



A Furukawa Company

Your Optical Fiber Solutions Partner™

How next generation optical fibres provide value by reducing installation and system cost

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How to improve single-mode optical fibre?



Outline

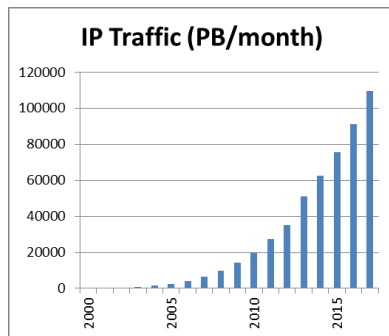


- Explosive Bandwidth Growth is changing the network
- Optical fibres optimized for in building applications
- Optical fibres optimized for outside plant applications

Data traffic trends



Internet growth is explosive

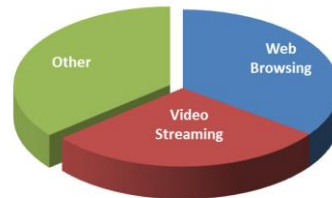


Source: Cisco Visual Networking Index (VNI):
May 29, 2013

Facebook

- ✓ March 2014 – 1.28 billion monthly users,
802 million daily users

2013 IP Usage

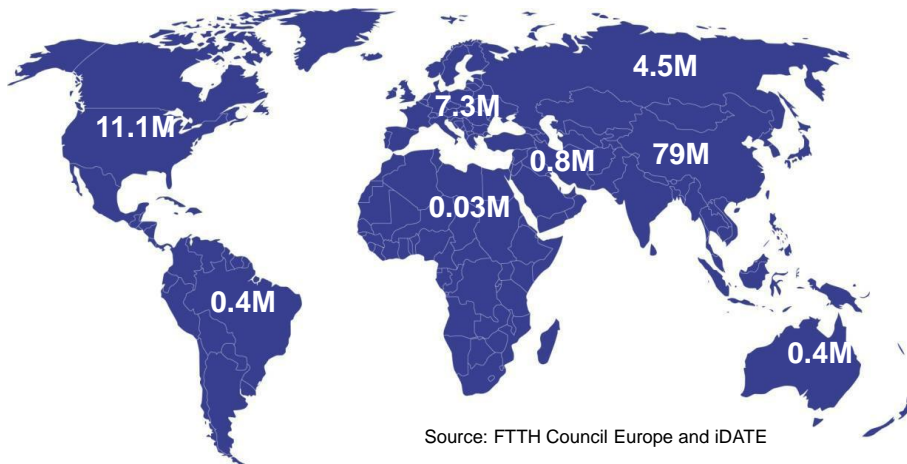


Driven by common applications

Netflix

- ✓ March 2014 – 1 billion hours of video
watched per month

fibre To The Home / Building – 2013
103M Connected today - 600M projected by 2025

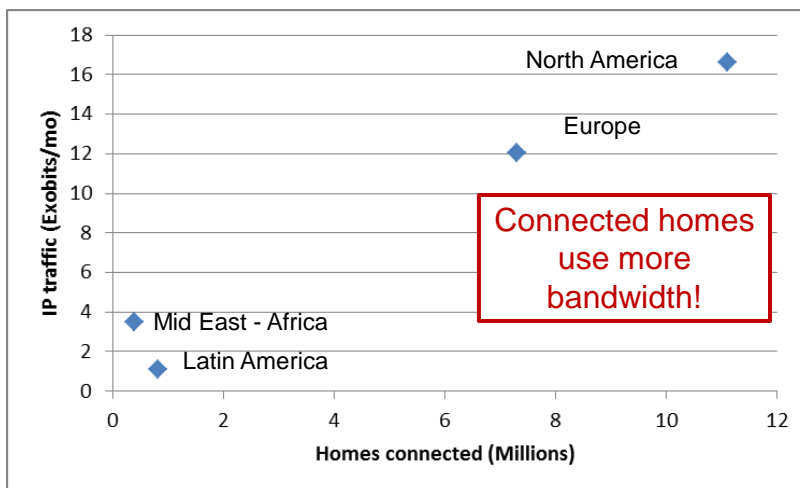


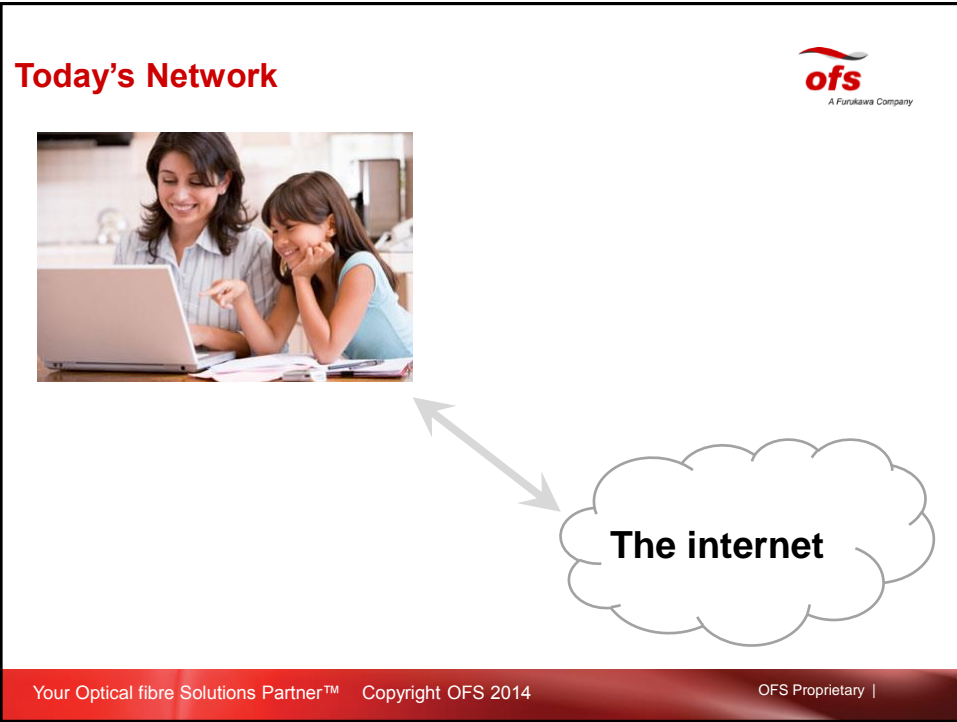
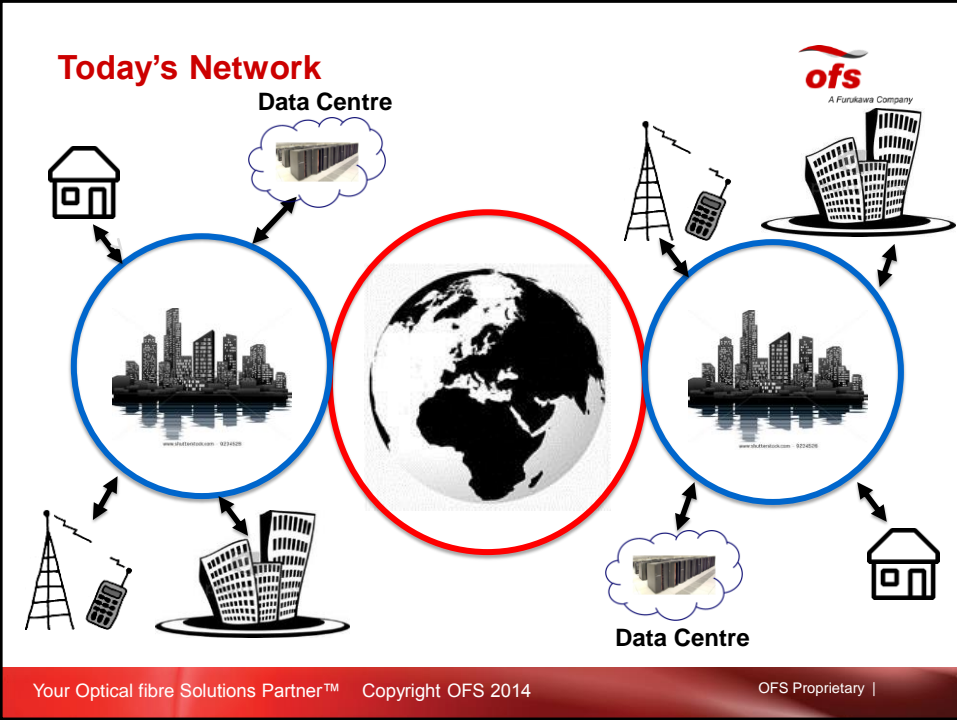
Source: FTTH Council Europe and iDATE

Japan and Korea have >30% of homes connected - All other regions <10%

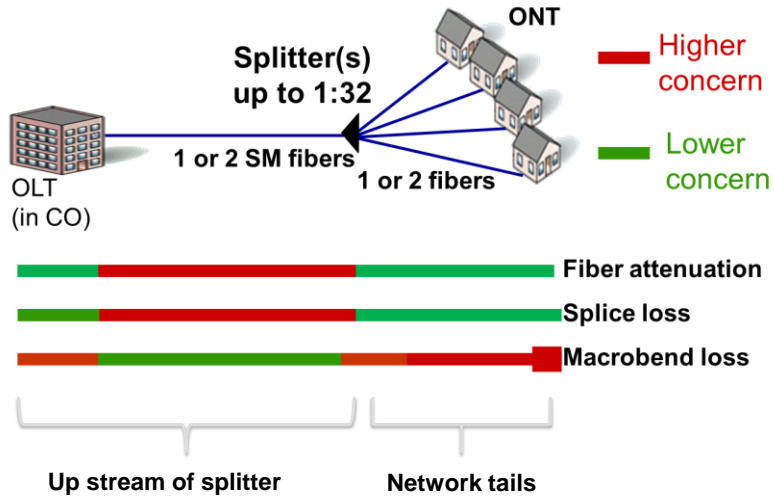
Comparison

Homes connected (FTTH counsel)
IP usage (Cisco)





FTTH Passive Optical Network (PON)



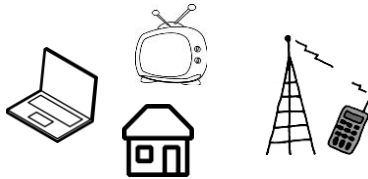
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More Bandwidth everywhere!



More Devices
connected at higher
speeds



Access network

Challenges

- More wavelengths required
- Copper network not meeting end users expectations
- Dense Connectivity
- Multi-Dwelling Units
- Bringing fibres into houses
- Bringing fibres to antenna
- Deployment costs



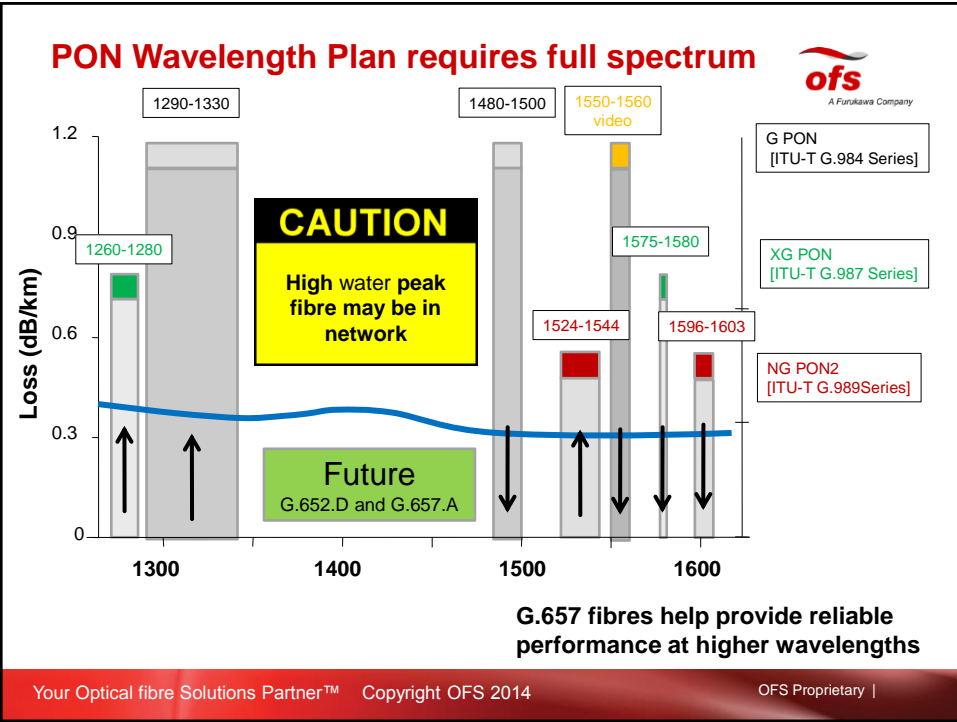
Network
tails

Solution

- Bend insensitive Fibres

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Changes in the cell network

- fibre is needed to and up the tower
- Coax is heavy, expensive, hard to work with, lossy
 - Requires extra bracing/construction for the towers
- fibre solves many problems

Bandwidth



Weight
Tower loading/bracing
Grounding
Installation time
Power losses
Space
Cooling requirements



Traditional use for G.657 Single-mode fibres: Access network



Connectivity and
In building
ITU-T G.657

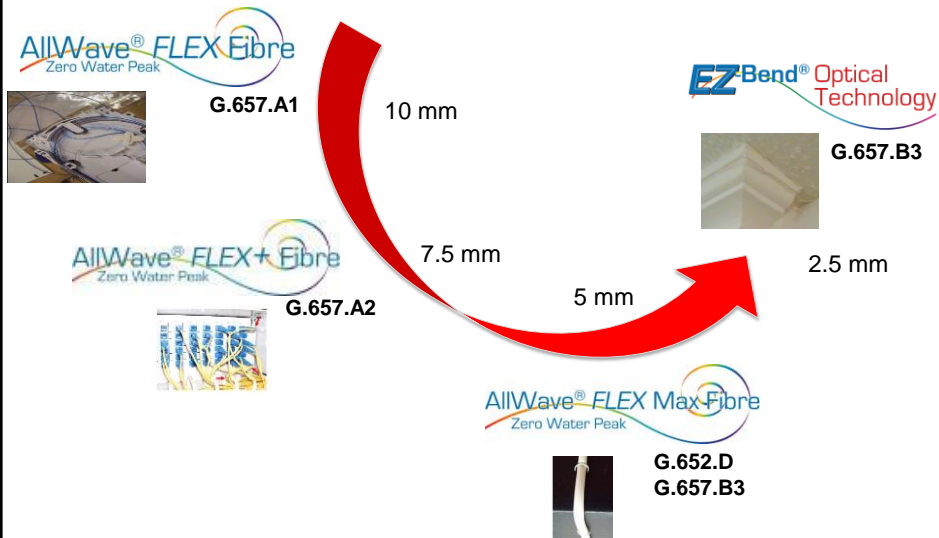


Operators have found many reasons
to deploy G.657 fibres

- Improved reliability
- Smaller more aesthetically pleasing connectivity
- Increased fibre density
- Simplified installations

Expected that growth of G.657 fibres in
access network will continue

Increased Macrobend Performance for added capability



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More Bandwidth everywhere!



More Devices
connected at higher
speeds



Access network

Up stream of splitter
and
Point to point links

Challenges

- More wavelengths required
- Higher count optical cables
- Limited duct space
- Compatibility with embedded base

Solutions

- 200 micron coated fibres
- G.652 fibres with 9.2 MFD and G.657 macrobend performance

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General rules for single-mode fibre deployment



AllWave® Fibre
Zero Water Peak

Outside Plant
ITU-T G.652



O, S, C Band and L Band operation

9.2 MFD to simplify OTDR testing

AllWave® FLEX Fibre
Zero Water Peak

Connectivity and In building
ITU-T G.657



Good Macrobend properties for reliable performance to 1625 nm

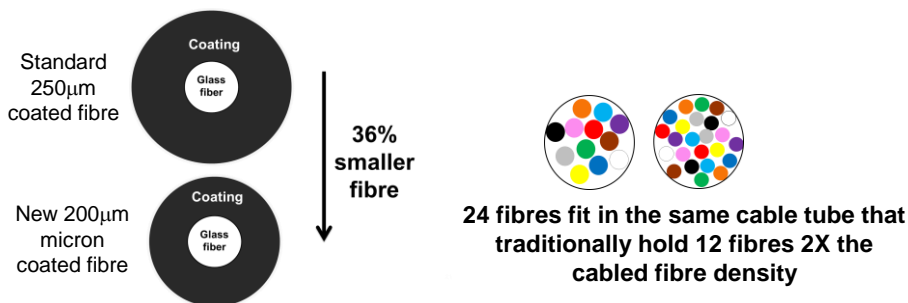
Perceived splicing issues

Crowded outside plant applications

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200 micron coated fibre making new cable designs possible

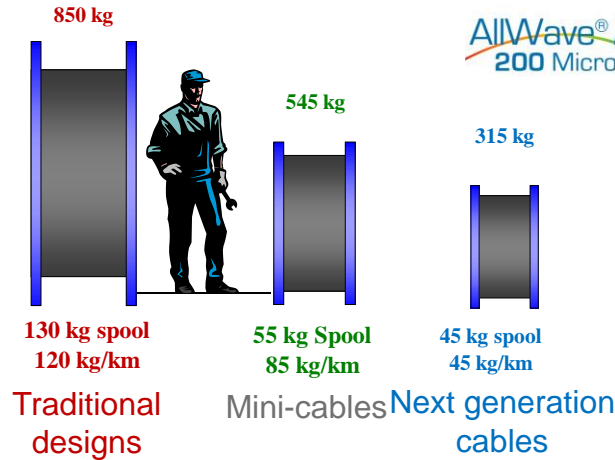


- **Compliant to IEC 60793-2-50 single-mode fibre specification**
- **Compliant to Telcordia's stringent GR-20 reliability requirements**
- **Splices with standard equipment**
- **Over 1 Million km deployed today (OFS Estimate)**

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New cable designs enabled by 200 micron coated fibres (144 count 6 km example)



Benefit: Lower installation costs

- Longer blowing distances
- Higher fibre counts in a duct

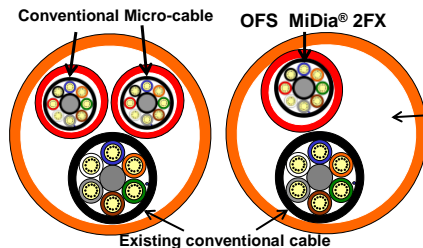
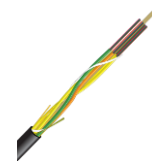
Micro-Cables using 200 micron fibre Value Proposition Example



Operator Need	MiDia® 2FX Delivers Capacity and Savings
Serve more customers using existing civil works	50 to 100% more fibres in the same duct
Lower Installed Cost	>20% lower system installation cost
Longer Installation	>14% lower system installation cost

Double the Fibre in the same duct

- ✓ 1 micro duct vs. 2
- ✓ 1 set-up vs. 2
- ✓ 1 cable vs. 2



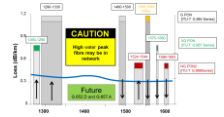
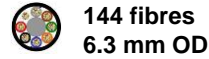
Huge Future Upgrade Savings

- ✓ Room for second micro-cable avoids expensive digging to installed new duct

New applications for G.657 fibres



- Smaller optical Cables
- Smaller and more aesthetically pleasing connectivity
- Preserving 1625nm attenuation in the outside plant



G.657 fibres provide advantages for challenging deployments but what about traditional applications?

Outside Plant Fibres



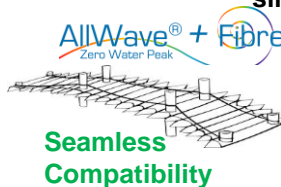
Outside Plant
ITU-T G.652



Operators would like G.652 fibres with improved macrobend performance

- G.657.A1 Macrobend performance to improve reliability at higher wavelengths
- 9.2 μm mode-field diameter to simplify splicing and testing

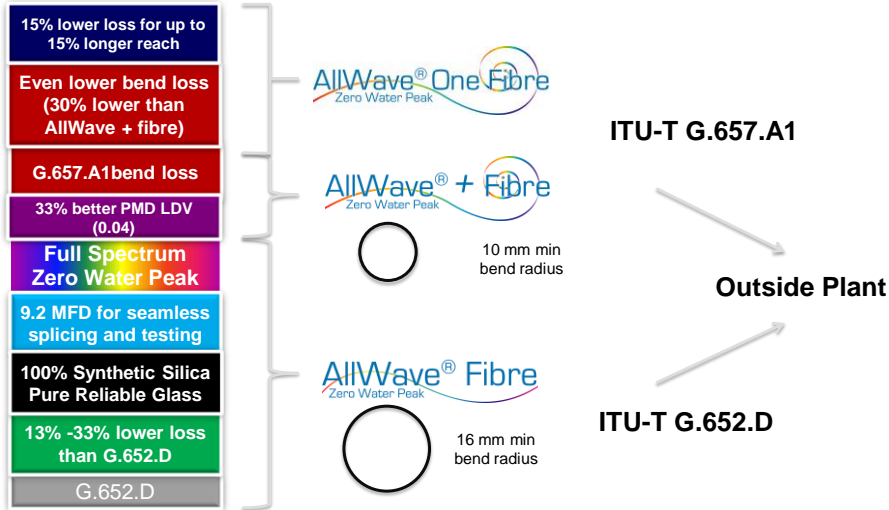
AllWave® Fibre
Zero Water Peak
Yesterday/Today



Today/Tomorrow

AllWave® One Fibre
Zero Water Peak

AllWave®+ and AllWave One fibres
 The next generation of single mode fibre merges these properties



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Splice performance to Allwave® fibre or other G.652.D
 Seamless splicing with a G.657.A1 fibre!



Bi-directional OTDR loss (dB average)	AllWave fibre	AllWave+ and AllWave One fibres	AllWave FLEX fibre
AllWave fibre	0.02	0.02	0.03
AllWave + and AllWave One fibres	0.02	0.02	0.03
AllWave FLEX fibre	0.03	0.03	0.02

Unidirectional OTDR measurements (Perceived maximum splice loss)

- AllWave to AllWave fibre 0.2 dB Max
- AllWave to AllWave + fibre 0.2 dB Max
- AllWave FLEX to AllWave FLEX fibre 0.2 dB Max
- AllWave FLEX and AllWave fibre 0.4 dB Max

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AllWave+ and AllWave One fibres

The new industry standards for outside plant



AllWave + fibre - the first choice for outside plant FTTx, Access and metro applications

- Reliability for full spectrum
- Seamless splicing – fewer calls from the field
- Improved macrobend performance (benefit higher transmission wavelengths)



AllWave One fibre - for longer links where low loss is also required

- Reliability for full spectrum
- Seamless splicing – fewer calls from the field
- Improved macrobend performance (benefit higher transmission wavelengths)
- Lower loss



Summary



- **Explosive Bandwidth Growth is changing the network**
- **Full spectrum fibres (1270 – 1625nm) required**
- **A new generation of application specific optical fibres to support today and tomorrow's network including:**
 - **G.657.A2 and G.657.B3 fibres designed for deployment inside buildings**
 - **200 micron coated fibres to support denser optical cables**
 - **G.657.A1 fibres that splice seamlessly into the embedded base of G.652 fibres**

Summary: More fibre will be deployed



The network is changing fast

New fibres provide more cost effective solutions

Thank You!

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