STL 25 YEARS OF OPTICAL FIBRE

stl.tech

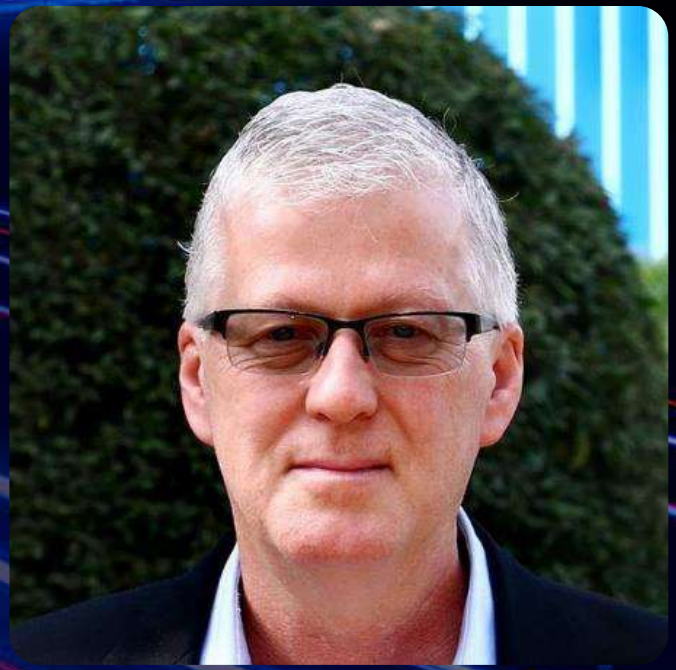
Webinar

Bend Insensitive Fibers

Improve Network Installation, Performance and Maintenance

13th July 2020

Speaker



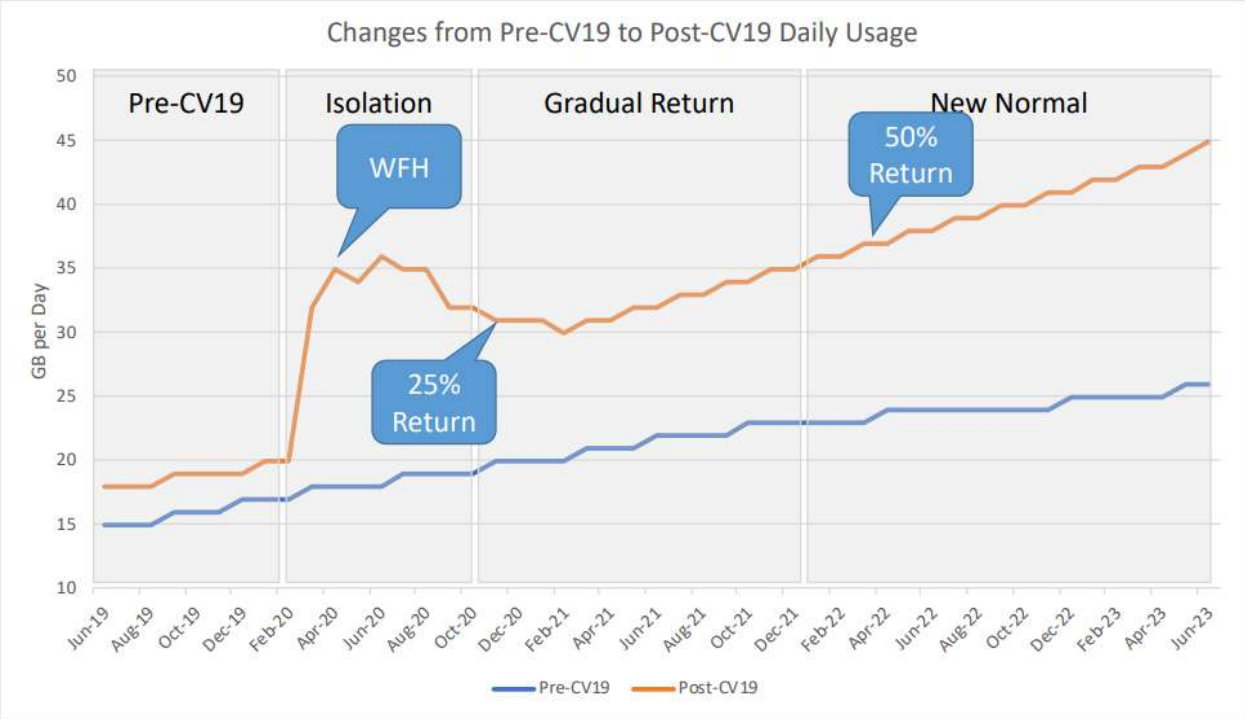
Dr. Seldon Benjamin

Principal Solutions Architect- Optical Interconnect

Sterlite Technologies Ltd.

seldon.benjamin@stl.tech

Covid-19 Lockdown Accelerated Use-case Adoption; Long-term Growth Trend On Data Consumption Already Emerging



Trends from European operators on COVID lockdown

New networks would be different

Converged, fiber dense and deep fiberized

Denser Networks

Access layer end points will multiply

Deep Fiberization

Fiber intensive network to support latency and capacity requirements

ITU Standards Focus On Bend Optimization But Maintaining Backward Compatibility Is An Industry Imperative

Same MFD for true backward compatibility

STL Fiber	Attn. 1310nm (dB/km)	Attn. 1550nm (dB/km)	MFD Mean (μm)
?	?	?	?
OH-LITE NOVA	0.33	0.19	9.1
BOW-LITE-250	0.34	0.20	9.1
OH-LITE (E)	0.33	0.19	9.1
OH-LITE	0.34	0.20	9.1

ITU Standards

- G.657.B3
- G.657.A2
- G.657.A1(+)
- G.657.A1
- G.652.D

Bend optimized fibers

STL Fiber	Attn. 1310nm (dB/km)	Attn. 1550nm (dB/km)	MFD Mean (μm)
BOW-LITE SUPER	0.35	0.21	8.6
BOW-LITE (E)	0.35	0.21	8.6
BOW-LITE PLUS	0.33	0.20	8.8
BOW-LITE 200	0.34	0.20	8.8

New Networks – Perform Better, Provisioned Faster And Cost Less

1

Enhanced network performance

Optical products ensuring optimized power budget throughout network lifetime

2

Reduced network ownership cost

Optical products ensuring lesser network capital and operational expense

3

Faster network provisioning

Solutions enabling faster network deployment and thus, faster customer on-boarding

Deep Dive Into Each One Of These

Optical Solutions Solving For These Challenges

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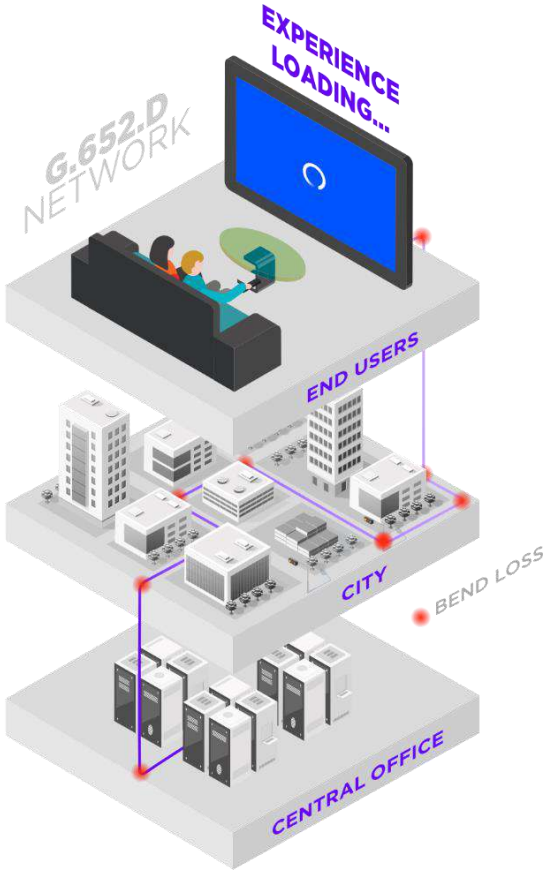
Networks Are Susceptible To Optical Losses

Macro Bend Loss

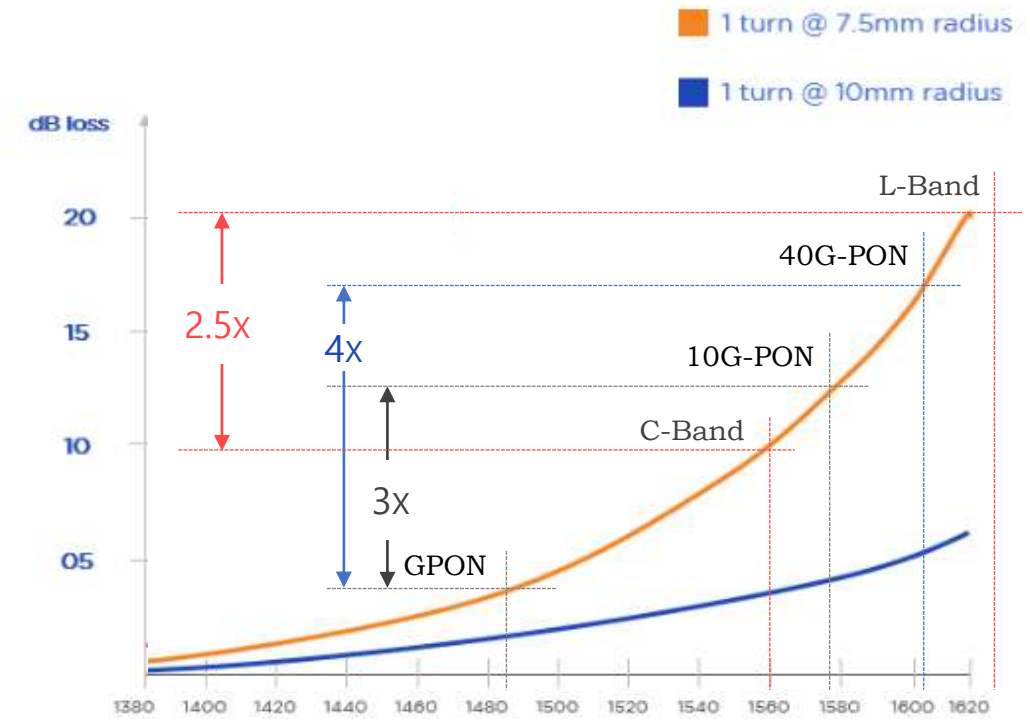
Increasing Geographical Spread

More no. of tight bends & turns



Legacy Fiber (G.652.D) Loss Increasing

At higher wavelengths and tighter bends



Macro-bend Loss Prevalent In Passive Ancillaries

Long Distance Route

1.06dB avg. Macro Bend Loss

per macro-bend point with legacy G.652.D fiber @ 1625nm

Location	No. of M-bend	Total M-bend loss (dB)		Average M-bend loss (dB)	
		1550 nm	1625 nm	1550 nm	1625 nm
Link 1	4	1.22	3.78	0.31	0.95
Link 2	2	0.43	0.8	0.22	0.40
Link 3	3	1.45	2.25	0.48	0.75
Link 4	3	2.97	5.94	0.99	1.98
Overall average / macro-bend points				**0.51**	**1.06**

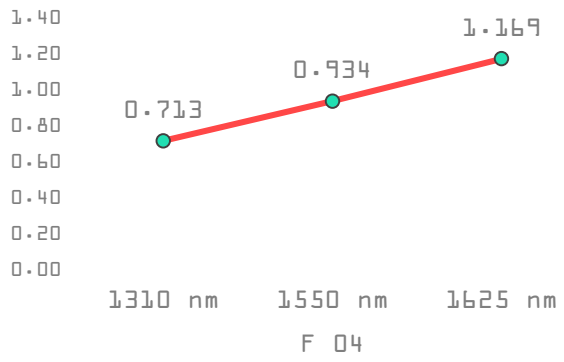
Source: Route survey of a leading Indian Telco

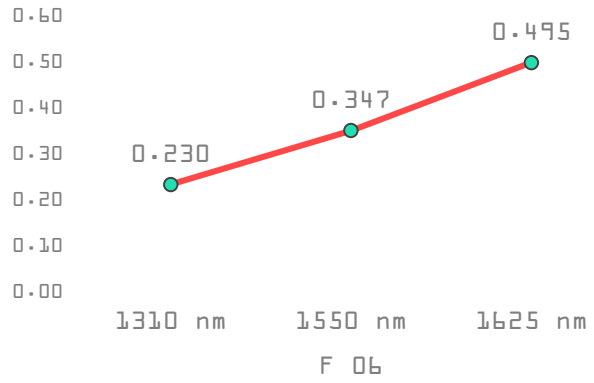
Macro-bend Prevalent In Passive Ancillaries

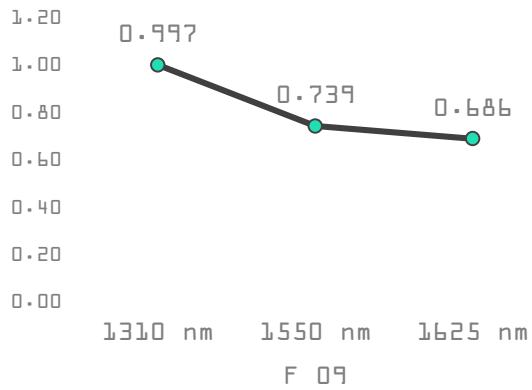
Access Networks

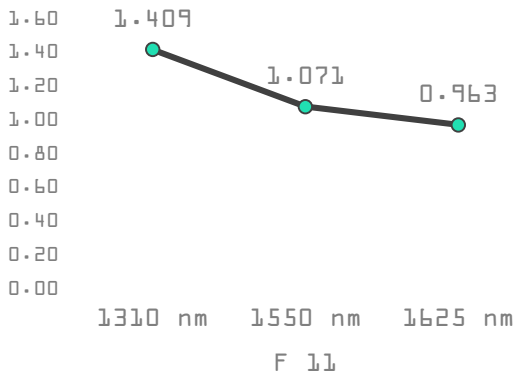
6 Out Of 16 Routes Tested Positive For Losses

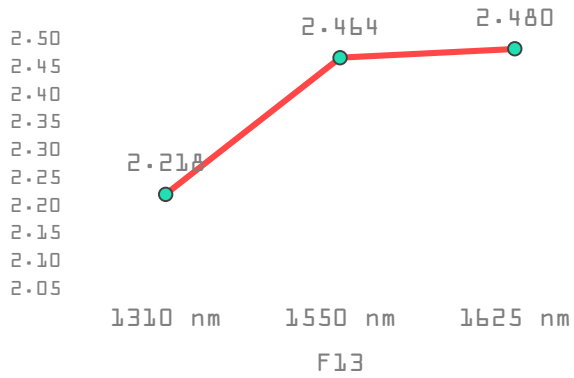
Significant (>0.5 dB) macro bend losses found in JBs, Tapping Boxes etc.

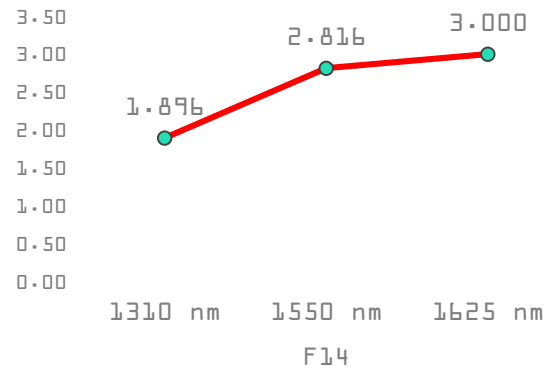












Several Factors Across Network Span Lead To Macro Bend Losses

Feeder Network

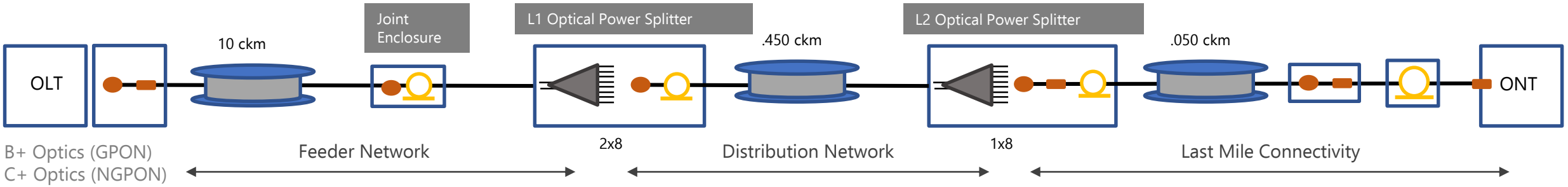
- Joint Splicing
- Fiber Attenuation
- Fiber Cuts
- Connector Loss
- Accidental Bends

Distribution Network

- Splitter loss
- Connector loss
- Splice loss
- Accidental Bend

Last Mile
Inside Building

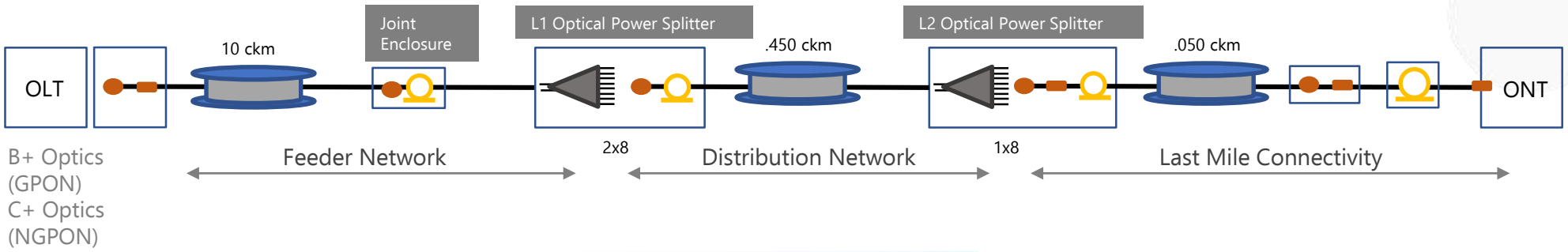
- HTB connector loss
- Bend loss
- Staple loss
- Accidental Bend during O&M



Schematic of a 10Km FTTH network

Connector Splice Macro Bend

One Accidental Bend →
Data Transmission Interrupted With Legacy Fiber

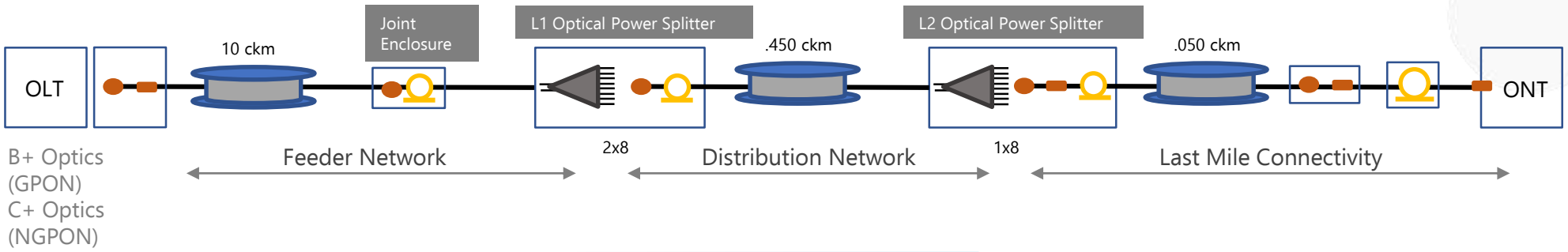


	Fiber Attenuation (10.5Ckm)	+ Splice Losses (15 splices)	+ Connector losses (2 Connector + 4 FMC)	+ Splitter losses	+ Accidental Bends (10mm / 7.5mm)	+ Bend and Staple loss	= Total
GPON 28dB budget	2.11 dB	1.0 dB	1.52 dB	20 dB	**0.5 dB / 3.755 dB**	.15 dB	25.28 dB / 28.53 dB
NGPON 32dB budget	2.43 dB	1.0 dB	1.52 dB	20 dB	**1.5 dB / 6.275 dB**	.75 dB	27.20 dB / 31.92 dB

Due to
- Accidental bends during cut repairs
- Rushed rollout & unskilled manpower

Connector Splice Macro Bend

A Bend Insensitive Fiber Solves The Challenge



	Fiber Attenuation (10.5Ckm)	+ Splice Losses (15 splices)	+ Connector losses (2 Connector + 4 FMC)	+ Splitter losses	+ Accidental Bends (10mm / 7.5mm)	+ Bend and Staple loss	= Total
GPON 28dB budget	2.11 dB	1.0 dB	1.52 dB	20 dB	**0.1 dB / 0.5 dB**	.15 dB	24.88 dB / 25.28 dB
NGPON 32dB budget	2.43 dB	1.0 dB	1.52 dB	20 dB	**0.2 dB / 1.0 dB**	.75 dB	25.9 dB / 26.7 dB

Resilience to
- Accidental bends during cut repairs
- Deskilled installation for faster rollout

Connector Splice Macro Bend

Bend insensitive fiber ensures passive infra can be reutilized when upgrading GPON to XGS-PON/NG-PON/NG-PON2

Deep Dive Into Each One Of These

Optical Solutions Solving For These Challenges

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Faster network provisioning

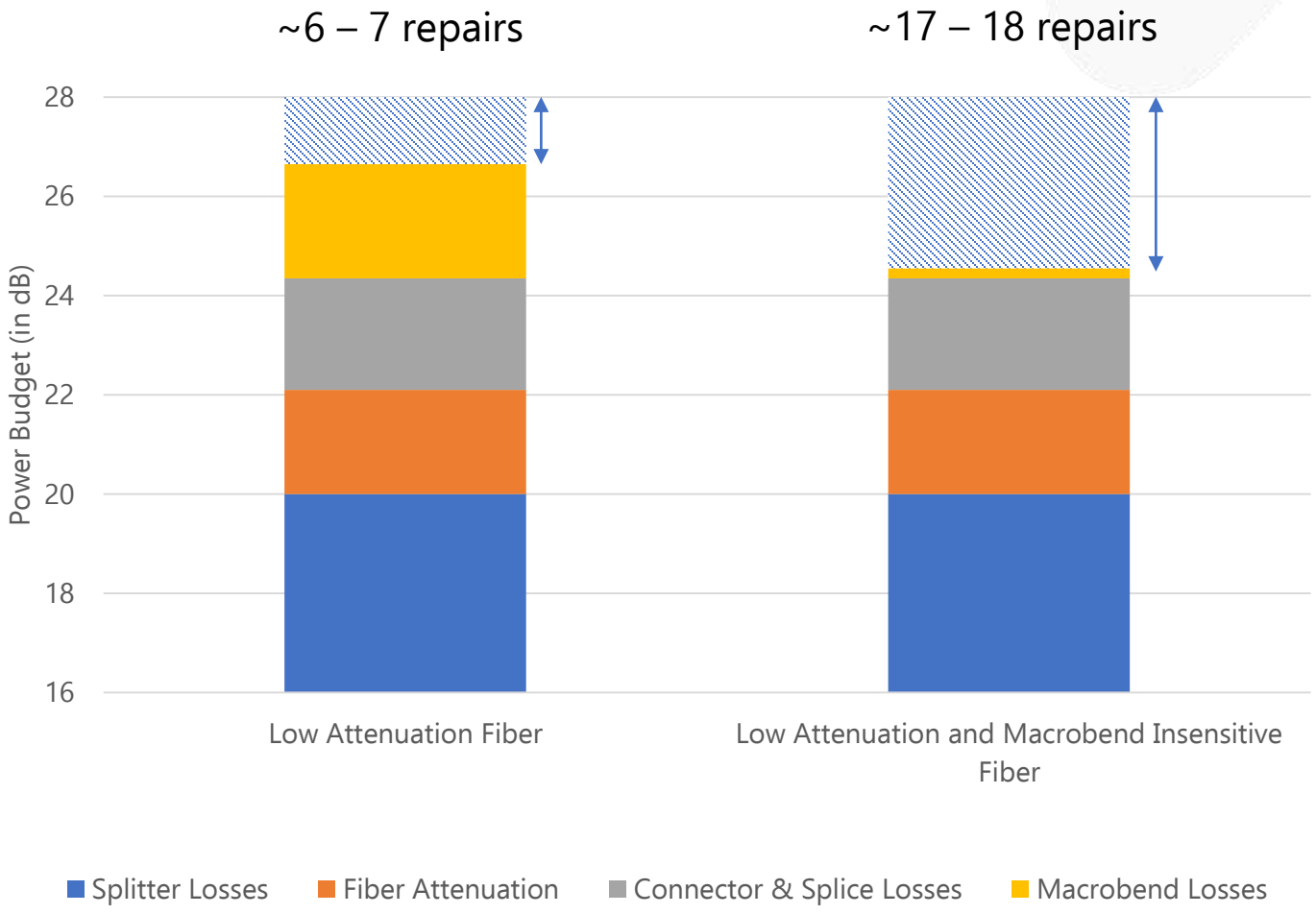
Solutions enabling faster network deployment and thus, faster customer on-boarding

Reduced Operational Expense With Bend Insensitive Fiber

10+ years

increased network life*

Lower loss increases repair resilience enhancing overall network life



Assumptions:

- *Accidental 15mm bend at time of repair*
- *Average link length : 14kms, 1000 links per sim and 51 sims in total*
- *Splice loss: 0.1 dB (G.652.D vs G.657.A2)*
- *Cuts/1000km/month: 10*
- *BOL drum attenuation: 0.20/0.21/0.22/0.23 dB/km*

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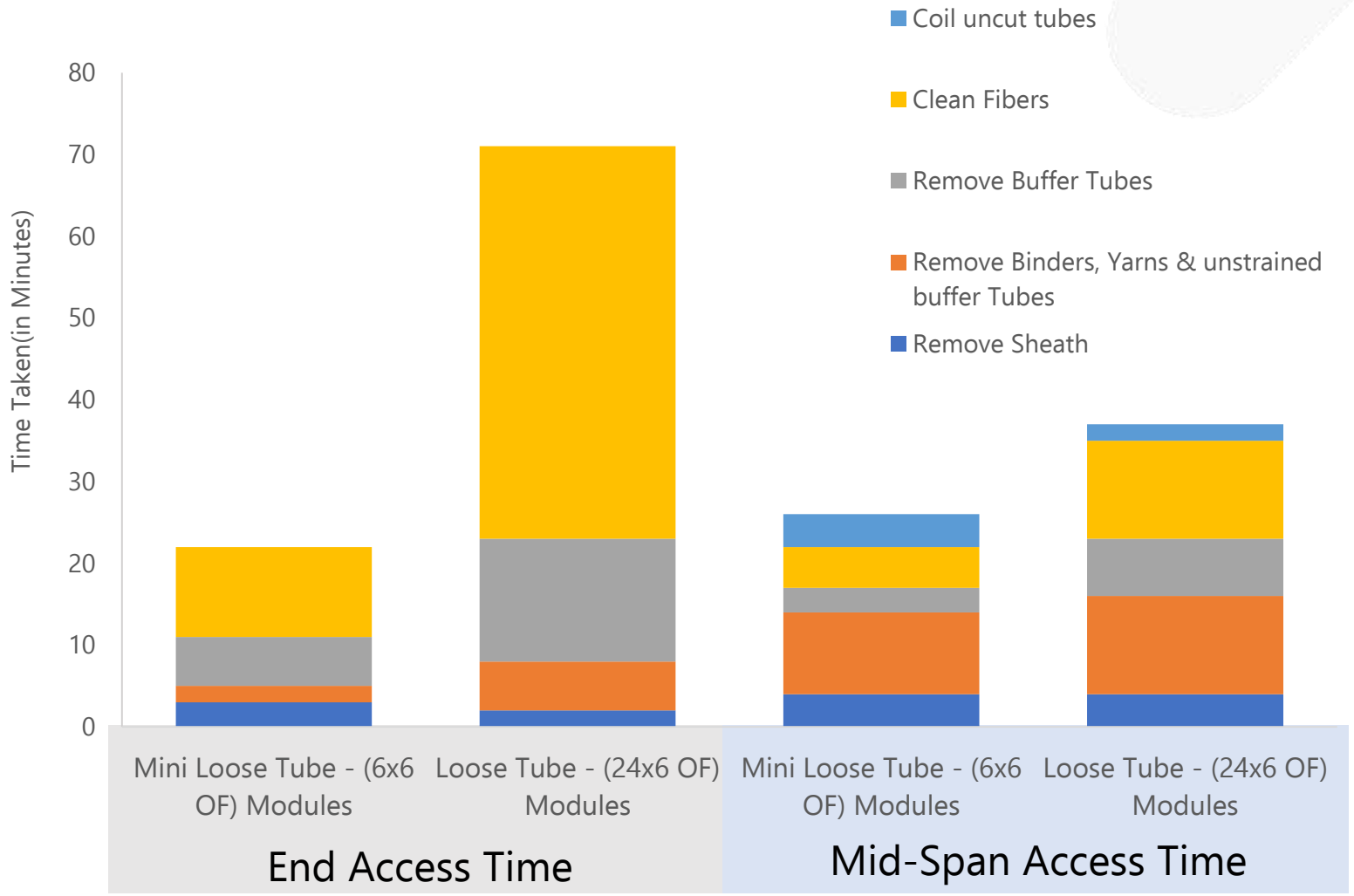
Cables Based On Legacy Fiber - Not Suitable For Faster Network Densification

End-to-end
joint splicing
process of
≥144 fiber
count cables can take an
entire day!

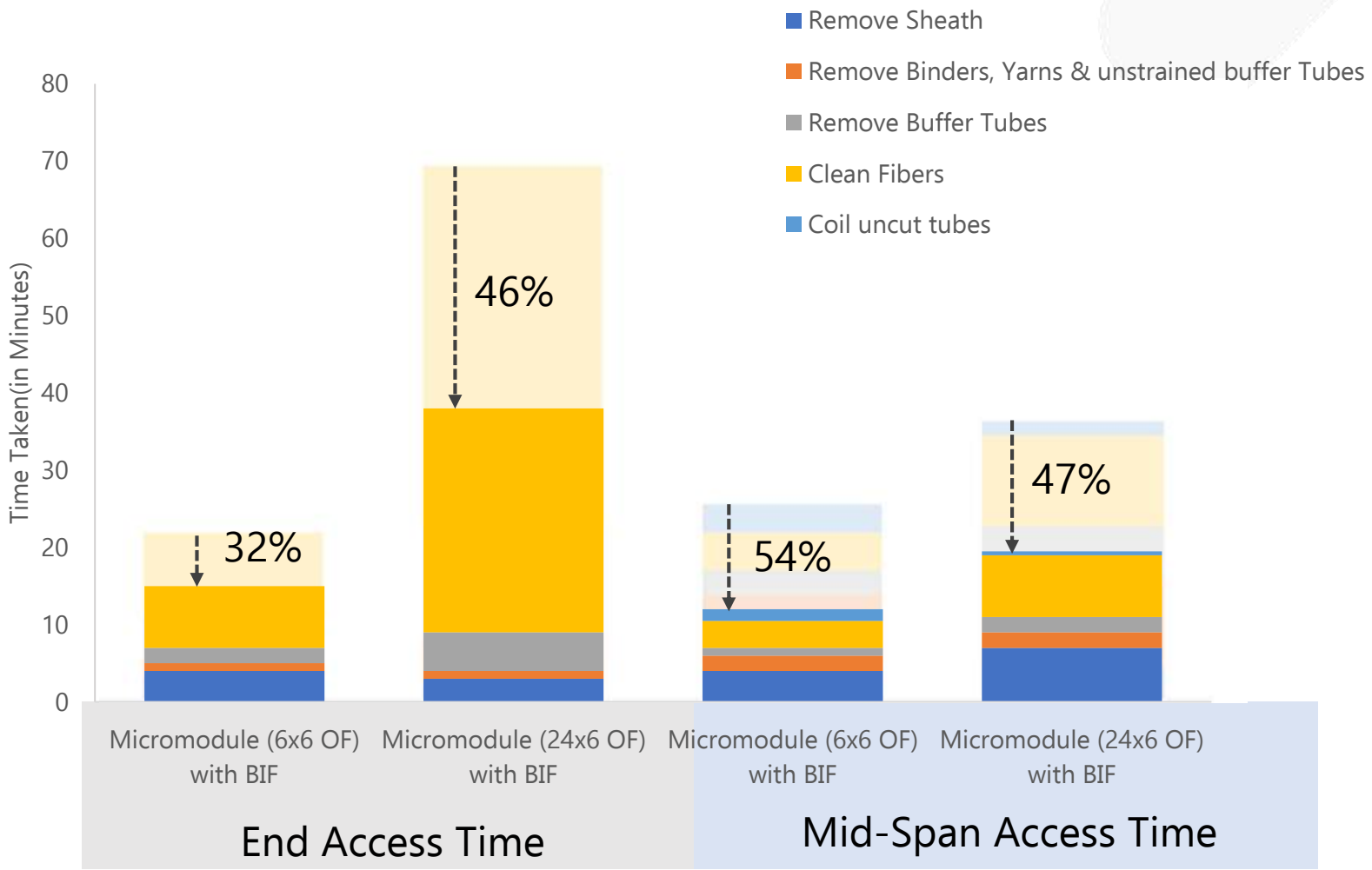


Bend Insensitive Fiber Enables Faster Network Provisioning

40% reduction

in installation time

Micro module designs made using bend insensitive fiber



So, While BIF Enables All These…

New Network Provisioning Or Capacity Augmentation

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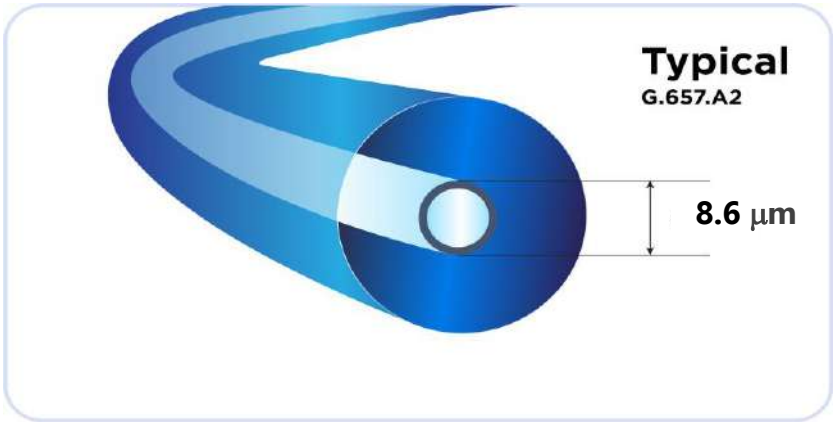
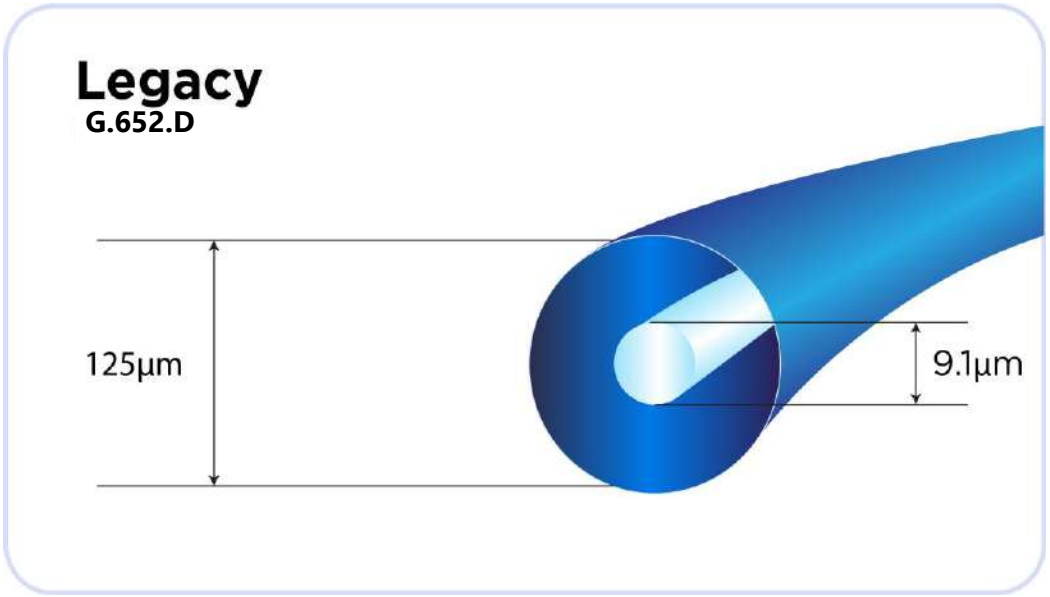
The Challenge That Still Remains

MFD Mismatch

G.657.A2 with 8.6 +/- 0.4µ MFD @ 1310 nm



G.652.D with 9.1 +/- 0.4µ MFD @ 1310 nm



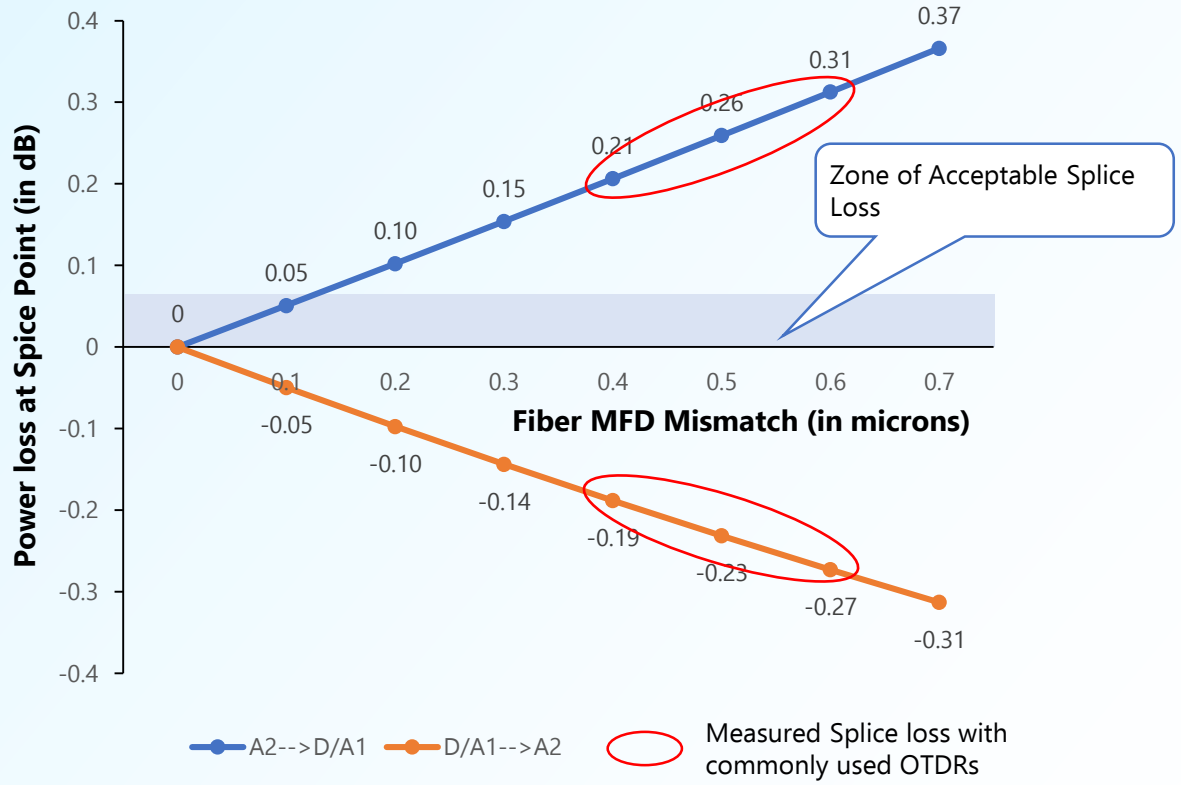
MFD Mismatch Makes Link Qualification Confusing

- Low loss fusion splice between A2 and D fibers is easily achieved using appropriate splicing recipe

- However, measuring that splice loss in order to qualify a link is not straightforward
  - Preferred OTDR single ended method does not work
  - Optical power loss measurement works but requires matched/calibrated Laser Source and Power Meter pairs and technician at each end of the network

OTDR reading mismatch → Apparent bad splice

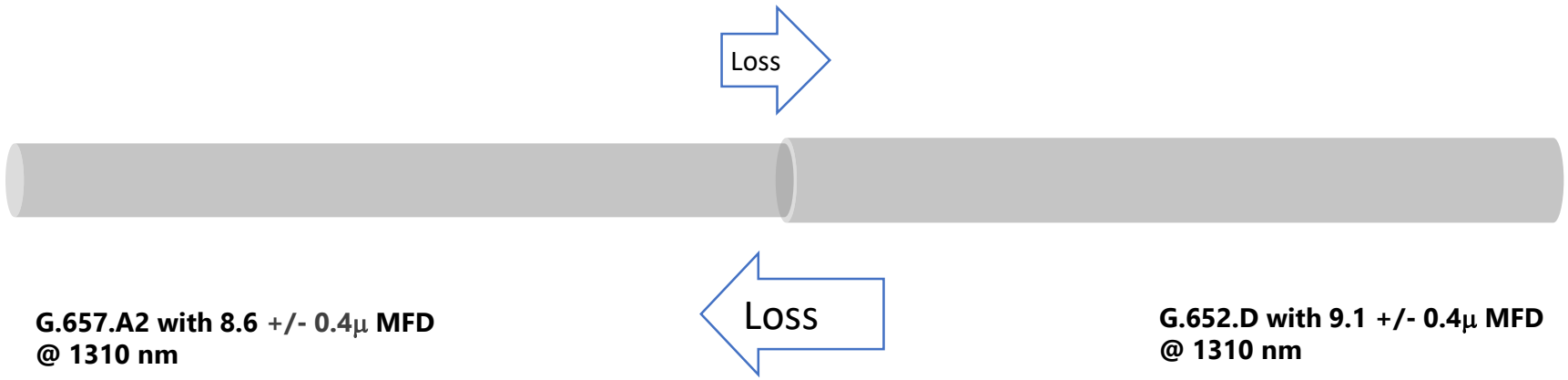
Time wasted in replacing by installer



MFD Mismatch At A Connector Interface

Don’t do it, but if you have to…..

- Results in real loss at connector interface that will *actually* vary depending on which direction you measure it
- Add OTDR gainer/looser errors on top of that
- Good luck extracting any useful loss measurement



One Product, Multiple Applications

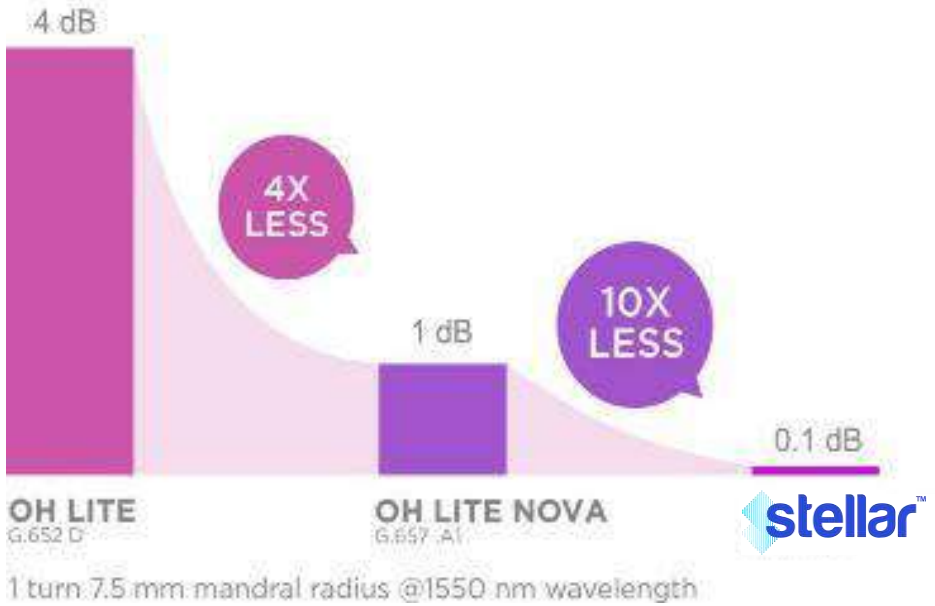
Bringing The Best Of Both Worlds

We've Achieved The Right Balance

Best-in-class Attenuation And Bend Insensitivity

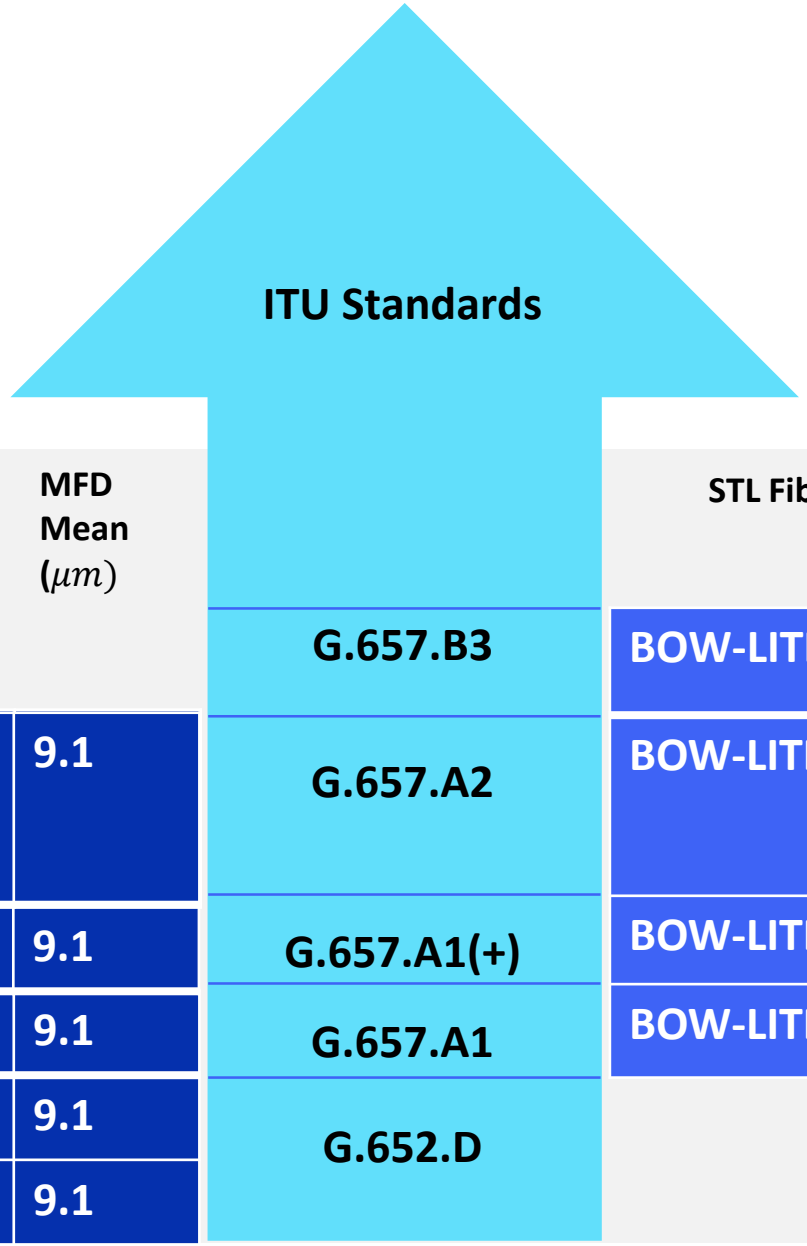
Attribute	STL OH-LITE NOVA (Enhanced G.652.D and G.657.A1)	STL BOW -LITE (E) (G.657.A2)	stellar™
Typical Attenuation Values (in dB/km)			
@ 1310nm	0.33	0.34	**0.33**
@ 1550nm	0.19	0.20	**0.19**
@ 1625nm	0.21	0.22	**0.21**
@ 1383nm +/- 3nm	0.31	0.34	**0.31**
MFD @1310NM	9.1 +/- 0.4µ	8.6 +/- 0.4µ	**9.1 +/- 0.4µ**
Typical Macro Bend Loss Values (in dB)			
1 turn 10mm radius, 1550 nm	≤0.5	≤0.1	**≤0.1**
1 turn 10mm radius, 1625 nm	≤1.5	≤0.2	**≤0.2**

Upto 10x Reduced Bend Losses Than OH-LITE NOVA



Same MFD For True Backward Compatibility

STL Fiber	Attn. 1310nm (dB/km)	Attn. 1550nm (dB/km)	MFD Mean (μm)
STELLAR	0.33	0.19	9.1
OH-LITE NOVA	0.33	0.19	9.1
BOW-LITE-250	0.34	0.20	9.1
OH-LITE (E)	0.33	0.19	9.1
OH-LITE	0.34	0.20	9.1



Bend Optimized Fibers

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BOW-LITE SUPER	0.35	0.21	8.6
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We Integrate Digital Networks For Our Customers

Core Business

Customer Segments

- Telcos
- Cloud Companies
- Citizen Networks
- Large Enterprises

End-to-End Solutions

- opticonn — Optical Connectivity
- LEAD 360° — Fiber Deployment
- FTTx mantra — One Solution. Countless Opportunities — FTTx Access Network
- netmode — Network Modernisation

Portfolio Offerings

Optical Interconnect Products

Unique Capabilities

- Glass Preform
- Optical Interconnect
- Optical and Speciality Cables
- Optical Fiber

Virtualised Access Products

- Programmable FTTx
- Virtualised Radio
- RAN Intelligent Controller
- RAN Orchestration

Network Software Products

- Telecom Billing Operations Software
- Monetisation and Engagement Software

System Integration Services

- Network Design Services
- Fiber Rollout Services
- Network O&M Services
- Data Centre Integration
- Private Enterprise Integration

STL In Numbers

$736 Mn.

FY20 REVENUE
India (66%), Europe (22%),
China (3%), Rest of world (9%)

7

GLOBAL PRODUCTION FACILITIES
50m fkm optical fiber capacity

GLOBAL FOOTPRINT

4

INNOVATION CENTRES
Research & Development

358

PATENTS
Across the network layer

Zero

WASTE TO LANDFILL
Shendra, Rakholi, Dadra

30+

NATIONALITIES
~3,100 Employees

Let us know your thoughts

#STLWebinar