IPv6 at Fermilab

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Outline

- Introduction
- OMB IPv6 Mandate
- Fermilab IPv6 Program
- Current Status
- 2014
- Scientific Computing

Introduction

- I am reporting on the work to deploy IPv6 at Fermilab,
- This work is driven by the mandate that our public facing services (defined as external DNS, central web server and email) must be IPv6 capable by 30-Sep-2012:
  - external DNS servers - ns1.fnal.gov and ns2.fnal.gov
  - www.fnal.gov
  - email.fnal.gov
- This work is being done by the personnel in the Network and Virtual Services Department and the Enterprise Services Operations Department in the Core Computing Division,
  - Please credit them with all the hard work and accomplishments,
  - Please blame me for any errors or misunderstandings in this presentation.
- The Grid and Cloud Computing Department is using the IPv6 testbed deployment as a vehicle to understand the implications of IPv6 for Scientific Computing,
  - We are in the process of connecting the FermiGrid and FermiCloud ***test*** systems to the IPv6 testbed network.

OMB IPv6 Mandate

- External/public-facing servers & services to support native IPv6 by end of FY2012
  - For DOE, this means e-mail, DNS, & web services
  - "Public-facing" interpreted as "intended for the general public"
- Internal client systems to support IPv6 by the end of FY2014
  - Essentially, this means all desktops
- No IPv6 transition mandate for all systems
  - Scientific computing systems are not within scope
- "Mandate" lacks enforcement element
  - NIST dashboard for agency compliance
  - DOE dashboard for Department compliance
    - Not clear yet whether there'll be a Lab dashboard

2012 Implications for Fermilab

- 2012 mandates achievable with modest effort
- 2012 scope is very limited & well defined:
  - We define 'web services intended for general public' = www.fnal.gov
- Will lay a foundation for 2014 deliverables:
  - Build IPv6 knowledge base
  - Leads to development IPv6-capability in basic tools

2014 Implications for Fermilab

- 2014 mandates much more difficult to achieve:
  - Campus-wide scope,
  - Technically, much more difficult & complex
  - Major issues will need to be addressed:
    - Auto-configuration options & neighbor discovery concerns
    - Security concerns with tunneling, IPv6 address agility, etc
    - Undoubtedly, lots of other things

Fermilab IPv6 Working Group

- Fermilab IPv6 working group formed in late 2010
  - Initial membership = network support staff
  - Expanded participation in 2011:
    - Quadrant (now division) management,
    - Computer security
    - Essential services (e-mail, web services)
    - Grid and Cloud Computing
  - Focus has been on 2012 milestones & deliverables

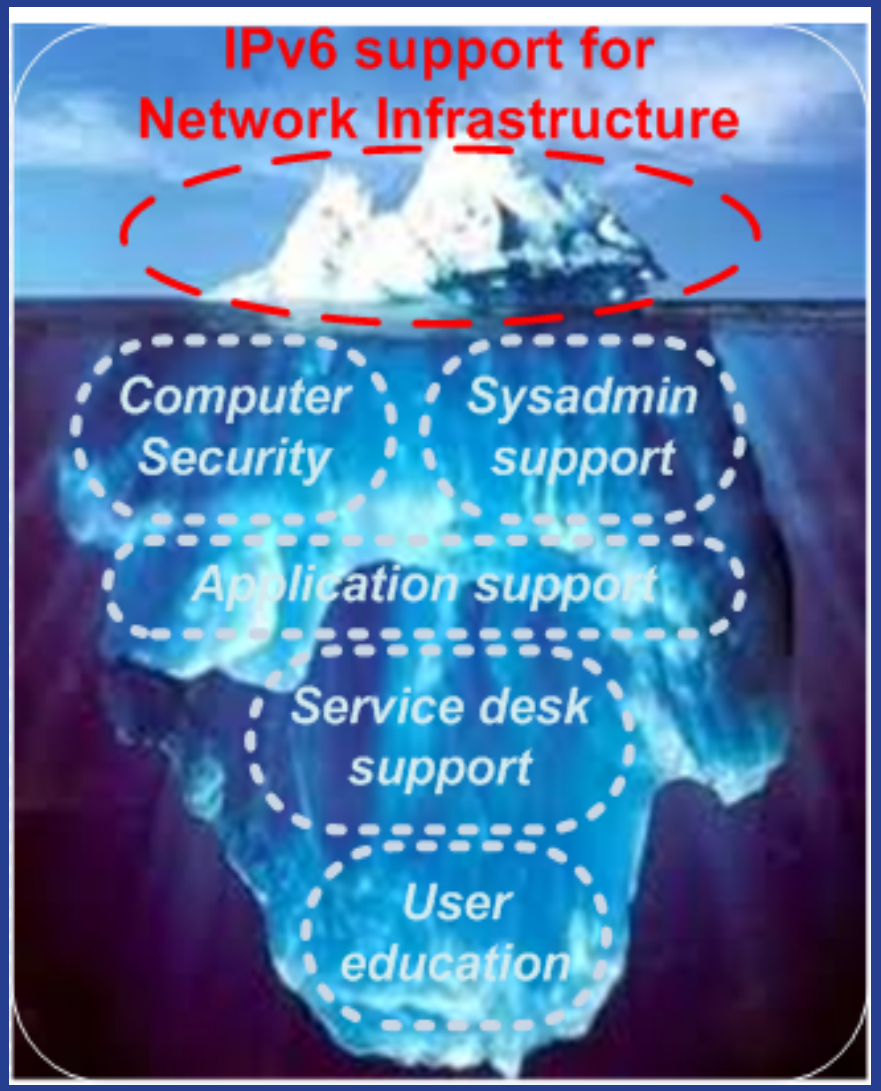
- Level of effort:
  - Biweekly 1 hour meetings
  - ~2-4 hours effort / week / person outside of meetings
  - Personnel effort has been opportunity cost
  - Not budgeted in FY11; varies by Dept/Group in FY12

IPv6 for Fermilab Scientific Computing

- Scientific computing systems not within scope of OMB mandates for either 2012 or 2014.
  - But I expect that there will be a growing call for IPv6 by scientific stakeholders
- The Grid and Cloud Computing Department (GCC) is investing effort to understand the IPv6 technology implications
  - And get ahead of our stakeholders requirements…
- This is part of the ongoing GCC "fabric" investigations:
  - Virtualized MPI over IB, IPv6, NFS v4.1, 100Gb/s WAN, SAN, etc.

FNAL IPv6 Planning: Strategic view

- What you see shouldn't sink your ship…
- What you don't see might…

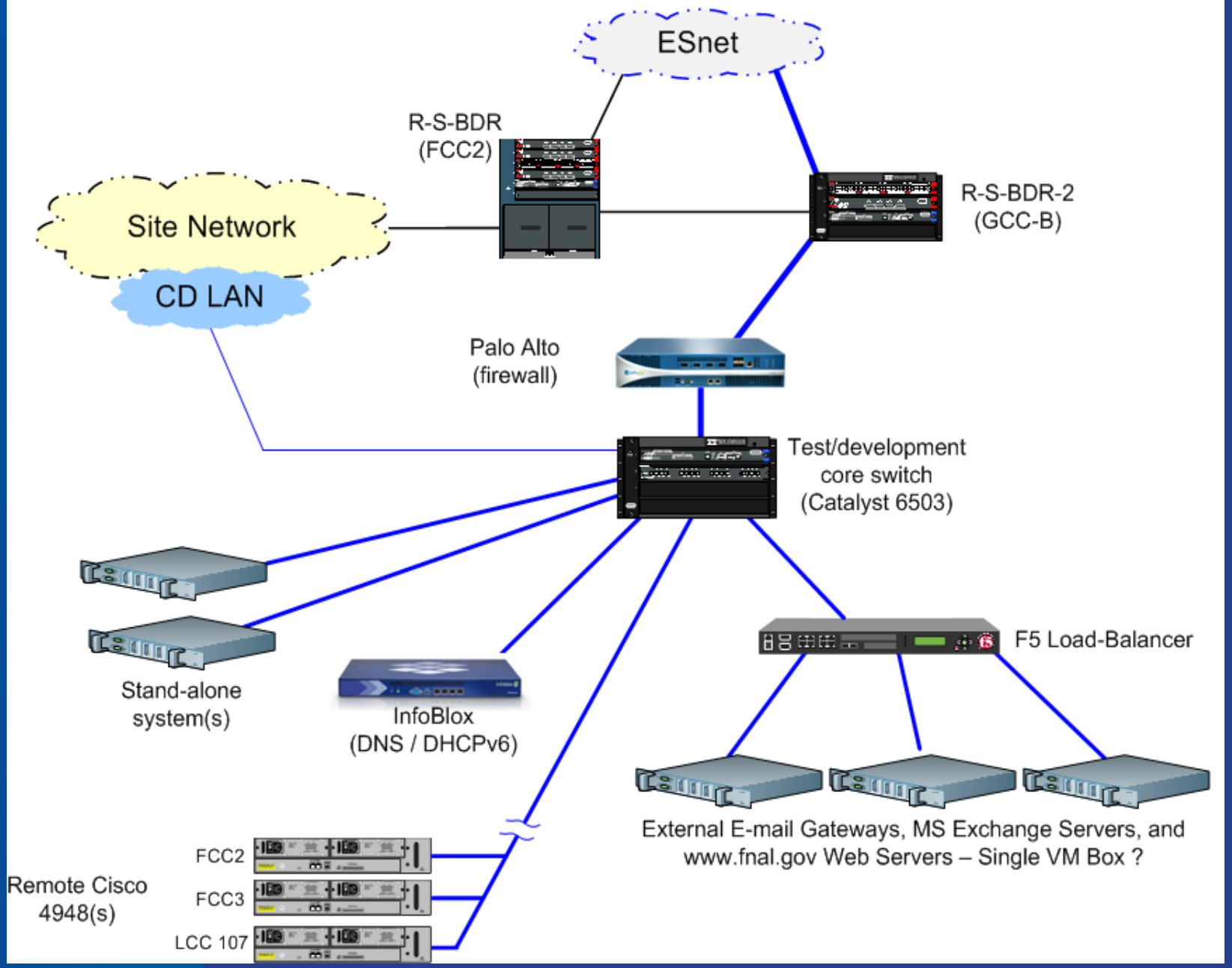


IPv6 Network Infrastructure Deployment at FNAL

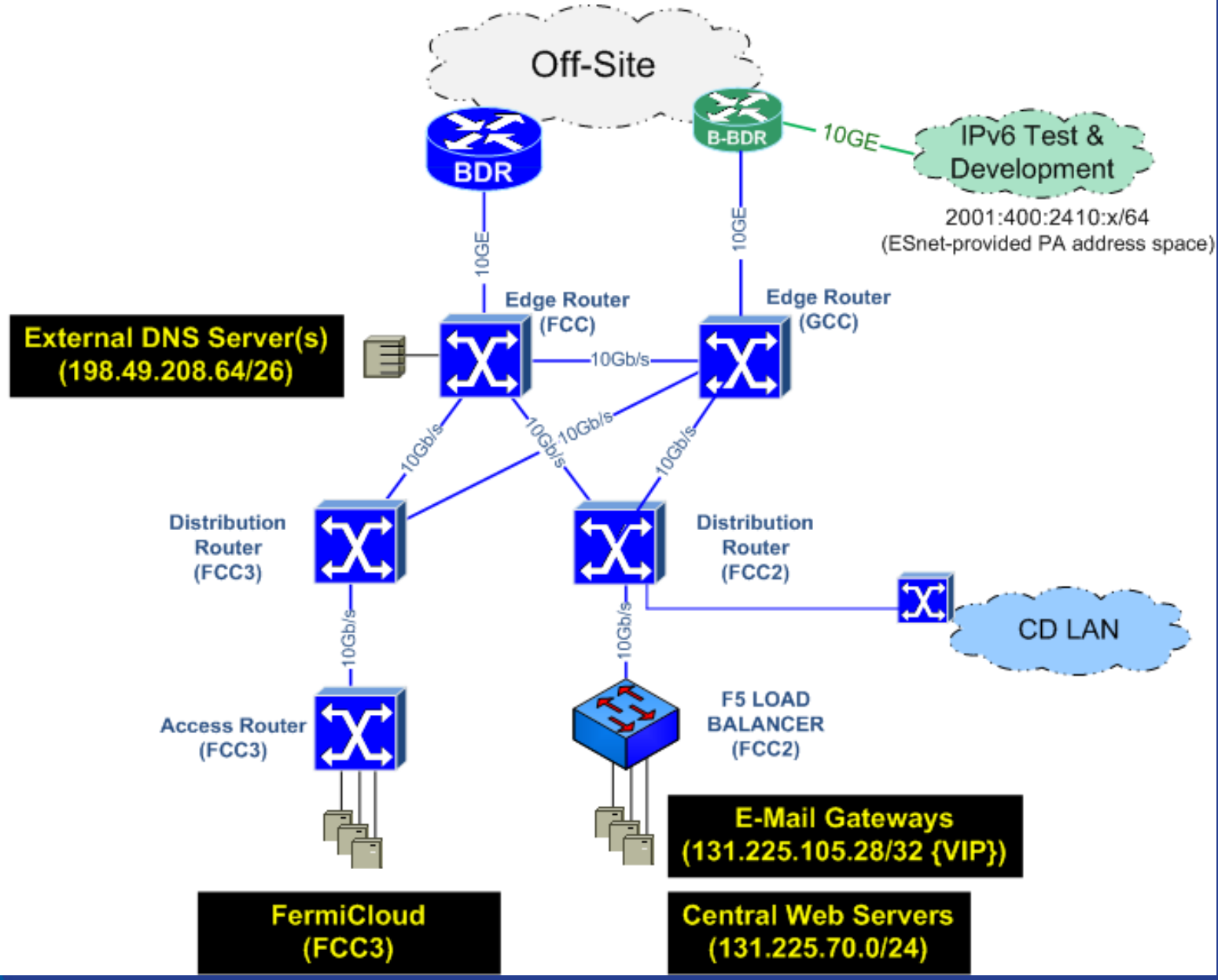
- IPv6 test bed:
  - Deployed as place to test & evaluation IPv6 services
  - Includes load-balancer, firewall, & DNS/IPAM system
  - Some capability to move production systems into test environment

- Computing Sector user subnet has been (quietly…) supporting IPv6 for ~5 years
  - Early testers of local & off-site IPv6 services
  - Currently using Stateless Auto-configuration:
    - Any system configured for IPv6 will receive an address
    - This may not be the permanent addressing model

Fully Functional IPv6 Test / Development Network (10/31)



2012 IPv6 Target Deployment



Status of IPv6 Services (6-Apr-2012)

- External DNS servers are now IPv6-accessible,
- Central web:
  - Personnel slot with IPv6 support responsibilities open
  - Central web development systems now IPv6 enabled
- Email gateway support involves externally contracted service,
  - Current deployment estimate is ~60 days.
- External (DMZ) IPv6 test system in place for testing external access.

Monitoring of IPv6-enabled services

Networking is investigating monitoring options for IPv6 DNS service:

- Permanent solution will be integration into current networking IPv4-based service monitoring capability,
  - Working on determining the effort needed to facilitate that (assumed to be significant…)
  - Investigating simple IPv6 monitoring tools in test bed for interim coverage
- NGOP currently used to monitor e-mail service, but no development seen likely there,
  - Azeleos monitors e-mail, so this needs to be specified in new contract to include IPv6,
  - SolarWinds might be usable as an email monitoring tool,
  - further investigation needed.
- Currently, web service monitoring is left to the web page owners,
  - Not clear this would be sufficient in a dual-stack environment,
  - further discussion expected.

Framework for 2014 Planning

- Networking is starting to look toward the 2014 deliverables
  - Preliminary framework for planning components drafted
  - Doesn't include client system support perspective (desktop support or service desk)
- Central computing services may not have additional 2014 requirements
  - But its considered desirable to continue to enhance IPv6 support as a general practice
  - Not clear whether or how needs to be involved in 2014 IPv6 deliverables planning
- Desktop & service desk support will need to become engaged in 2014 planning (within next 2-3 months)

2014 IPv6 framework from a network perspective

- IPv6 routing support across campus infrastructure
- IPv6 address allocation and support services
- IPv6 network management & monitoring capabilities
- IPv6 network services (NTP, VPN, <what else?>)
- IPv6 network security issues
- IPv6 dual-stack host configuration considerations
- Scientific Computing IPv6 requirements & implications

Grid and Cloud Computing IPv6 Plans

- Survey IPv6 Compatibility & Readiness:
  - Scientific Linux (Fermi) on "bare metal", virtualization (Xen, KVM) & other tools (IPtables, NFS, LVS, MySQL, etc.),
  - Grid middleware and applications (Globus, VOMS, GUMS, SAZ, Squid, MyProxy, etc.),
  - Batch systems (Condor, PBS, SGE, etc.),
  - Client tools (voms-proxy-init, globus-job-run, globus-url-copy, etc.)
  - Hardware (BlueArc, etc.),
  - Network performance (IPv4 only, dual stack, IPv6 only),
    - Does "IPv6 only" break anything?
- Participate in the HEPiX IPv6 testbed,
  - Unfortunately we had a departure of a staff member and as a consequence are running shorthanded, so this will be delayed.

Thank You!

Any Questions?