



Defense Research and Engineering Network (DREN) Deployment VA Inter-Agency IPv6 Meeting

Mr. John M. Baird
August 4, 2010

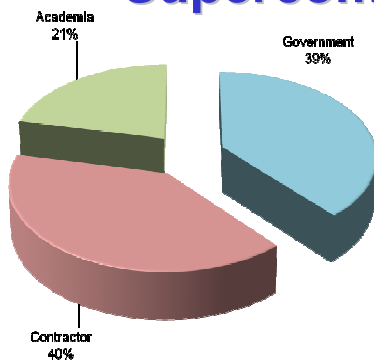


DREN Deployment: 2003-2005

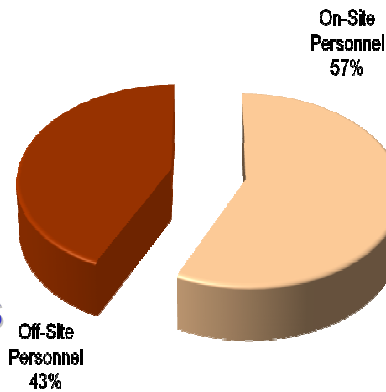


12+ HPC Modernization Program Supercomputing Centers

200+ DREN sites



4000+ User's desktops



PKI-Enabled



**DC
OA
DC**



1 core mission application





DREN Deployment: Success factors

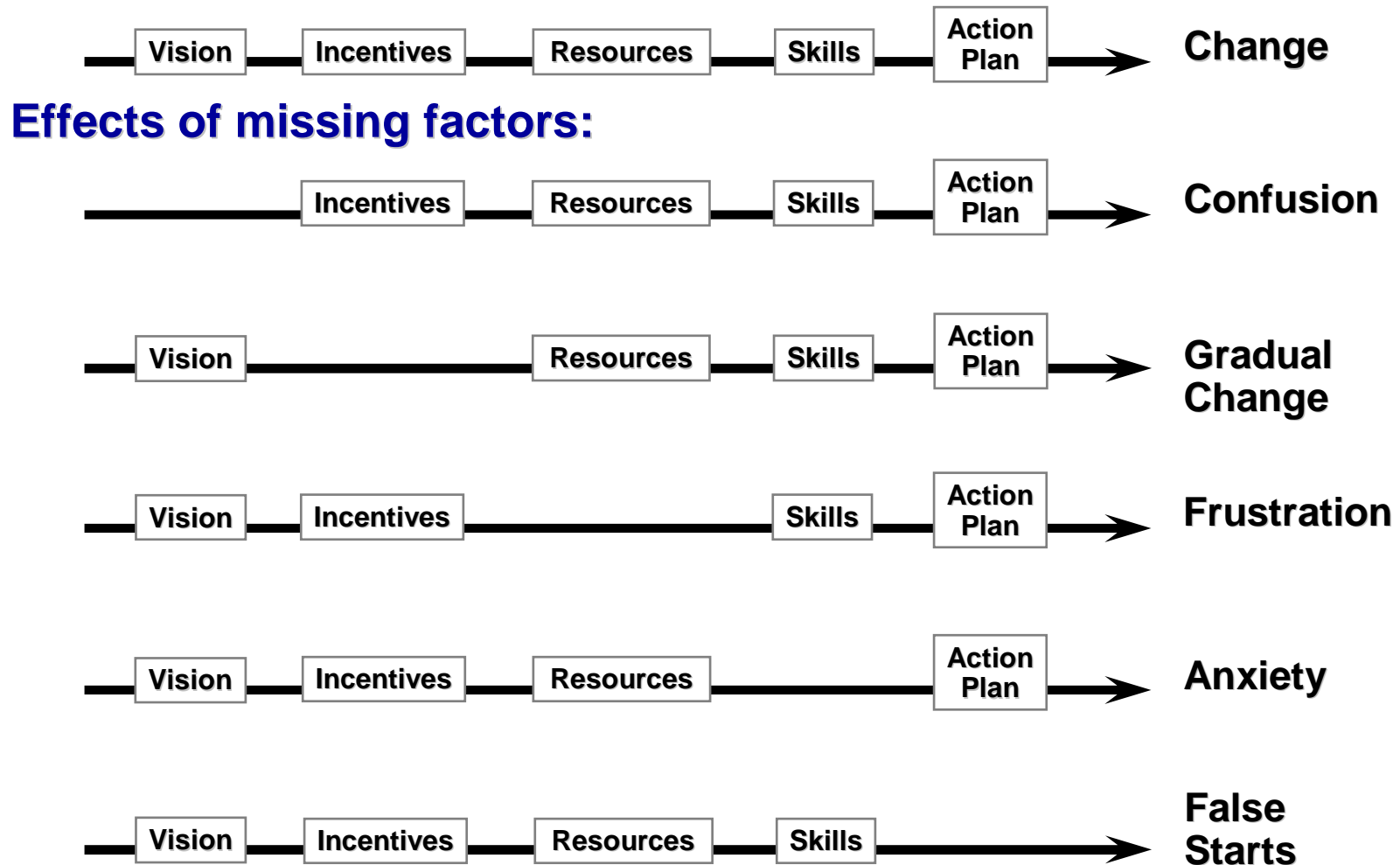


- **Vision – To be THE DoD IPv6 pilot, leading the way for others**
 - Quickly deploy IPv6 across the WAN, mission critical application, local sites' infrastructures, computer systems and servers, and user desktops
 - Share lessons learned with others
- **Incentive – Hey DREN, how quickly can you make IPv6 happen?**
- **Resources**
 - Recent, homogeneous equipment
 - Skilled network and systems personnel
 - Option for IPv6 support in existing contract
- **Skills**
 - A community familiar with supporting new technology and being pioneers
 - Previous experience with an IPv6 test bed (since shut down)
- **Action Plan**
 - Build on what someone else has done rather than invent our own process
 - Adapt TransPlant technology transition process developed and refined by Carnegie-Mellon University (CMU) Software Engineering Institute (SEI)

See: DoD Success Story at www.whitehouse.gov/omb/E-Gov/ea_success.aspx



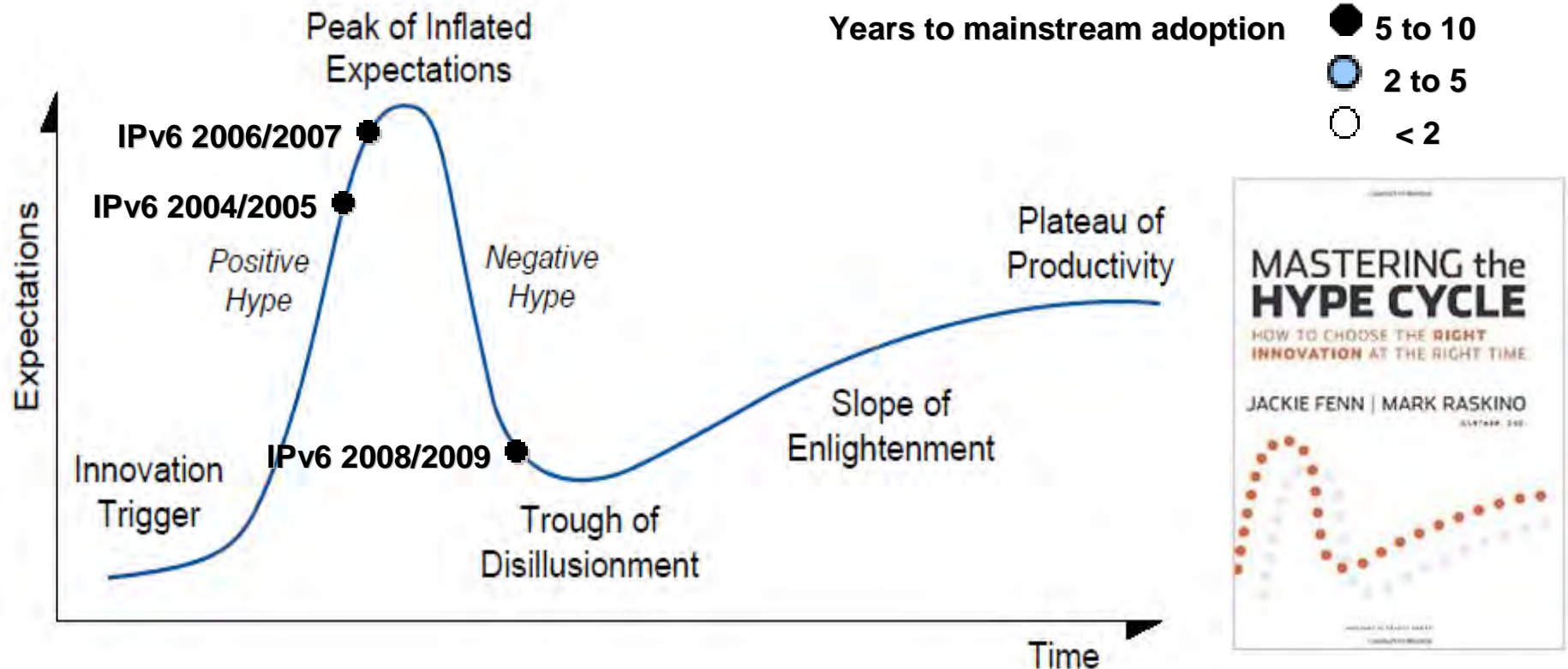
Factors needed for *any* change



Source: Delorese Ambrose, in 1987 communication to CMU-SEI TransPlant personnel. Originally from the Enterprise Corporation, a consulting firm no longer in existence.



Vision: Perceptions Vary



Hype Cycle © Gartner, Inc. and/or its Affiliates, beginning in 1995

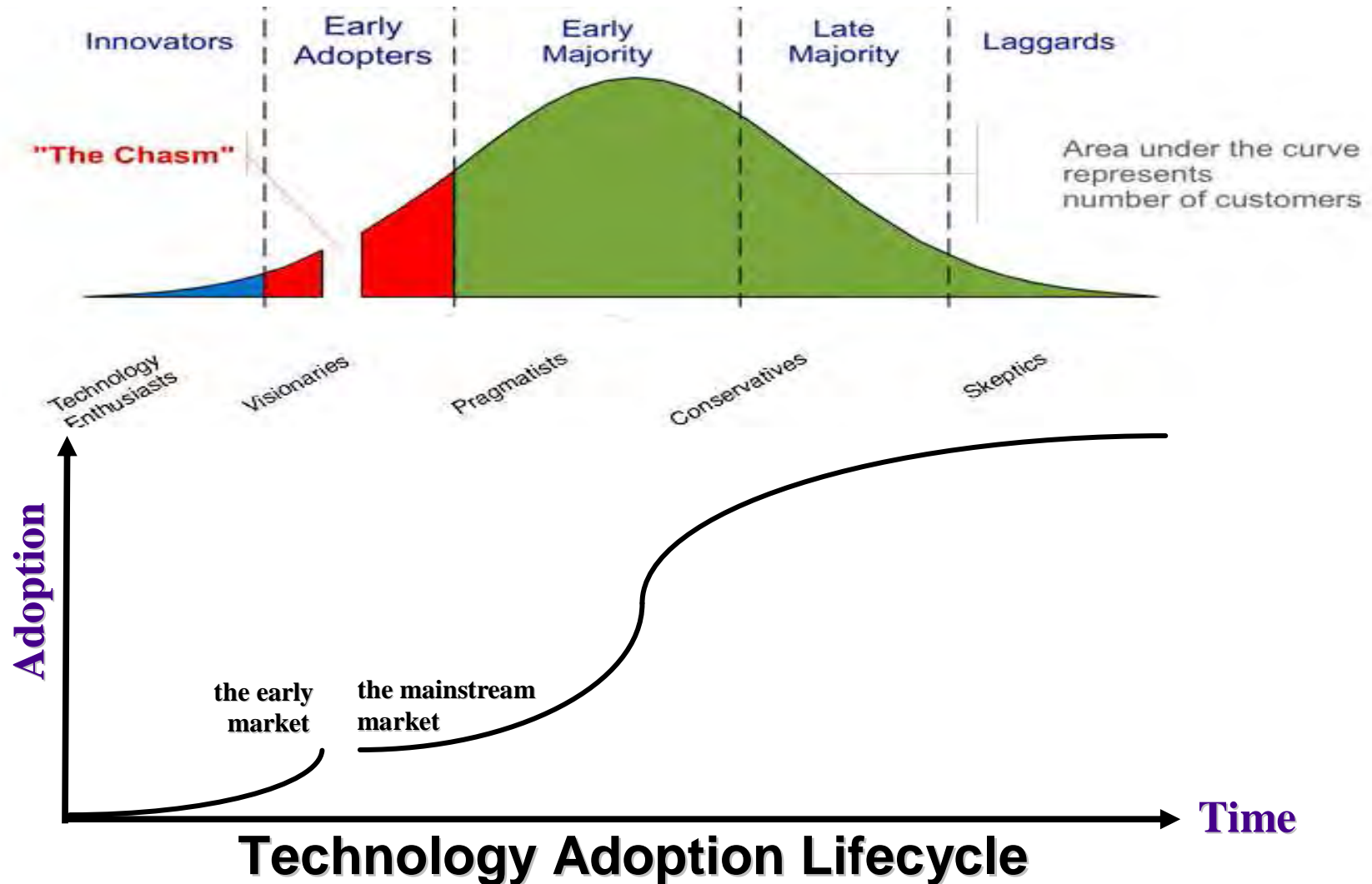
IPv6 2010 ?

“Smart is when you believe only half of what you hear. Brilliant is when you know which half to believe.” — Robert Orben





Vision: Perceptions Matter



Bohlen, Beal & Rogers, "Diffusion Process", 1957, Moore, "The Chasm", 1991





Vision: Perceptions Motivate

“Internet will soon be running on IPv4 address fumes ” – Arstechnica



inetcore.com
IPv4 counter
(predecessor to
HE ByeBye v4)

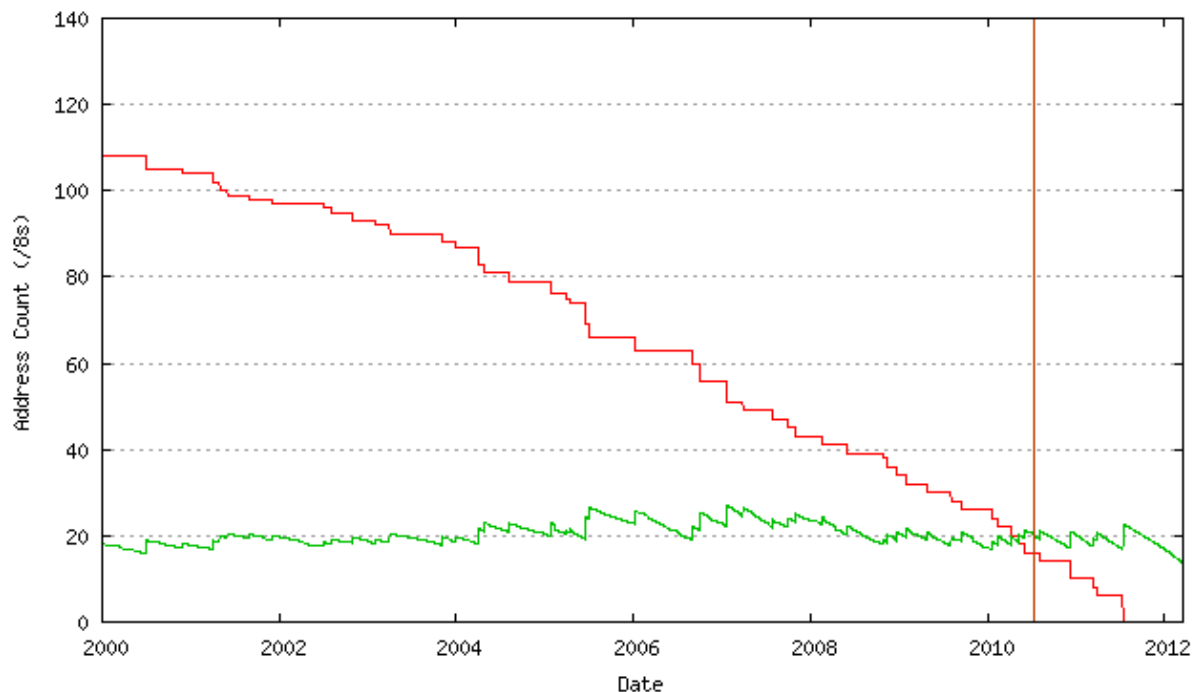


Fig. 35

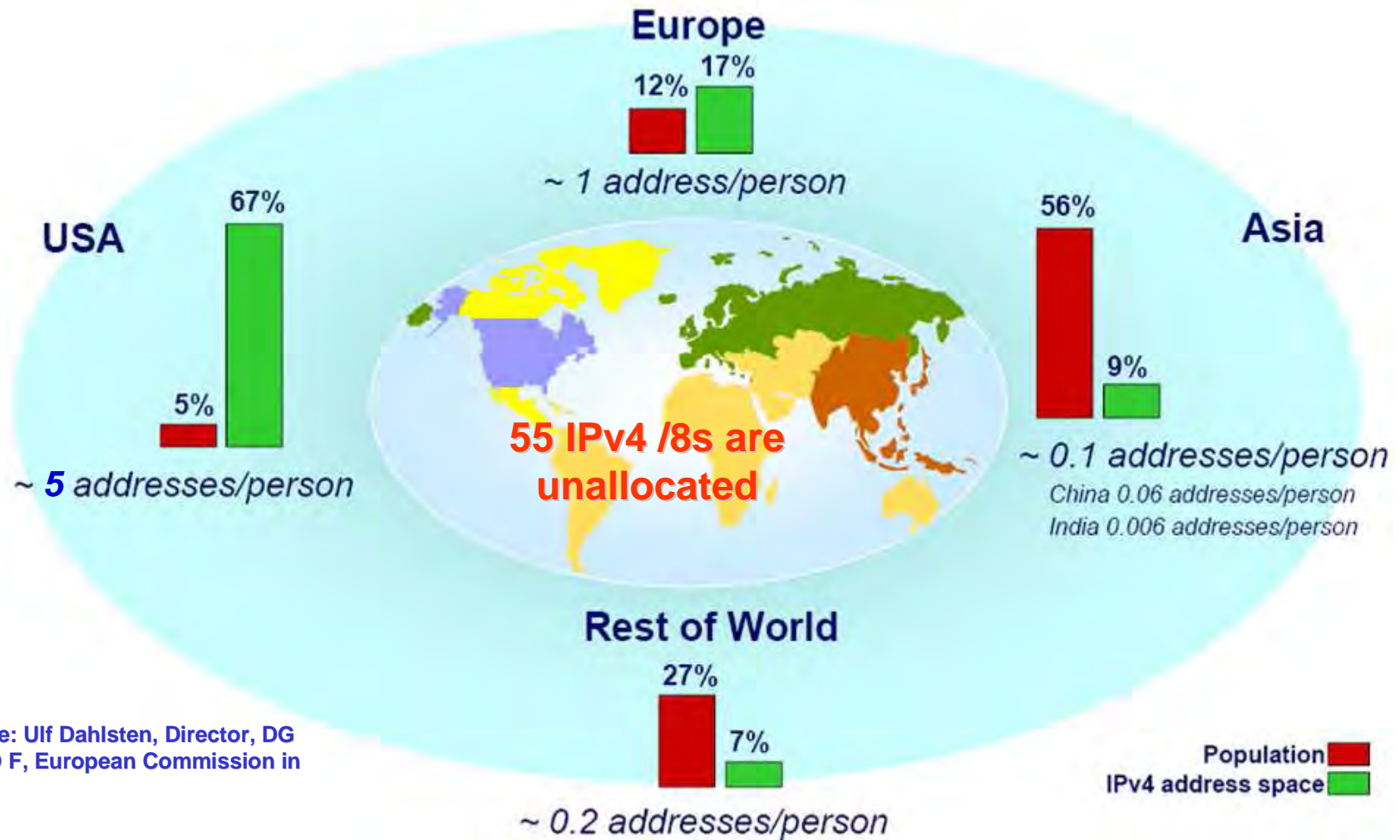
IANA Pool — RIR Pool — Projection —

Geoff Huston
potaroo.net

“Faced with the choice between changing one's mind and proving that there is no need to do so, almost everyone gets busy on the proof.” – *John Kenneth Galbraith*



Vision: Perceptions Motivate

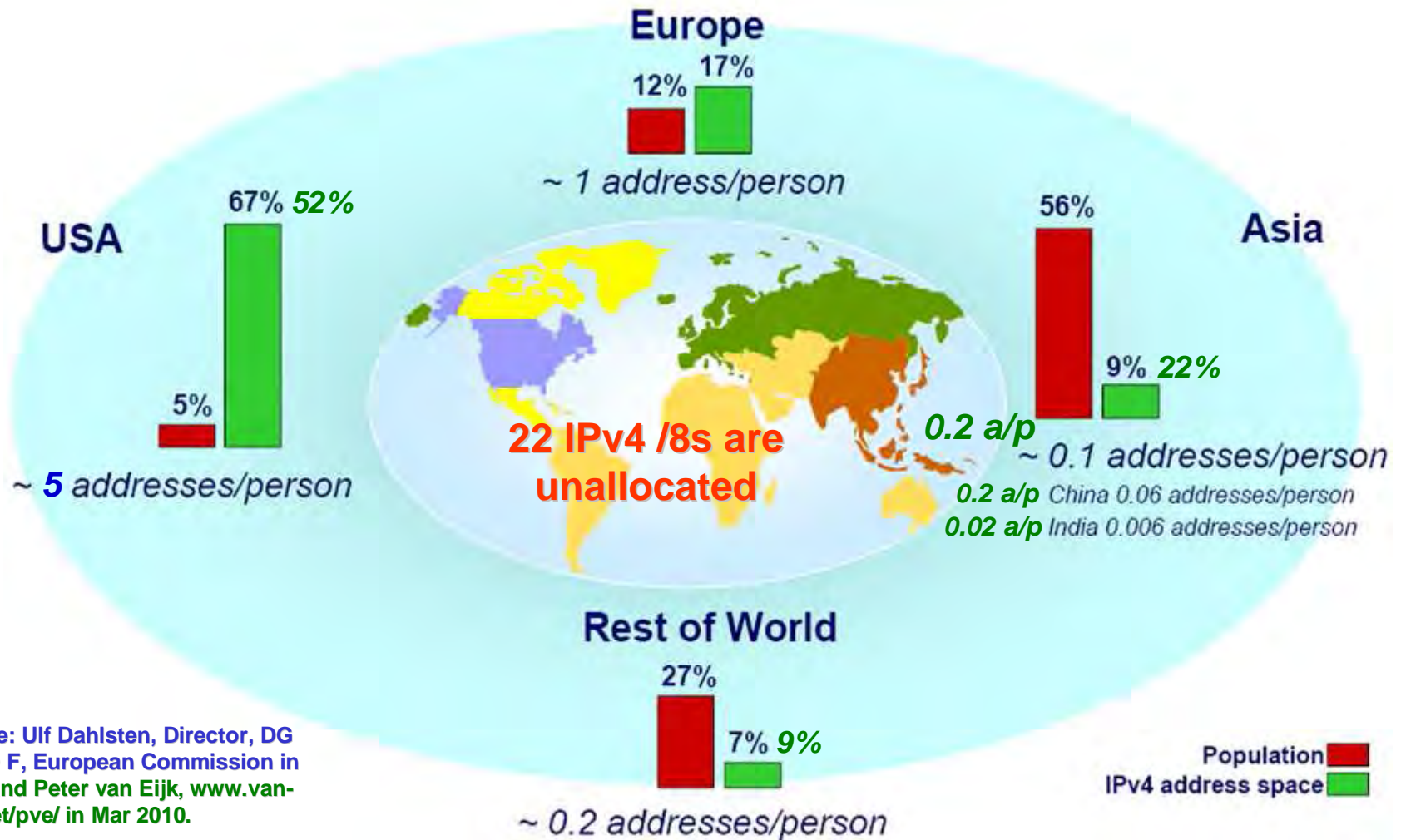


Source: Ulf Dahlsten, Director, DG INFSO F, European Commission in 2007.

2007: IPv4 allocations were made unevenly



Vision: Perceptions Motivate

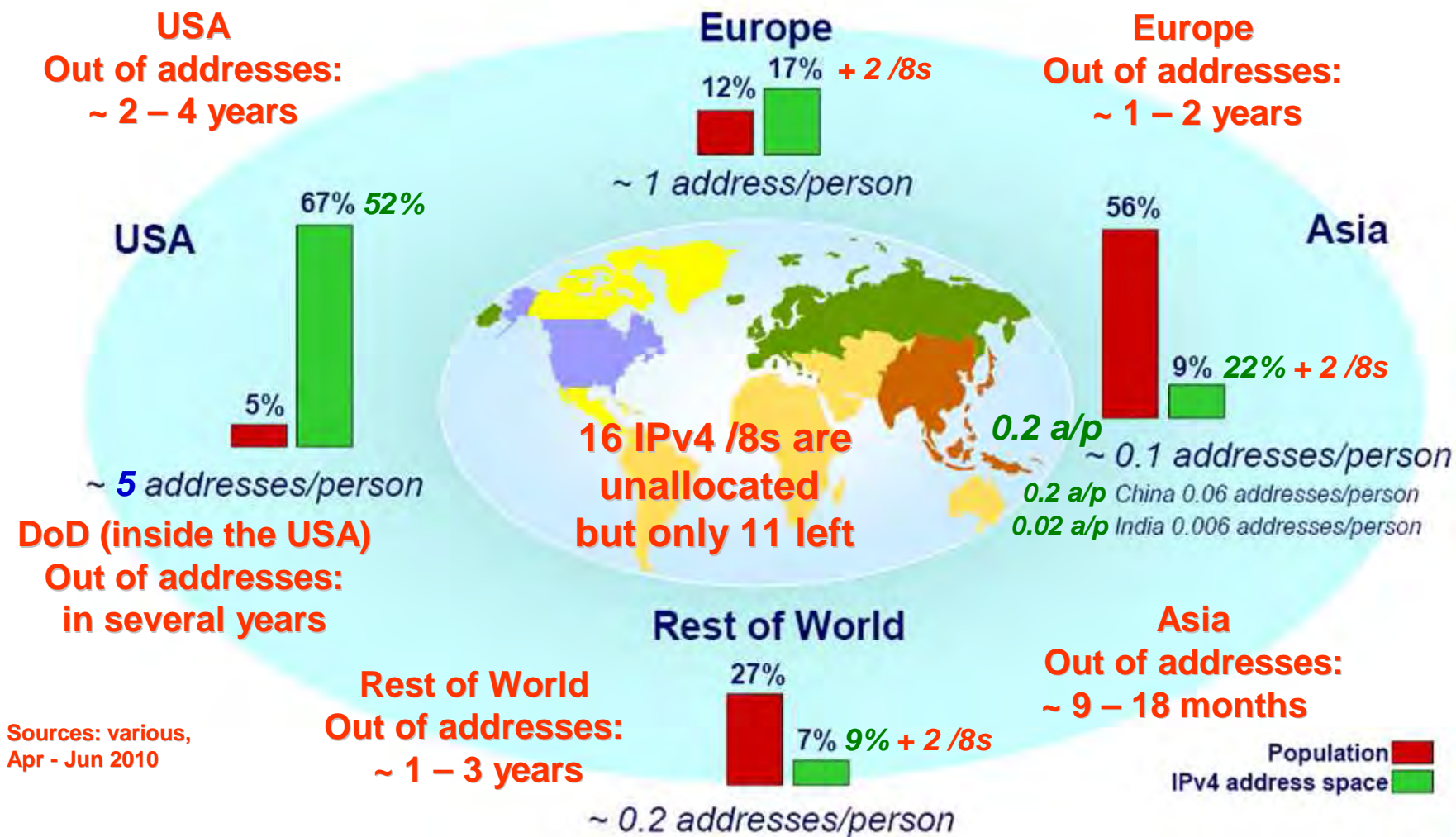


Source: Ulf Dahlsten, Director, DG INFSO F, European Commission in 2007 and Peter van Eijk, www.van-eijk.net/pve/ in Mar 2010.

2010: IPv4 allocations were made unevenly



Vision: Perceptions Motivate



Sources: various, Apr - Jun 2010

IPv4 exhaustion will occur unevenly





Vision: Perceptions Motivate



- **In the 1990s, IPv4 exhaustion was delayed for over a decade by several useful hacks:**
 - Dynamic Host Configuration Protocol (DHCP)
 - Classless Inter-Domain Routing (CIDR)
 - Private IP addresses
 - Network Address Translation (NAT)
- **Recently, various extensions to NAT have been proposed to further delay IPv4 exhaustion:**
 - NAT-PT, DS-Lite, LSN, 6rd, IVI, A+P, and others
 - All NATs share a faulty premise: the devices behind the NAT will not be online all the time
 - SOHO servers, sensor nets, power grids, streaming media servers, set-top boxes, iPads violate this premise
- **NATs delay but cannot prevent IPv4 exhaustion**



Incentives



- **For deploying IPv6:**
 - **Insecurity – ignoring IPv6 does not make it go away**
 - Open question: Disable internally or enable the perimeter?
 - **Enterprise-specific internal applications**
 - Microsoft's DirectAccess
 - "I have a dream..." – *Martin Luther King, Jr.*
 - **Much larger address space (128 versus 32 bits)**
 - International customer support (external email, www, etc)
 - "Its the addresses, 'stupid'!!" – apologies to Pres. Clinton
 - **Government mandates**
 - National – DoD, OMB
 - International – Japan, EU, China, OECD, India
 - **Rich Content: Google, Facebook, YouTube, Netflix, eBay, etc**
- **Against IPv6:**
 - **15 years of "Chicken Little" and hype**
 - **"If it ain't broke, don't fix it." – Bert Lance**
 - "No funding or resource requirements identified at this time"
 - July 2010 Air Force IPv6 Conference
 - **Lack of confidence in IPv6 security tools: Catch-22**



Resources: Free is Good



- **IPv6 test programs**

- IPv6 Ready Logo
- NIST USGv6
- DoD UCR APL

(why none for IPv4???)

www.ipv6ready.org

www.antd.nist.gov/usgv6

jitc.fhu.disa.mil/apl

- **Contracts**

- IPv6 Case 2005-041 Dec 2009 FAR final rule E9-28931
- GSA Networx May 2007 contract limited IPv6 support
- **Special clauses in specific contracts**
 - Example: DREN Feb 2001 SOW NSP clause “The Contractor shall provide the capability to support IP version 6 (IPv6) when IPv6 becomes available through commercial service offerings. The Contractor shall support the Government in transition from IPv4 to IPv6.”

- **Lessons Learned**

- DREN IPv6 knowledge base <https://kb.v6.dren.net>
- ARIN IPv6 wiki www.getipv6.info
- Linux IPv6 HOWTO www.bieringer.de/linux/IPv6/



Resources: Networks

- **Look at what you currently have**
 - **Will it be part of the solution, or part of the problem?**
 - Are maps and configs for your network up to date?
 - Are current security and network management adequate?
- **Next, think about your IPv6 deployment**
 - **Adding another protocol stack adds complexity**
 - Making IPv6 topology congruent to IPv4 minimizes impact
 - **Addresses are no longer a constraining resource**
 - Don't let compromises from the past hinder the future
 - The IETF had good reasons for their guidelines
- **Then, rethink your IPv4 address plan**
 - **Making IPv4 topology congruent to IPv6 minimizes impact**

“There is never time to do it right, but there is always time to do it over” – *Murphy*



Resources: Hardware



- **Look at what you currently have**
 - Most hardware built since 2005 can support IPv6
 - Does your inventory tell you when it was made (not install date)? When the software was last updated?
 - “Don't expect something to work just because it's supported” – *Lorenzo Colitti, Google*
- **WAN Router memory demands will grow**
 - IPv4 full Internet routing table continuing growth
 - new allocations
 - address exhaustion
 - IPv6 full Internet routing table is small but it will grow
 - DREN expanded memory/upgraded routers in 2007
- **When are we going to stop buying it unless it supports IPv6?**



Resources: Software

- **Computer O/S and Network IOS**
 - Modern systems mostly just work, default to IPv6 on
 - Windows XP is not modern (and needs IPv4 to work)
- **Network services**
 - Built-in mostly just work, 3rd party can be incomplete
- **Network management**
 - Support rapidly improving, IPv4 continues to work
- **Applications**
 - S/W conglomerates sometimes don't "get it"
 - Small developers will support IPv6 if we pay for it
 - Good news – Application migration is straightforward
 - Bad news – Migration tool support is weak
 - PortToIPv6 Framework porttoipv6.sourceforge.net
- **When are we going to stop buying it unless it supports IPv6?**



Resources: Software

- **Security – an excuse but not a reason to delay deploying IPv6**

DOCTOR FUN

4 June



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<http://ibiblio.org/Dave/drfun.html>

The brave new world of IPv6

“Just because you're not paranoid, doesn't mean they're not out to get you.” – Colin Sautar

- 30 years ago, if they had waited for IPv4 to be secure
 - Wouldn't we still be waiting!?!
- Designing an IPv6 security infrastructure to co-exist with your present IPv4 infrastructure is extra work
 - $v4 + v6 > 2 * v4$
 - Dual-stack can be over twice as hard as single-stack due to interactions
- Maintaining that structure doesn't have to be harder
 - Dual-stack need not be more expensive than IPv4 alone



Resources: People

- **Prepare for IPv6 Now**

- Hiring Practices
- Performance Reviews
- Promotion Factors

- **A vision shared is better than a “just because”**

- Perceptions Motivate

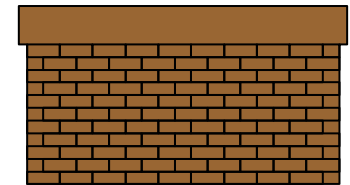
- The story: A stranger saw three stonemasons working and asked each one the same question
- Three people doing the same job, with different perceptions/motivations

- “Technology makes change possible, or even necessary, but people make change happen.” – *David S. McIntosh*

1. The first mason was toting rocks to a pile, near a wall. “**What are you doing?**” asked the stranger. “Can’t you see that I’m carrying rocks?” was the reply



2. The stranger asked the second laborer, “**What are you doing?**” “I’m building a wall,” he replied



3. A few steps away, the stranger came upon a third worker and asked “**What are you doing?**” The worker smiled. “I’m building a cathedral to the glory of God!” was the reply





Resources: Time is Money



Software Engineering
Economics, Barry Boehm,
1981
Extreme Programming
Explained, Beck, 1999

“Never put off till tomorrow what you can put off till next weekend!” – *Born Loser comic strip*



Skills: Experience

- **Experience is the best teacher**
 - **The May 2009 Planning Guide/Roadmap Toward IPv6 Adoption recommends setting up an IPv6 test lab**
 - **2 computers, a router, and some cabling is enough to begin**
 - **Microsoft describes a virtual lab using only one computer**
 - **Need an external IPv6-only address?**
 - **ipv6.google.com**
 - **Need to test your IPv6 infrastructure?**
 - **www.ipv6tools.org allows you to ping, trace, and query DNS**
 - **ipv6-speedtest.net allows you to test performance ('-' not '.')**
 - **Want IPv6 connectivity today? (try this at home)**
 - **Use the gogoCLIENT from gogoware.gogo6.com and the authenticated.freenet6.net tunnel broker**
 - **Hurricane Electric provides another: tunnelbroker.net**

“Build a Little, Test a Little, Learn a Lot!” – RADM Wayne Meyer



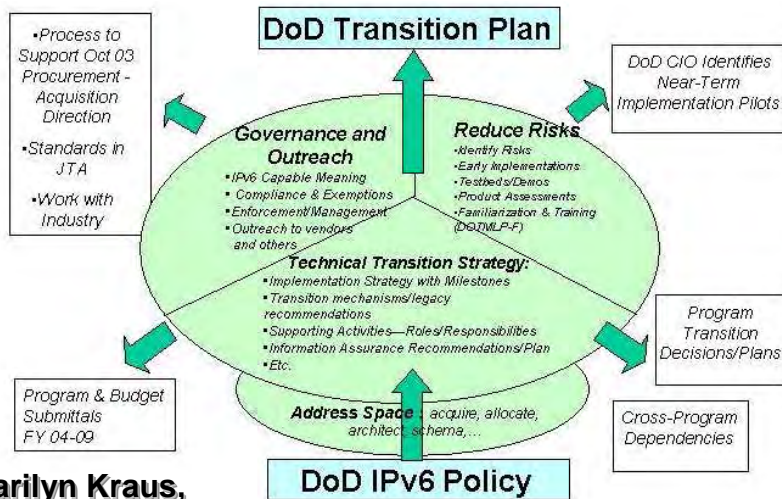
Skills: Training



- **Training Sources**
 - Free is best (web sites and webinars)
 - Low cost is good (books, Internet2, conferences)
 - Commercial training is available from multiple sources
 - “Just because you’re trained for something doesn't mean you’re prepared to do it.” – *Anonymous*
- **Who needs training (and how much)**
 - **IPv6: The more you know IPv4, the less you need**
 - IPv6 details: for system administrators, network managers, software developers, trainers ... ranges from a 1 week short course → 7 week refresher on IPv4 plus IPv6
 - IPv6 awareness: for executives, managers, security officers, procurement officers, help desk, maintenance personnel, tech writers, testers ... ranges from ¼ hour → 2 hours
 - **Change process: only those involved in preparing plans**
 - The next few slides with their links are typically adequate



Action Plan: So Many Choices, Choose Carefully

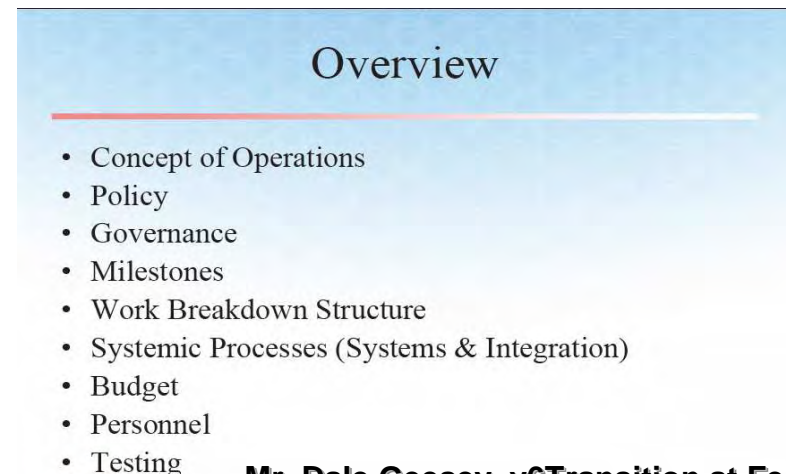


Ms. Marilyn Kraus,
office of DoD CIO, Nov 2003

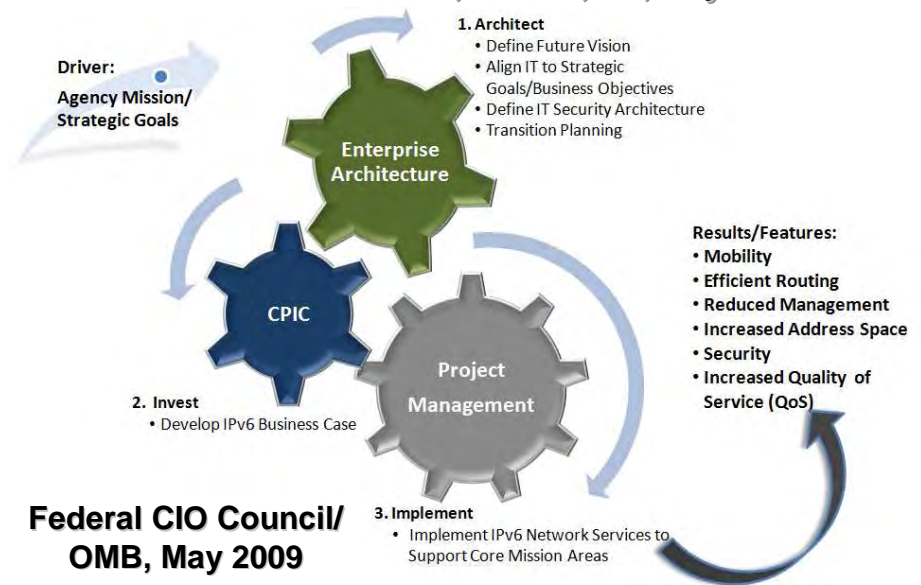
IPv6 Transition Outline

Pre-Deployment Phases	Deployment Phases
<ul style="list-style-type: none"> • Establish the network starting point • Importance of a network assessment and available tools • Defining early IPv6 security guidelines specific to agency • Additional IPv6 "pre-deployment" tasks needing consideration 	<ul style="list-style-type: none"> • Transport considerations for transition • Campus IPv6 transition options • WAN IPv6 transition options • Advanced IPv6 services options

Mr. Craig Hill, Cisco, Road Map to IPv6
Integration webinar, Dec 2006



Mr. Dale Geesey, v6Transition at Federal IPv6 Summit, Reston, VA, May 2006



Federal CIO Council/
OMB, May 2009





Action Plan: Think globally, act locally



- **Top Level Action Plan for the enterprise transition process:**
 1. Define problem, solution, and scope for planning
 2. Decide on a transition strategy
 3. Characterize adopters
 4. Identify effective transition mechanisms
 5. Select and synthesize
 - refine scope and strategy
 - design interactions among adopters
 - refine whole product
 - set priorities for action
 6. Prepare to manage risk
 7. Document the plan

See Carnegie-Mellon University (CMU) Software Engineering Institute (SEI) <http://www.sei.cmu.edu/news-at-sei/features/2001/4q01/feature-4-4q01.htm> for details of TransPlant technology transition **process**. See DREN IPv6 knowledge base for our adaptation



Action Plan: Think globally, act locally



- **Lower Level Action Plans** for the local enclaves making the technology **transition** to IPv6:
 1. Learn the terminology and technology*
 2. Establish the Change Team
 3. Describe Desired State
 4. Baseline Current State
 5. Analyze the Gap
 6. Develop the Solution(s)
 7. Trial the Solution(s) (on a local test bed)
 8. Roll Out the Solution(s)
 9. Analyze Lessons Learned
 10. Iterate until transition complete*

*Shown in grey since not in the SEI steps

See CMU SIE <http://www.sei.cmu.edu/pub/documents/98.reports/pdf/98tr004.pdf> for details of TransPlant technology **transition** process. See DREN IPv6 knowledge base for our adaptation



Factors needed for *any* change



Effects of missing factors:



Source: Delorese Ambrose, in 1987 communication to CMU-SEI TransPlant personnel. Originally from the Enterprise Corporation, a consulting firm no longer in existence.



Backup Slides

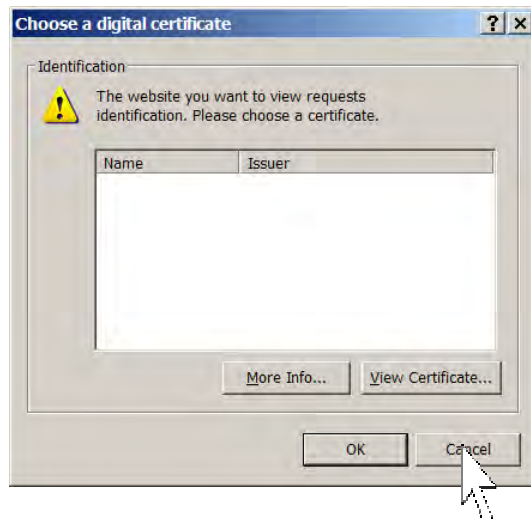




DREN IPv6 knowledge base access



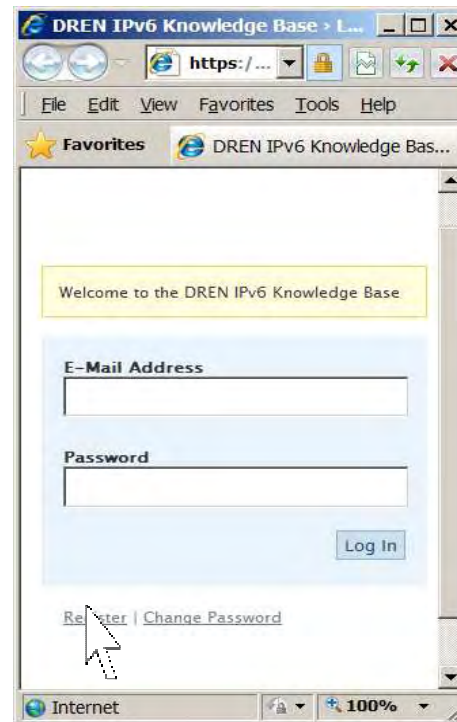
Step 1: In a web browser, go to <https://kb.v6.dren.net>. This window will pop up. Click on Cancel.



Note 1: If you have a DoD-issued Common Access Card (CAC), click on one of the certificates listed. Then click on OK to access the web site. You do not need to complete the registration process.

Note 2: If you use Safari on a Mac and have a DoD-issued CAC, open the "Keychain Access" application, select the CAC keychain, right click on the ID certificate, and then select "New Identify Preference". Enter **both** <https://kb.v6.dren.net> and <https://kb.v6.dren.net/> **before** performing step 1. You do not need to complete the registration process.

Step 2: Another window will open. Do not enter any information. Just click on Register.



Step 3: Another window will open. Enter information shown and click on Submit. Then wait ... a Password will arrive via email.

Access: Repeat step 1. In step 2, enter your E-Mail Address and your Password. Then click on [Log In](#). The temporary Password is changed during initial access.