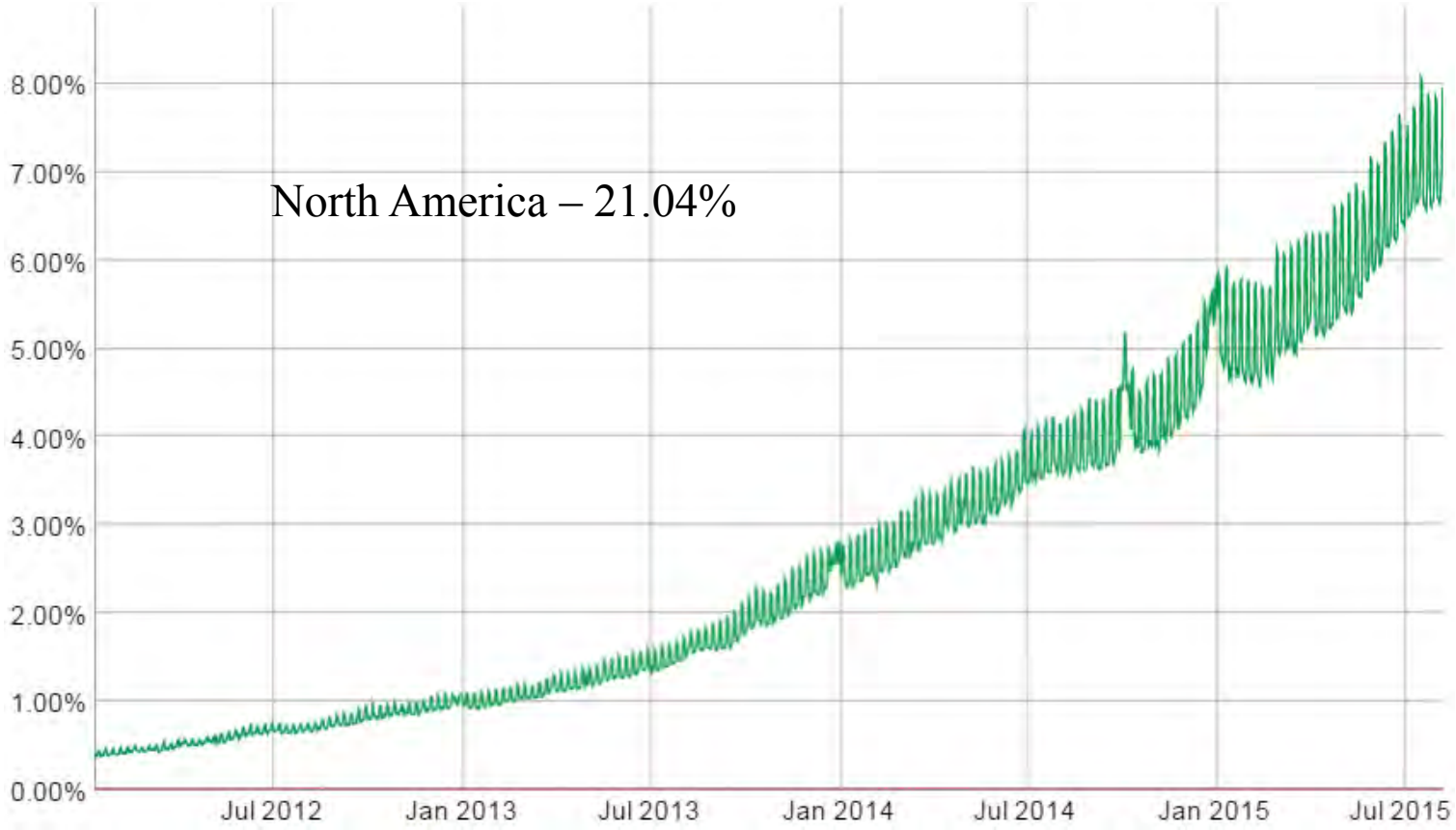
- Participation
  - Websites = 2,608
  - Network Operators = 63
  - Home Router Vendors = 4
  - USG Sites = 20
- USG Domains using IPv6 = 130
  - http://usgv6-deploymon.antd.nist.gov/cgi-bin/generate-all.www
- Measurements
  - ISOC: http://www.worldipv6launch.org/measurements/
  - Akamai: http://www.akamai.com/ipv6
  - Google: http://www.google.com/intl/en/ipv6/statistics/



World IPv6 Launch Latest Metrics

Network	% IPv6 Traffic	Network	% IPv6 Traffic	Network	% IPv6 Traffic
Louisiana State University	78.78%	University of Buffalo	51.74%	Time Warner Cable	20.10%
Google Fiber	71.77%	University of Pennsylvania	49.38%	US Dept of Transportation	18.75%
Verizon Wireless	70.27%	University of Minnesota	47.86%	KDDI	17.59%
T-Mobile USA	57.55%	Cisco	41.59%	University of Iowa	17.37%
Rensselaer Polytechnic Institute	57.64%	Comcast	39.24%	DREN	9.68%
Virginia Tech	56.93%	CloudFlare, Inc.	33.30%	Georgia Institute of Technology	6.44%
SPAWAR	56.74%	Tulane University	29.34%	SoftBank BB	3.25%
ATT	52.10%	Deutsche Telekom AG	28.31%	Sprint Wireless	3.15%
University of South Florida	51.88%	Hurricane Electric	26.71%	AT&T Wireless	2.46%

Google IPv6 End-User Tracking (Global)



http://www.google.com/intl/en/ipv6/statistics/

Akamai IPv6 Ranking

Rank	IPv6 %	Network
1	38.3%	Comcast Cable
2	35.6%	AT&T Communications Americas
3	72.6%	Verizon Wireless
4	18.6%	Time Warner Cable Inc.
5	23.7%	Deutsche Telekom (formerly T-Systems USA, Inc.)
6	45.7%	T-Mobile
7	8.4%	Virtua - DH&C datacenter(TIVIT (formerly Optiglobe Brasil))
8	21.3%	Telefonica Del Peru
9	22.5%	Proxad/Free
10	46.8%	Kabel Deutschland

Rank	IPv6 %	Country
1	34.8%	Belgium
2	18.9%	Switzerland
3	18.6%	United States of America
4	17.3%	Peru
5	16.9%	Germany
6	12.4%	Luxembourg
7	12.3%	Portugal
8	11.2%	Greece
9	8.6%	Estonia
10	8.2%	Czech Republic

Introduction to IPv6: Summary

- IPv6 was created primarily to solve the IPv4 address depletion issue, but additional capabilities were included to help the Internet scale into the future.
- Many steps were successfully taken to extend the life of IPv4, such as the wide spread use of NAT
- IPv4 and IPv6 has many similarities and differences, examples of differences include a larger address space and the use of extension headers
- Extension headers are a great example of the “extensibility” of IPv6, they allow for the continued expansion of IPv6 capabilities
- Almost all network operators have deployed IPv6 and many have a significant percent of IPv6 customers/traffic

Introduction to IPv6: Review Question and Answers

1. Why was IPv6 created?
2. Name at least two steps taken to extend the life of IPv4?
3. How many bits are in an IPv4 address and how many bits are in an IPv6 address?
4. What type of DNS records are used for IPv4 and IPv6?
5. Which major US Wireless carrier is identified with the most IPv6 traffic?

Introduction to IPv6

BREAK + Q&A

FEDERAL IPV6 TRANSITION

Federal IPv6 Transition: Learning Objectives

- Understand the history of the Federal IPv6 transition
- Describe why “technology Refreshment” is a critical part of the Federal IPv6 transition strategy
- Explain the milestones established in the 2010 Federal CIO IPv6 Memorandum
- Identify Agency assets that need to be transitioned
- Describe the IPv6 requirements in the FAR

Federal IPv6 Transition History

FEDERAL IPV6 TRANSITION

Federal IPv6 Transition Thought Process

- How to transition?
  - Infrastructure first
  - Applications first

WINNER – BUILD IT AND THEY WILL COME

- Utilize Agency's Enterprise Architecture Process (Enterprise Focus)
  - Track progress
  - Show value
- How to pay for it?
  - Existing budget – Technology Refreshment
  - Business case by specific program
- The Real Question: Why Transition to IPv6 in the First Place?
  - Real Answer – It is inevitable!
  - Other Answers (Money/Capability/Security)
- Other Big Question – Why transition now?
  - Government requires a much longer timeframe than industry to integrate new technology
  - Waiting will have a negative impacts on Government & industry
  - No more time

Federal IPv6 Acquisition Focus

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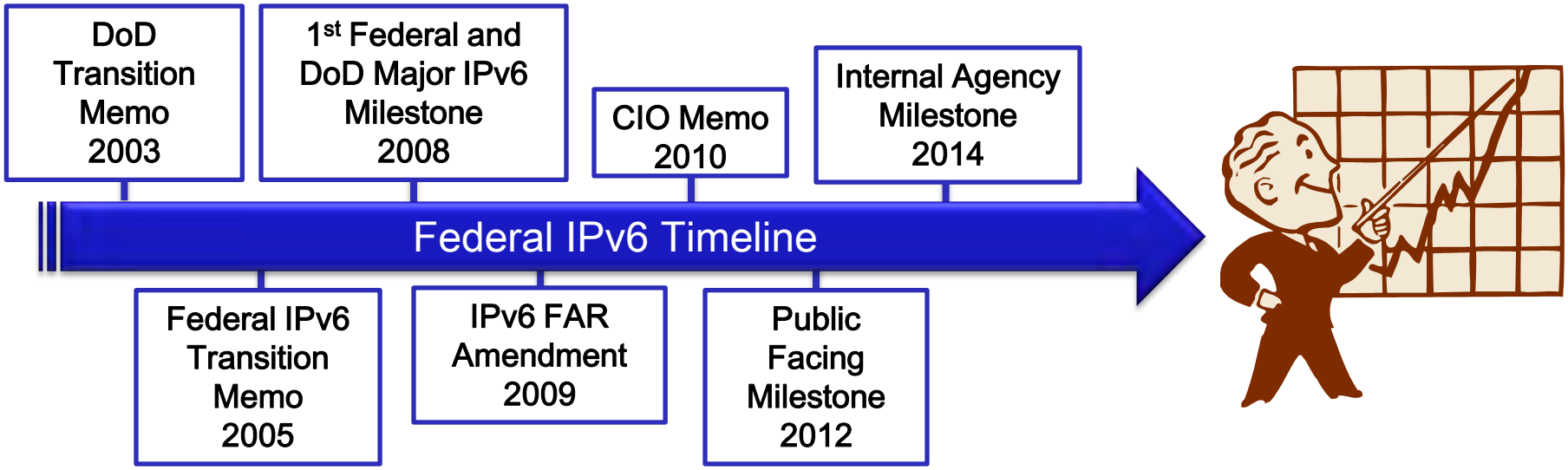
Strategy

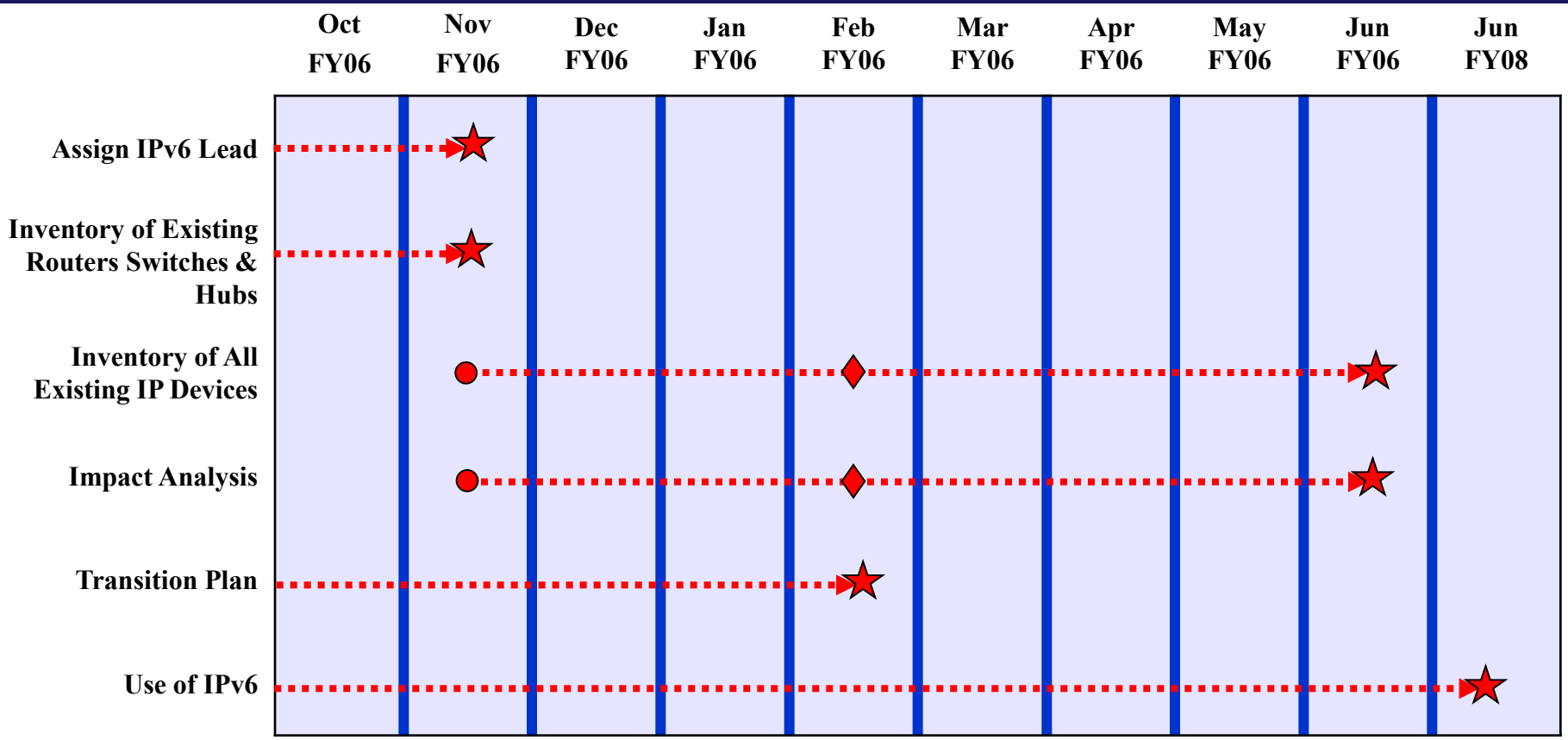
- Start buying IPv6 immediately
- Technology refreshment
- Roll-in IPv6 over time
- Reduce cost & impact

Results

- Mixed - slow acquisition start
- Pockets of victory
- Vendors adopting IPv6



M-05-22 Requirements & Dates



June 2008 IPv6 Milestone Results

- OMB Public Statement
  - All major USG agencies reported that they successfully demonstrated IPv6 capabilities on their network backbones.
- Reality
  - Most agencies turned IPv6 on
  - Performed basic network tests (ping, trace routes, etc.)
  - Turned IPv6 off
- Bottom Line - IPv6 not operationally ready
  - C&A and security
  - Operational procedures
  - Training
  - Interoperability
  - Etc.
- Is this Success?
  - Yes!
  - First, critical step in the overall transition

Federal IPv6 Transition Policy and Guidance

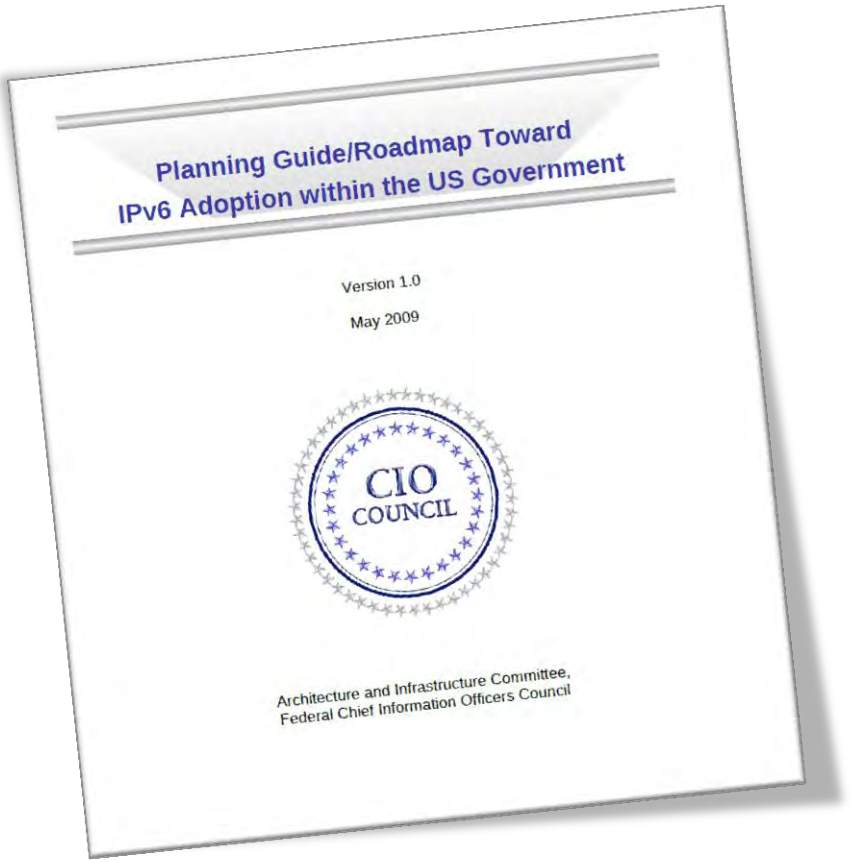
FEDERAL IPV6 TRANSITION

The Business Case and Roadmap for Completing IPv6 Adoption in US Government

DISCOVER THE TRUE VALUE OF TECHNOLOGY

What Does it Cover

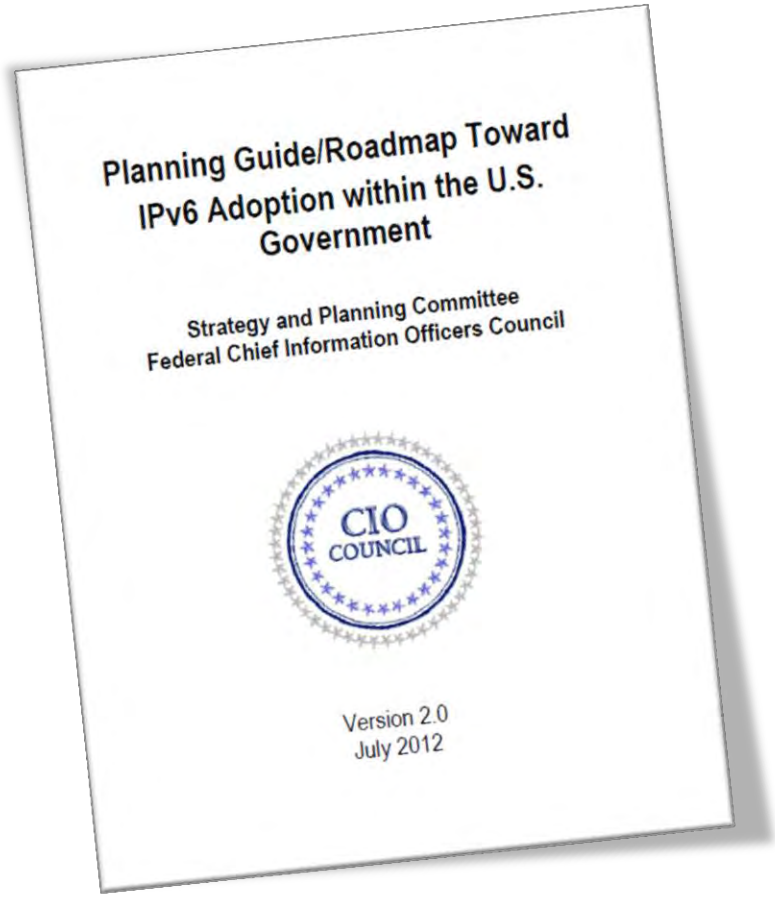
1. Federal IPv6 Transition – Progress to Date
2. Federal IPv6 Transition – The Next Steps
3. Leveraging Enterprise Architecture
4. Transition Roadmap and Milestones
5. IPv6 Impact on Federal Initiatives
6. IPv6 in IT Governance and Procurement



Planning Guide/Roadmap Toward IPv6 Adoption within the U.S. Government v2.0

What Does it Cover

1. Federal Transition Components
2. The Business Rationale for IPv6
3. Federal IPv6 Transition: The "To Be" State
4. Leveraging the Common Approach to Federal Enterprise Architecture
5. Transition Steps
6. IPv6 Impact on Federal Initiatives
7. IPv6 in IT Governance and Procurement



The New OMB IPv6 Memo

DISCOVER THE TRUE VALUE OF TECHNOLOGY

Why

- **Enable key Federal IT modernization initiatives:**
  - Cloud Computing
  - Broadband
  - SmartGrid
- **Reduce complexity and increase transparency:**
  - Eliminate NAT technologies;
- **Enable ubiquitous security services:**
  - End-to-end network communications
  - Foundation for securing future Federal IT systems
- **Enable the Internet to continue to operate efficiently**:
  - Integrated & well-architected networking platform
  - Accommodate future expansion of Internet-based services

What & When

- **Procurements:**
  - Comply with FAR requirements
  - Use of the USGv6 Profile and Test Program
  - Ensure completeness of IPv6 capabilities
  - Now
- **Designate an IPv6 Transition Manager:**
  - October 30, 2010
- **External Services:**
  - Public/external facing servers and services
  - e.g. web, email, DNS, ISP services, etc
  - Operationally use native IPv6
  - End of FY 2012 (September 30, 2012)
- **Internal Services:**
  - Applications that communicate with public Internet servers
  - Supporting enterprise networks
  - Operationally use native IPv6
  - End of FY 2014 (September 30 2014)

OMB IPv6 2010 – 2012 Milestone

- External Services:
  - Public/external facing servers and services
  - e.g. web, email, DNS, ISP services, etc
  - Operationally use native IPv6
  - End of FY 2012 (September 30, 2012)
- Other Publix/External Service

2012 Target Explained*

- The 2012 requirement makes sure that Federal information systems are accessible to IPv6-enabled end systems on the public Internet.
- Major access and mobile networks have announced plans to begin connecting customers using IPv6 within the next 2 years.
- The 2012 requirement will ensure that Federal information systems (and their supporting network infrastructure) keep pace with these developments and remain accessible to the emerging base of IP6-connected users.

*Source: Federal IPv6 FAQs 11/4/2011

Examples of Impacted Applications (2012)

Typical examples of server applications that are publically accessible include*:

- Web servers,
- Email servers,
- DNS,
- FTP,
- Messaging and social media servers.

*Source: Federal IPv6 FAQs 11/4/2011

OMB IPv6 2014 Milestone

The 2010 OMB Transition to IPv6 memo states that :

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

The IPv6 Transition objectives to be completed by the end of FY 2014 (Sept 30 2014) are as follows:

- Internal Client Applications that communicate with public Internet servers must support IPv6,
- Enterprise networks must support IPv6,
- Must operationally use native IPv6.

2014 Target Explained*

- The intent of the 2014 requirement is to ensure that public IPv6-enabled network services that are provided external to an agency, are accessible to USG users residing in their agency enterprise networks.

- The definitions of what is meant by “public” are the same. That is, in this case, the same service that an USG client/application is trying to access, is available to everyone on the Internet.

- The agency clients applications, host operating systems, and supporting networking infrastructure should be IPv6-enabled such that it is possible to establish native IPv6 end-to-end communication between client applications and the external IPv6-enabled public servers/services.

*Source: Federal IPv6 FAQs 11/4/2011

Examples of Impacted Applications (2014)

Typical examples of client applications that access public Internet servers/services include*:

- External web (browsers),
- Email (mail user agents),
- DNS (resolvers),
- Host operating systems,
- Messaging and social media applications that access publicly available network servers are also within scope.

*Source: Federal IPv6 FAQs 11/4/2011

2014 Bottom Line*

- If there is an IPv6-enabled external network service that is currently available to all users of the public Internet, that service must be available to an Agency network user who only has IPv6 capabilities.

- This Does not override agency policies that might restrict employee access to such services.
  - However: If such a service is permissible to access using IPv4, it must be possible to access the same service using IPv6.

*Source: Federal IPv6 FAQs 11/4/2011

2014 – Where to Start?

- Agency Specific 2014 Definition
  - Tailor definition to your agency (with buy-in)
  - Be specific (systems, services, etc.)
  - Can be broad or narrow in scope
- Success Metrics
  - What is expected?
  - When is it expected?
  - How will it be measured?
- Specific Requirements
  - Detailed & Technical
  - Based on agency approach
- Make Execution Progress *(Most Important!)*
  - Cannot plan forever
  - Need quick wins & experience
  - Generate momentum

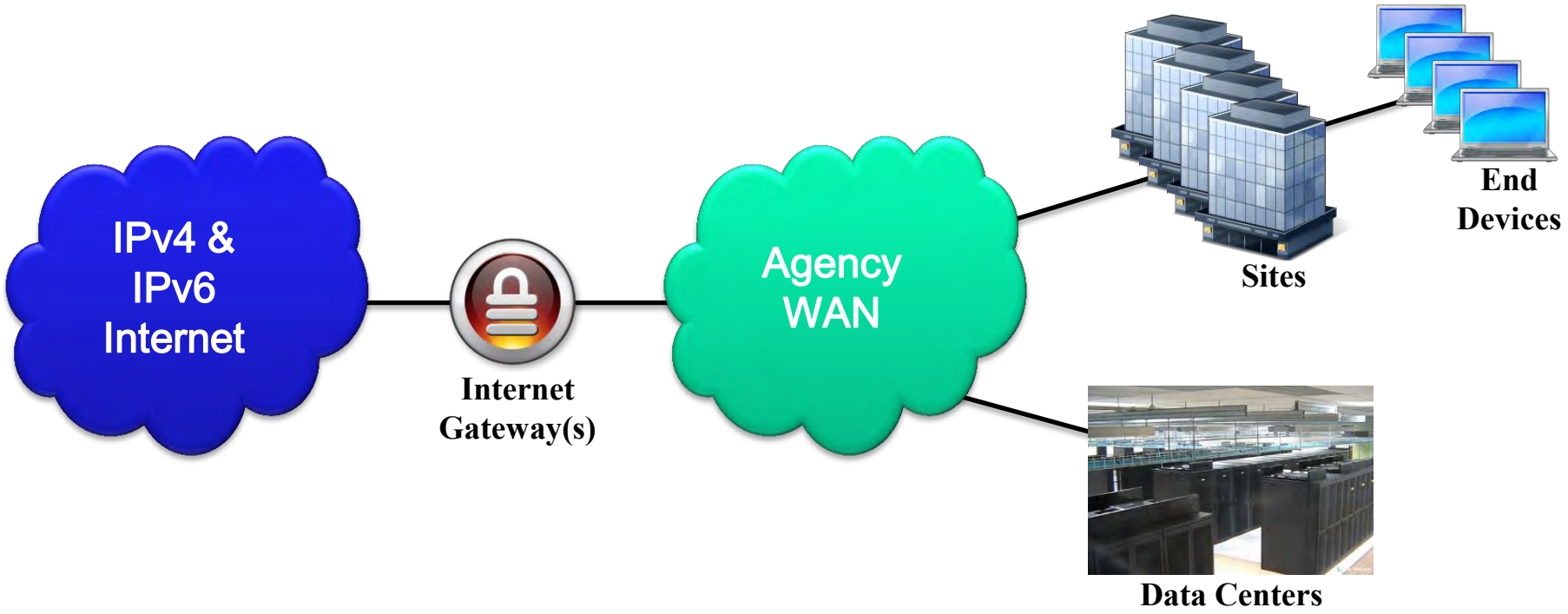
"Mission Thread" Approach

What operational IPv6 capabilities are required for a simple service such as web browsing?

- ✓ OS
- ✓ Application(s)
- ✓ Addresses
- ✓ Network Connectivity
- ✓ Routing
- ✓ DNS
- ✓ Security
- ✓ Network Management
- ✓ Internet

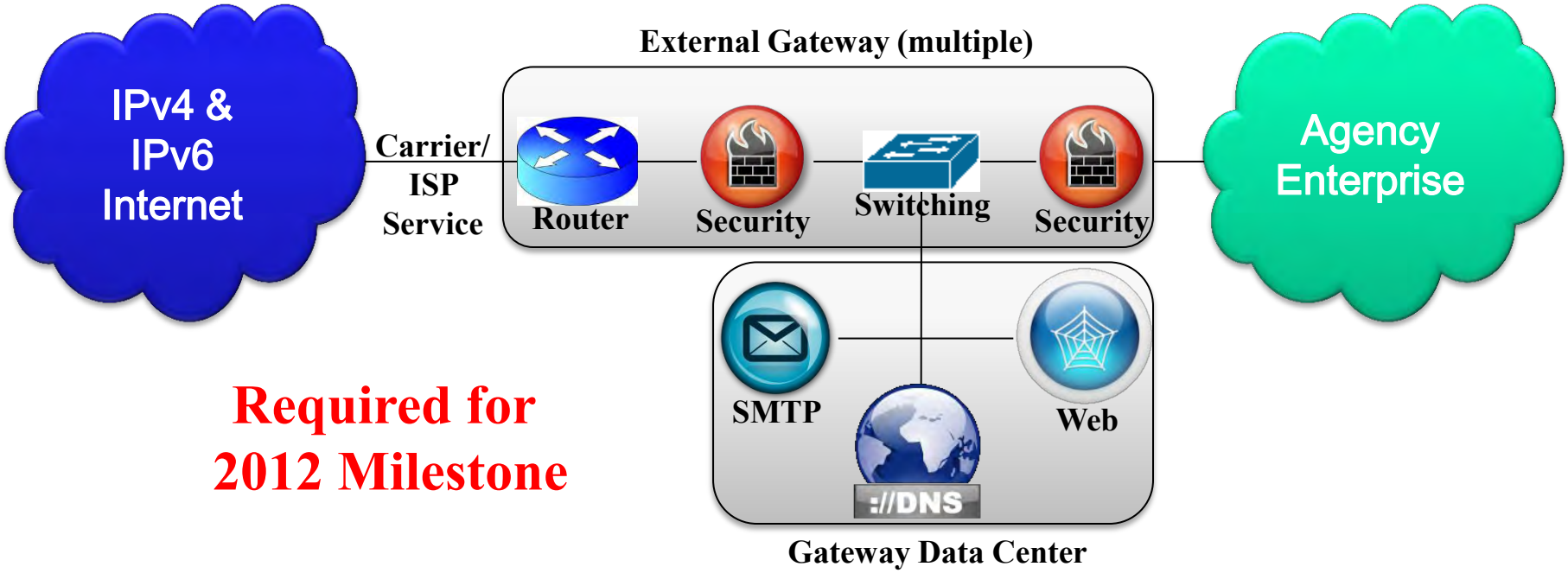
Example Enterprise Connectivity

- Network Connectivity
- Addressing
- Routing
- DNS
- Data Centers
- Mail
- Security
- Network Management
- Transition Mechanisms
- Applications/Services
- End Devices
- Pilots



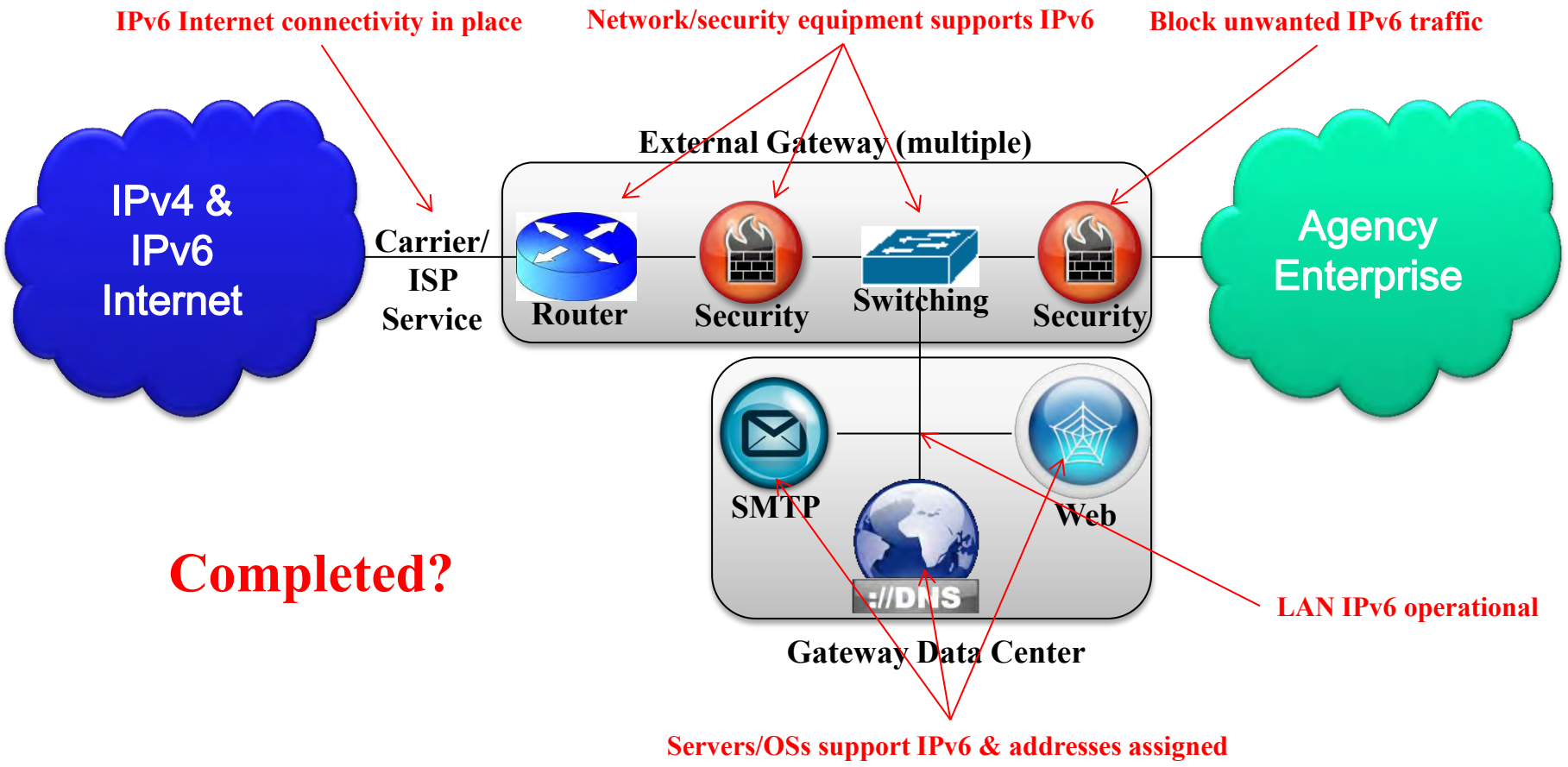
Example Internet Gateway Architecture

- Addressing
- Routing
- Connectivity
- Web
- DNS
- Mail
- Security
- Network Management
- Transition Mechanisms



Required for 2012 Milestone

Ensuring Gateway Connectivity



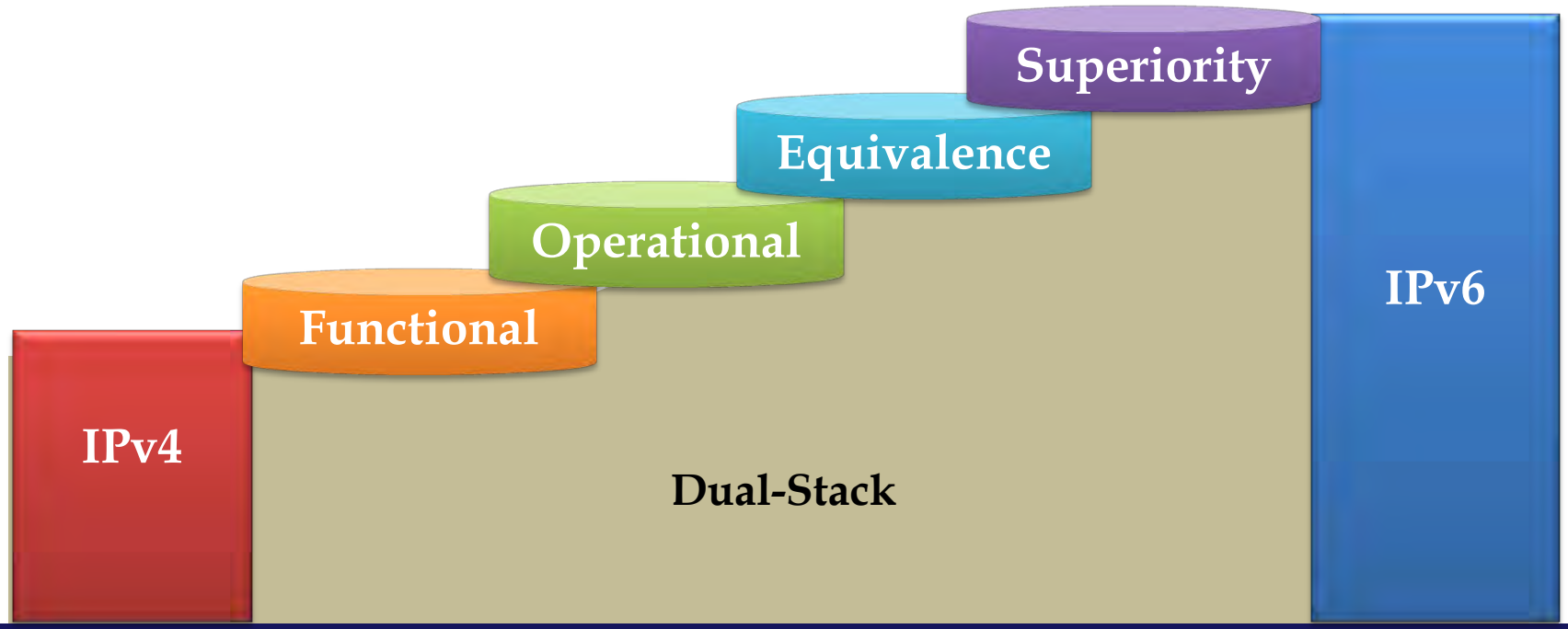
Sample 2014 Execution Timeline

Sample Agency IPv6 Execution Timeline 2014 Enterprise Network Execution	Key Stakeholders (External)	Milestone 1 Jun-11	2 Dec-11	3 Jun-12	4 Dec-12	5 Jun-13	6 Dec-13	7 Jun-14	8 Dec-14
Network Connectivity									
Core/Backbone Network	Networx or other Carriers Router Vendors								
Infrastructure Routers 25%									
Infrastructure Routers 50%									
Infrastructure Routers 100%									
Addressing									
Internal IPv6 Addresses Allocated	ARIN DCHPv6 Vendors								
DHCPv6 Enabled 25%									
DHCPv6 Enabled 50%									
DHCPv6 Enabled 100%									
Routing									
Core/Backbone Network Routing	Networx or other Carriers Router Vendors								
Infrastructure Routing 25%									
Infrastructure Routing 50%									
Infrastructure Routing 100%									
Domain Name Services (DNS)									
Internal DNS IPv6 Enabled	DNS Vendors								
Data Centers									
Data Center 1 IPv6 Enabled	Networx or other Carriers Router Vendors IT Vendors Service Providers								
Data Center 2 IPv6 Enabled									
Data Center 3 IPv6 Enabled									
Data Center 4 IPv6 Enabled									
Mail									
Exchange IPv6 Enabled	Mail Vendors								

Sample 2014 Execution Timeline Cont.

Sample Agency IPv6 Execution Timeline 2014 Enterprise Network Execution	Key Stakeholders (External)	Milestone 1 Jun-11	2 Dec-11	3 Jun-12	4 Dec-12	5 Jun-13	6 Dec-13	7 Jun-14	8 Dec-14
Internal Applications & Services									
IPv6 Enabled Apps & Services 25%	Application Vendors Service Providers IT Vendors								
IPv6 Enabled Apps & Services 50%									
IPv6 Enabled Apps & Services 75%									
IPv6 Enabled Apps & Services 100%									
End Device Transition									
Internal Servers IPv6 Enabled 25%	Server & OS Vendors Virtualization Vendors IT Vendors								
Internal Servers IPv6 Enabled 50%									
Internal Servers IPv6 Enabled 75%									
Internal Servers IPv6 Enabled 100%									
User Computers IPv6 Enabled 25%	Laptop/Desktop & OS Vendors								
User Computers IPv6 Enabled 50%									
User Computers IPv6 Enabled 75%									
User Computers IPv6 Enabled 100%									
PDA/Mobile Devices IPv6 Enabled 25%	PDA Vendors								
PDA/Mobile Devices IPv6 Enabled 50%									
PDA/Mobile Devices IPv6 Enabled 75%									
PDA/Mobile Devices IPv6 Enabled 100%									
Mission Devices IPv6 Enabled 25%	IT Vendors Device Vendors								
Mission Devices IPv6 Enabled 50%									
Mission Devices IPv6 Enabled 75%									
Mission Devices IPv6 Enabled 100%									
Pilots									
Enclave Pilot Phase 1	IT Vendors								
Enclave Pilot Phase 2									
Enclave Pilot Phase 3									

IPv6 Levels of Implementation



Other Considerations for 2014 and Beyond

- Translation & Tunneling
- Services/Systems not covered by 2012/2014 Milestones
  - External
    - Telecommuter
    - Mission Services
  - Internal
    - Applications
    - Devices
- When to dual-stack everything
- IPv6-only testing
- IPv6-only environments
- Turning IPv4 off

Federal Information Technology Acquisition Reform Act (FITARA)

- Enhances CIO authority
  - …and accountability
- CFO act agencies
  - …and DoD/Intel to a limited scope
- Establishes common baseline for IT Management
- Utilizes PortfolioStat Performance Metrics
  - Includes tracking agency IPv6 adoption status

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

June 10, 2015

THE DIRECTOR

M-15-14

MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Shaun Donovan
Director

SUBJECT: Management and Oversight of Federal Information Technology

Purpose

The purpose of this memorandum is to provide implementation guidance for the Federal Information Technology Acquisition Reform Act (FITARA)[1] and related information technology (IT) management practices.

Background

FITARA was enacted on December 19, 2014. FITARA outlines specific requirements related to:

1. Agency Chief Information Officer (CIO) Authority Enhancements
2. Enhanced Transparency and Improved Risk Management in IT Investments
3. Portfolio Review
4. Federal Data Center Consolidation Initiative
5. Expansion of Training and Use of IT Cadres
6. Maximizing the Benefit of the Federal Strategic Sourcing Initiative
7. Governmentwide Software Purchasing Program

How is OMB Managing the Transition

- CIO Council
- Federal IPv6 Task Force
  - Monthly Meetings
  - Interagency Meeting
  - Outreach
  - Agency Transition Managers Checklist
  - Working Groups
  - IAC
  - Other
- NIST USGv6
- FAR
- Direct Agency Contact

IPv6 Requirements in the FAR

FEDERAL IPV6 TRANSITION

IPv6 Addition to the FAR – Primary Clause

11.002(g) - Policy

Unless the agency Chief Information Officer waives the requirement, when acquiring information technology using Internet Protocol, the requirements documents must include reference to the appropriate technical capabilities defined in the USGv6 Profile (NIST Special Publication 500-267) and the corresponding declarations of conformance defined in the USGv6 Test Program. The applicability of IPv6 to agency networks, infrastructure, and applications specific to individual acquisitions will be in accordance with the agency's Enterprise Architecture (see OMB Memorandum M-05-22 dated August 2, 2005).

IPv6 Addition to the FAR – Additional Clauses

- 7.105 (b)(5)(iii) - Contents of written acquisition plans

  For information technology acquisitions using Internet Protocol, discuss whether the requirements documents include the Internet Protocol compliance requirements specified in 11.002(g) or a waiver of these requirements has been granted by the agency's Chief Information Officer.

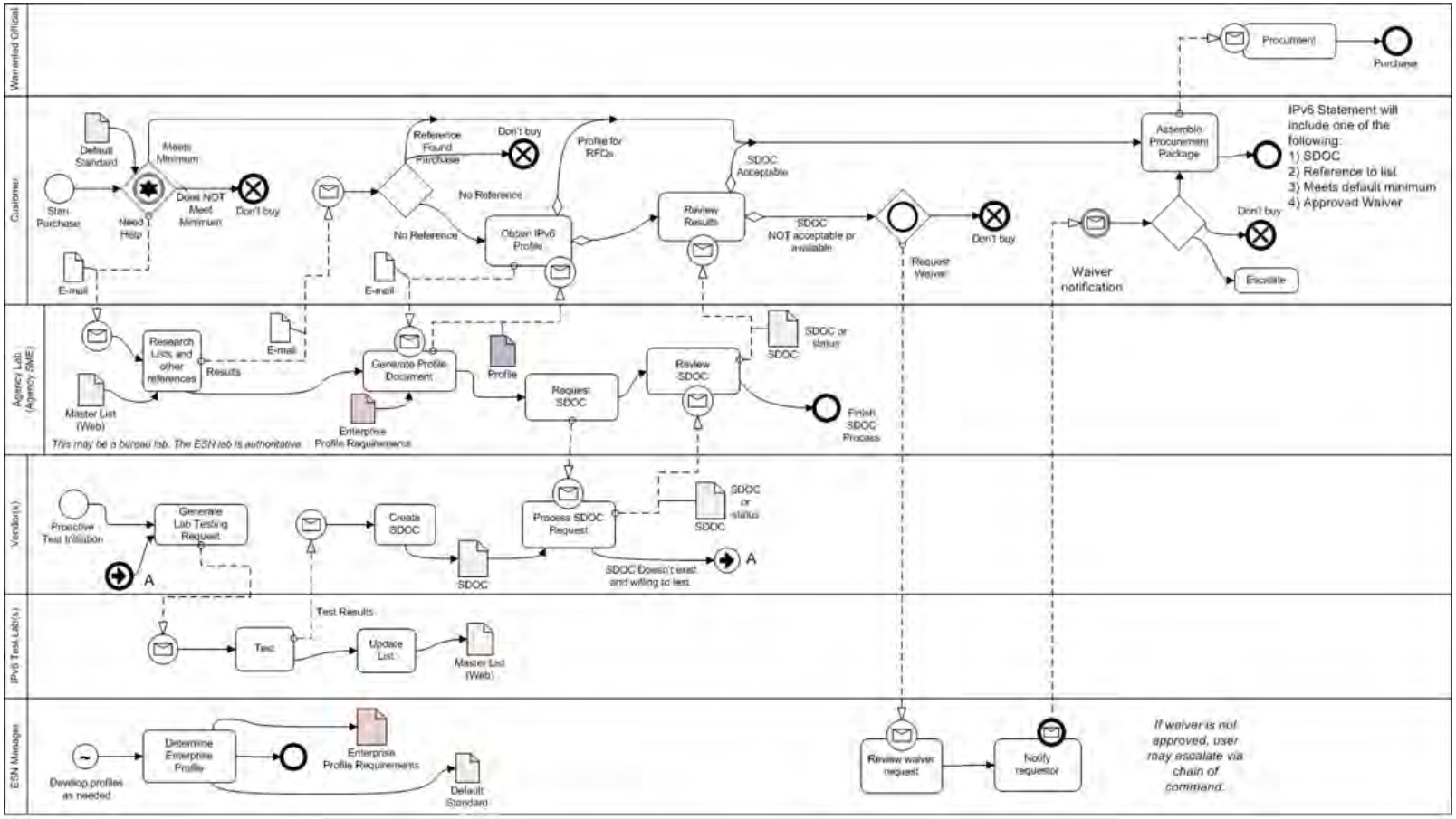
- 12.202 (e) - Market research and description of agency need

  When acquiring information technology using Internet Protocol, agencies must include the appropriate Internet Protocol compliance requirements in accordance with 11.002(g).

- 39.101 (e) - Policy

  When acquiring information technology using Internet Protocol, agencies must include the appropriate Internet Protocol compliance requirements in accordance with 11.002(g).

Build an IPv6 Acquisition Process

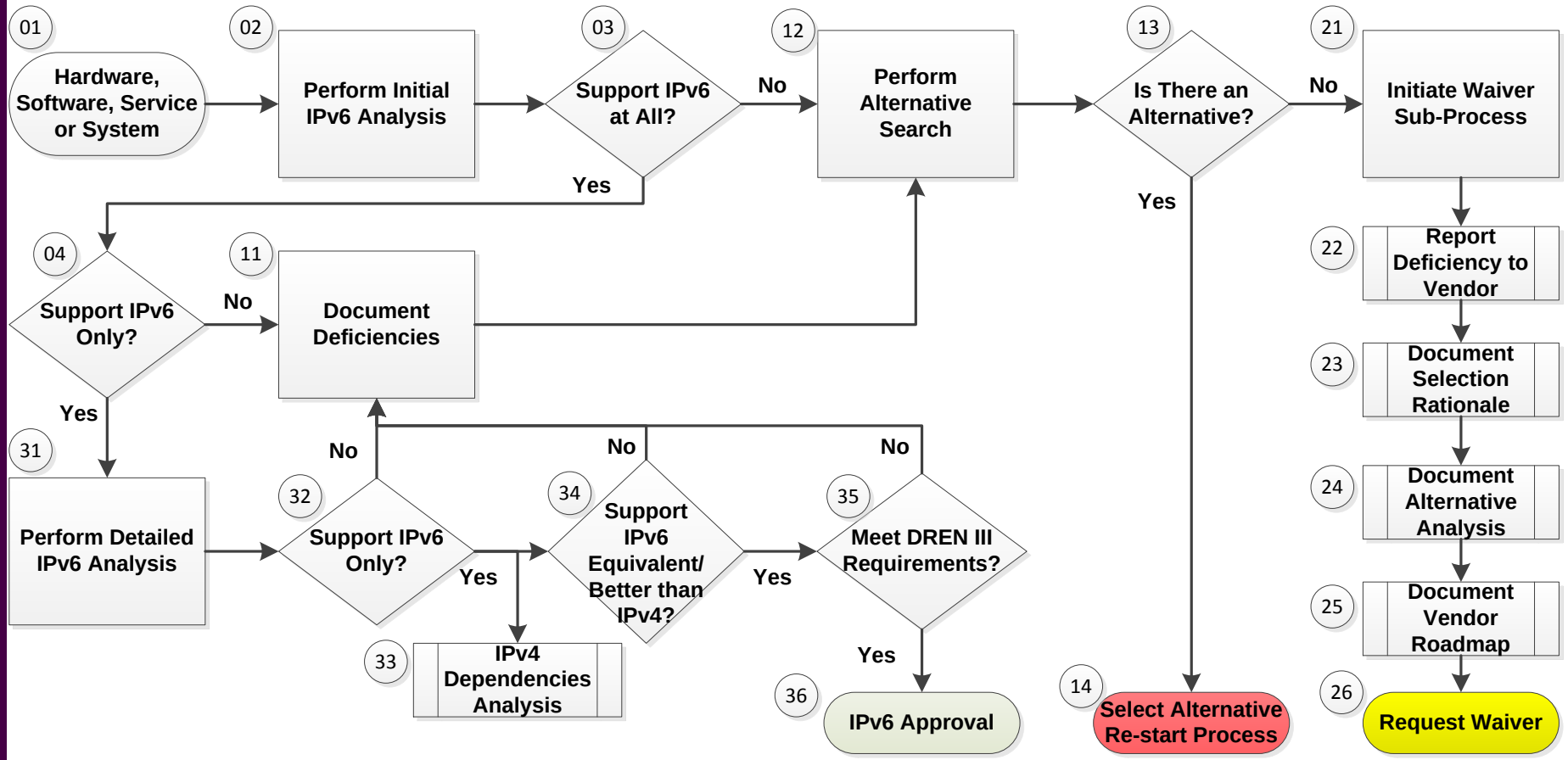


Barrowed from DOI

IPv6 Acquisition Process

Version 1.0
25 July 2011

Build an IPv6 Evaluation Process



Create an Acquisition Plan

- Conduct market analysis
  - Awareness of IPv6 products/services
- Estimate investment costs
- Obtain authorization to proceed from appropriate agency departments
  - Procurement,
  - Finance,
  - IT,
  - agency head,
  - etc.
- Create a Project Procurement Team
  - Program Manager,
  - Project Manager,
  - Project Subject Matter Experts,
  - Agency Procurement Officer,
  - IPv6 IT experts,
  - Business Partners, Legal experts, Finance, CIO, CFO, etc.

Example Language for Hardware Acquisitions

"In accordance with CIO Directives and with agency Enterprise Architecture and Technical Reference Model (TRM), this acquisition requires all functionality, capabilities and features to be supported and operational in both a dual-stack IPv4/IPv6 environment and an IPv6 only environment. Furthermore, all management, user interfaces, configuration options, reports and other administrative capabilities that support IPv4 functionality will support comparable IPv6 functionality. Respondents are required to include in their response a letter of self-certification that their product has been tested in both a dual-stack IPv4/IPv6 and IPv6 only environment and meets this requirement. Agency reserves the right to require the respondent's products to be tested within an agency or 3rd party test facility to show compliance with this requirement.

In accordance with FAR 11.002(g) and CIO Directives, this acquisition must comply with the NIST USGv6 Profile and IPv6 Test Program. All interested parties responding to this acquisition are required to provide a Self Declaration of Conformance (SDOC) based on the attached "agency USGv6 Profile xxxx-xxxx" and in accordance with NIST SP 500-267, NIST SP-273, and NIST SP 500-281."

Example Language for Software Acquisitions

"In accordance with CIO Directives and with agency Enterprise Architecture and Technical Reference Model (TRM), this acquisition requires all functionality, capabilities and features to be supported and operational in both a dual-stack IPv4/IPv6 environment and an IPv6 only environment. Furthermore, all management, user interfaces, configuration options, reports and other administrative capabilities that support IPv4 functionality will support comparable IPv6 functionality. Respondents are required to include in their response a letter of self-certification that their product has been tested in both a dual-stack IPv4/IPv6 and IPv6 only environment and meets this requirement. Agency reserves the right to require the respondent's products to be tested within a agency or 3rd party test facility to show compliance with this requirement.

In addition, respondents are required to certify that they have tested and their product operates on a platform that has an SDOC based on the attached "agency USGv6 Profile xxxx-xxxx" and in accordance with NIST SP 500-267, NIST SP-273, and NIST SP 500-281."

Example Language for Systems Development Acquisition

"In accordance with CIO Directives and with agency Enterprise Architecture and Technical Reference Model (TRM), this acquisition requires all functionality, capabilities and features to be supported and operational in both a dual-stack IPv4/IPv6 environment and an IPv6 only environment. Furthermore, all management, user interfaces, configuration options, reports and other administrative capabilities that support IPv4 functionality will support comparable IPv6 functionality. Respondents are required to include in their response a complete description of how they will include IPv6 requirements in the systems development life-cycle and incorporate both dual-stack IPv4/IPv6 and IPv6 only testing scenarios across all testing activities. Agency reserves the right to require the respondent's solutions to be tested within an agency or 3rd party test facility to show compliance with this requirement.

In addition, respondents are required to utilize platforms that have an SDOC based on the attached "agency USGv6 Profile xxxx-xxxx" and in accordance with NIST SP 500-267, NIST SP-273, and NIST SP 500-281."

Example Language for Telecommunications Services Acquisition

"In accordance with CIO Directives and with agency Enterprise Architecture and Technical Reference Model (TRM), this acquisition requires all functionality, capabilities and features to be supported and operational in both a dual-stack IPv4/IPv6 environment and an IPv6 only environment. Furthermore, all management, user interfaces, configuration options, reports and other administrative capabilities that support IPv4 functionality will support comparable IPv6 functionality. Respondents are required to include in their response a letter of self-certification that their services have been tested in both a dual-stack IPv4/IPv6 and IPv6 only environment and meets this requirement. All service performance requirements and service level agreements will apply to both IPv4 and IPv6 services. Agency reserves the right to require the respondent's services to be tested within by agency or 3rd party to show compliance with this requirement.

In addition, respondents are required to certify that they have tested and their product interoperates on a platform that has an SDOC based on the attached "agency USGv6 Profile xxxx-xxxx" and in accordance with NIST SP 500-267, NIST SP-273, and NIST SP 500-281."

Example Language for Support Services Acquisition

"In accordance with CIO Directives, this acquisition requires the service provider to include IPv6 expertise as part of its support services. Respondents are required to include in their response a description of how they will provide IPv6 expertise as a part of their solutions offering for each area of service being acquired. Agency reserves the right to audit the respondent's proposed IPv6 expertise"

Federal IPv6 Transition: Summary

- The formal Federal IPv6 transition started with the DoD Memorandum in 2003 and the later release of the OMB Memorandum in 2005
- June 2008 was the first significant Federal IPv6 transition milestone date where agencies were supposed to demonstrate their IPv6 capabilities
- The OMB 2010 IPv6 Memorandum established specific agency IPv6 operational milestones for public facing services in 2012 and internal services in 2014
- The Far was updated in 2009 to include IPv6 acquisition requirements
- OMB memorandum in 2005 (and reiterated in 2010) require all agency IT acquisitions to include IPv6 capable products and service

Federal IPv6 Transition: Review Question and Answers

1. When were agencies required to establish their IPv6 Transition Plan?
2. What two IPv6 guidance documents were developed as a joint effort between industry to help agencies with their transition efforts?
3. What services were included in the OMB 2012 Milestone?
4. What services were included in the OMB 2014 Milestone?
5. What NIST publication and program are identified in the FAR for Agencies to use to acquire IPv6 capable products?

Federal IPv6 Transition

BREAK + Q&A

NIST USGV6 PROGRAM

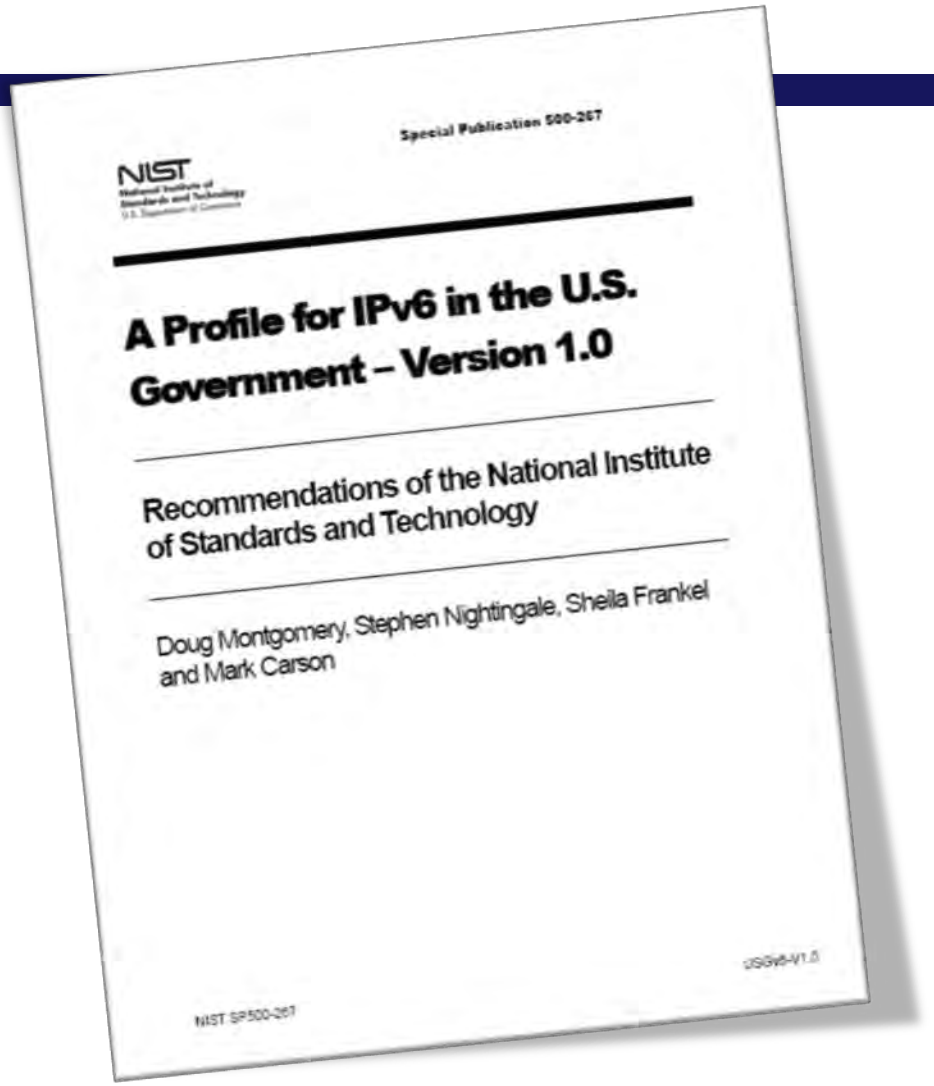
NIST USGv6 Program: Learning Objectives

- Understand the device types used in the NIST USGv6 Profile
- Name the functional categories in the NIST USGv6 Profile
- Understand who is responsible for defining the IPv6 requirements for an IT acquisition
- Explain how an SDOC is used
- Be able to find and read the NUST USGv6 Deployment Status website

USGv6 Profile

NIST USGV6 PROGRAM

USGV6 – BUILDING PROFILES



NIST SP 500-267 A Profile for IPv6 in the U.S. Government – Version 1.0

- Acquisition Focused (not deployment, operational, etc.)
- Purpose
  - *Define a simple taxonomy of common network devices;*
  - *Define their minimal mandatory IPv6 capabilities and identify significant configuration options so as to assist agencies in the development of more specific acquisition and deployment plans; and,*
  - *Provide the technical basis upon which future USG polices can be defined.*
- Why
  - OMB Directed (05-22)
  - USG-wide benefit from a common definition of IPv6 capabilities
  - Promote confidence and protect IPv6 investments
  - “Raise the bar” of IPv6 security and network protection technologies
  - Existing profiling and testing efforts are insufficient for USG requirements
  - Support IPv6 progression to meeting future USG IPv6 requirements and protect investments

Device Types

Host

- Any Node that is not a Router. A Host's primary purpose is to support application protocols that are the source and/or destination of IP layer communication.

Router

- A Node that interconnects sub-networks by packet forwarding. A Router's primary purpose is to support the control protocols necessary to enable interconnection of distinct IP sub-networks by IP layer packet forwarding.

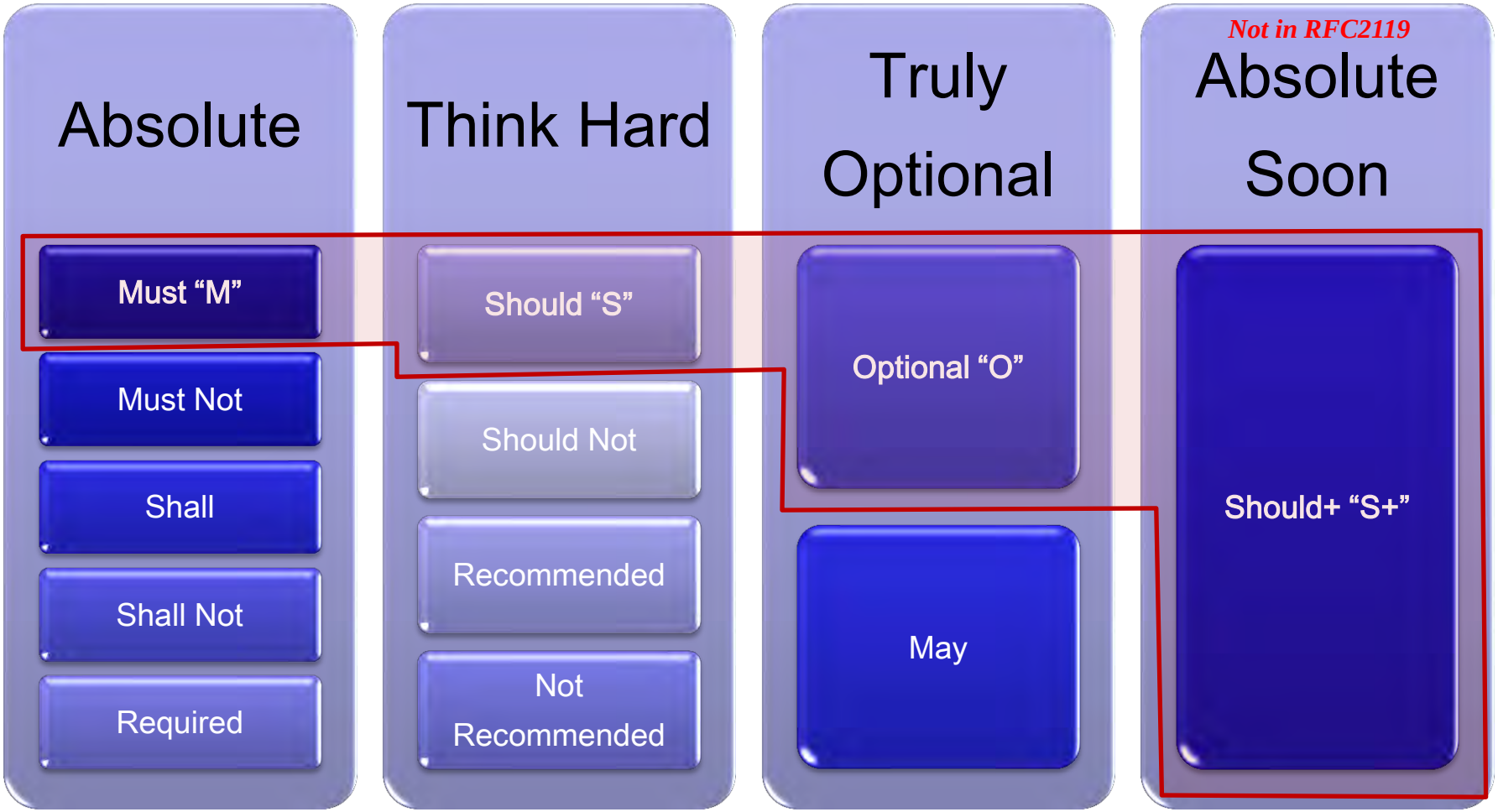
Network Protection Device

- Firewalls or Intrusion Detection / Prevention devices that examine and selectively block or modify network traffic.

Functional Categories

IPv6 Basic Capabilities	Routing Protocols	Quality of Service	Transition Mechanisms
Link Specific Capabilities	Addressing	IP Security	Network Management
Multicast	Mobility	Application Requirements	Network Protection Device Requirements

Profile Utilizes IETF RCF2119 Terminology



USGv6 Profile Specific Terminology

- Specific Line Items
  - Requirements Table
    - "**M**" = Mandatory "**O**" = Optional "**S**" = Should "**S+**" = Should+ (mandatory in future)
    - **c(X,Y)** = Configuration Option, if selected then the requirement is "X", otherwise "Y"
      - Example "c(M,S)" if true then it is "M", otherwise it is "S"
    - **c(X)** = Shorthand notation for above, "Y" in this case is considered "O" Optional.
  - Template
    - "**O:n**" = Optional, but must choose "n" options from the set
      - Example "O:1" choose 1 option, "O:3" choose 3 options
    - "**Y/N**" = Optional and a simple yes or no selection
    - Entire Functional Categories
      - "M" (mandatory): Contains unconditional MUSTs and may have Options
      - "O" (optional): Does not contain unconditional MUSTs
- "USGv6-V1-Capable" = set of requirements that are unconditionally mandatory
- "USGv6-V1-Compliant" = "USGv6-V1-Capable" + requirements that are mandatory under each of the selected configuration options

Reading the Node Requirements Table

Spec / Reference	Section	USGv6-V1 Node Requirements Title / Definition	Status	Year	Condition / Context	Host	Router	NPD	Effective Date
		IPv6 Basic Requirements							
RFC2460		**IPv6 Specification**	DS	1998		M	M		2010/07
		IPv6 Packets: send, receive				M	M		2010/07
		IPv6 packet forwarding					M		2010/07
		Extension headers: processing				M	M		2010/07
		Hop-by-Hop & unrecognized options				M	M		2010/07
		gment headers: send, receive, process				M	M		2010/07
		Destination Options extensions				M	M		2010/07
RFC5095		precation of Type 0 Routing Headers				M	M		2010/07
RFC2711		**IPv6 Router Alert Option**					M		2010/07
RFC4443		**ICMPv6**				M	M		2010/07
RFC4884		**Extended ICMP for Multi-Part Messages**	PS	2007		S+	S+		
RFC1981		**Path MTU Discovery for IPv6**	DS	1996		M	M		2010/07
	4	Discovery Protocol Requirements				M	S+		2010/07
RFC2675		**IPv6 Jumbograms**	PS	1999		O	O		
RFC4861		**Neighbor Discovery for IPv6**	DS	2006		M	M		2010/07
	4.1, 4.2	Router Discovery				M	M		2010/07
	4.6.2	Prefix Discovery				M	M		2010/07
	7.2	Address Resolution				M	M		2010/07
	7.2.5	NA and NS processing				M	M		2010/07
(RFC4862)	7.2.3	Duplicate Address Detection				M	M		2010/07
	7.3	Neighbor Unreachability Detection				M	M		2010/07
	8	Redirect functionality				S	M		2010/07
RFC5175		**IPv6 Router Advertisement Flags Option**	PS	2008		S	S		
RFC4191		**Default Router Preference**	PS	2005		S+	S+		
RFC3971		**Secure Neighbor Discovery**	PS	2005	SEND	c(M)	c(M)		2010/07

Specific Profile Item

Device Type

Functional Category

RFC Reference

Requirement Level

Creating a Product Specific Profile

- Agency Specific Product Profile
  - Decide the device type
  - Start with unconditional “M” mandatory set (USGv6-V1-Capable)
  - Add sets of requirements that are “C” conditional (USGv6-V1-Compliant)
  - Add “S” should and “S+” requirements for inclusion (Close)
  - Add “O” optional (USGv6-V1-Agency-Product-Compliant)
  - ** Modify any “M”s*
  - ** Add others*
- How many choices are there?

	M	S	S+	C	O	Choices
Host	54	10	15	69	18	**112**
Router	67	12	22	58	18	**92**
NPD	9	0	0	14	0	**14**

Is There An Easier Way?

- Yes - use the templates provided in the Profile
  - Host (20 Choices)
  - Router (22 Choices)
  - NPD (4 Choices)
- Common selections
- Shorthand Notation Available, examples:
  - USGv6-V1-Capable+DHCP-client+Sock+DNS-Client+Link=Ethernet
  - USGv6-V1-Capable+SLAAC+Sock+DNS-Client+MIP+Link=PPP+Link=Ethernet
- Is this the best approach?
  - Maybe/Maybe Not
  - Do you need more options?

USGv6-V1 Host Requirements Template:

- [M] – IPv6 Basic Requirements – see section 6.1.
  - [O:1] – SLAAC – require support of stateless address auto-configuration.
  - [O:1] – DHCP-Client – require support of stateful (DHCP) address auto-configuration.
  - [Y/N] – PrivAddr – require support of SLAAC privacy extensions.
  - [Y/N] – SEND – require support of neighbor discovery security extensions.
- [M] – Addressing Requirements – see section 6.6.
  - [Y/N] – CGA – require support of cryptographically generated addresses.
- [O] – Application Requirements – see section 6.11.
  - [Y/N] – DNS-Client – require support of DNS client/resolver functions.
  - [Y/N] – SOCK – require support of Socket application program interfaces.
  - [Y/N] – URI – require support of IPv6 uniform resource identifiers.
  - [Y/N] – DNS-Server – require support of a DNS server application.
  - [Y/N] – DHCP-Server – require support of a DHCP server application.
- [M] – IP Security Requirements – see section 6.7.
  - [M] – IPsec-V3 – require support of the IP security architecture.
  - [M] – IKEv2 – require support for automated key management.
  - [M] – ESP – require support for encapsulating security payloads in IP.
- [O] – Transition Mechanism Requirements – see section 6.4.
  - [Y/N] – IPv4 – require support to enable interoperation with IPv4-only systems.
- [O] – Network Management Requirements – see section 6.8.
  - [Y/N] – SNMP – require support of network management services.
- [M] – Multicast Requirements – see section 6.9.
  - [Y/N] – SSM – require full support of multicast communications.
- [O] – Mobility Requirements – see section 6.10.
  - [Y/N] – MIP – require support of capability for this host to be a mobile node.
- [O] – Quality of Service Requirements – see section 6.3.
  - [Y/N] – DS – require support of Differentiated Services capabilities.
- [M] – Link Specific Technologies – see section 6.5.
  - [O:1] – Link – require support of 1 or more link technologies.
  - [Y/N] – ROHC – require support of robust packet compression services.

How to Select Which S, S+, C and O's to Include

- This is the big question
  - Not really a one size fits all
  - Some profiles will be common across agencies
  - Many will not and may vary based on how much IPv6 you plan to use
- Sources to help select
  - Mission/Agency Requirements
  - Policies
  - Future Planning
  - Testing
  - Engineer Support (Internal/External)
  - NIST
  - Vendors
  - IETF
- Considerations
  - Will it do what I want it to do?
  - Will it do what I do not want it to do?
  - How much will it cost?
  - Security

USGv6 Profile Interesting Notes

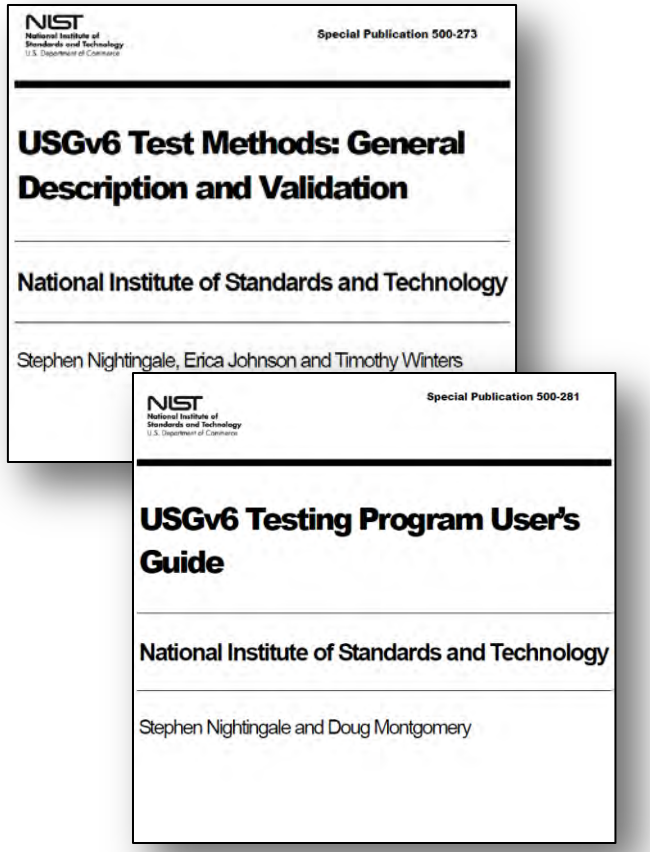
- Expected that agencies will augment and/or modify specifications
  - Meet their own requirements
  - Configuration options
  - Agencies may modify profile conformance requirements
    - Must ensure interoperability with conforming systems
    - No easy way to do this
- Scope of devices and mandatory capabilities
  - Partially Conservative: Lowest common denominator of capabilities common to the USG as a whole
  - Partially Aggressive: Areas for current and future security
  - Options: To make up the difference
- Only addresses IPv6 requirements
  - Cannot stand in isolation
  - IPv4 capabilities, Hardware, Performance, Reliability, Support, etc.

USGv6 Testing Program

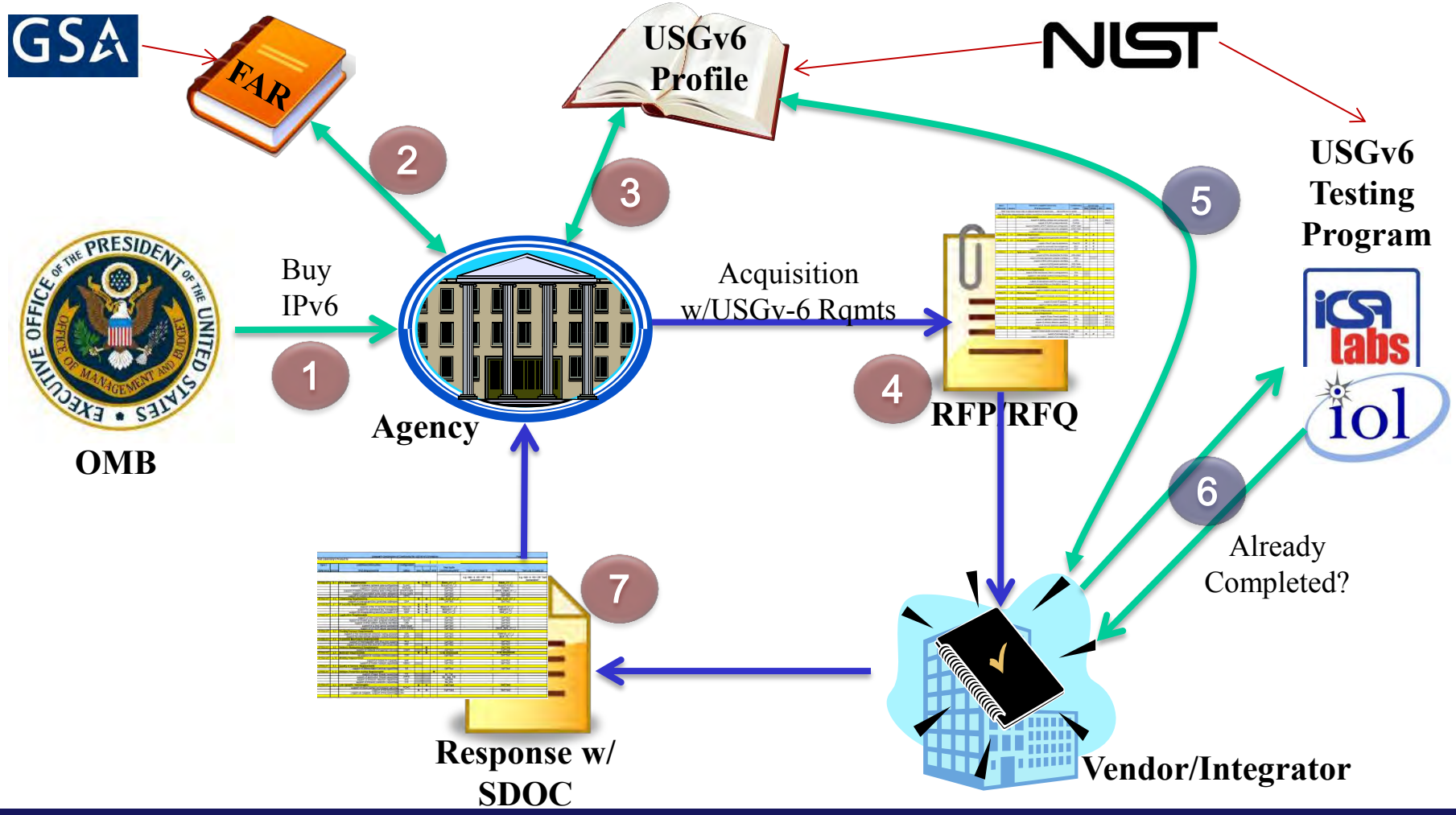
NIST USGV6 PROGRAM

Federal IPv6 Product Testing Program

- Tied to Federal IPv6 Product Profile
- Utilizes Suppliers Declaration of Conformity process
- Leveraged by changes to FAR
- Types of Testing
  - Conformance
  - Interoperability
  - Network Protection Device
- 1st/2nd/3rd Party Testing



USGv6 – A Concept in Agency IPv6 Acquisitions



USGv6 Acquisition Process in a Nutshell

- Provides the ability for an agency to specify what they mean when they say “I want to buy an IPv6 capable/enabled/etc product”
- Pulls from IETF RFCs (and other sources)
- Provides agency with tested products (to some degree)
  - Conformance
  - Interoperability
  - Security

Tools - Agency Sends out an IPv6 Profile (Part of RFP/RFQ)

Spec / Reference	Section	USGv6-V1 Node Requirements Title / Definition	Status	Year	Condition / Context	Host	Router	NPD	Effective Date
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	2	IPv6 packet forwarding					M		2010/07
	4	Extension headers: processing				M	M		2010/07
	4.3	Hop-by-Hop & unrecognized options				M	M		2010/07
	4.5	Fragment headers: send, receive, process				M	M		2010/07
	4.6	Destination Options extensions				M	M		2010/07
RFC5095		**Deprecation of Type 0 Routing Headers**	PS	2007		M	M		2010/07
RFC2711		**IPv6 Router Alert Option**	PS	1999			M		2010/07
RFC4443		**ICMPv6**	DS	2006		M	M		2010/07
RFC4884		**Extended ICMP for Multi-Part Messages**	PS	2007		S+	S+		
RFC1981		**Path MTU Discovery for IPv6**	DS	1996		M	M		2010/07
	4	Discovery Protocol Requirements				M	S+		2010/07
RFC2675		**IPv6 Jumbograms**	PS	1999		O	O		
RFC4861		**Neighbor Discovery for IPv6**	DS	2006		M	M		2010/07
	4.1, 4.2	Router Discovery				M	M		2010/07
	4.6.2	Prefix Discovery				M	M		2010/07
	7.2	Address Resolution				M	M		2010/07
	7.2.5	NA and NS processing				M	M		2010/07
(RFC4862)	7.2.3	Duplicate Address Detection				M	M		2010/07
	7.3	Neighbor Unreachability Detection				M	M		2010/07
	8	Redirect functionality				S	M		2010/07
RFC5175		**IPv6 Router Advertisement Flags Option**	PS	2008		S	S		
RFC4191		**Default Router Preference**	PS	2005		S+	S+		
RFC3971		**Secure Neighbor Discovery**	PS	2005	SEND	c(M)	c(M)		2010/07

Tools - Agency Gets an SDOC

11	Suppliers Declaration of Conformity for USGv6 Products: Declared Capabilities and Test Results Summary								USGv6-v1 SDOC-v1.9 Page 2
Product Id:			**Stack Id:**						
			Context /	**Supported Capabilities**			**USGv6 Testing Program Results**			
Spec / Reference	Section	**USGv6-v1 Profile Requirements**	Configuration Option	**Host**	**Router**	**NPD**	Test Suite Conformance/NPD	Test Lab / Result ID, Note #, or Component Ref	Test Suite Interoperability	Test Lab / Result ID, Note #, or Component Ref
SP500-267	**6.1**	**IPv6 Basic Requirements**								
		support of IPv6 base (IPv6;ICMPv6;PMTU;ND)	IPv6-Base				**Basic_v1.*_C**		**Basic_V1.*_I**	
		support of stateless address auto-configuration	SLAAC				**SLAAC-V1.*_C**		**SLAAC-V1.0_I**	
		support of SLAAC privacy extensions.	PrivAddr				*Self Test*		*Self Test*	
		support of stateful (DHCP) address auto-	DHCP-Client				**DHCP_Client_v1.*_C**		**DHCP_Client_v1.*_I**	
		support of automated router prefix delegation	DHCP-Prefix				*Self Test*		*Self Test*	
		support of neighbor discovery security extensions	SEND				*Self Test*		*Self Test*	
SP500-267	**6.6**	**Addressing Requirements**								
		support of addressing architecture reqts	Addr-Arch				**Addr_Arch_v1.*_C**		**Addr_Arch_v1.*_I**	
		support of cryptographically generated addresses	CGA				*Self Test*		*Self Test*	
SP500-267	**6.7**	**IP Security Requirements**								
		support of the IP security architecture	IPsecv3				**IPsecv3_v1.*_C**		**IPsecv3_v1.*_I**	
		support for automated key management	IKEv2				**IKEv2_v1.*_C**		**IKEv2_v2.*_I**	
		support for encapsulating security payloads in IP	ESP				**ESPv3_v1.*_C**		**ESP_v1.*_I**	
SP500-267	**6.11**	**Application Requirements**								
		support of DNS client/resolver functions	DNS-Client				*Self Test*		*Self Test*	
		support of Socket application program interfaces	SOCK				*Self Test*		*Self Test*	
		support of IPv6 uniform resource identifiers	URI				*Self Test*		*Self Test*	
		support of a DNS server application	DNS-Server				*Self Test*		*Self Test*	
		support of a DHCP server application	DHCP-Server				*Self Test*		**DHCP_Serv_v1.*_I**	
SP500-267	**6.2**	**Routing Protocol Requirements**								
		support of the intra-domain (interior) routing	IGW				*Self Test*		**OSPFv3_v1.*_I**	
		support for inter-domain (exterior) routing	EGW				*Self Test*		**BGP_v1.*_I**	
SP500-267	**6.4**	**Transition Mechanism Requirements**								
		support of interoperation with IPv4-only systems	IPv4				*Self Test*		*Self Test*	

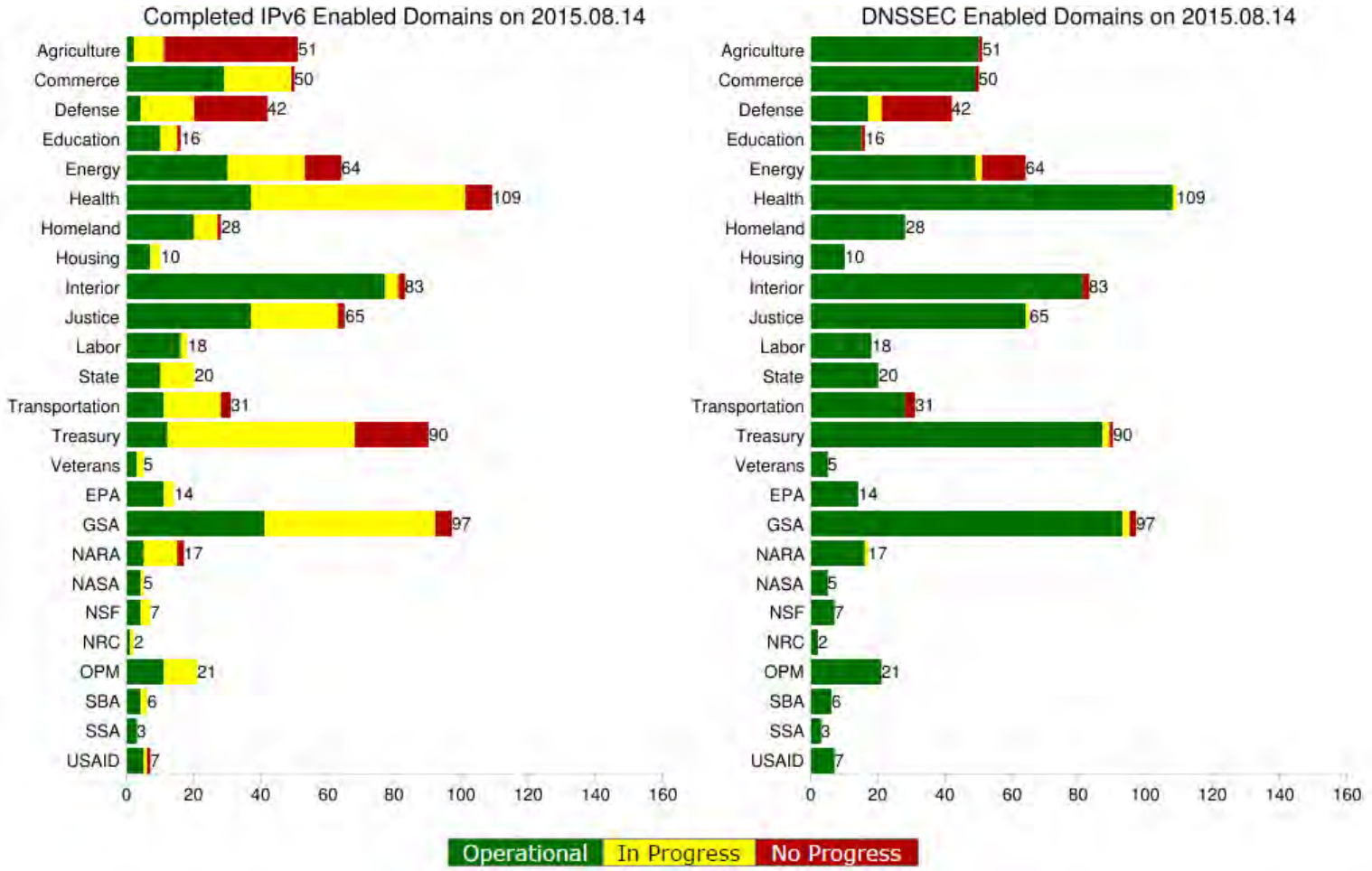
Federal IPv6 Transition Progress Measures

NIST USGV6 PROGRAM

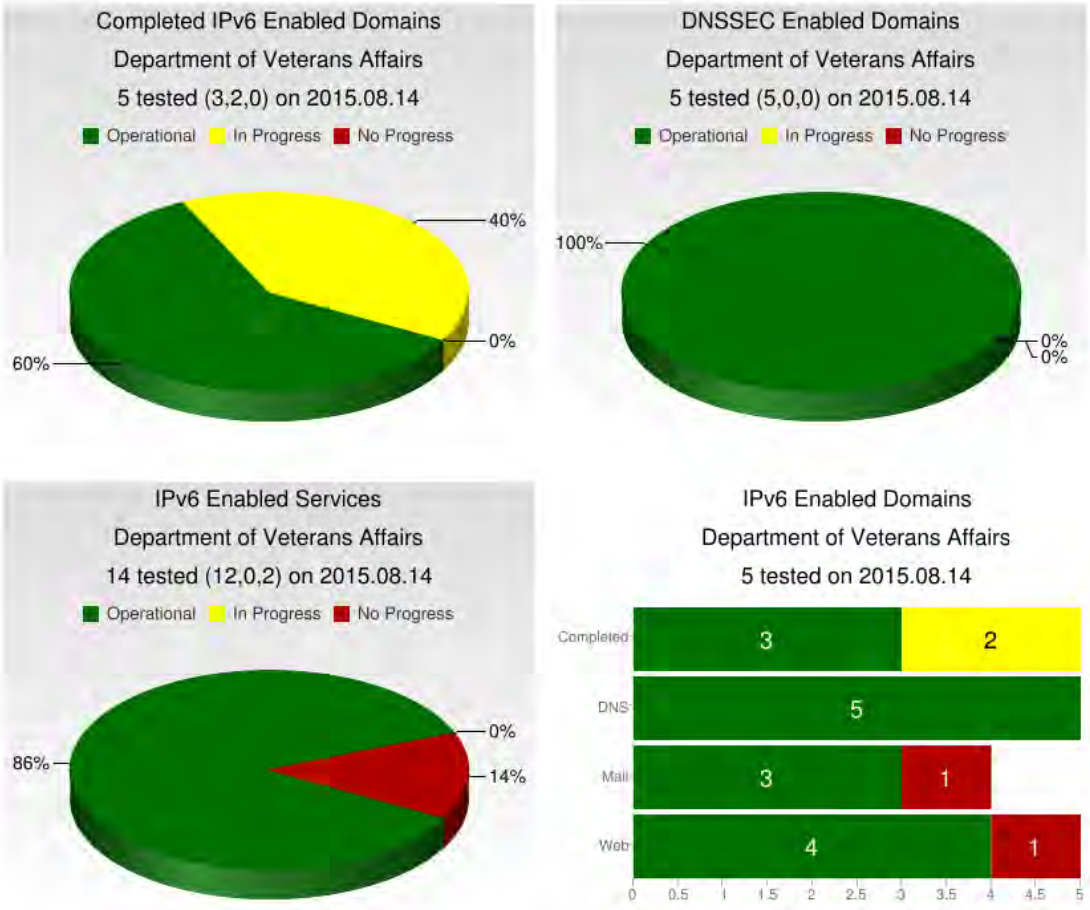
What is the NIST USGv6 Deployment Status Website?

- http://usgv6-deploymon.antd.nist.gov/cgi-bin/generate-gov.dept
- Provides a central place to track the status of the Departments and Agencies
- Currently focused on progress in meeting the 2012 Mandate for all public/external facing services to use operationally use IPv6
- Provides a status for Web, E-mail and DNS (and DNSSEC)
  - Only the primary agency website

What Does it Look Like? High Level



What Does it Look Like? Summary



- Detailed IPv6 & DNSSEC Service Interface Statistics for 2015.08.14 -

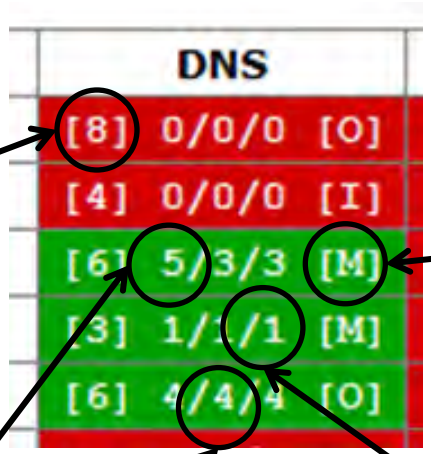
What Does it Look Like? Detailed

DISCOVER THE TRUE VALUE OF TECHNOLOGY

- Detailed IPv6 & DNSSEC Service Interface Statistics for 2015.08.14 -

Domain	Organization	DNS	Mail	Web	Links	DNSSEC
gov.cdco.	Department of Veterans Affairs	[4] 4/4/4 [O]	[1] 1/1/1 [O]	[1] 1/1/1 [I]	100%/73%	S/V/C
gov.nrd.	Department of Veterans Affairs	[4] 4/4/4 [O]	[2] 0/0/0 [O]	[1] 1/1/1 [I]	100%/61%	S/V/C
gov.thesecondthing.	Department of Veterans Affairs	[4] 4/4/4 [O]	[0] 0/0/0 [-]	[1] 0/0/0 [I]	0%/0%	S/V/C
gov.va.	Department of Veterans Affairs	[4] 4/4/4 [I]	[1] 1/1/1 [I]	[1] 1/1/1 [I]	78%/73%	S/V/C
gov.vetbiz.	Department of Veterans Affairs	[4] 4/4/4 [O]	[1] 1/1/1 [O]	[1] 1/1/1 [I]	50%/69%	S/V/C

How Do I Read DNS?



Estimated number of IPv4 servers/ interfaces found. If no name servers are found, the SOA Record (name server) of the parent domain is used and a (P) is indicated. In this example, the agency utilizes 8 DNS servers.

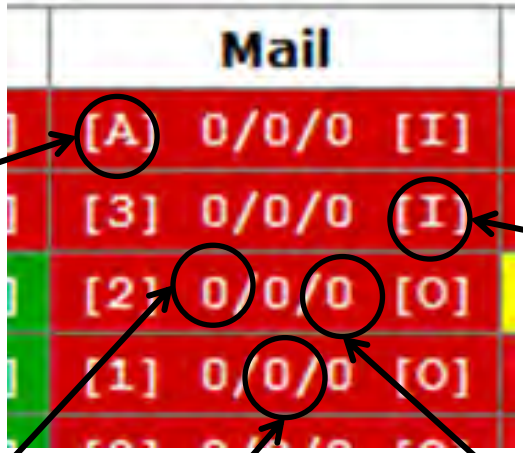
Location of service related to the domain:
(I) = Internal to domain
(P) = Parent of domain
(O) = Outside of domain
(M) = Mix of locations
In this example the DNS servers are located in a mix of locations.

Servers/interfaces with IPv6 address assignments. In this example (5) of the (6) DNS servers have IPv6 addresses.

Servers/interfaces with IPv6 addresses that respond to pings. In this example (4) of the (6) DNS servers respond to IPv6 pings.

Servers/interfaces that are fully operational over IPv6. In this example (1) of the (3) DNS servers are operational over IPv6.

How Do I Read Mail?



Estimated number of IPv4 MX records found. If no mx records are found the (A) record is used for the domain. In this example, no MX record was returned so an (A) was used..

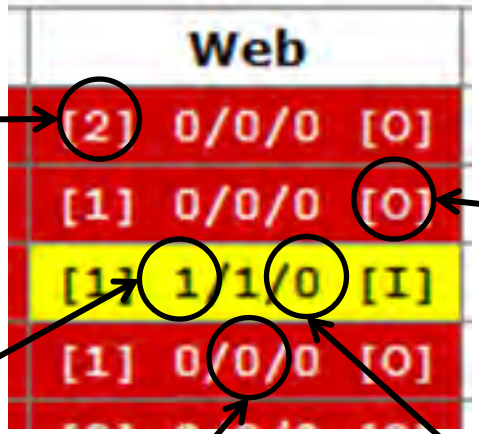
Location of service related to the domain:
(I) = Internal to domain
(P) = Parent of domain
(O) = Outside of domain
(M) = Mix of locations
In this example the Mail (SMTP) servers are located internal to the domain.

Servers/interfaces with IPv6 address assignments. In this example (0) of the (2) Mail (SMTP) servers have IPv6 addresses.

Servers/interfaces with IPv6 addresses that respond to pings. In this example (0) of the (1) Mail (SMTP) servers respond to IPv6 pings.

Servers/interfaces that are fully operational over IPv6. In this example (0) of the (2) Mail (SMTP) servers are operational over IPv6.

How Do I Read Web?



Estimated number of IPv4 web servers/interfaces found. In this example, (2) web servers were found.

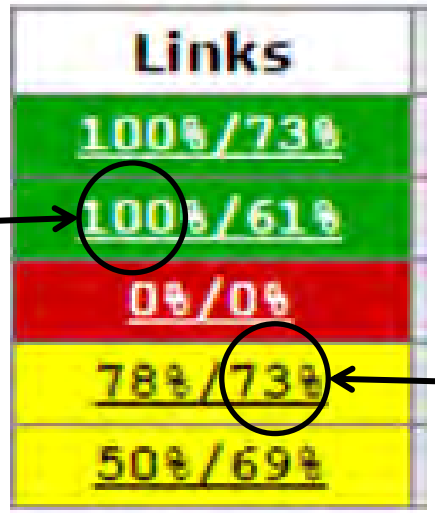
Location of service related to the domain:
(I) = Internal to domain
(P) = Parent of domain
(O) = Outside of domain
(M) = Mix of locations
In this example the Web server is located outside the domain.

Web servers with IPv6 address assignments. In this example (1) of the (1) Web servers have IPv6 addresses.

Web servers with IPv6 addresses that respond to pings. In this example (0) of the (1) Web servers respond to IPv6 pings.

Web servers that are fully operational over IPv6. In this example (0) of the (1) Web servers are operational over IPv6.

How Do I Read Links



Percent of subdomains referenced that are IPv6 operational

Percent of all domains referenced that are IPv6 operational

The Easy Way

Red: No IPv6 Service at all.	
Yellow: IPv6 deployment started, but not operational (or there is a problem)	
Green: IPv6 Operational	

NIST USGv6 Program: Summary

- NIST SP 500-267 (USGv6 Profile) was established to provide agencies with relate to vendors what IPv6 requirements/functionality they required
- The USGv6 Profile covers three device types and twelve functional categories
- The FAR directs agencies to include IPv6 requirements in their acquisitions based on the USGv6 profile
- Vendors provide agencies with SDOCs, based on third party lab verification, that show which IPv6 requirements/functionality their products meet
- The NIST USGv6 Deployment Status Website was established to provide a transparent status on and Agency's progress in meeting the OMB 2012 IPv6 Milestone

NIST USGv6 Program: Review Question and Answers

- Identify the three device types covered in the USGv6 Profile?
- Name three functional categories covered in the USGv6 Profile?
- Explain the difference in the USGv6 Profile of a “Mandatory” and “Optional” requirement?
- What document provides an agency with details about which IPv6 requirements/functionality a vendors product meets?
- Where can an Agency look to see their status in achieving the OMB 2012 IPv6 Milestone?

TMS Self-Certification

- Log in to the TMS https://www.tms.va.gov
- Enter **3949311** in the Search Catalogue field on your TMS home page
- Select the **GO** button
- Select the **Start Course** button
- Select the **Yes** button
- Select the **OK** button
- Select the **Close Window** button
- Complete the Course Evaluation survey that is on your TMS To-Do list.

For assistance, contact the TMS Help Desk vatmshelp@va.gov or 1-866-496-0463

Questions

Dale Geesey

Chief Operating Officer

Auspex Technologies, LLC

Phone: 703.319.1925

Fax: 866.873.1277

E-Mail:
dgeesey@auspextech.com

Web: www.auspextech.com

(IPv6 Enabled)

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