Gigabit Passive Optical Network (GPON) Powers Learning at Ryerson University's Largest Residences

Ryerson University

Computing & Communications Services

Partners

CORNING

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Pitman Hall

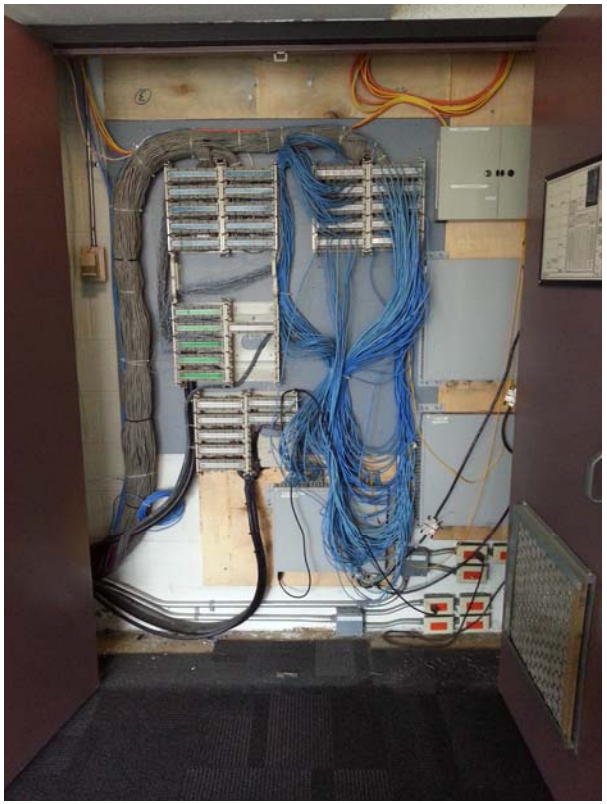
Pitman Hall

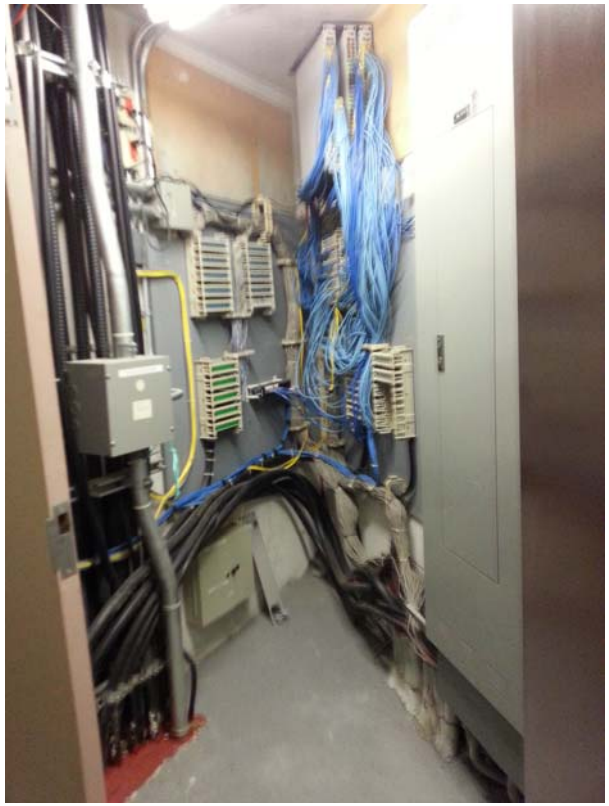
- Pitman Hall is Ryerson's largest residence.
- 14 floors and 565 rooms.
- It was built in 1991.
- The majority of rooms are a single format.

Communications Technology Prior to 2016

- The existing cabling, both for voice and data is IBM type 3 (category 3 performance)
- Supporting a bandwidth of 16 MHz and applications of only 10Mbs Ethernet.
- Both the cabling and the existing Nortel Networks 470 T Ethernet switches do not support Power Over Ethernet (POE).
- Limited wireless connectivity is available in Pitman hall.
- Both the phones and data are hard-wired connections

Communications Technology Prior to 2016





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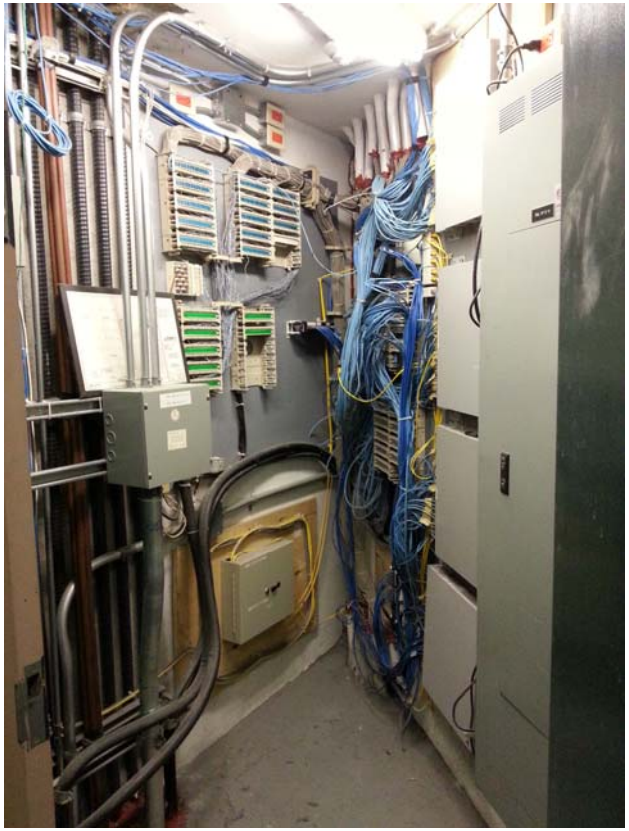

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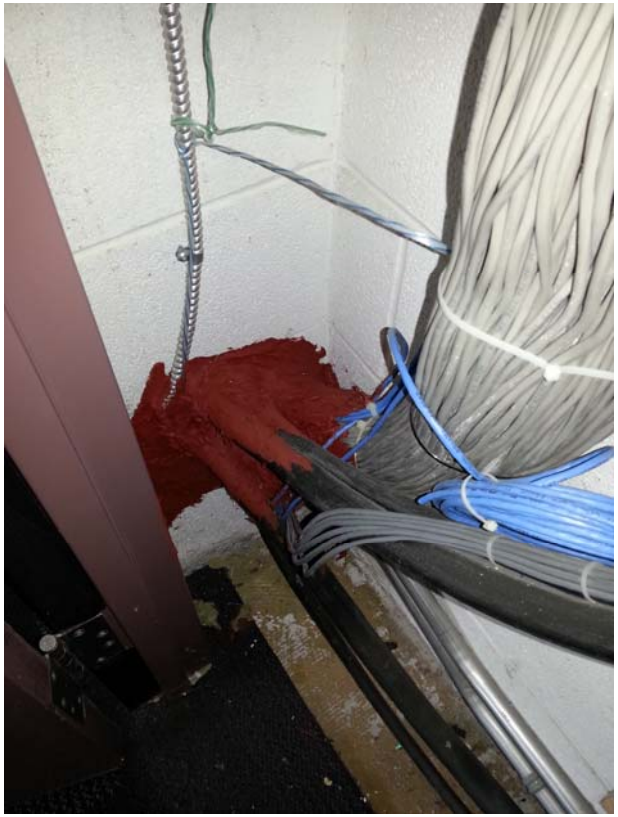

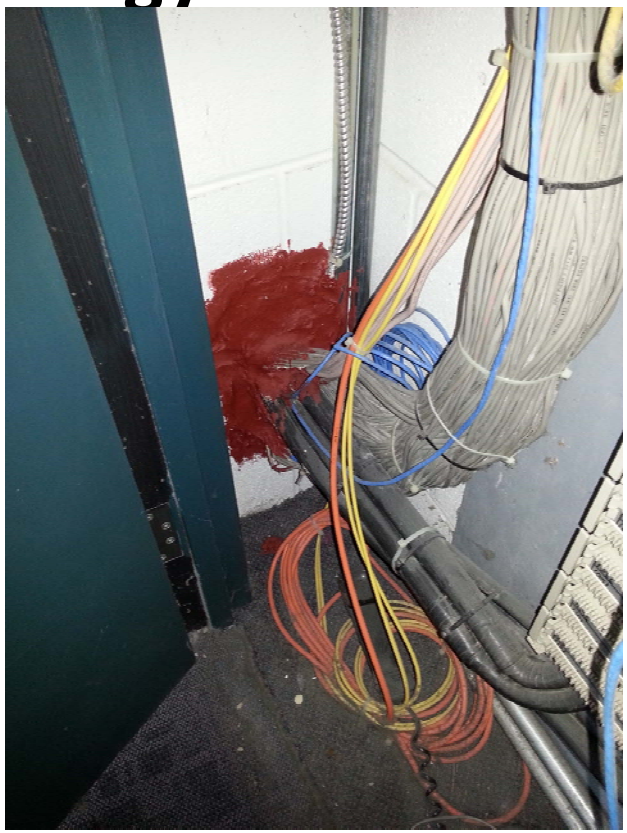

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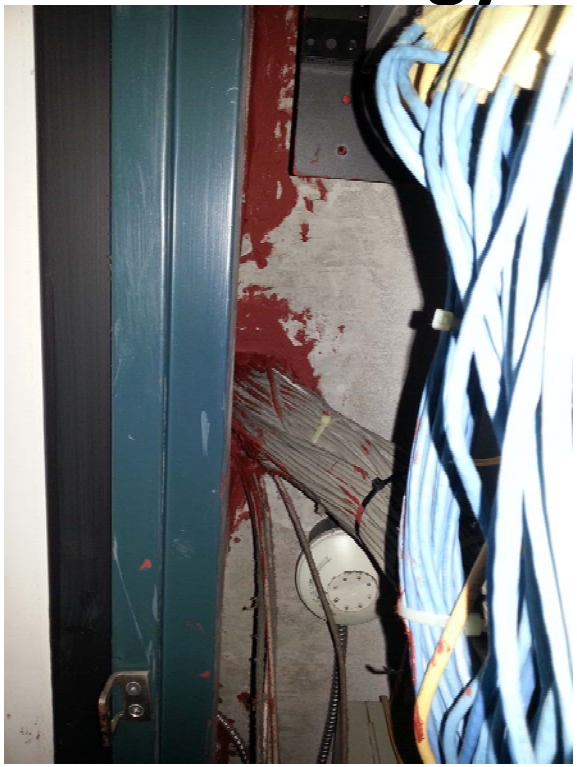


Daphne Cockwell Complex (DCC)

Daphne Cockwell Complex (DCC)

- **Construction start:** November 2015
- **Opened:** August 2019
- **Residence space:** 18 floors, 11,376 m2 (122,450 square feet), 100 units
- **Residence capacity:** 332 students

Daphne Cockwell Complex (DCC)

- Based on experience from Pitman Hall we were able to reduce the size of the Telecom Rooms on each floor by deploying GPON
- Horizontal fiber to the suites and backbone fiber to the Equipment Room – reduced conduit sizes
- Extremely short copper cables

Today's Environment

- However, the residence hall, where students spend a significant part of their time on campus, has tended to be left as a coverage-only model using hallway deployments.

Today's Environment

- The result is a wireless network that increasingly underperforms the rest of the campus.

Today's Environment

- This emerging trend represents a whole new scale for consumption of wireless network resources and capacity.
- Many residence hall Wi-Fi networks began as networks of convenience and they were intended to supplement wired connectivity.
- Now the general move is for Wi-Fi to replace wired networks for many types of users, especially students.

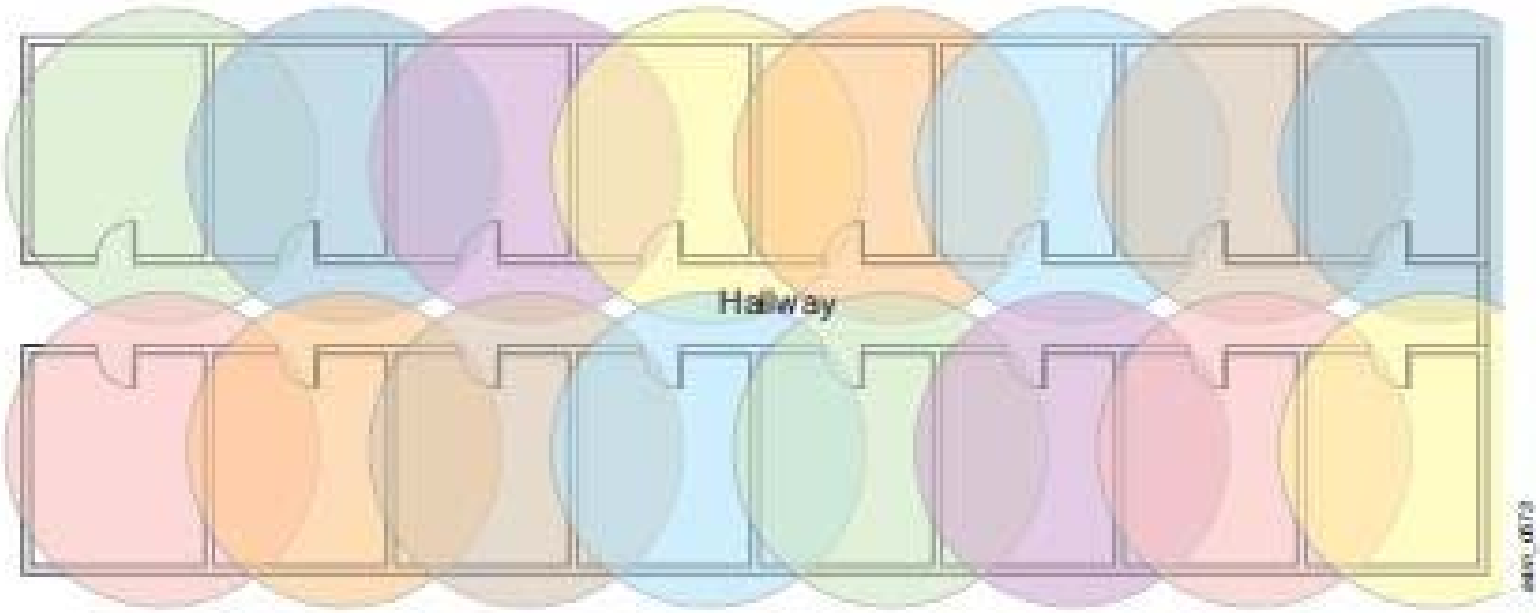
Today's Environment

- The network must be high performance. The network must be able to deliver a wire-like experience in each and every room.
- The network must work equally well, if not better, in 5 GHz to offload all possible traffic from the congested 2.4 GHz spectrum.

Microcell Architecture

- The primary way to increase capacity within any Wi-Fi system is to add APs.
- For residence halls, one of the best architectures for increasing AP density to meet the growing user demand for increased capacity is the “microcell” A microcell architecture uses APs that are set for very low transmit power with a small cell radius that covers only a few rooms at most.

Microcell Architecture



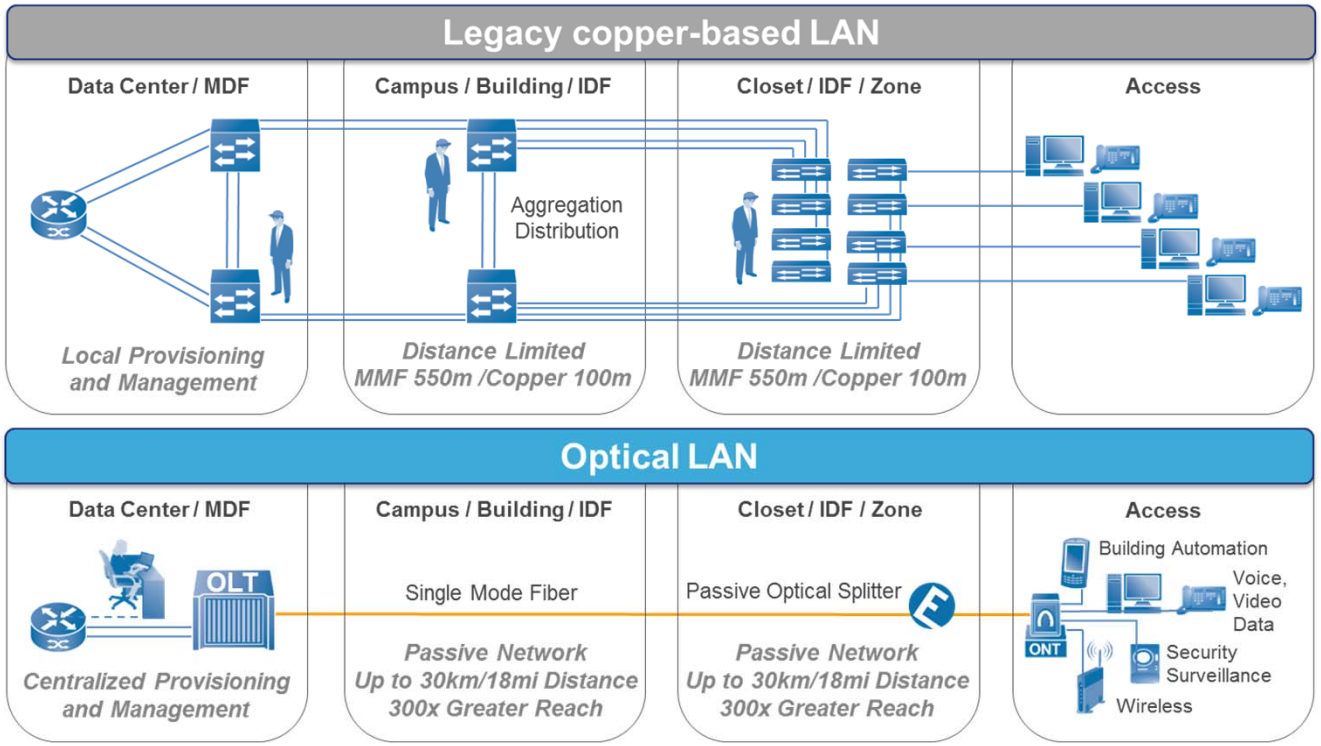
Passive Optical Networks (PON)

- GPON: **G**igabit **P**assive **O**ptical **N**etwork
- GPON conforms to the ITU-T G984.1 specification
- 2.4 Gbps download speed coupled with a 1.2 Gbps upload speed. Each GPON fiber is split to serve 16, 32, or 64 users per fiber.
- This is the technology used for Passive Optical LAN's (POL)

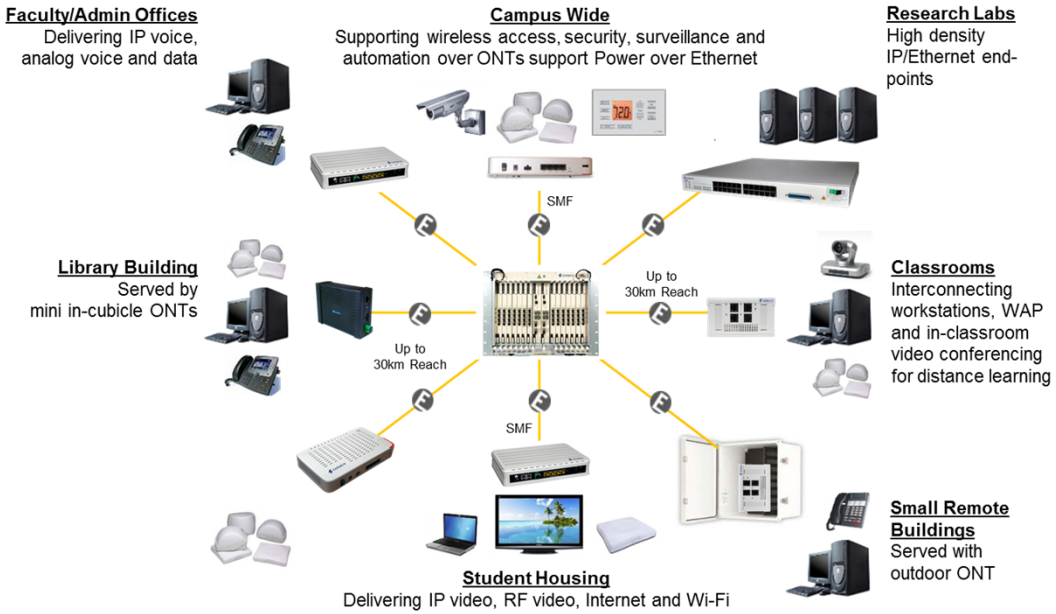
Passive Optical LAN – Higher Education

- University of Mary Washington
- Texas A&M University Kyle Field
- Howard University
- Clemson University
- Oklahoma State
- James Madison University
- University of Missouri
- University of Mississippi
- Penn State
- Washington State
- Capilano University
- Ryerson University

Passive Optical LAN - Comparison



Passive Optical LAN – Campus Architecture



Pitman Hall –The Opportunity

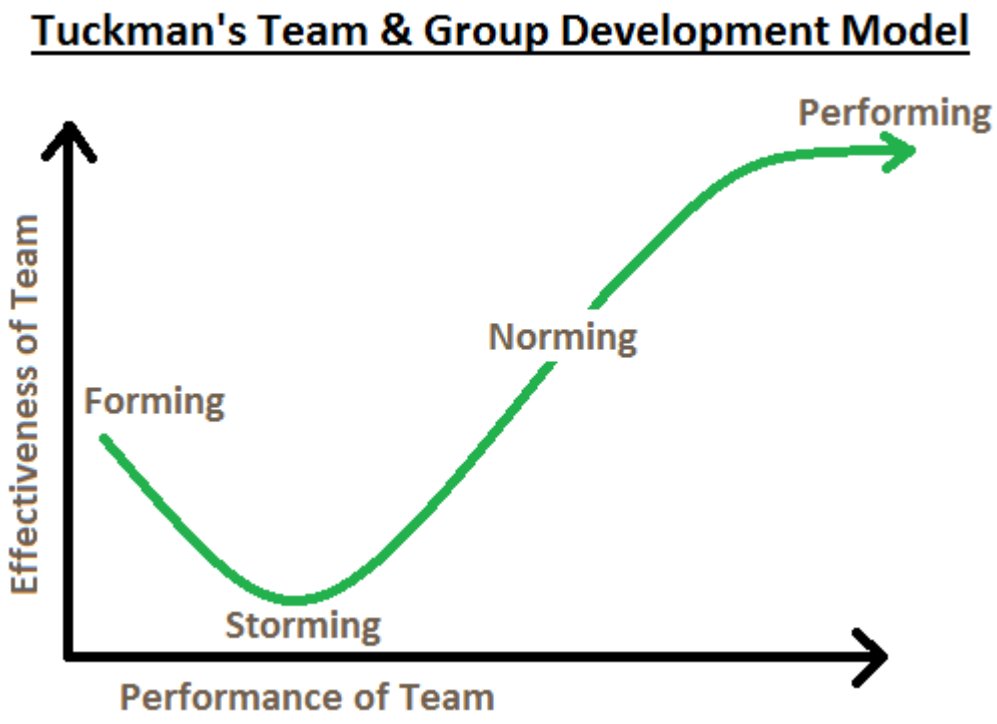
- Existing pathways full
- No room in existing Telecom Closets to establish new switches
- Needed to reduce the size of any new pathways
- Needed to limit the amount of equipment space required.

Pitman Hall – The Project(s)

- Project was divided into two separate projects
- Pathways, spaces and cabling was one Project (Divisions 25, 26, and 27)
- Project began May 2, 2016 needed to finish by August 12, 2016
- Second Project was equipment deployment
- Project needed to start August 15, 2016 and end Sept. 2

Phases of a Project - PMBOK

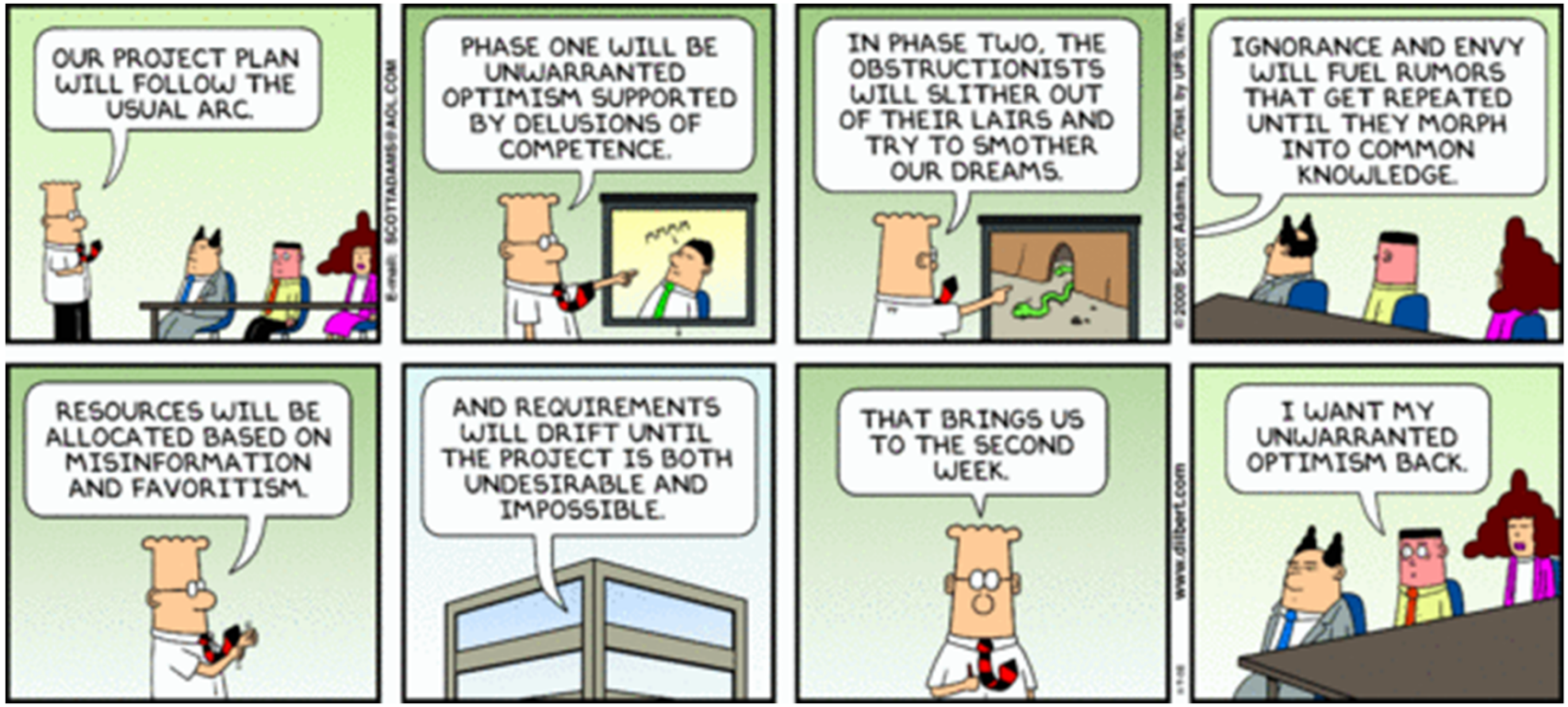
Phases of a Project



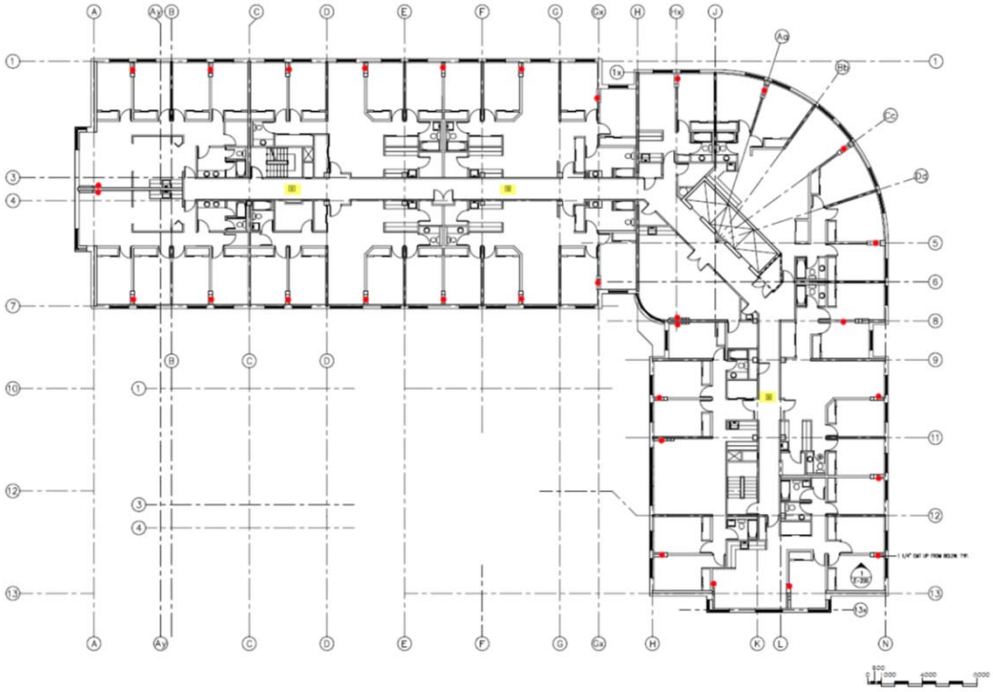
Phases of a Project -Reality

- Wild enthusiasm
- Disillusionment
- Confusion
- Panic
- Search for the guilty
- Punishment of the innocent
- Promotion of non-participants

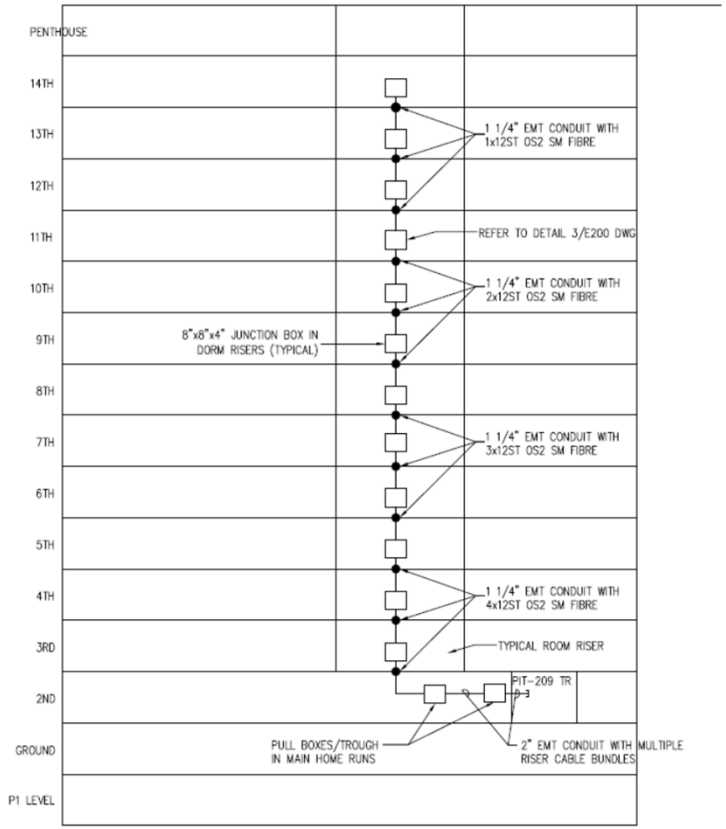
After Only 2 Weeks



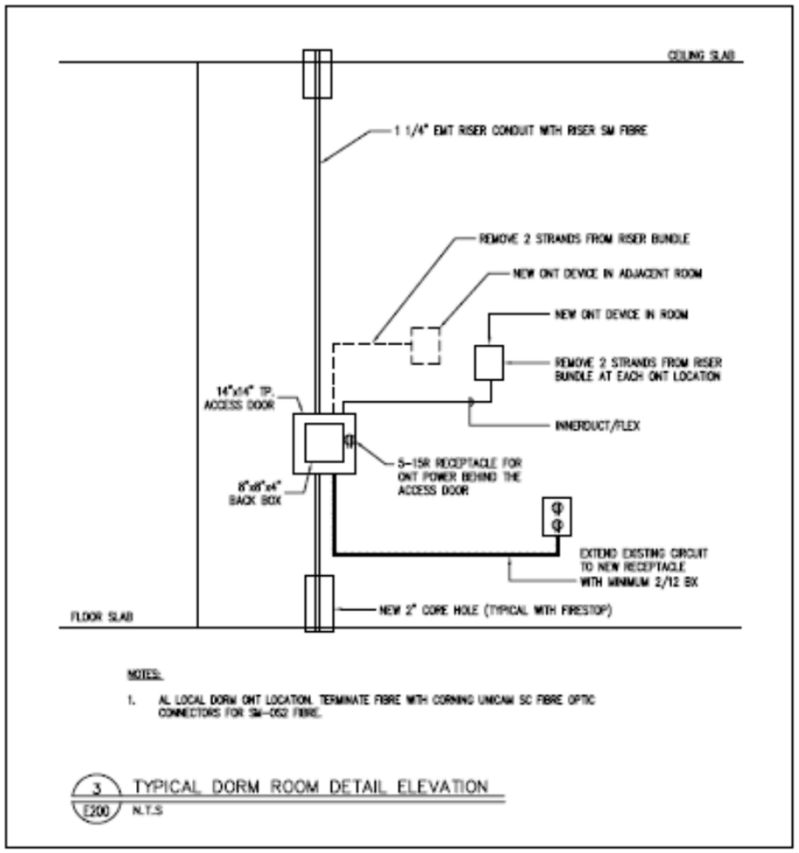
Project 1 – Pathways, Spaces and Cable

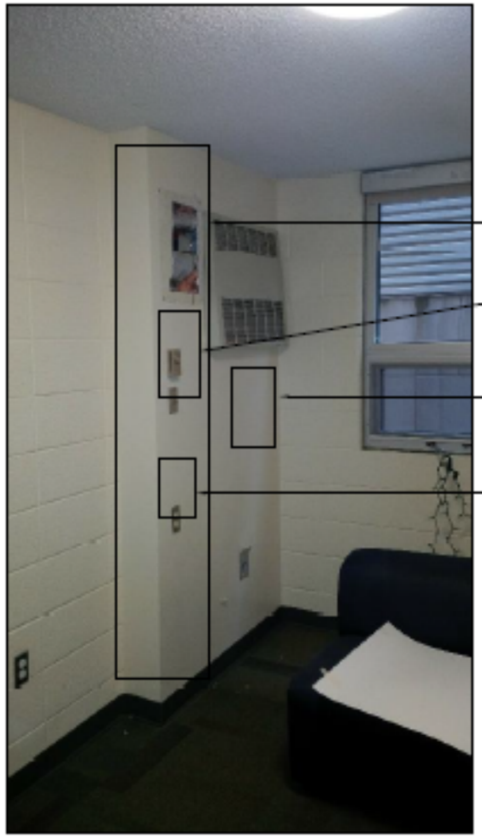


Fiber Riser


PENTHOUSE
14TH
13TH
12TH
11TH
10TH
9TH
8TH
7TH
6TH
5TH
4TH
3RD
2ND
GROUND
P1 LEVEL
1 1/4" EMT CONDUIT WITH 1x12ST OS2 SM FIBRE
REFER TO DETAIL 3/E200 DWG
1 1/4" EMT CONDUIT WITH 2x12ST OS2 SM FIBRE
8"x8"x4" JUNCTION BOX IN DORM RISERS (TYPICAL)
1 1/4" EMT CONDUIT WITH 3x12ST OS2 SM FIBRE
1 1/4" EMT CONDUIT WITH 4x12ST OS2 SM FIBRE
TYPICAL ROOM RISER
PIT-209 TR
PULL BOXES/TROUGH IN MAIN HOME RUNS
2" EMT CONDUIT WITH MULTIPLE RISER CABLE BUNDLES

Typical Dorm Room





EXISTING DRYWALL REMOVED AND RE-INSTALLED TO MATCH EXISTING. DEVICE QUANTITY MAY VARY. ENSURE ALL DEVICES ARE RE-INSTALLED.

EXISTING DEVICE

ADD ONT DEVICE

EXISTING DEVICE

NOTES:

1. CONTRACTOR SHALL REMOVE EXISTING DEVICE AND DRYWALL, AS REQUIRED TO COMPLETE THE SCOPE OF WORK. CONTRACTOR SHALL REPLACE THE EXISTING DEVICES AND RE-DRYWALL ALONG WITH PAINT TO MATCH THE EXISTING WALL.
2. RESPONDING CONTRACTOR TO MAKE GOOD ALL SURFACES AS REQUIRED TO MATCH EXISTING FINISHES. ALL CLEANING TO BE FINISHED TO "MOVE IN" CONDITION AFTER THE WORK IS COMPLETE.

1 / E200 TYPICAL DORM – SIDE B ROOM ELEVATION

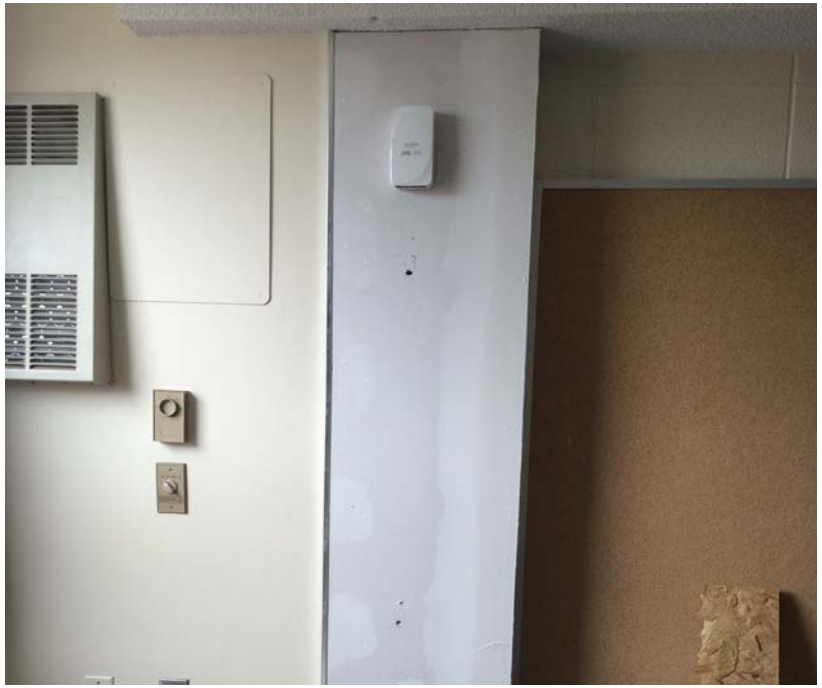
1:20

Riser Fiber

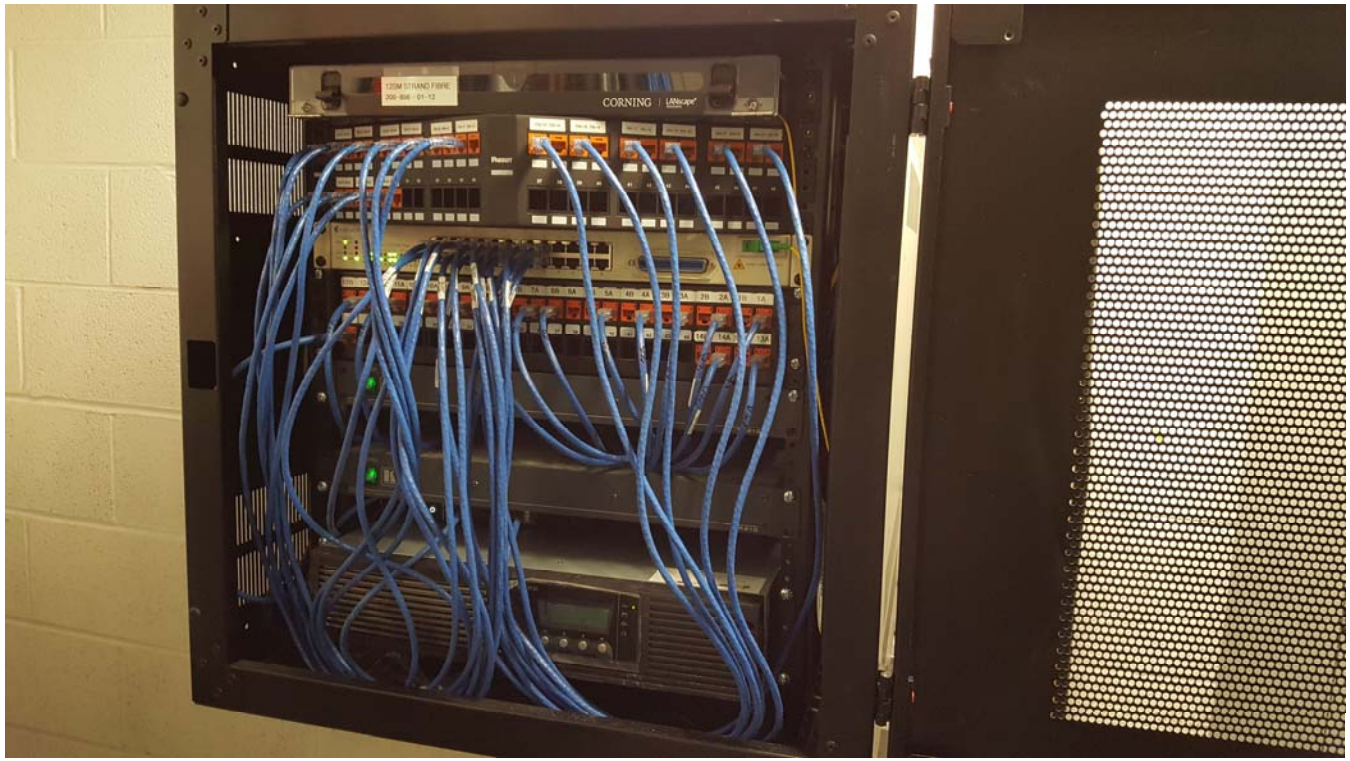
- 12 fiber
- 6.6 mm (0.26 inches)
- Pre connectorized
  with SC APC
- 2 fibers each room

Passive Optical LAN – Optical Network Terminal (ONT)

Room Wireless Access Points

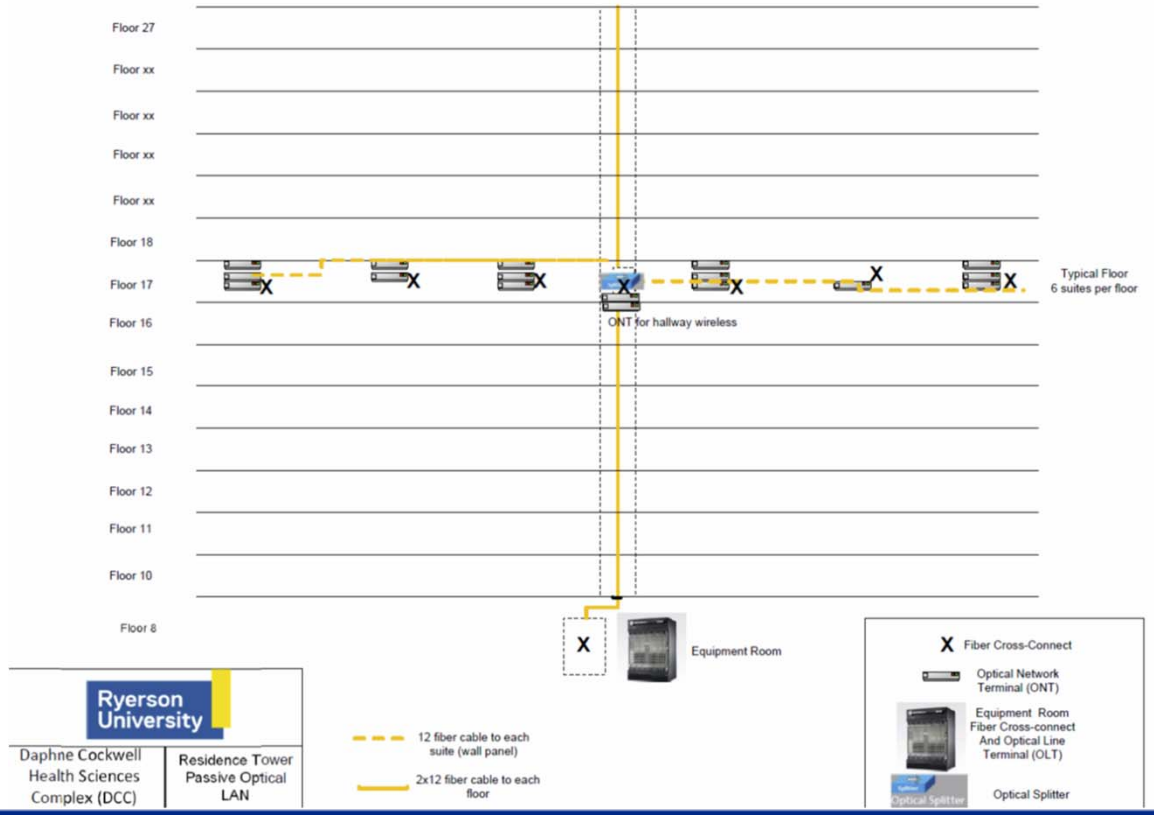


Passive Optical LAN – Optical Network Terminal (ONT)

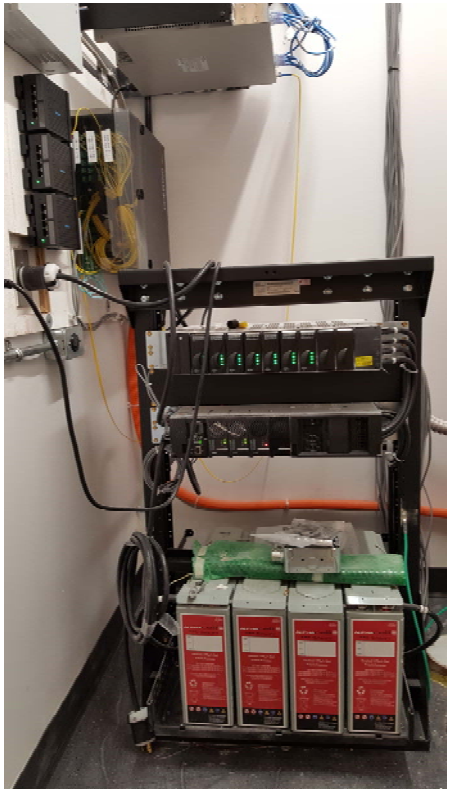


Hallway Wireless Access Points

DCC Cable Design



Telecom Room



e-Limiter+

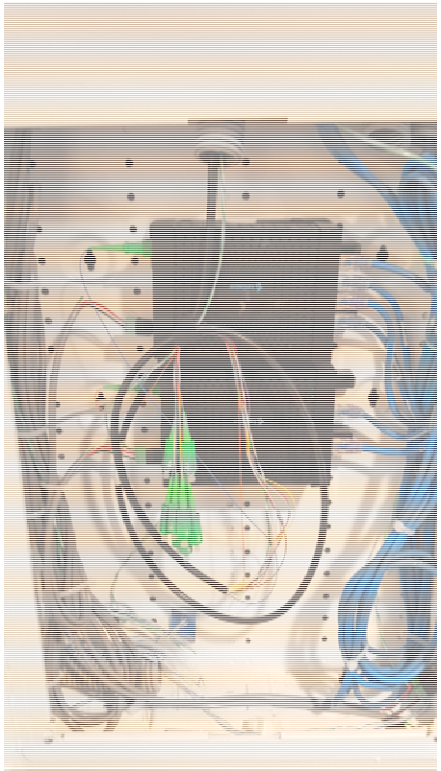
Rear panel view

e-Limiter+

- 36 channels per chassis (4 per card)
- Meets NEC class 2 and communication circuit requirements for limited power circuits
- 100VA
- ONT: Max Power Delivered (Watts): 60W

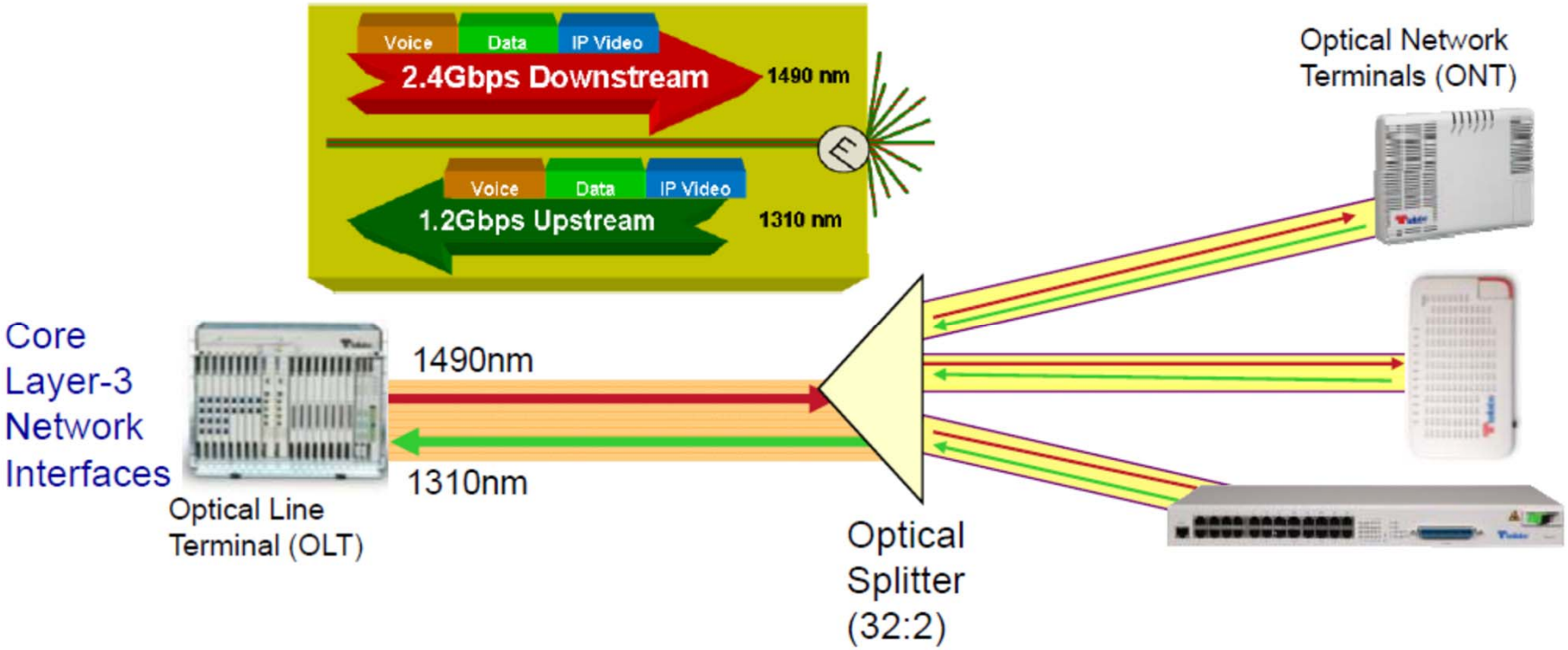
PoE Standards: IEEE 802.3at and IEEE 802.3af

Optical Network Terminal



Equipment Room

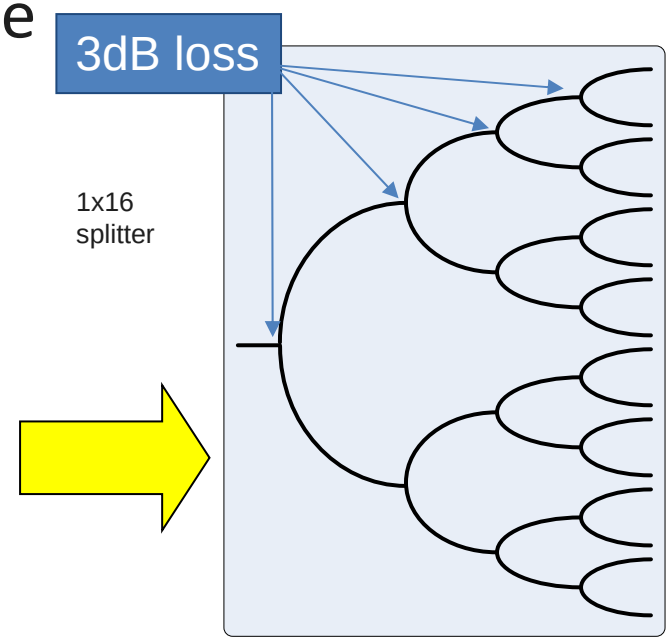
Residence GPON Architecture



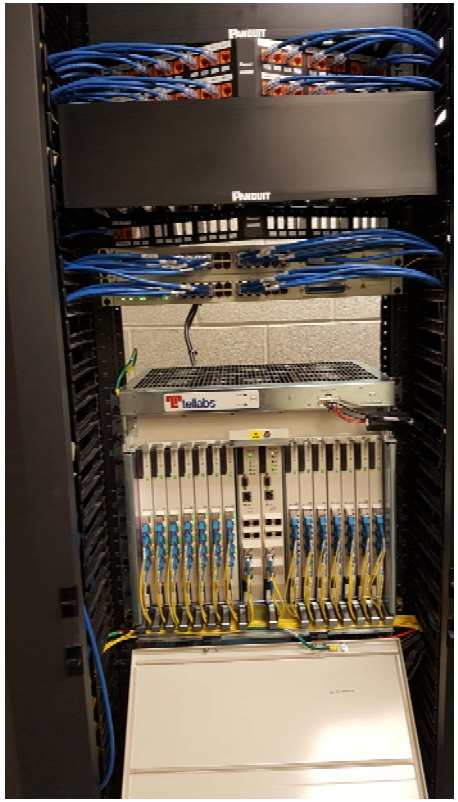
Passive Optical LAN – Fiber Splitter

Optical Splitters

- Optical splitters are critical to the Passive Optical Network
  - Splits an incoming light source into 2 separate paths
  - Repeating this split multiplies the number of devices that can be connected to a single port
- Typical splits in the LAN
  - 1x16, 1x32, 2x32
  - Other splits available



Passive Optical LAN – Optical Line Terminal (OLT)

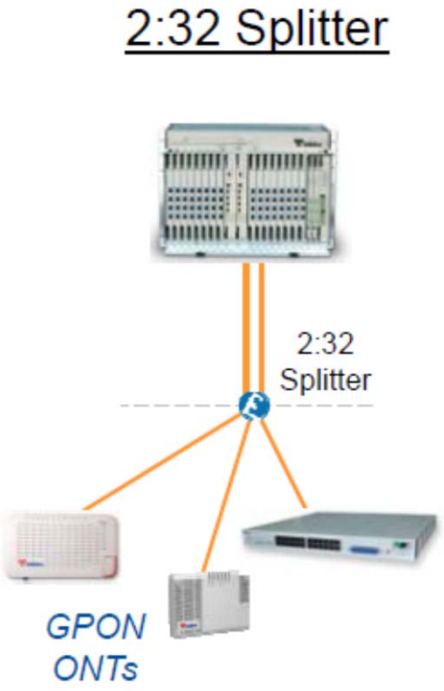


OLT1150E

- 19” or 23” mounting
- 11RU high
- 1.12Tbps backplane*
- 80Gbps per slot*
- 14 multi-service slots
- 56 PON ports
- up to 1,792 ONTs
- up to 7,168 10/100/1000

Availability

- GPON Optical LAN solution provides for > 99.999% availability with a dual PON interface to the ONTs
- Pitman Hall has been operating for over 3 years with zero downtime.
- Since both residences are the same we are able to reuse maintenance spares if required
- Same management platform



Futureproofing

- **10-GPON** conforms to the ITU-T G987 specification
- 10 Gbps download speed coupled with a 2.5 Gbps upload speed.
- **NG-PON2** (also known as **TWDM-PON**)conforms to the ITU-T G989 specification
- 4 wavelengths - Each upstream/downstream wavelength is capable of providing up to 10 Gbit/s symmetric bandwidth to each subscriber