

VA IPv6 Inter-Agency Meeting



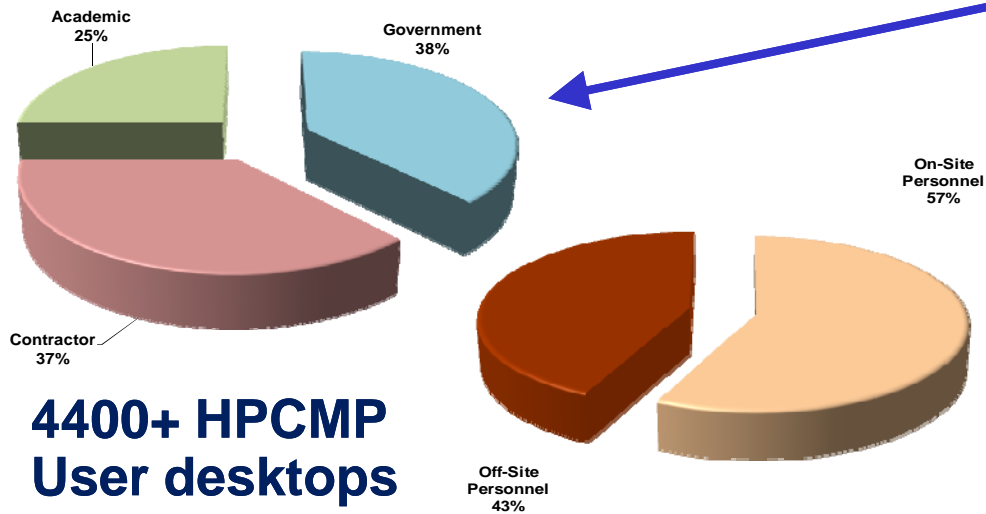
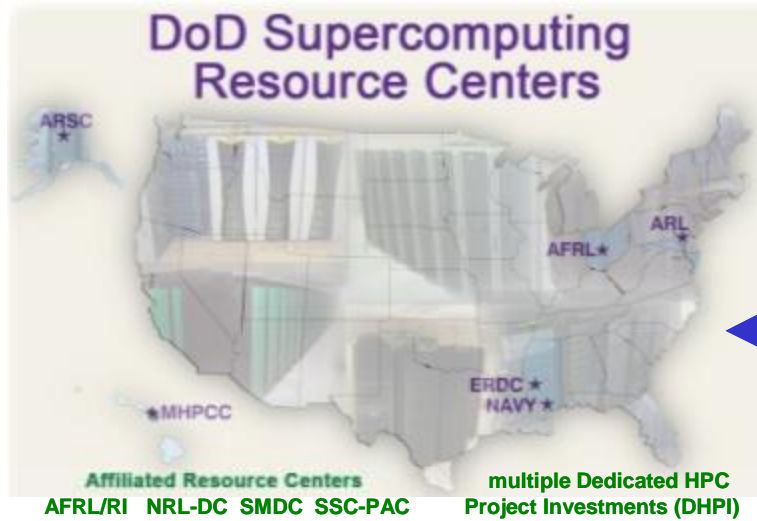
Defense Research and Engineering Network (DREN) Challenges and Lessons Learned

Mr. John M. Baird

Oct 12, 2011



Situation 2003

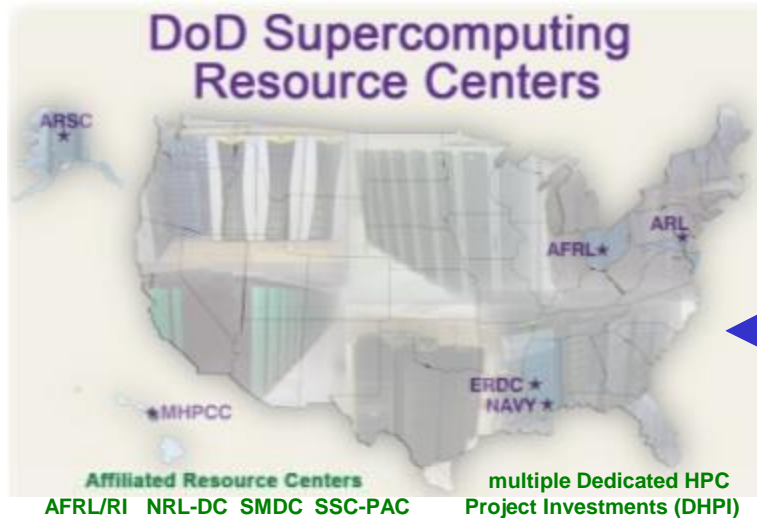


4400+ HPCMP User desktops





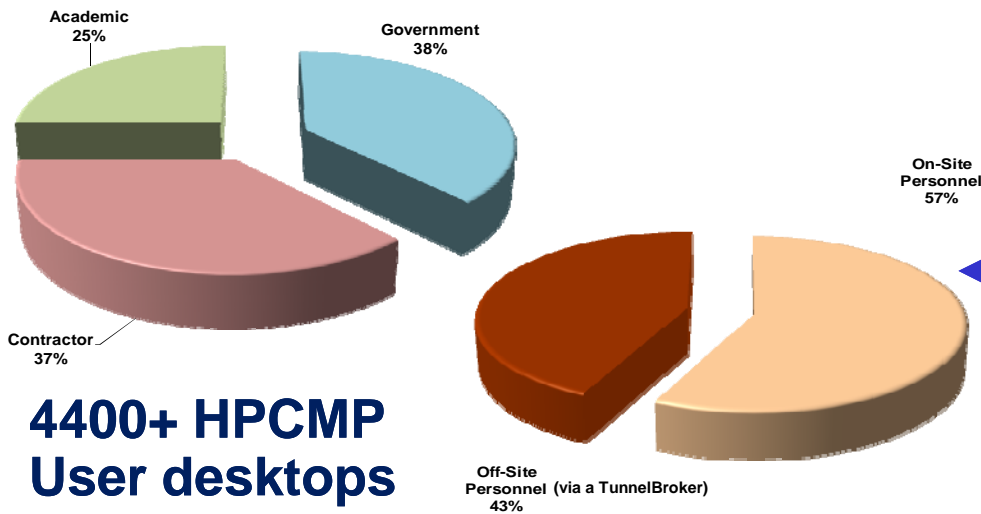
What we did IPv6: 2003-2005



6 DoD SRCs & 9 DREN user sites



Wide-area backbone



**4400+ HPCMP
User desktops**

**PKI-Enabled
KERBEROS**

DC
o A
DC



core mission application





IPv6 Challenges

- **Enterprise Level**
 - IPv6 Connectivity from Anywhere
 - Server Domain Names in DNS
- **Site Level**
 - Motivation
 - Internet Protocol (IP) Addresses in DNS
- **Lessons Learned**
 - Core Mission Application – Kerberos
 - Other Applications/Utilities
 - Network Security Products
 - IPv6 Knowledge Base

See DoD Success Story at <http://www.whitehouse.gov/omb/E-Gov/EA-Success>



IPv6 Challenges

IPv6 Connectivity From Anywhere

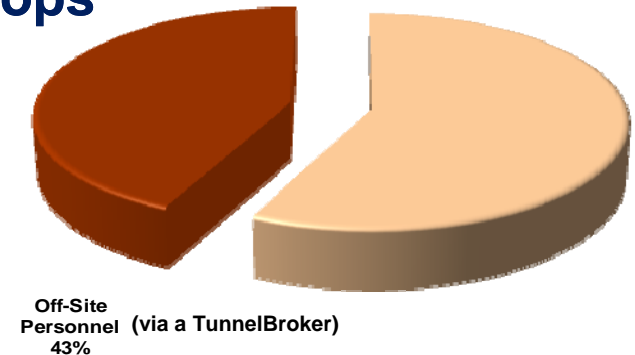


4400+ HPCMP
User desktops

On-Site
Personnel
57%

- **Problem**

- The supercomputers centers supported IPv6 for on-site users
- Only a handful of DREN user sites would deploy IPv6
- How to provide IPv6 connectivity for other DREN user sites and for Internet users?



- **Solution**

- Then: Install Hexago (now gogo6) TunnelBroker
Offer client kits to all users – very few used them
- Now: Use dual-stack VPN or Microsoft DirectAccess



IPv6 Challenges

Server Domain Names in DNS



- **Problem**
 - Chicken and egg for any server (HPC or web)
 - No AAAA = no IPv6 access
 - AAAA = timeouts for users with partial IPv6 access
- **Solution**
 - AAAA after public-facing services are IPv6-enabled
 - “Special” domain names with AAAA
 - Then: name-v6.domain or name.v6.domain
 - Now: limited use only while testing!
 - Time healed this wound – just do it
 - World IPv6 Day June 8, 2011 showed O/S and web browsers are much smarter than they used to be



IPv6 Challenges Motivation

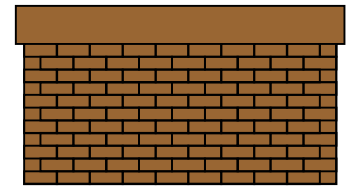


- **Train early and often**
 - Hiring Practices
 - Promotion Factors
 - Performance Reviews
- **COMMUNICATE, motivate!**
 - Perceptions Do Motivate
 - The story: A stranger saw three stonemasons working and asked each one the same question →
 - **3 people; one mission, but very different perceptions/motivations**

1. The first worker 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 worker, “**What are you doing?**” “I’m building a wall,” he snarled



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 his answer



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



IPv6 Challenges

IP Addresses in DNS



- **Enterprise Challenges**
 - IPv6 address allocation and address plan
 - How much, from whom, overcome IPv4 habits
 - **DNS servers ready for IPv6**
 - **Separate AAAA records in DNS from IPv6 transport issues**
- **Site Challenges**
 - **Goal: Automated DNS entries for both IPv4 and IPv6**
 - **Stateless Address Auto-Configuration (SLAAC)**
 - **To DHCPv6 or not to DHCPv6?**
 - **Privacy Addresses (RFC4941)**
 - **Microsoft and more recently others complicate matters**



IPv6 Lessons Learned Core Mission Application



- **Kerberos**

- Developed and supported by MIT
- Authenticated Single Sign-On
- Encrypted remote terminal access
- Encrypted file transfer



- **Get someone else to do the work**

- Originally IPv4 only, but MIT added basic IPv6 support at just the right time
- We only had to tweak IPv6 and integrate PKI

- **We spent more time distributing security patches than we did adding IPv6 or PKI**



IPv6 Lessons Learned Other Applications/Utilities



- **Situation then**

- All operating systems and network IOS already enabled IPv6 support, and their utilities – at no cost
 - Microsoft/Apple software was/is an exception
- We prepared guidelines and located tools to add IPv6 support to applications – but we never used them

- **Situation now**

- Often programmers take longer to learn IPv6 technology than to modify and test their application
- Mail service simple with split domain servers
- Web servers now easier thanks to protocol translators (PT, ADC, ALG, LL) and content distribution networks (Akamai, Limelight, CloudFlare, *et cetera*)



IPv6 Lessons Learned Network Security Products



Security – no longer a reason to delay IPv6



“The only truly secure computer is one buried in concrete, with the power turned off and the network cable cut!” – *Anonymous*

- **Good news**
 - IPv6 security is a lot like IPv4
- **Bad news**
 - IPv6 security is a lot like IPv4
 - “If it ain’t broke, don’t fix it”
 - But it *is* broken
- **DREN was ahead of its time**
- **Designing one dual-stack infrastructure is extra work**
 - $v4 + v6 > 2 * v4$
- **One infrastructure will have**
 - Lower on-going cost
 - Better protection
 - Lower risk



IPv6 Lessons Learned



www.hpcmo.hpc.mil/cms2/index.php/ipv6-knowledge-base-general-info

Home » IPv6 KB: General Information

IPv6 Knowledge Base: General Information

Welcome to the *Internet Protocol version 6 (IPv6) Knowledge Base*. The IPv6 Knowledge Base provides a wide variety of information about planning for IPv6 deployment and installing, configuring, securing, and testing IPv6 products, services, and networks. Please explore the articles listed in the General Information section below, and in the other IPv6 KB sections in the column to the right.

A first time visitor to the IPv6 Knowledge Base might want to begin by skimming the [Initial Introduction](#) and [Frequently Asked Questions \(FAQ\)](#) articles below, and then looking at the Overview articles below and in the [Deployment](#) section.

Related Sites: These [web sites](#) may also be useful.

Title Filter Display # 10

#	Article Title
1	IPv6 Policy and Guidance
2	IPv6 Standards and RFCs
3	IPv6 Points of Contact
4	IPv6 Not Needed Here
5	Overview of Lessons Learned
6	IPv6 Frequently Asked Questions
7	IPv6 Initial Introduction

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- [Memo Selection of FY 2012 DoD Challenge Projects](#)
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- [Memo Call for Dedicated Support Partitions](#)
- [Call for FY 2012 Dedicated Support Partitions](#)

IPv6 KNOWLEDGE BASE

- [IPv6 KB: General Information](#)
- [IPv6 KB: Deployment](#)
- [IPv6 KB: IP Transport](#)
- [IPv6 KB: Infrastructure](#)
- [IPv6 KB: Network Management](#)
- [IPv6 KB: Security](#)
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