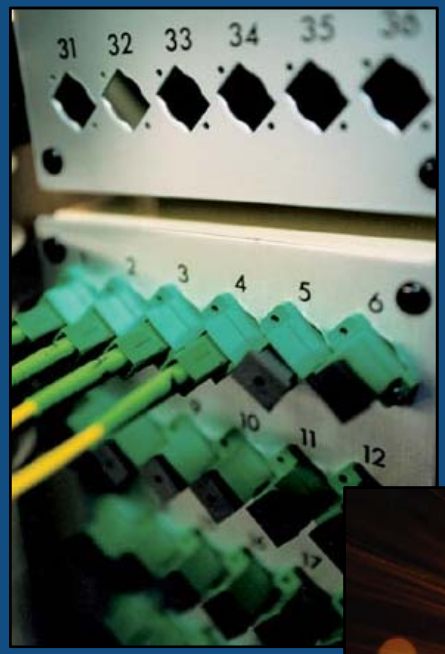
Gigabit Passive Optical Networks



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1. Overview
2. Background
3. GPON Architecture
4. Infrast. Support Systems
5. Pathway Sizing

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1 Overview

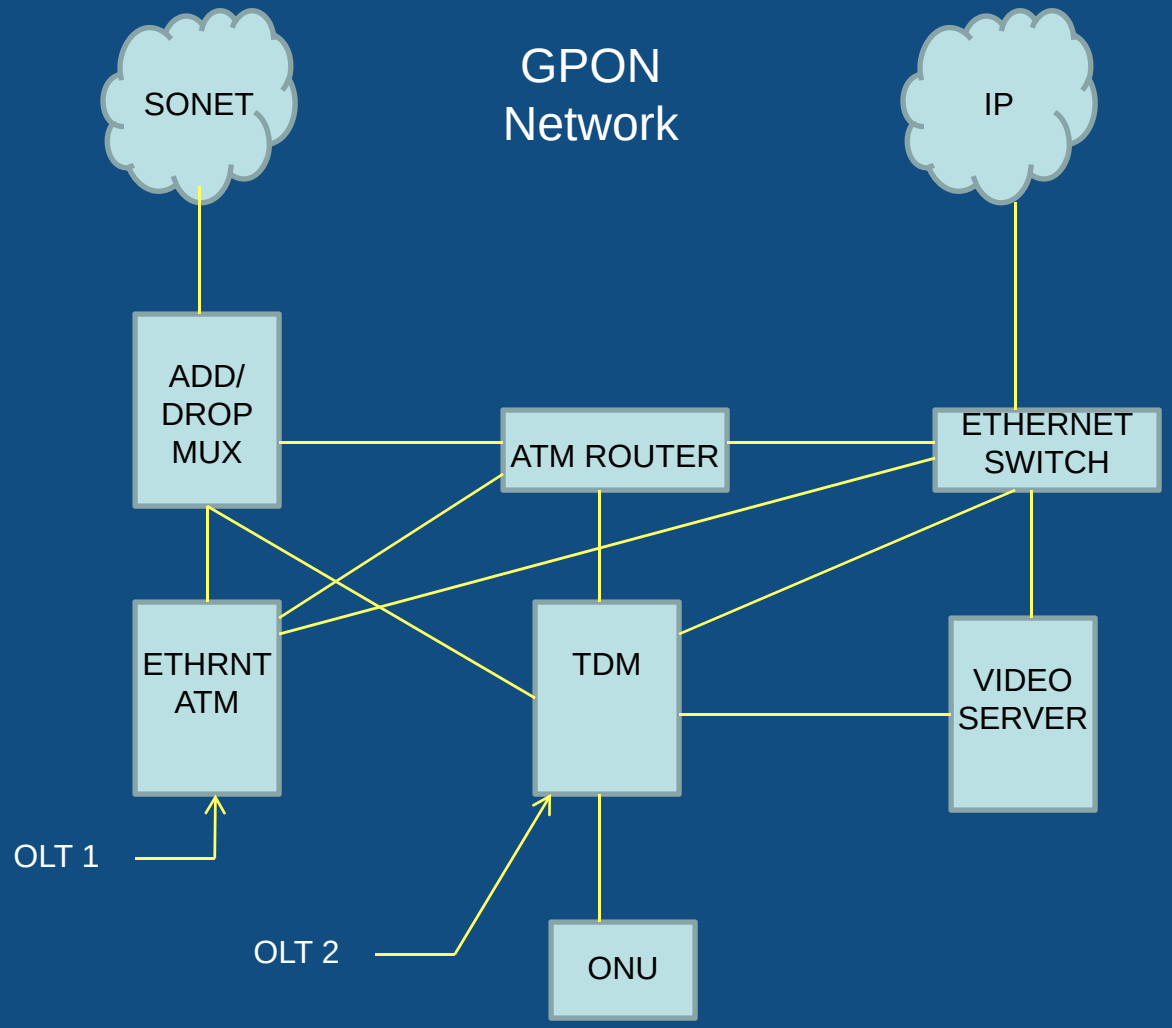
- ✓ Challenges
- ✓ Interpretation of Structured Cabling Market
- ✓ Design Approach

Background

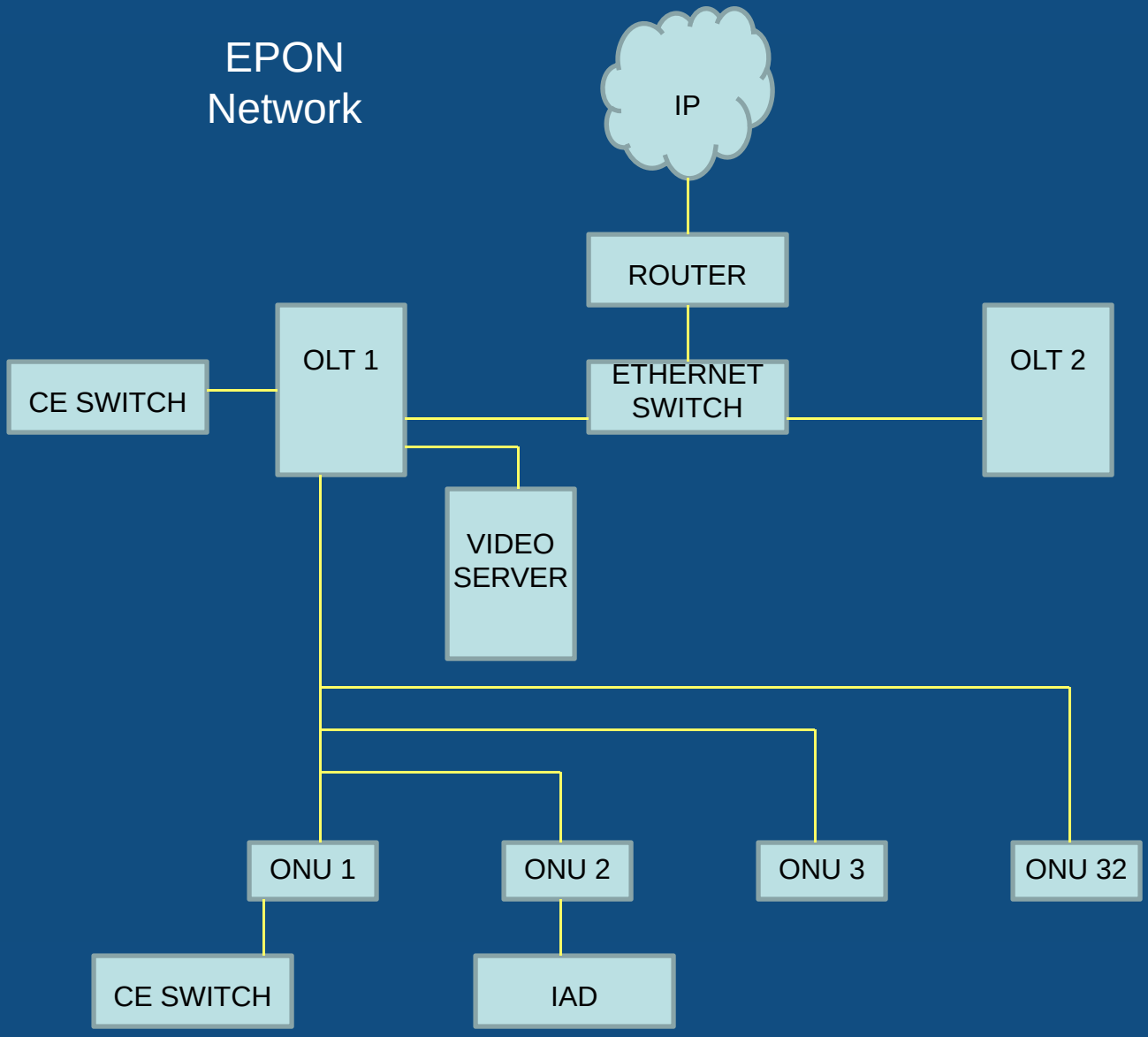
- ✓ What is GPON?
- ✓ How Does GPON Work?
- ✓ Standards

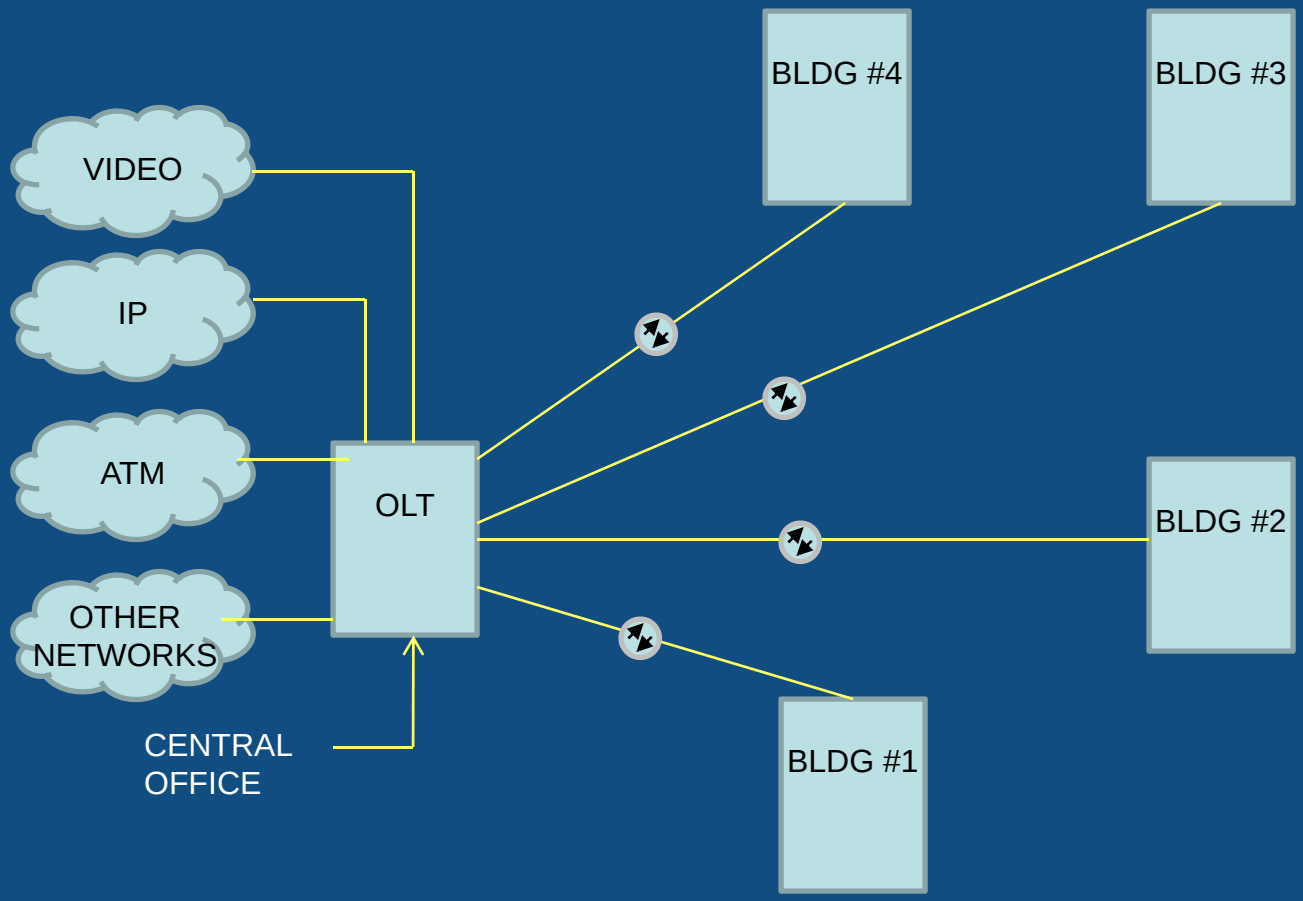
GPON Architecture

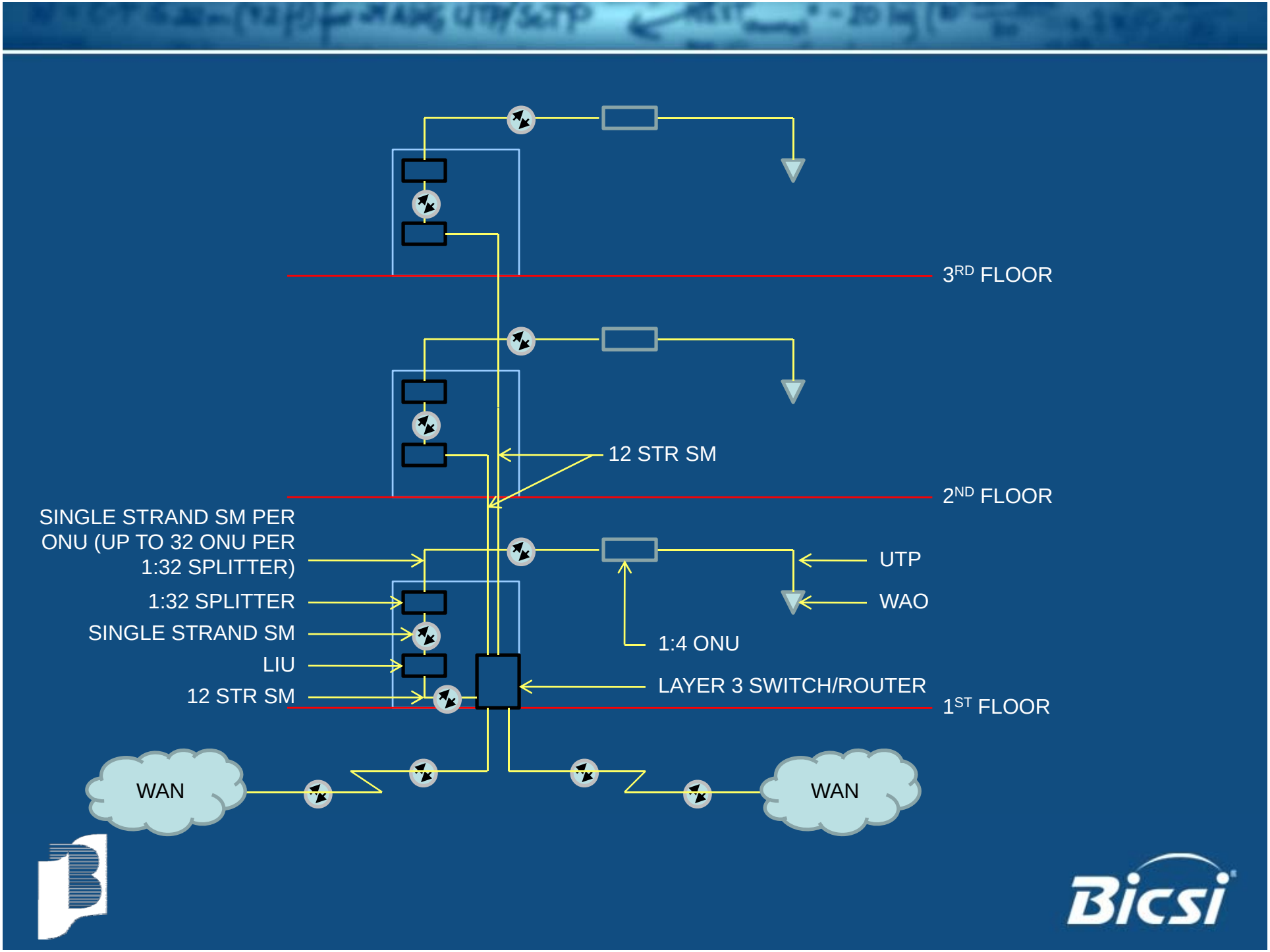
- ✓ Cable Plant
- ✓ Splitters
- ✓ Optical Line Terminal (OLT)
- ✓ Optical Network Terminal (ONT)
- ✓ Optical Network Unit (ONU)


GPON
Network
SONET
IP
ADD/
DROP
MUX
ATM ROUTER
ETHERNET
SWITCH
ETHRNT
ATM
TDM
VIDEO
SERVER
OLT 1
OLT 2
ONU

EPON Network




VIDEO
IP
ATM
OTHER NETWORKS
CENTRAL OFFICE
OLT
BLDG #4
BLDG #3
BLDG #2
BLDG #1


3RD FLOOR
12 STR SM
2ND FLOOR
SINGLE STRAND SM PER ONU (UP TO 32 ONU PER 1:32 SPLITTER)
1:32 SPLITTER
SINGLE STRAND SM
LIU
12 STR SM
UTP
WAO
1:4 ONU
LAYER 3 SWITCH/ROUTER
1ST FLOOR
WAN
WAN

4 Infrastructure Support Systems

- ✓ Core and Shell 100,000 sq ft
- ✓ Usable Square Feet 75,000 sq ft
- ✓ Verticality of Space 8.5’ clg, 30” to deck
- ✓ Support Spaces
  - Mechanical 2,000 sq ft
  - Electrical 1,000 sq ft

5

Pathway Sizing

	STAR	WIRELESS	ZONE	PON
CT Size	18” x 2”	8” x 2”	J-Hook	J-Hook
Ind. Support	85LBS./5LFT	1.92LBS./5LFT	1.92LBS./5LFT	33LBS./5LFT
LBS/LFT	17	.384	.384	6.6

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Pathway Sizing

	STAR	WIRELESS	ZONE	PON
UTP	443K	Reduced 75-80%	Reduced 55%	Reduced to WAO patch
OF-MM	100FT	7K	100FT	X
OF-SM	X	X	X	237K

NOTE: Zone based on fiber to each CP

Technology Spaces

Based on Number of Users

	STAR	WIRELESS	ZONE	PON
TR Size	(4) @ 100SQ.FT EA	(4) @ 24SQ.FT EA	(4) @ 24SQ.FT EA	(1) In MDF
# of Racks	(2) / TR	(1) / TR	(1) In MDF	(1) In MDF
Occupied RUs	72	24	24	20

UTP Star - Pros

- ✓ Gigabit Ethernet dedicated bandwidth per user at 1000mbps based on category 6 deployments - 10 Gigabit speeds available but not widely deployed to the desktop at this time
- ✓ Administration management is centralized at closets
- ✓ Supports-video, voice, VoIP, Data transport services
- ✓ Bandwidth potential limited by electronics and UTP bandwidth capability restrictions
- ✓ Centralized area for backup equipment power and system redundancy
- ✓ Field PoE devices can be powered by switches

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UTP Star - Cons

- X PC is "leashed" or tied to fixed outlet- local access
- X Distance limitations on UTP of 90m for horizontal link runs
- X Wiring support infrastructure costs are high
- X High power and cooling costs for equipment
- X Requires more "real estate" for equipment and infrastructure termination components
- X Not as flexible for moves adds and changes (MAC's).
- X Typical lifespan for UTP infrastructure before upgrading has been historically 5-7yrs average
- X Copper and FEP material costs can be volatile
- X Subject to EMI and interference issues
- X Wiring infrastructure costs are high
- X Significant source of flammable materials within ceiling spaces
- X Requires grounding which can add significant costs
- X Requires labor intensive UTP termination and testing
- X Adds significant weight to building structure

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Wireless - Pros

- ✓ Mobile access- no fixed PC leash - wider area of coverage,
- ✓ Flexible for moves adds and changes (MAC's).
- ✓ Reduction in UTP infrastructure cost compared to UTP star
- ✓ Reduction in real-estate requirements compared to UTP star
- ✓ Reduction in power and cooling costs compared to UTP star
- ✓ Supports-video, VoIP, Data transport services
- ✓ Reduction in requirements for pathways and spaces for UTP cabling infrastructure compared to star
- ✓ Bandwidth potential limited by electronics and UTP bandwidth capacities
- ✓ Centralized area for backup equipment power and system redundancy
- ✓ AP units can be powered by PoE from switches
- ✓ Reduction in cable weight applied to building structure

Wireless - Cons

- X Bandwidth is shared among users
- X Maximum achievable bandwidth with current "N" draft technologies is 600mbps shared.
- X Not all devices are currently wireless capable, fixed UTP outlets will still need to be deployed for ancillary devices such as fax machines, POTS line phones, etc.
- X Requires additional electronics security investment compared to a hardwired star topology- wireless signals can be intercepted
- X Subject to signal and environmental interference issues
- X Significant reduction of flammable materials within ceiling spaces compared to star
- X Typical lifespan for UTP infrastructure before upgrading has been historically 5-7yrs average
- X Distance limitations on UTP of 90m for horizontal link run

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Zone - Pros

- ✓ Gigabit Ethernet dedicated bandwidth per user limited to 1000mbps based on category 6 deployment - 10 Gigabit speeds available but not widely deployed to the desktop at this time
- ✓ Easier station reconfigurations for furniture cubicles, MACs
- ✓ Reduction in real-estate requirements compared to star
- ✓ Reduction in UTP infrastructure cost compared to star
- ✓ Reduction in power and cooling costs compared to star
- ✓ Supports-video, voice, VoIP, Data transport services
- ✓ Bandwidth potential limited by electronics and UTP bandwidth capacities
- ✓ Field PoE devices can be powered by switches
- ✓ Reduction in requirements for pathways and spaces for UTP cabling infrastructure compared to

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Zone - Cons

- X Administration management is not centralized in closets
- X UTP is subject to EMI and interference issues
- X Typical lifespan for UTP infrastructure before upgrading has been historically 5-7yrs average
- X Copper and FEP material costs can be volatile
- X PC is "leashed" or tied to fixed outlet - local access
- X Moderate source of flammable materials within ceiling spaces compared to UTP star
- X Distance limitations on UTP of 90m for horizontal link runs
- X CP enclosures require local backup power for active equipment – not centralized in IDF
- X Requires grounding which adds costs to the project
- X Requires field UTP termination and testing
- X Adds moderate weight to building structure

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PON - Pros

- ✓ Significant reduction of UTP infrastructure costs compared to UTP star (copper patch cords required at WAO)
- ✓ Significant reduction of IT real-estate requirements compared to UTP star
- ✓ Significant reduction of power and cooling costs compared to UTP star
- ✓ Optical Fiber is not subject to EMI or interference issues
- ✓ Longer potential lifespan for infrastructure - 15-20 years* compared to UTP
- ✓ Higher security / fiber optic signals are difficult to intercept and decode
- ✓ Significant reduction of flammable materials within ceiling spaces compared to UTP star
- ✓ Use of preterm fiber assemblies or fusion splice pre-connector-ed assemblies can reduce field termination errors and labor intensive testing required by UTP based systems.
- ✓ Single Mode Fiber costs are more stable and predictable

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PON - Pros

- ✓ Reduction in wiring support infrastructure and costs compared to UTP star
- ✓ Supports-video, voice*, VoIP, Data transport services
- ✓ Single Mode fiber has virtually unlimited bandwidth potential
- ✓ Reduction in required pathways and spaces for SM fiber cabling and support infrastructure compared to UTP star
- ✓ Reduction of grounding requirements - Fiber is non-conductive
- ✓ Cable run Distance can be extended up to 60km with mid-span
- ✓ Reduced backbone support requirements compared to UTP star
- ✓ TR's can be eliminated and consolidated to single MDF
- ✓ Reduction in cable weight applied to building structure compared to UTP star
- ✓ Higher speeds may be available depending on future electronics

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PON - Cons

- X Maximum achievable bandwidth with GPON is 1.25Gbps uplink/2.5Gbps downlink shared, EPON 1Gbps symmetrical
- X Single strand bi-directional SM fiber infrastructure limits usage of current and migration to future technologies
- X Single Mode optical interfaces required in electronics increase equipment costs
- X PC is "leashed" or tied to fixed outlet - local access
- X Administration management is not centralized in closets
- X Not as flexible for moves adds and changes (MAC's).
- X Backup Power required at each WAO for the ONT, not centralized in IDF

Summary

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Questions?

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