COMMSCOPE®

YOUR NETWORK
RUNS ON COMMSCOPE™

Ensuring end to end Broadband QoS on FTTx

ITU Broadband Training – Bangkok 27-10-2015

Wes Oxlee

Principal Customer Architect

COMMSCOPE®

#1 Structured Cabling and Connectivity Solutions

In-Building Cellular

Intelligent Building Solutions

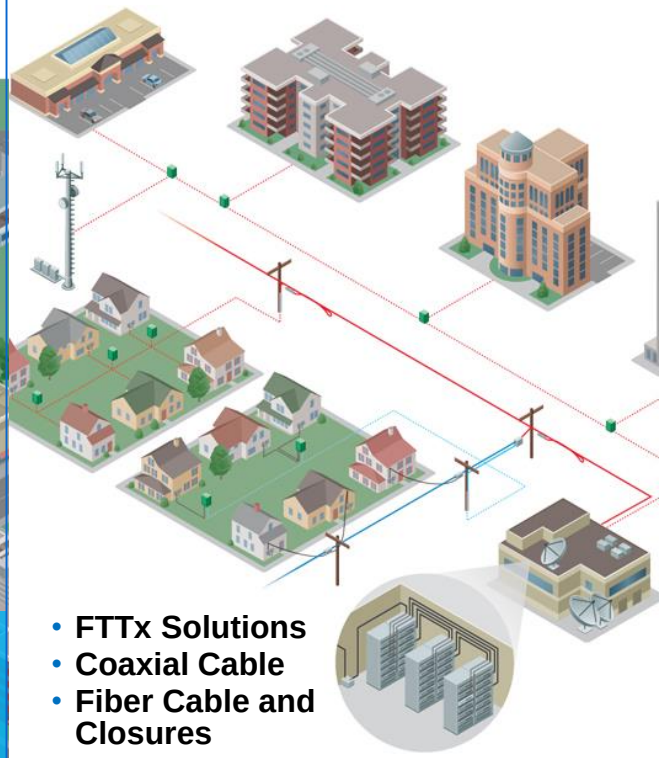
Data Center Solutions

#1 in RF Infrastructure Solutions

DAS
Distributed Coverage and Capacity Solutions

Cell Site Solutions
- Base Station Antennas
- Cables and Connectivity
- Microwave Antennas
- Base Station Subsystems
- Cabinets

#1 Access Network Infrastructure Solutions



- **FTTx Solutions**
- **Coaxial Cable**
- **Fiber Cable and Closures**
- **Central Office Connectivity**
- **Headend Connectivity**

Market Trends

….data delivered to customers today and tomorrow

DATA - ANYWHERE - ANYTIME

3X **VIDEO ON DEMAND**

Traffic increase by 2017

NEW PLAYERS

Driving investment in higher-speed networks

Connected devices increasing

EXPONENTIALLY

Governments are investing in broadband infrastructure, connecting **MILLIONS OF HOMES**

BIG DATA TRAFFIC in ONE MINUTE

Today, the number of networked devices is equal to the global population. By 2016, the number of networked devices will be twice the global population.

>**1** million
VIDEO VIEWS

>**2** million
SEARCH QUERIES

>**6** million
PROFILE VIEWS

>**15** million
TEXT MESSAGES

>**20** million
PHOTO VIEWS

>**180** million
EMAILS SENT

Source: ITU,

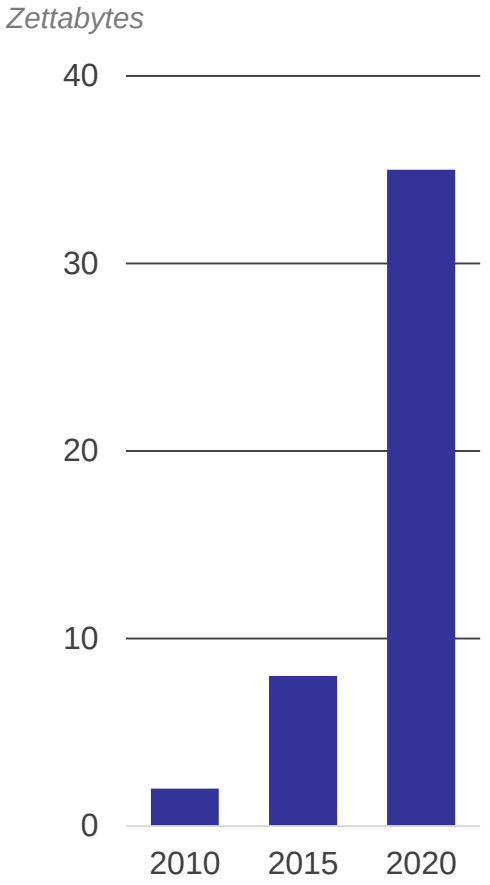
BIG BANDWIDTH CHALLENGE

Big data is expected to grow

800%

within the next 3 years, whereas today's existing data networks and present infrastructures are not ready for such loads.

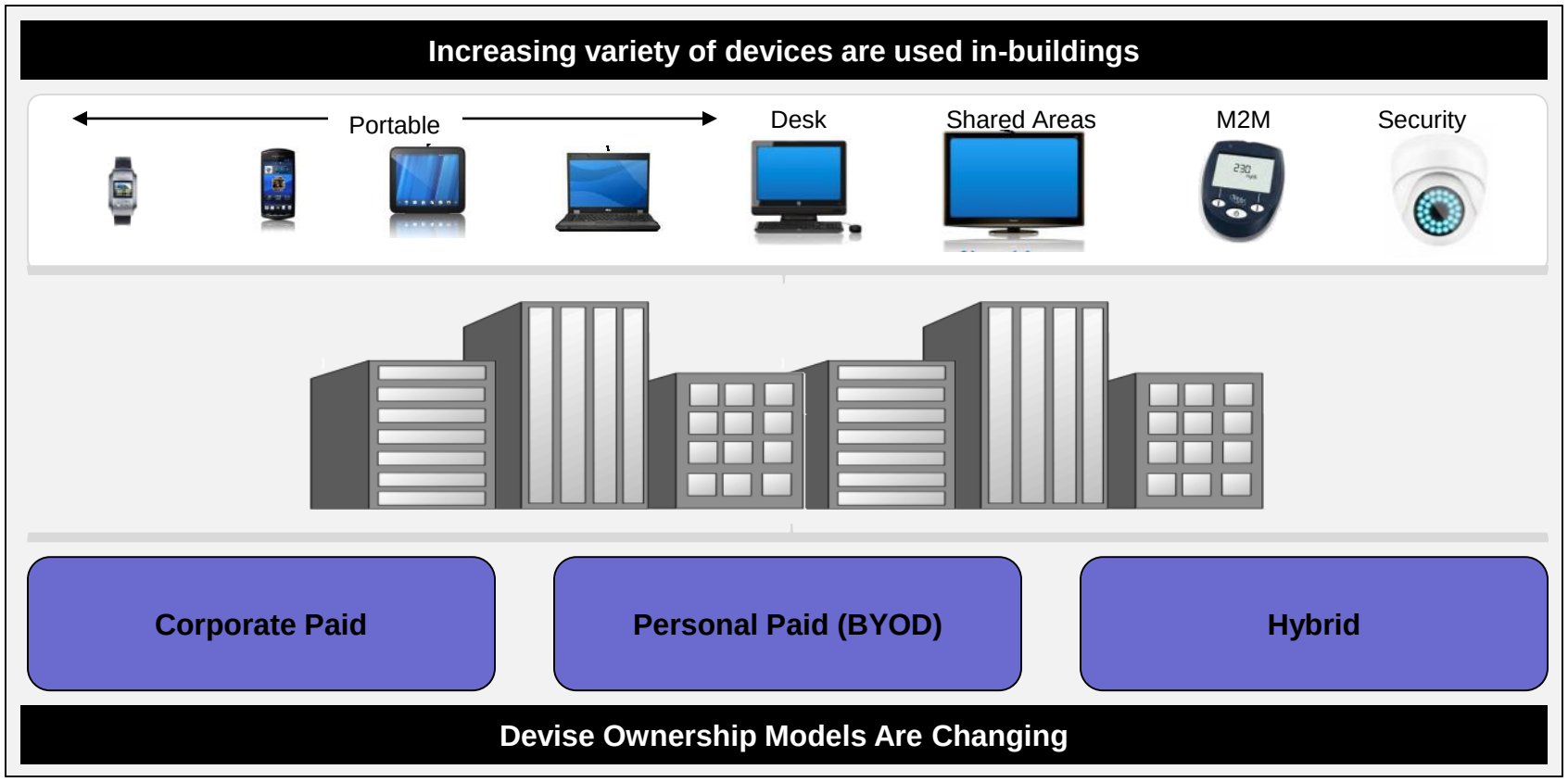
Bandwidth capacity growth will be key in tackling the rising demand for transmission of this stored data.



1 Zettabyte is one million Petabytes

Source: Reuters, 2013

The in-building network infrastructure is increasing in complexity



- Wireless LAN
- Decrease In Wired LAN ports

- In Building Management Solutions
- Service Provider LAN

- Converged In-Building Networks
- Increase Fiber Usage

In-Building architectures are changing in response to these trends

Device Proliferation

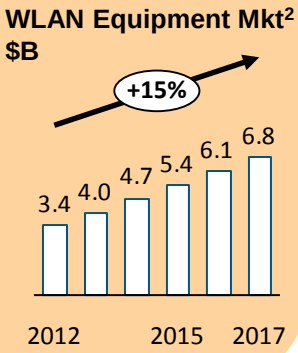
M2M

Security

Ownership

New Wireless Technologies

- Increase usage of DAS, Small Cell, and Wifi
- Initial adoption of 1 Gbps wireless technology[1]



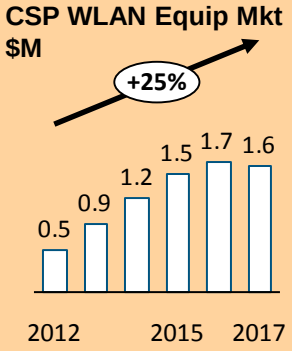
New Software to Manage Buildings & Networks

- Software solutions to help manage building and network resources

Potential Solutions
- Building Infrastructure
- Building Security
- Network Security
- Network Planning

Service Provider WLAN

- Service providers are developing outsource models for LAN systems



Passive Optical LAN

- Benefits from Opex reduction, increased security, and rising copper costs are creating high growth for this nascent market

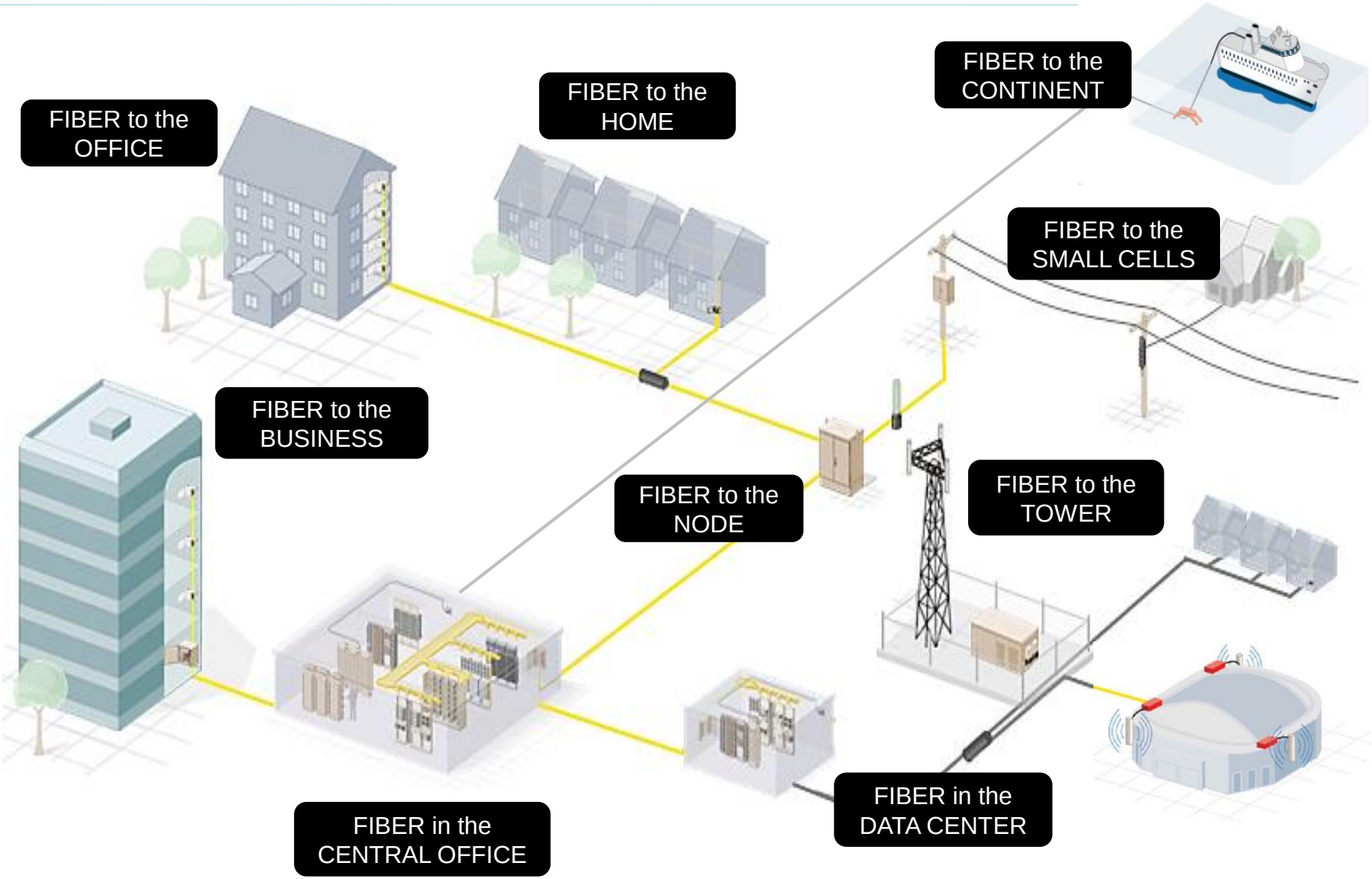
tellabs
COMMSCOPE
CORNING
ZHONE
3M

[1] 802.11ac: Small portion of the market until 2015, but significant uplift expected at the backend of the planning cycle
[2] Excludes CSP WLAN Market

FTTx

....End to End QoS

THE FIBER NETWORK IS KEY



Guaranteeing QoS in FTTx

- QoS is a concrete, Important objective to be strive for in all equipment designs
- Achieving QoS in FTTx has never been as important as it is today.
- When looking at PON solutions, You must ask how QoS can be guaranteed for different types of services over PON?
  - Content, Voice, Video, Data, Cloud, SDN, NFV, Mobile

Guaranteeing QoS in FTTx

COMMSCOPE®

- It lies in PON Architecture.
  - Desirable benefit of PON - QoS is not managed in ODN
  - OLT and ONTs are the only active elements, QoS mechanisms are controlled and managed.
  - Failure in ODN – Great Impact to Overall Network, PON, SDN, NFV, C-RAN, Backhaul

The six challenges

Providing more detail on the six challenges he outlined, Willis says the first issue is connecting VNFs to the infrastructure. OpenStack does this in a sequential manner, with the sequence serially numbered in the VNF, but the difficulty comes when trying to verify that the LAN has been connected to the correct LAN port, the WAN has been connected to the correct WAN port and so on. "If we get this wrong for a firewall function it could be the end of a CIO's career," says Willis.

The "start-up storms" to which he refers can happen when, say, a fiber connection is broken and then subsequently fixed. "Imagine we have a controller with 100,000 nodes and all these distributed agents try to reconnect at the same time," says Willis. "They're all using encryption and that's slow and computationally intensive and the only way to get the network back is to phone up customers and tell them to turn their nodes off and on again one at a time -- that is not going to be very pleasant with 100,000 customers."

http://www.lightreading.com/nfv/nfv-specs-open-source/bt-threatens-to-ditch-openstack/d/d-id/718735?itc=lrnewsletter%5Fspitupdate&page_number=2

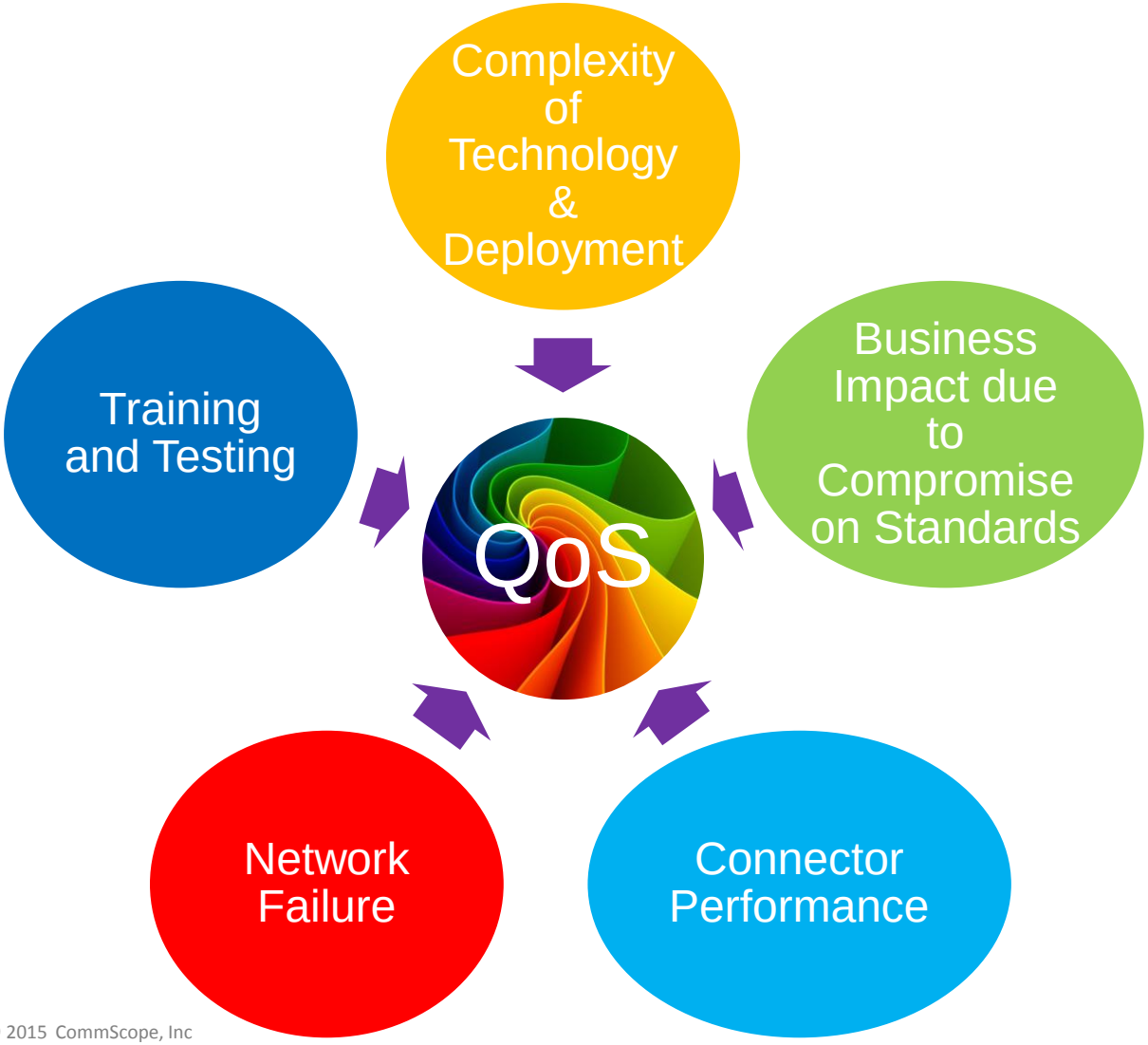
Source: Light Reading 2015

Challenges

....End to End QoS

Complexity, Challenges to Achieve QoS

- Major Challenges to Achieve & Sustain End to End QoS



When FTTx QoS is desired – More challenges

COMMSCOPE®

OPEX & CAPEX

- Fiber OSP and network components being damaged
- Training cost massive impact on OPEX expenditure
- Expensive network re-rolls for maintenance & troubleshooting

Constraints

- High volume of fiber connectors, splitter, splices need testing. Installed in harsh OSP environment
- Shortages of fiber experts
- Open networks with various networks and service providers

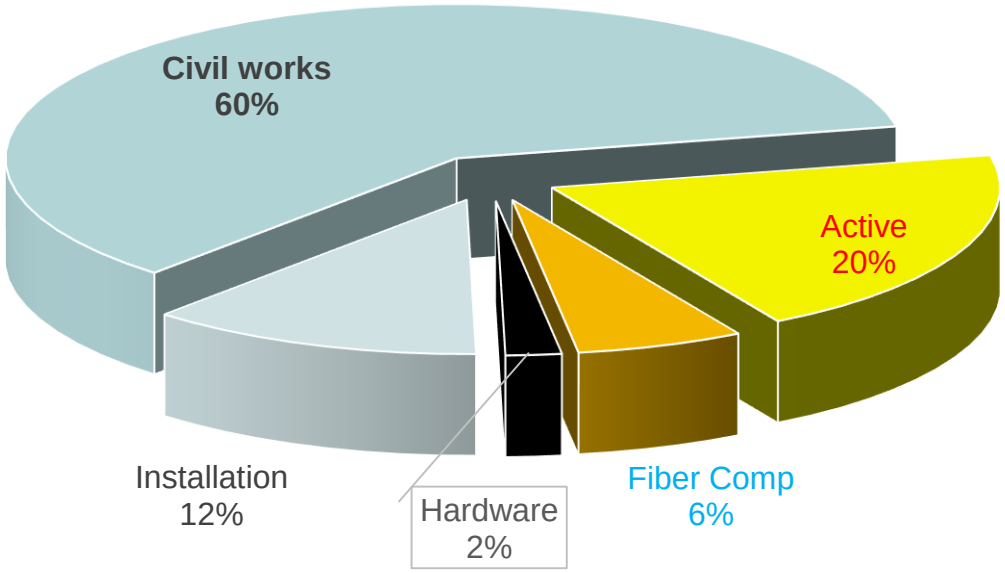
Impacts

- Poor Installation, Difficulties faced during roll-out
- Service disruption due to customer churn, bad connections causing frequent outages, sub-compliance products
- Failing to turn up customer services

When FTTx QoS is desired – More challenges

- Civil works contribute up to 60%
- Fiber cable and accessories estimated 6%
- Insignificant Cost of Fiber yet Sub-standard products deployed
- Compromise Network Resilience

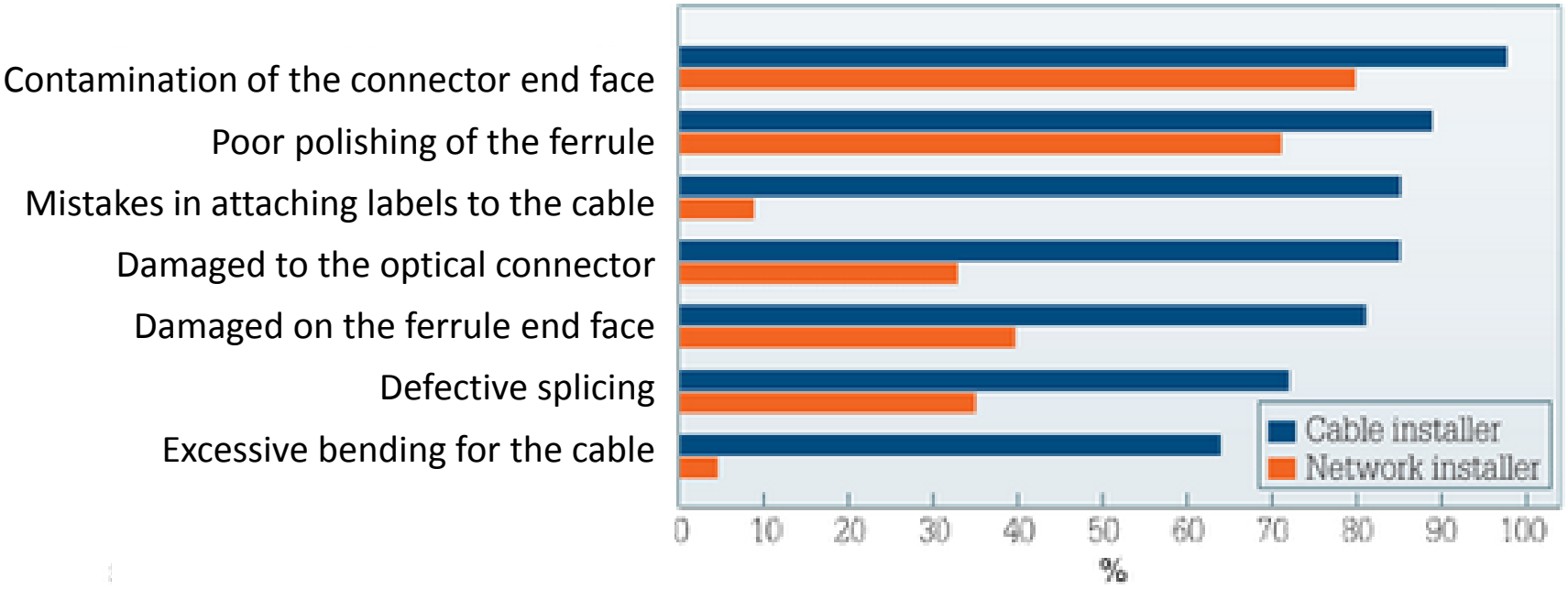
CAPEX distribution for FTTH deployments



When FTTx QoS is desired – More challenges

COMMSCOPE®

Causes of optical network failures



Study by NTT-Advanced Technology:
98% of installers (blue) and **80%** of network owners (red) reported that issues with connector contamination was the greatest cause of network failure
Other major failures are coming from splices and bends (high loss and ORL/Reflectance)

Source: NTT – Advanced Technology

When FTTx QoS is desired – More challenges

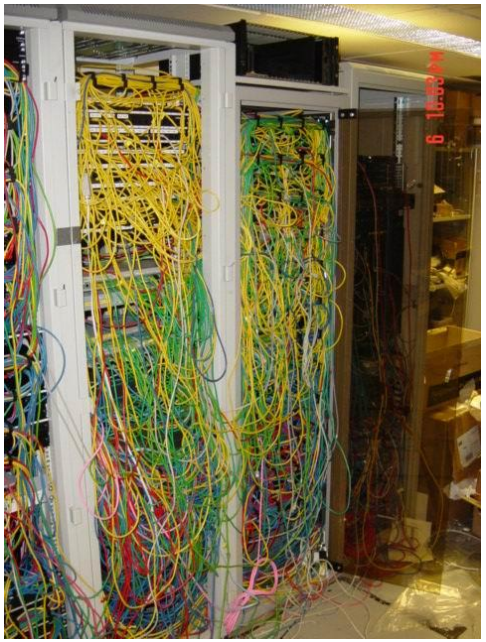
- Business Impact due to Compromise on International Standards

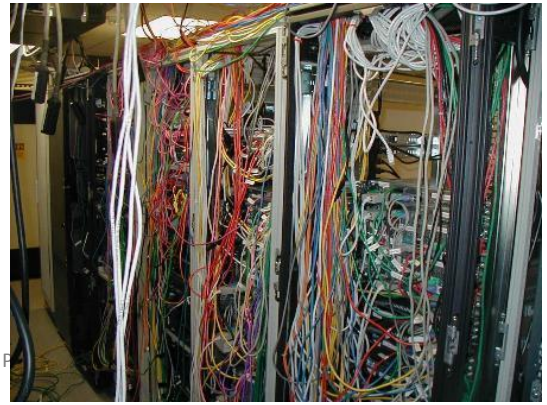
- **QoS:** Prove functionality, minimize early failures
- **Lifetime:** Best engineering practices for testing
- **OPEX:** Minimizing replacement costs
- **Intermateability:** Compatibility between multiple suppliers

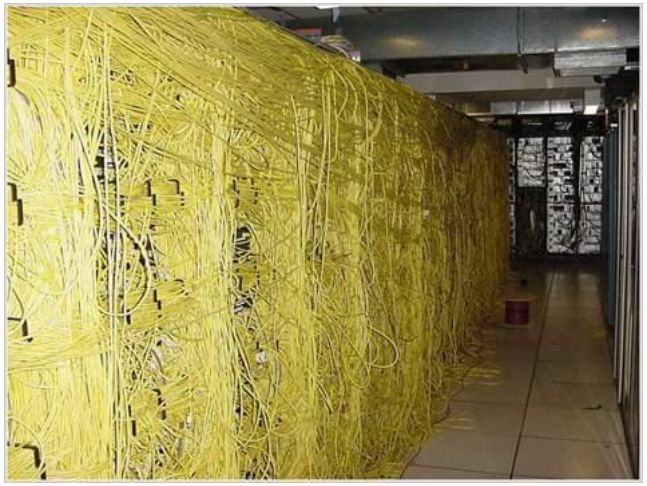
- **Smarter:** Common agreed practice for evaluation of products
- **Faster:** Solid basis for audits, resource planning & equipment investment
- **Better:** Minimize cost and risk for customers

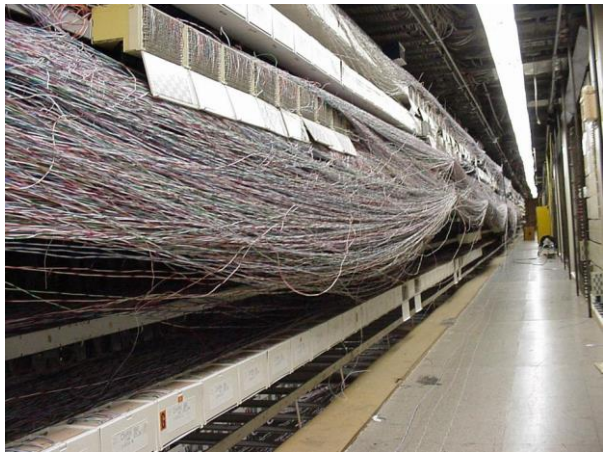
When FTTx QoS is desired – More challenges

- Non-existence of Cable Management
- Poor Pathways and Record Keeping









When FTTx QoS is desired – More challenges

-

COMMSCOPE®

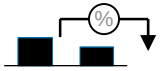
Case Study

....The importance of QoS and its impact on future technology

Solutions need to meet customers challenges

Customer Challenges

1. **Minimize CAPEX & OPEX**



2. **Faster response time**

3. **Leverage multi-skilled personnel**

4. **Reduce long-term maintenance expense**

5. **Improve utilization of network infrastructure**

Technological Innovations

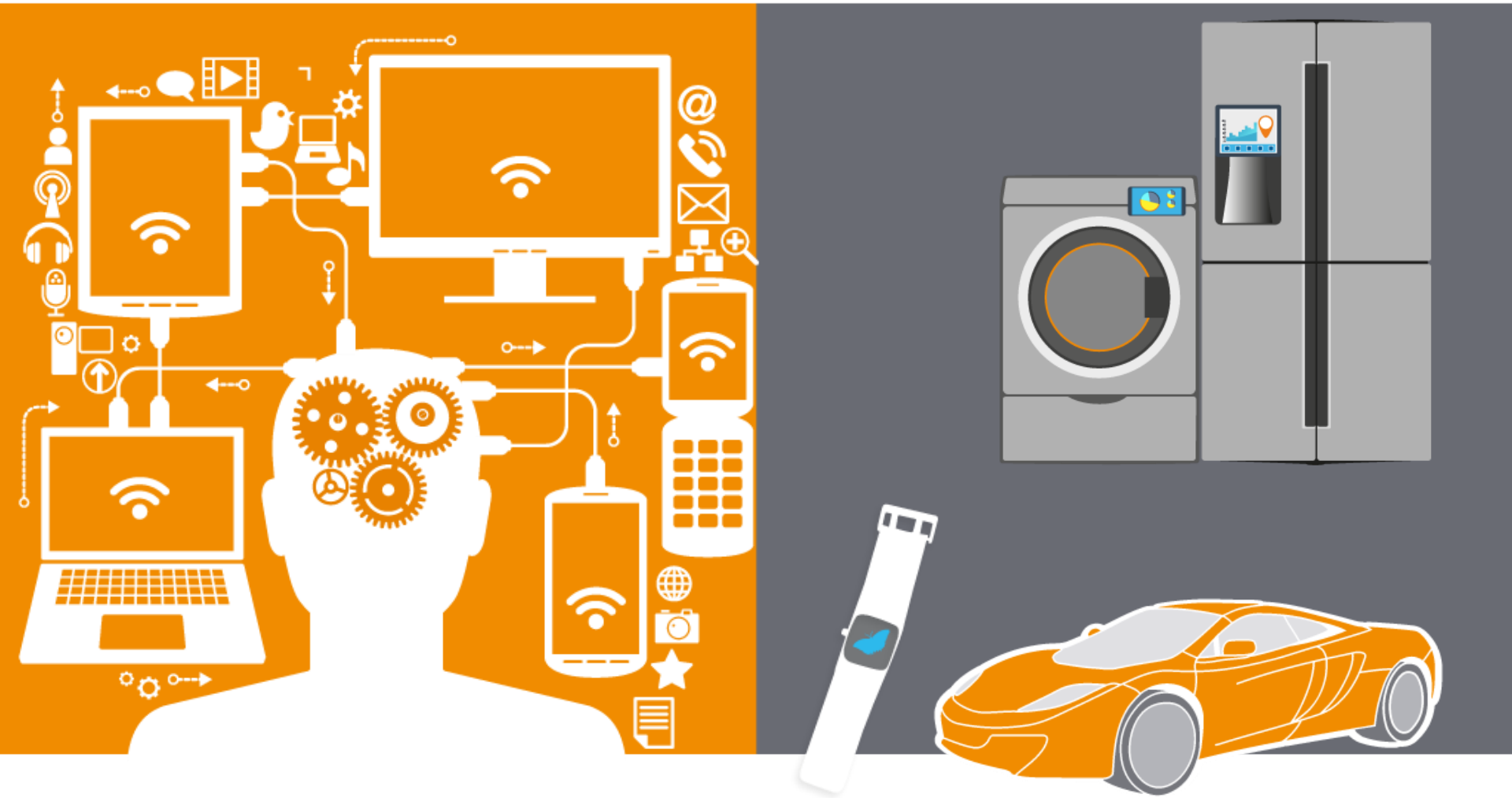
Move labor from field to factory

Customer benefits:

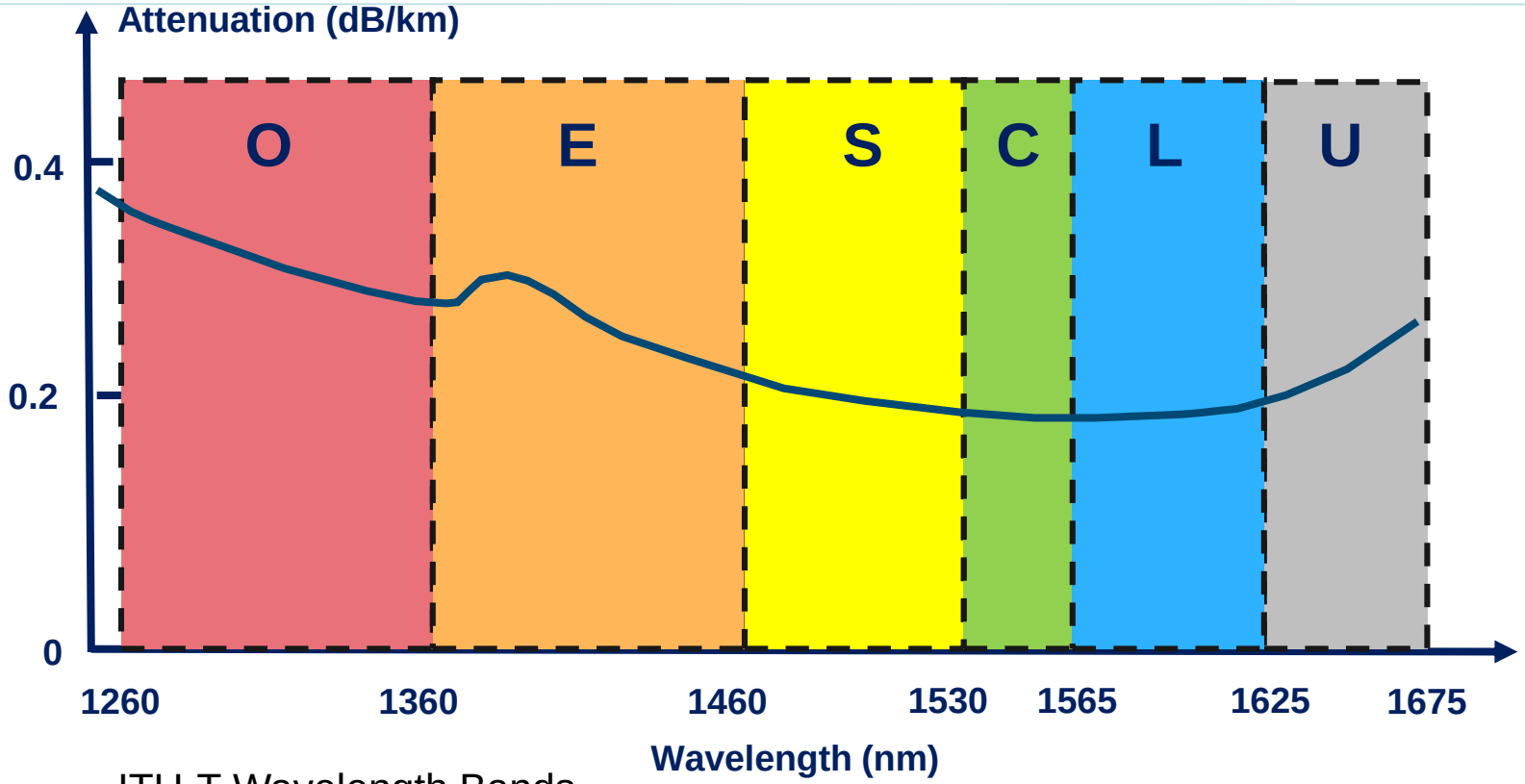
↑ Speed of installation	↓ Need for training
↑ Network connection	↓ CapEx & OpEx
↑ New revenue streams	↓ Labor costs

Solutions to Meet Customer Challenges

Technologies of FTTH Networks:



Core networks



ITU-T Wavelength Bands

O band: Original band 1260 nm-1360 nm

E band: Extended band (contains water peak) 1360 nm – 1460 nm

S band: Short wavelength band 1460 nm – 1530 nm

C band: Conventional band 1530 nm – 1565 nm

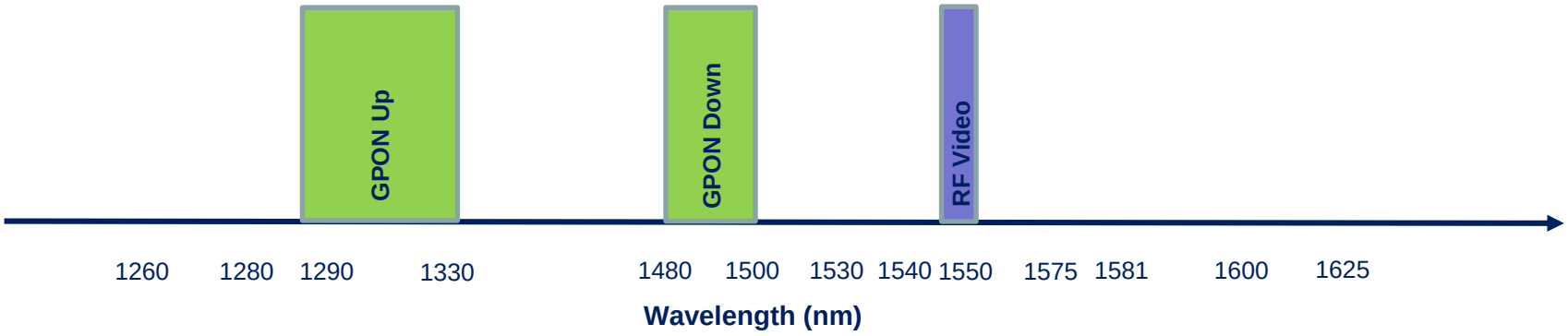
L band: Long wavelength band 1565 nm – 1625 nm

U band: Ultra long wavelength band 1625 nm – 1675 nm

FTTH PON

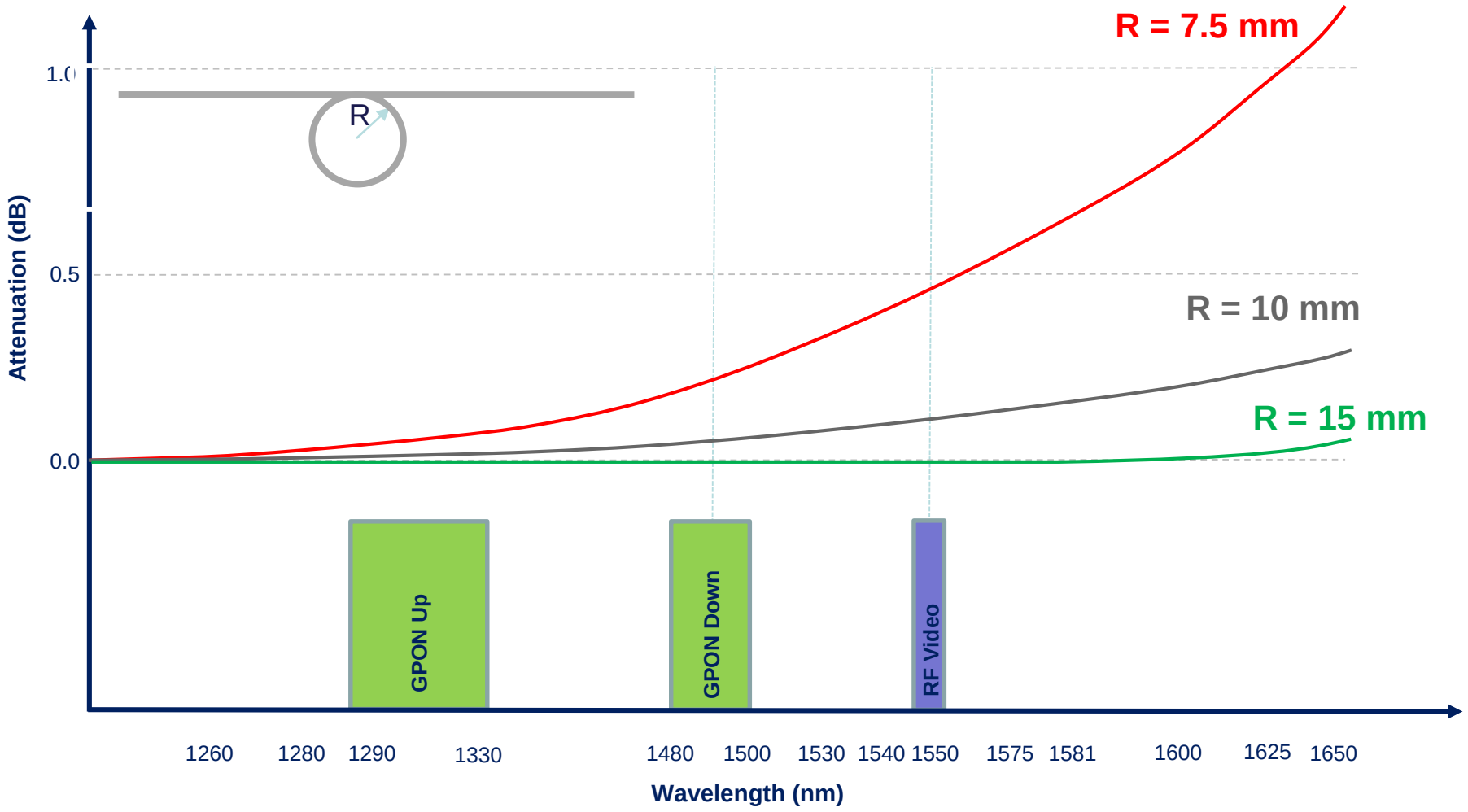
ITU-T G.987 series

- GPON 2.5 Gb/s down, 1.2 Gb/s up, shared = 78 Mb/s downstream (32 users per line)
- RF Video overlay



COMMSCOPE®

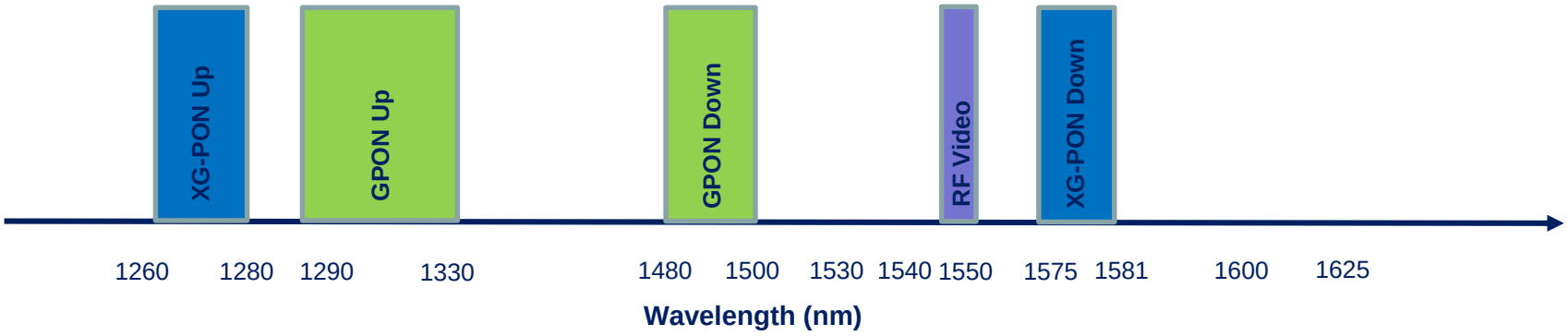
Macrobend loss with one turn of ITU-T G.657A2 fiber with radius R



FTTH PON

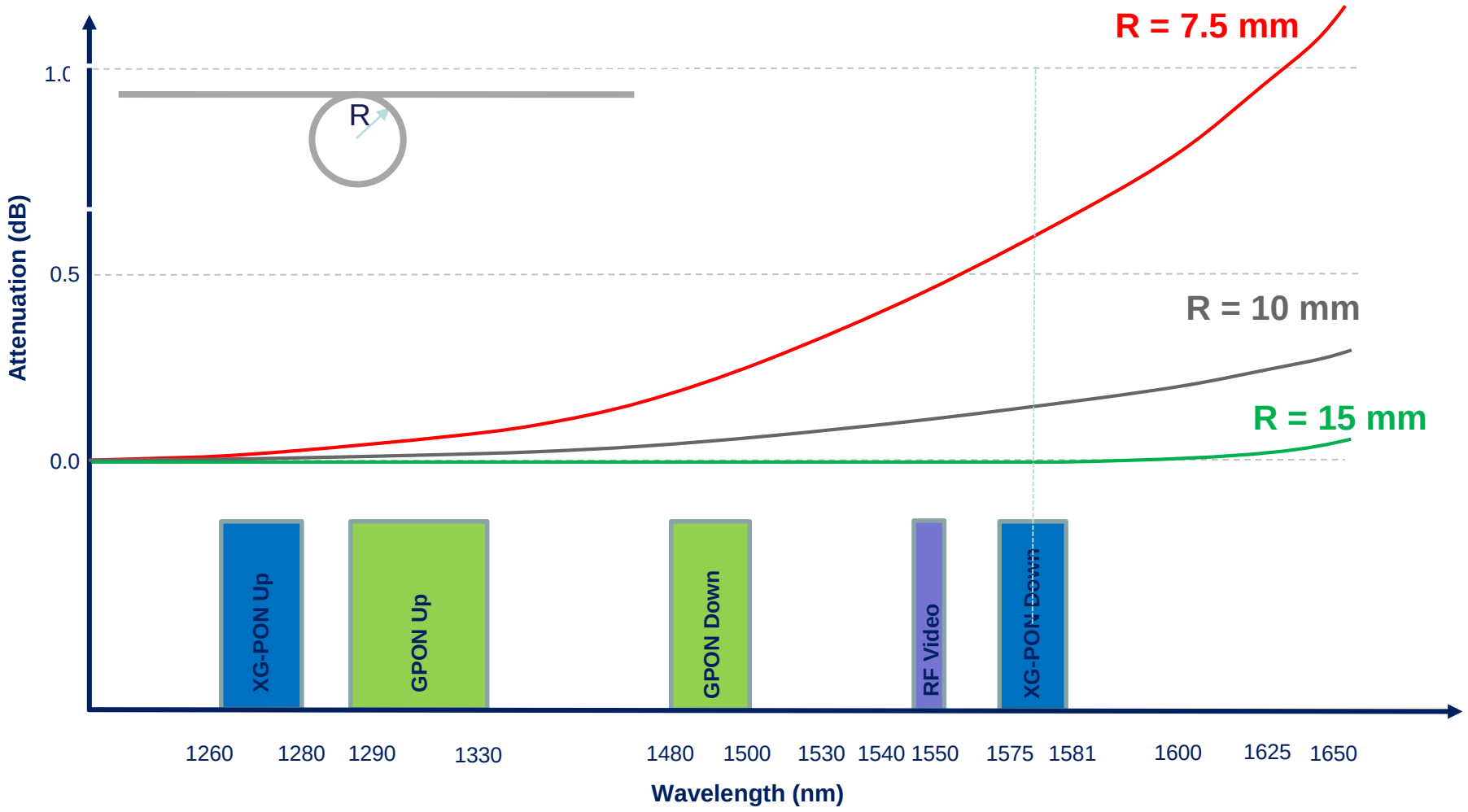
ITU-T G.987 series

- XG-PON1 10 Gb/s down, 2.5 Gb/s up, shared = 156 Mb/s (64 customers per line)
- XG-PON2 10 Gb/s up and down, shared



COMMSCOPE®

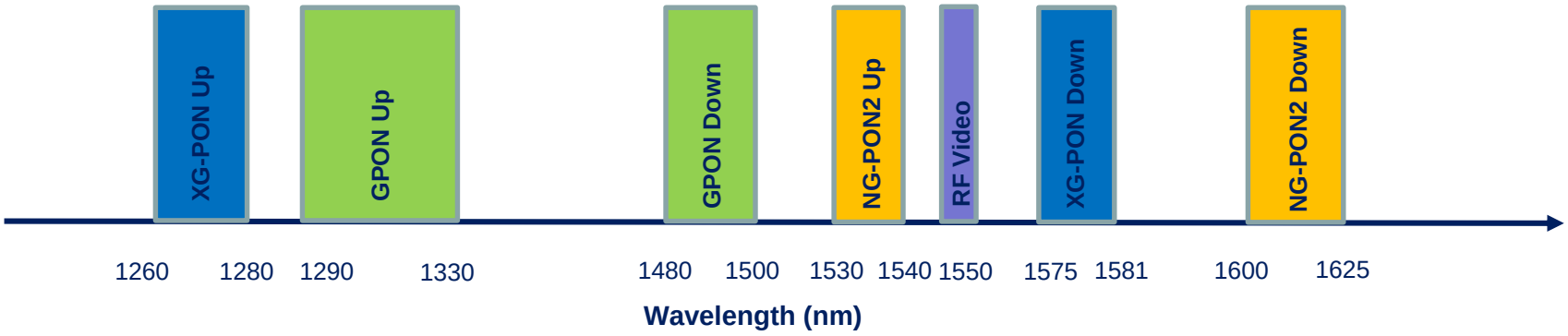
Macrobend loss with one turn of ITU-T G.657A2 fiber with radius R



FTTH PON

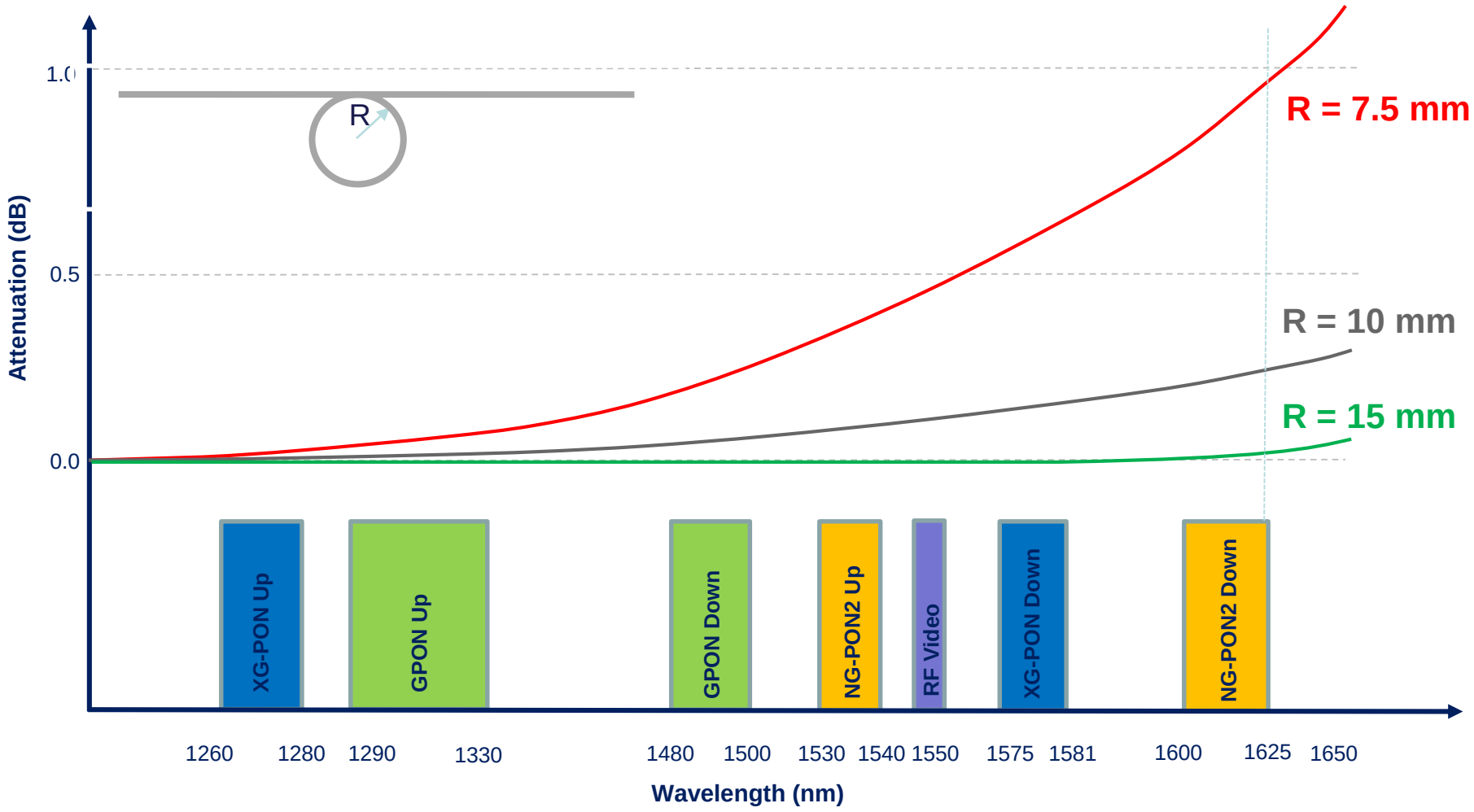
ITU-T G.987 series

- NG-PON2 10 Gb/s per wavelength (4 wavelengths downstream, 8 wavelengths upstream)
- Up to 1 Gb/s per customer or more customers



COMMSCOPE®

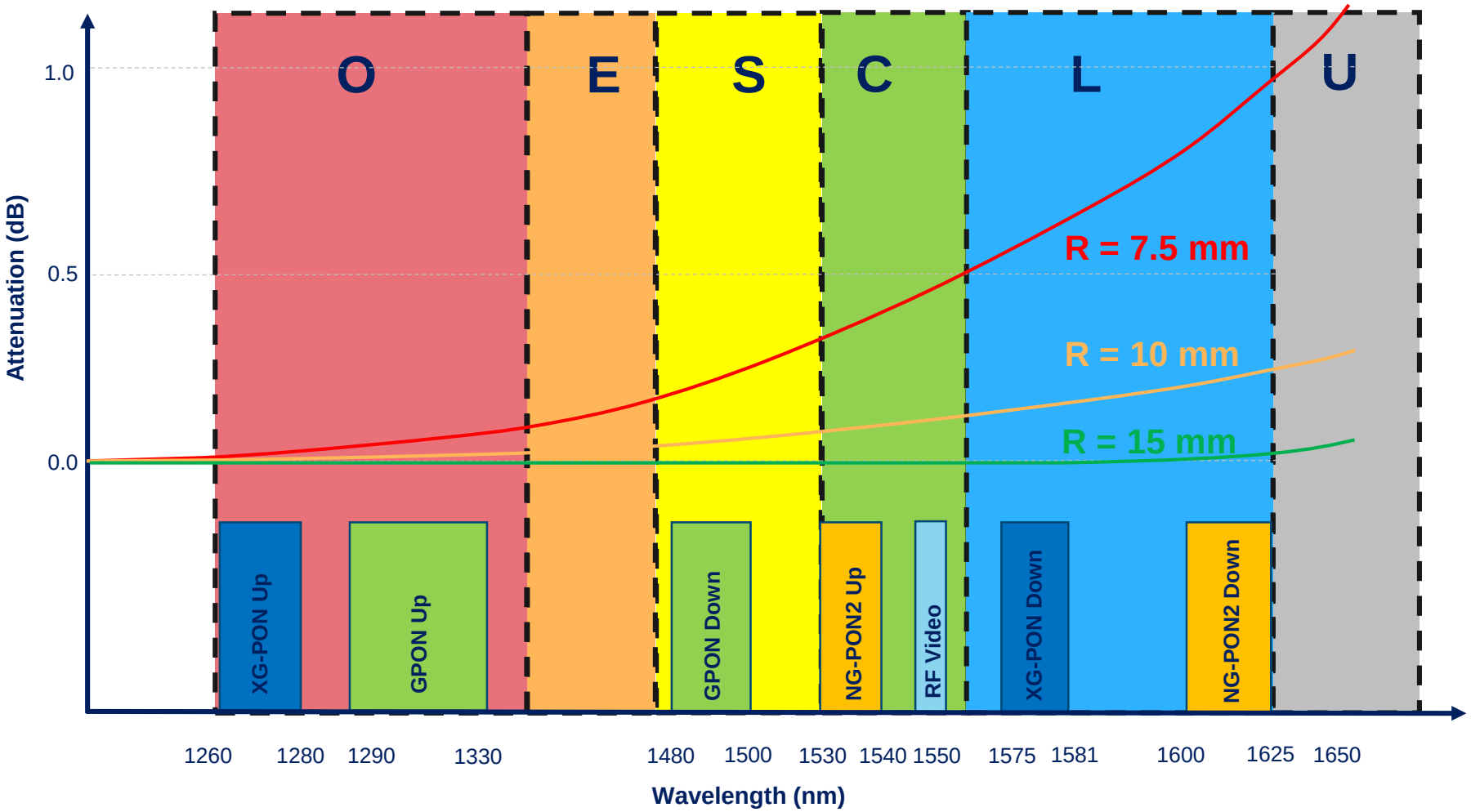
Macrobend loss with one turn of ITU-T G.657A2 fiber with radius R



Macrobending loss in fibers

COMMSCOPE®

Attenuation increase with one turn of ITU-T G.657A2 fiber with radius R



Wavelengths specified by standards

Conclusion…..

Reduce Installation Time

Simplified Connectivity

- Flexible Solution
- Faster Installation
- Easy Maintenance & Reconfiguration

Reduce Opportunity for Field Installation Error

Factory Termination

- Speed of installation
- Network connection

- Training
- CapEx & OpEx
- Labor costs

Reduce Field Engineering

Rapid Solutions

- Reduced site surveys
- Reduced engineering designs
- Integrated slack storage

Want to learn more?

COMMSCOPE®

- Visit http://www.te.com/en/industries/broadband-network-solutions/insights/ftth.html
- "FTTH FOR THIS CENTURY: HOW TO BUILD NETWORKS THAT LAST AND SURVIVE FUTURE REQUIREMENTS"
- "INCREASING DATA TRAFFIC REQUIRES FULL SPECTRAL WINDOW USAGE IN OPTICAL SINGLE-MODE FIBER CABLES"
- "THE ELEMENTS OF FIBER CABLE MANAGEMENT "

EVERYTHING RUNS ON

YOUR NETWORK

How Can We Help You?