Next Generation MITnet

Presented to IT Partners Conference, 6/13/2017, by:
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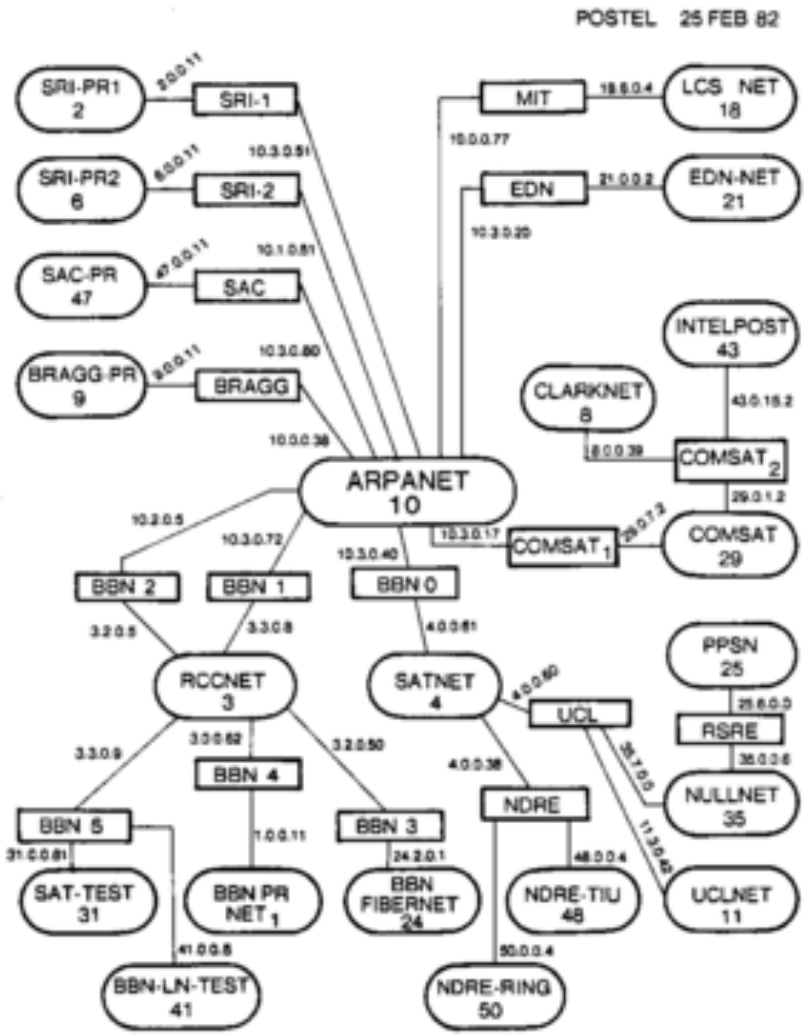
The Way We Were



Changing Times

Massachusetts Institute of Technology

Martin A. Schmidt, Provost
Israel Ruiz, Executive Vice President and Treasurer

To the members of the MIT community:

We are writing to inform you of plans to upgrade the MIT campus network, and in particular to upgrade MIT to the next generation of Internet addressing. *(Please note that no action is required on your part.)*

Machines on the Internet are identified by addresses. The current addressing scheme, called IPv4, was specified around 1980, and allowed for about 4 billion addresses. That seemed enough at the time, which was before local area networks, personal computers and the like, but the Internet research community recognized around 1990 that this supply of addresses was inadequate, and put in place a plan to replace the IPv4 addresses with a new address format, called IPv6. IPv6 uses a 128-bit address scheme and is capable of 340 undecillion addresses (340 times 10^36, or 340 trillion trillion trillion possible IP addresses). This stock of addresses allows great flexibility in how addresses are assigned to hosts, for example allowing every host to use a range of addresses to make tracking more difficult. With IPv6, we need not worry about the proliferation of smart phones, the Internet of Things, or whatever comes next.

While IPv4 is still the workhorse of Internet addressing, IPv6 is coming. All major operating systems and devices already support both IPv4 and IPv6. Many of the large Internet Service Providers are supporting IPv6, and major content providers are moving to support IPv6, and so it is time to upgrade the MIT network for the future and make our network IPv6-capable.

For most users, this upgrade will be transparent. Once we upgrade our network infrastructure, most computers will start using IPv6 addresses automatically as appropriate. We will have to make some upgrades to our infrastructure, and the plans for this are under way.

MIT's excess IPv4 capacity

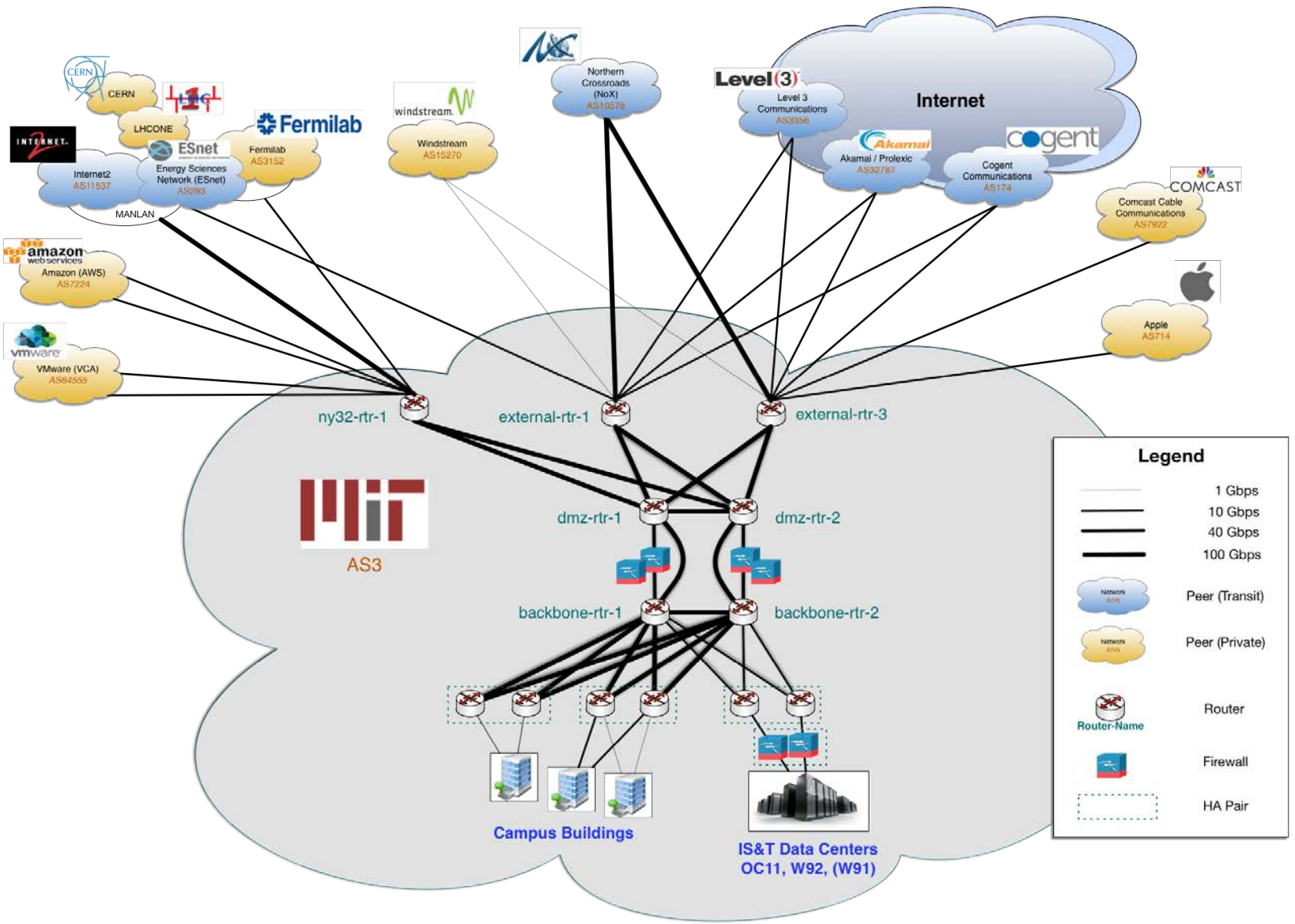
As we plan our migration to IPv6, it is appropriate for MIT to consider its own stock of IPv4 addresses. While the Internet is running out of addresses overall, MIT actually has a large

The Road Ahead

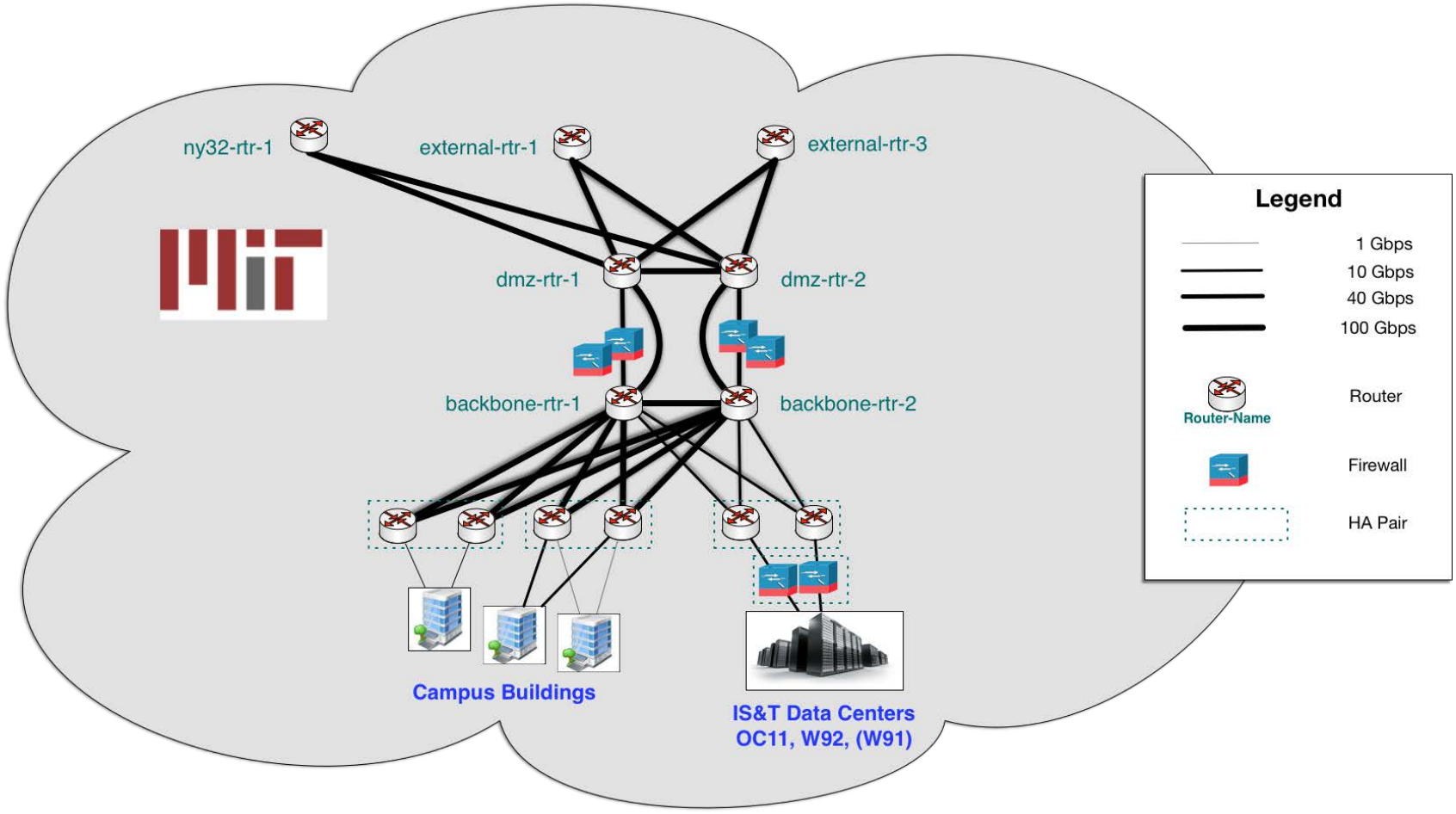
- MIT will be re-numbering its existing IPv4 address space into private address space using 10.0.0.0/8 addresses. Provisions will be available to provide for a public IPv4 address should it be required.
- Migrating away from static IP addressing, in order to ensure future flexibility for other network changes.
- Taking the opportunity to prepare the MIT network for the next generation of the IP protocol with the introduction of IPv6.
- This will require a variety of upgrades of infrastructure throughout the campus including our edge switches, firewalls, and core routers.
- The new infrastructure elements in addition to providing capability for IPv6 will also provide higher bandwidth capacity, enhanced security measures and improved reliability.
- As this is a significant migration effort for the campus, we will be providing resources and services through our DITR team to assist members of the MIT community throughout the transition.

Next Generation Core MITnet Infrastructure

Next Generation MITnet



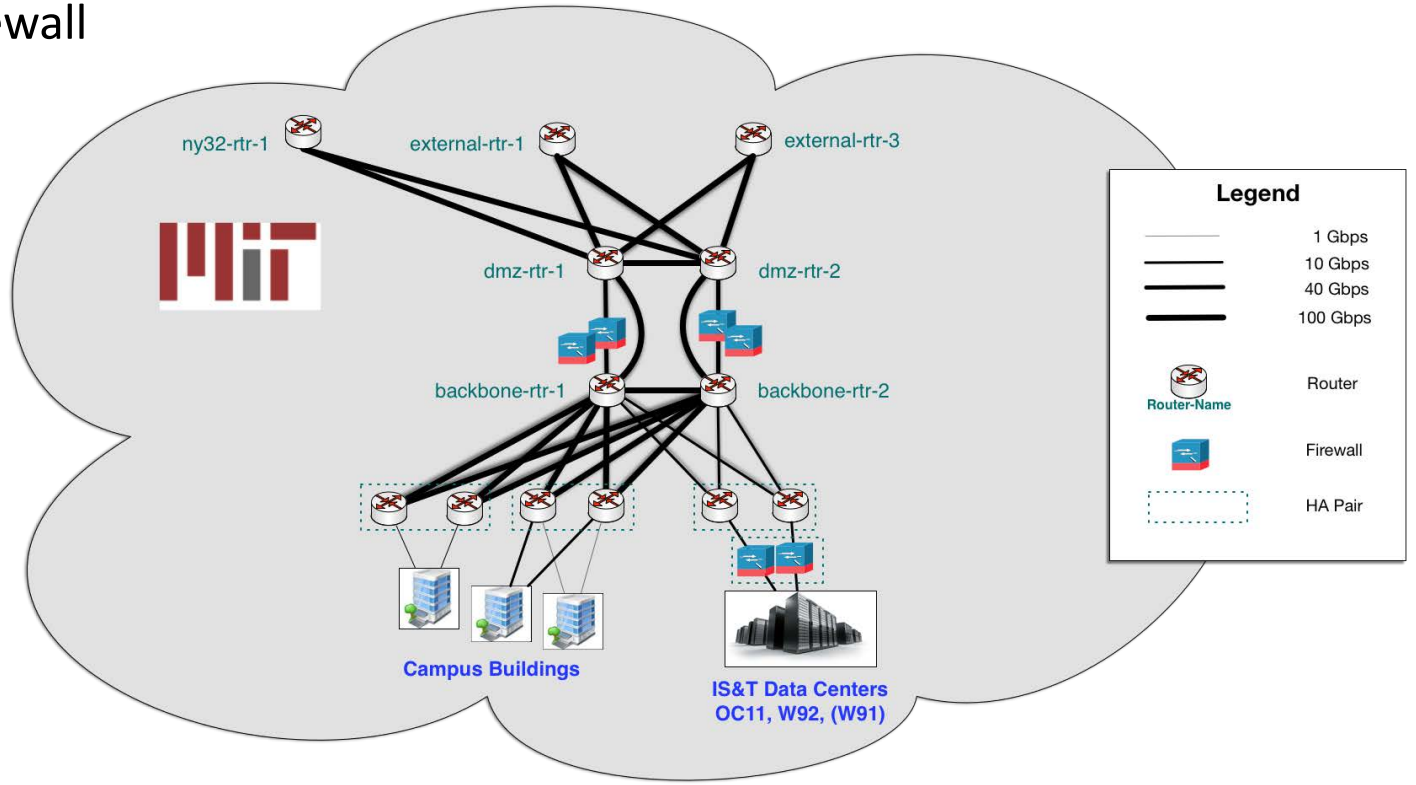
Next Generation MITnet



Next Generation MITnet

Next Generation – Differences:

- Dynamic Addressing (DHCP)
- MITnet IPv6 = 2603:4000::/24
- Private IPv4 Address (RFC-1918) = 10.0.0.0/8
- New Campus Firewall



MITnet - Campus Firewalls

Firewalls: Palo Alto 7050

- (2) Active/Standby Pairs
- 40 Gbps
- NextGen Firewalls

Next Generation MITnet

Firewall:

- Outbound Connectivity to Internet Unimpaired (Unchanged)
- Network Address Translation (NAT)
  - 10.x.x.x ➔18.x.x.x
- Protection from Unsolicited Internet Inbound Connection Attempts/Scans
- Building Classification: Academic / Residential / Administrative
  - Ability to Add Protective Controls within MITnet

Next Generation Edge MITnet Infrastructure

Current Status of Edge Network Equipment

Next Generation MITnet

Sources: IS&T (2017)
Basemap: Facility Information Systems (2017)

Scheduled Network Switch Upgrades for FY18

Next Generation MITnet FY2018

Sources: IS&T (2017)
Basemap: Facility Information Systems (2017)

Scheduled Network Switch Upgrades for FY19 and FY20

500 Feet	Next Generation MITnet FY2019 & FY2020	Sources: IS&T (2017) Basemap: Facility Information Systems (2017)

Next Generation MITnet Edge Switch Upgrades

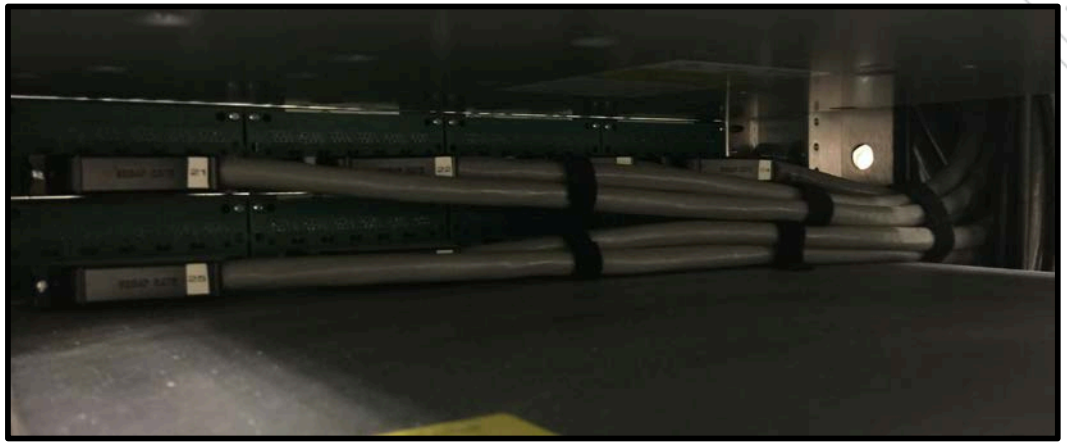
- Next Generation MITnet efforts will address years of deferred maintenance to networking infrastructure by retiring over 500 edge switches that are no longer supported by the vendor

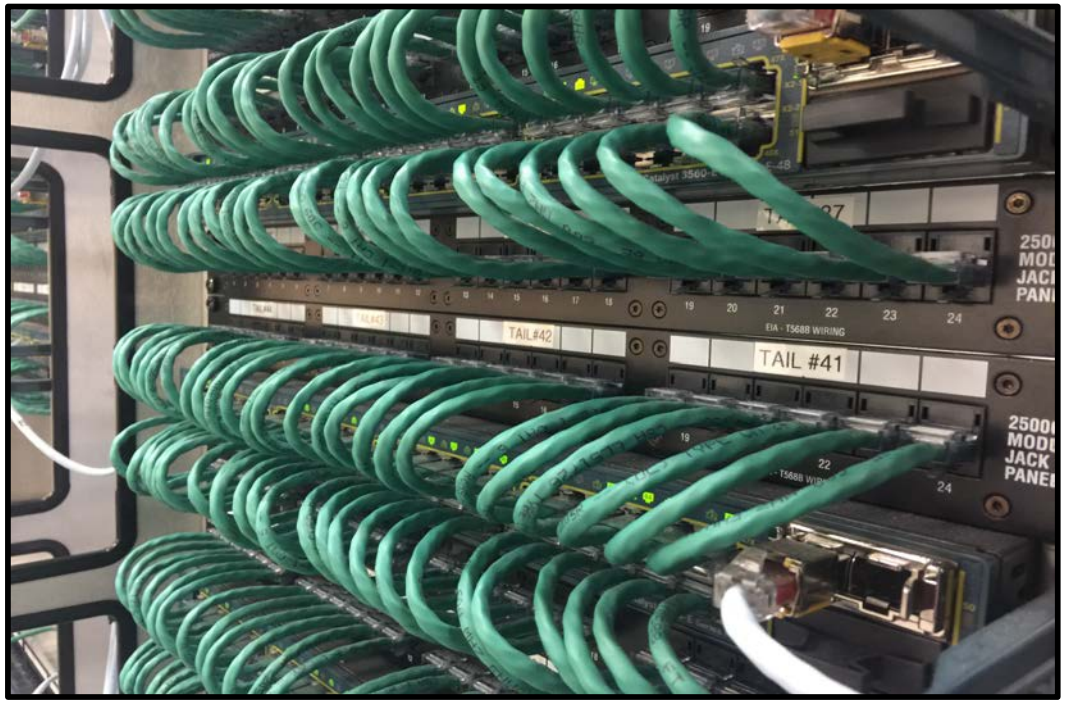
- Over 125 edge network switches are scheduled to be retired in FY18

- Over 400 edge network switches that are no longer supported by the vendor will be retired by 2020

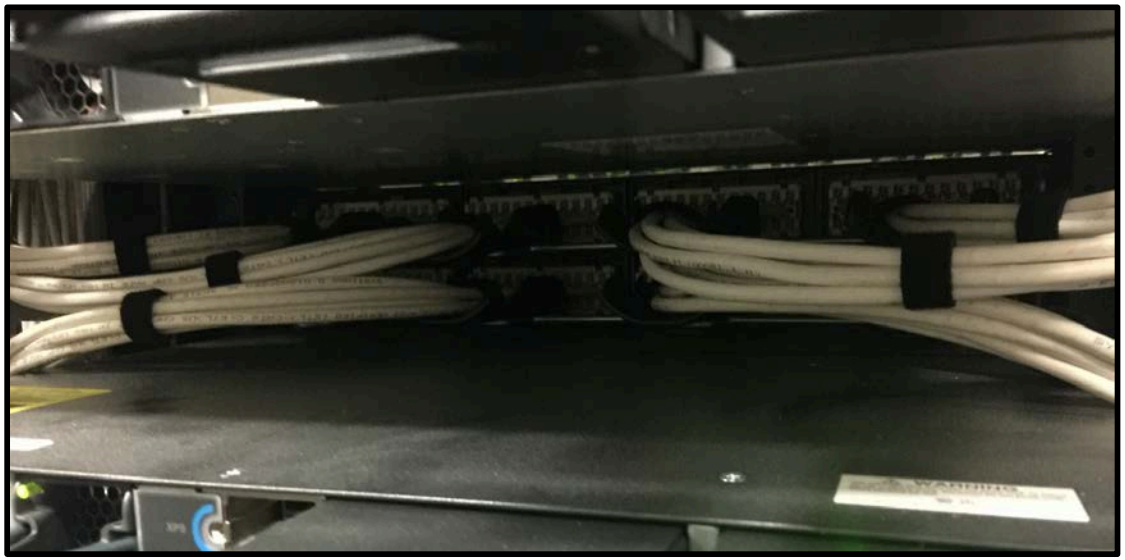
- New modern hardware will allow for better management tools to operate the network and will also provide increased bandwidth in many areas

Example of Legacy Network Equipment Conversions

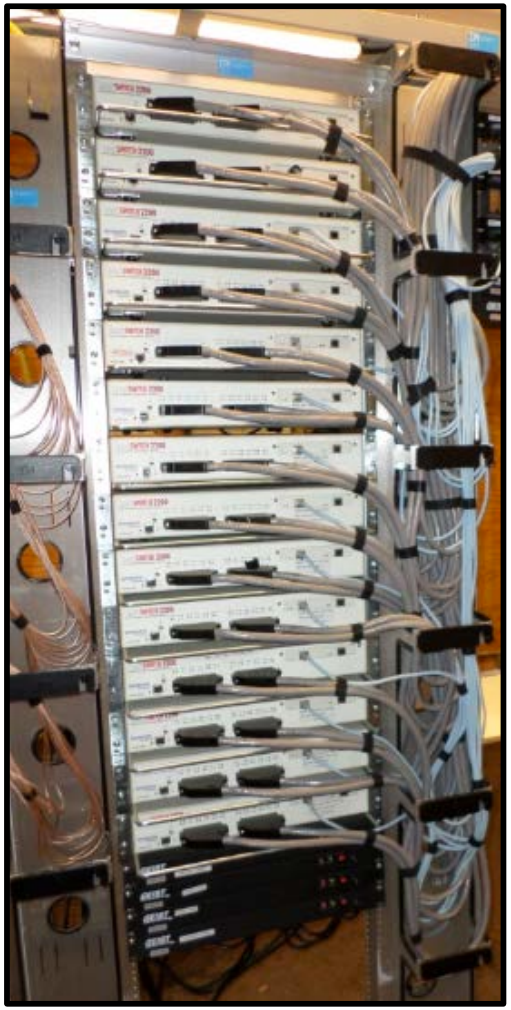


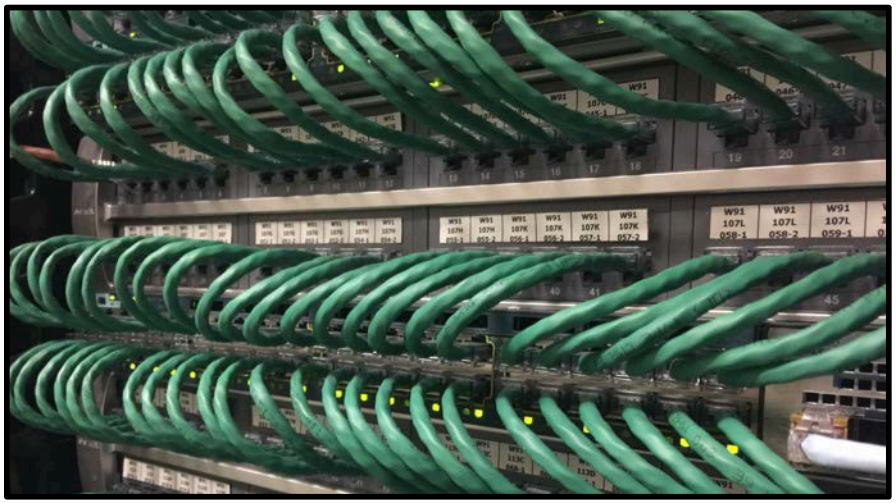


Converting Legacy Equipment to More Modern Standards



Moving to the Next Generation of Edge Network Equipment and Rack Configuration





Migration Assistance

Migration Services

- On-site assistance will be provided by the Distributed Support Field Team at no cost
- Recent moves for Central HR and the Center for Transportation and Logistics
  - 100+ machines at each site were converted from static IP to DHCP
  - Many laptop users use MIT Secure as their main connection
- Migrations currently in process at IS&T and at all DITR supported DLCs
  - Standard process for all new moves
- DITR is always happy to provide assistance with projects, staffing augmentation, endpoint management, and office moves. Contact Matt Harrington (mjharrin@mit.edu) to arrange consultation.

Conclusion and Questions?