

Creating a brighter future

Webinar: FTTH – New Technologies and Innovative Deployment

Moderator: **Rong Zhao**

Deployment & Operations Committee
FTTH Council Europe

FTTH Council Europe



A sustainable future
for Europe
enabled by
Fibre to the Home

FTTH Conference 2015

Join us Next Year in Warsaw!

10-12 February 2015



Warsaw, 10 – 12 February 2015

Webinar

- Post your questions in the questions box of the webinar system
- Questions will be answered after the Webinar and sent to all attendees by email
- The slides will be available for download after the webinar
- The webinar is recorded and can be viewed as video-stream afterwards. The video will be available on the website of the FTTH Council Europe within one week
- Slides and information about the availability will be sent to registered attendees by email

The following presentation does not necessarily reflect the opinion of the FTTH Council Europe



FTTH Council Europe

Post your comments on the Webinar on Twitter:

#ftthwebinar



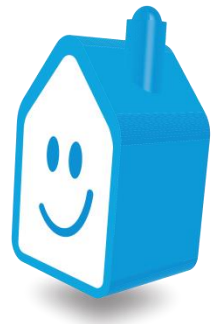
Creating a brighter future

Webinar: FTTH – New Technologies and Innovative Deployment

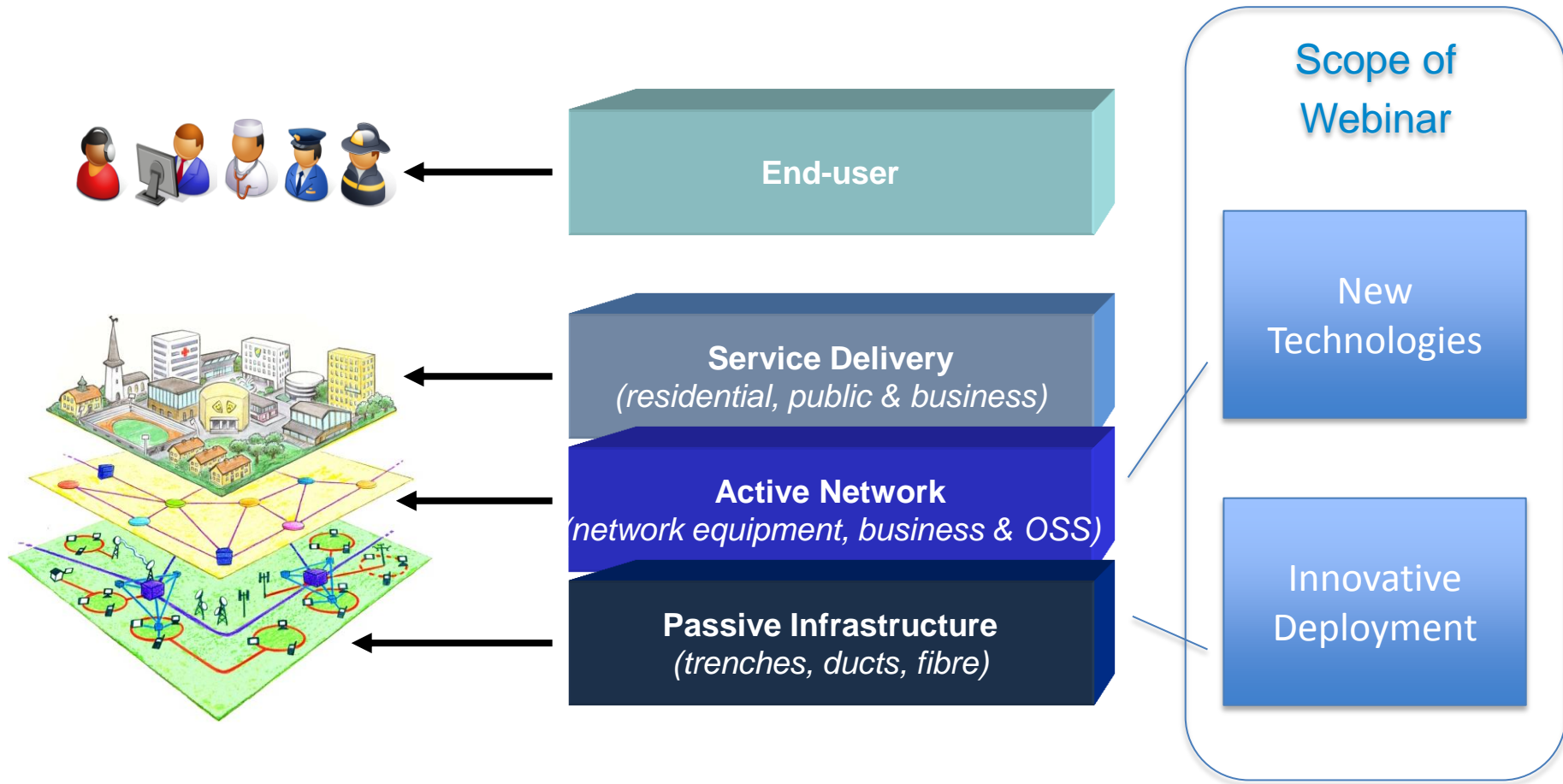
Presenters: **José Salgado** and **Tony Stockman**
Deployment & Operations Committee
FTTH Council Europe

Content

- Scope of Webinar (Rong Zhao)
- New FTTH Technologies (José Salgado)
 - Technology Basics
 - Trends and Evolution
 - NG-PON2 and Applications
- Innovative Deployment (Tony Stockman)
 - Infrastructure Sharing
 - Deskillling and Speeding Up Methods
 - Case Study
- Source (white paper)



Scope of Webinar



New FTTH Technologies

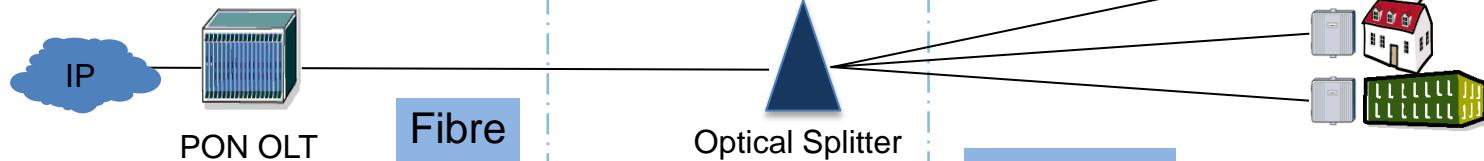
Technology Basics

Point of Presence

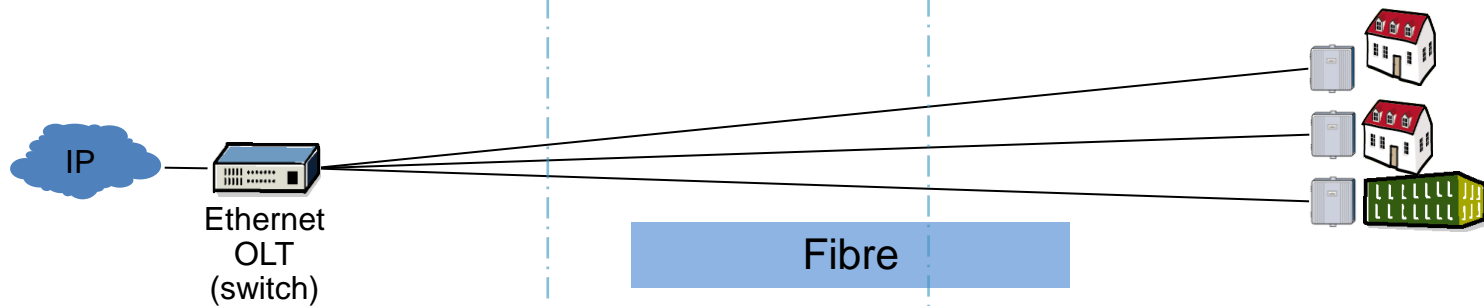
Access loop

Customer Premise

PON
(P2MP)



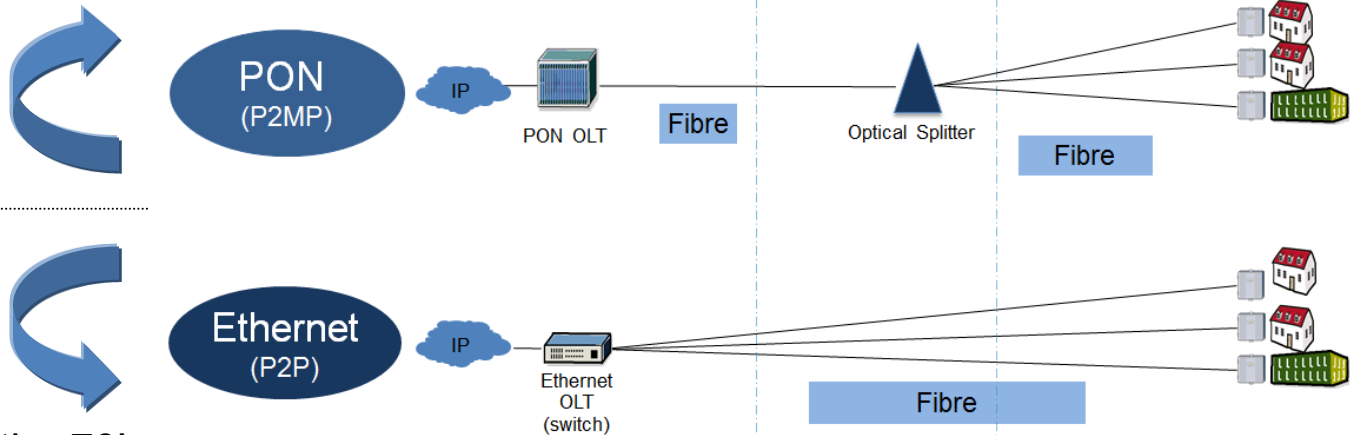
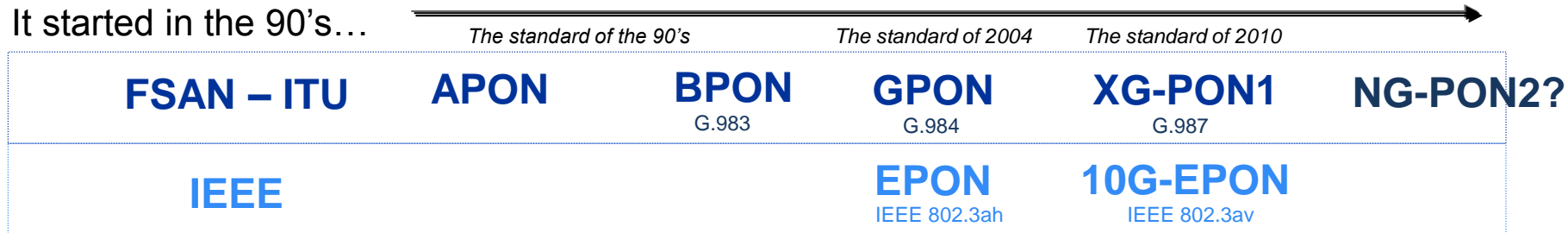
Ethernet
(P2P)



New FTTH Technologies

Standardization Basics

It started in the 90's...



It started in the 70's...



New FTTH Technologies

Evolution of Ethernet-based FTTH solutions

- **Higher speeds**
 - 10 Gigabit Ethernet technology (10GBase-BX) is the obvious next step – (pre-standard) transceivers readily available → no immediate mass-market requirement seen today
- **Longer reach**
 - Extended reach modules available at low premium which can reach up to 70km without reach extender – coverage of rural areas, or for CO consolidation
- **Higher packaging densities**
 - C-SFP (two independent transceivers in one SFP package) is the first step in multi-channel optical modules
 - Transceiver vendors are already working on advanced multi-channel modules with transceiver arrays and multi-fiber connectors
 - ⇒ 12 transceivers in a pluggable module appears to be next step
 - ⇒ significant increase in number of subscriber terminations per rack – smaller footprint
 - ⇒ easier fiber management – from single-fiber to multi-fiber patch cable
 - ⇒ reduction in power consumption

New FTTH Technologies

Application of GPON

- **GPON succeeded at the residential, why not enhance it to cover full access?**
- IPTV and content streaming services were a big ally for the past FTTx massive investments.
- Mobile Backhaul, business and cloud based services should also be taken into account in present and near future FTTx business case scenarios, allowing resisting network operators to join the FTTx Community and taking part on full fibre benefits.
- Higher split ratios means lower ranges as well as lower customer bitrates
- Asymmetric speed

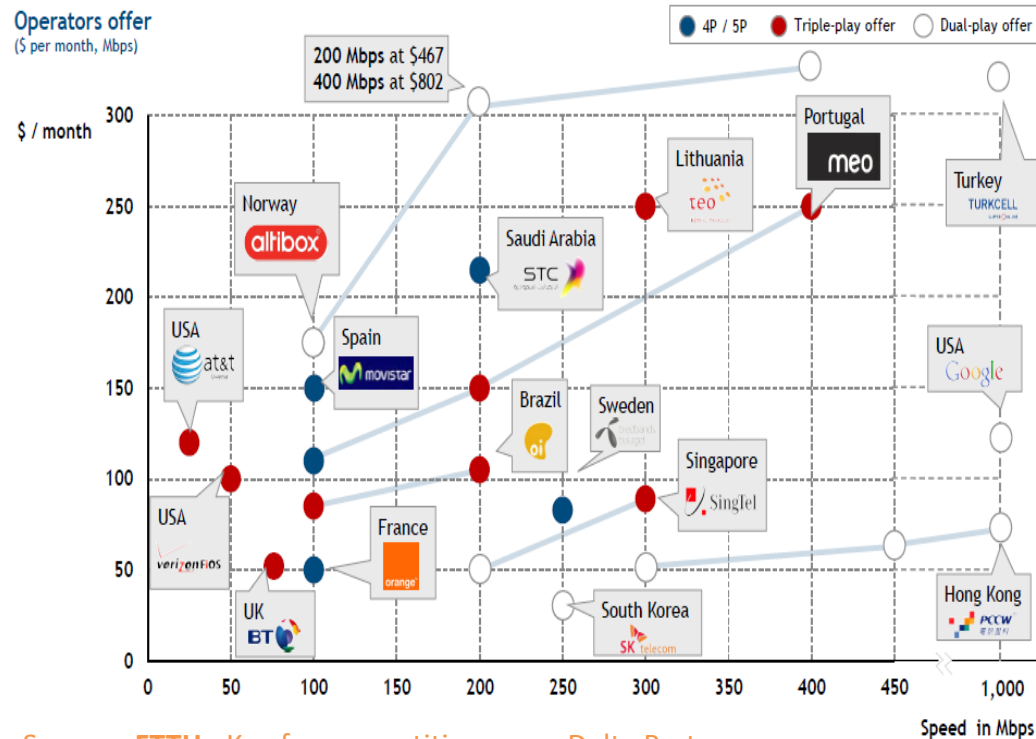
Split Ratio	Downstream speed (2.5 Gpbs total)	Upstream speed (1.24Gpbs total)
1:8 split	312 Mbps	155 Mbps
1:16 split	156 Mbps	78 Mbps
1:32 split	78 Mbps	39 Mbps
1:64 split	39 Mbps	19 Mbps
1:128 split	19 Mbps	9.5 Mbps

New FTTH-based Technologies

Application of GPON

One should also keep in mind:

- Residential and Business users as well as mobile backhaul are increasingly asking for symmetric speeds (with data volumes remaining asymmetric) and data rates of 1 Gbps and beyond
- Cloud services are also becoming more and more important for residences.
- Symmetric gigabit services are hardly feasible over current-generation GPON networks
- Accurate and reliable sync protocols may also be ready along PON network elements
- Additional MPLS features may improve integration into typical metro network environments.

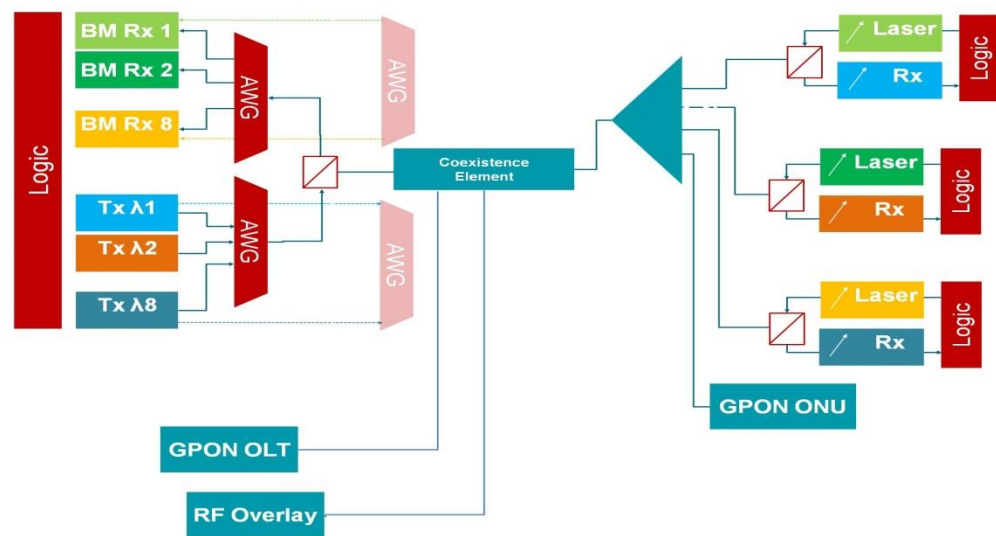


Source: FTTH - Key for competitiveness – Delta Partners

New FTTH Technologies

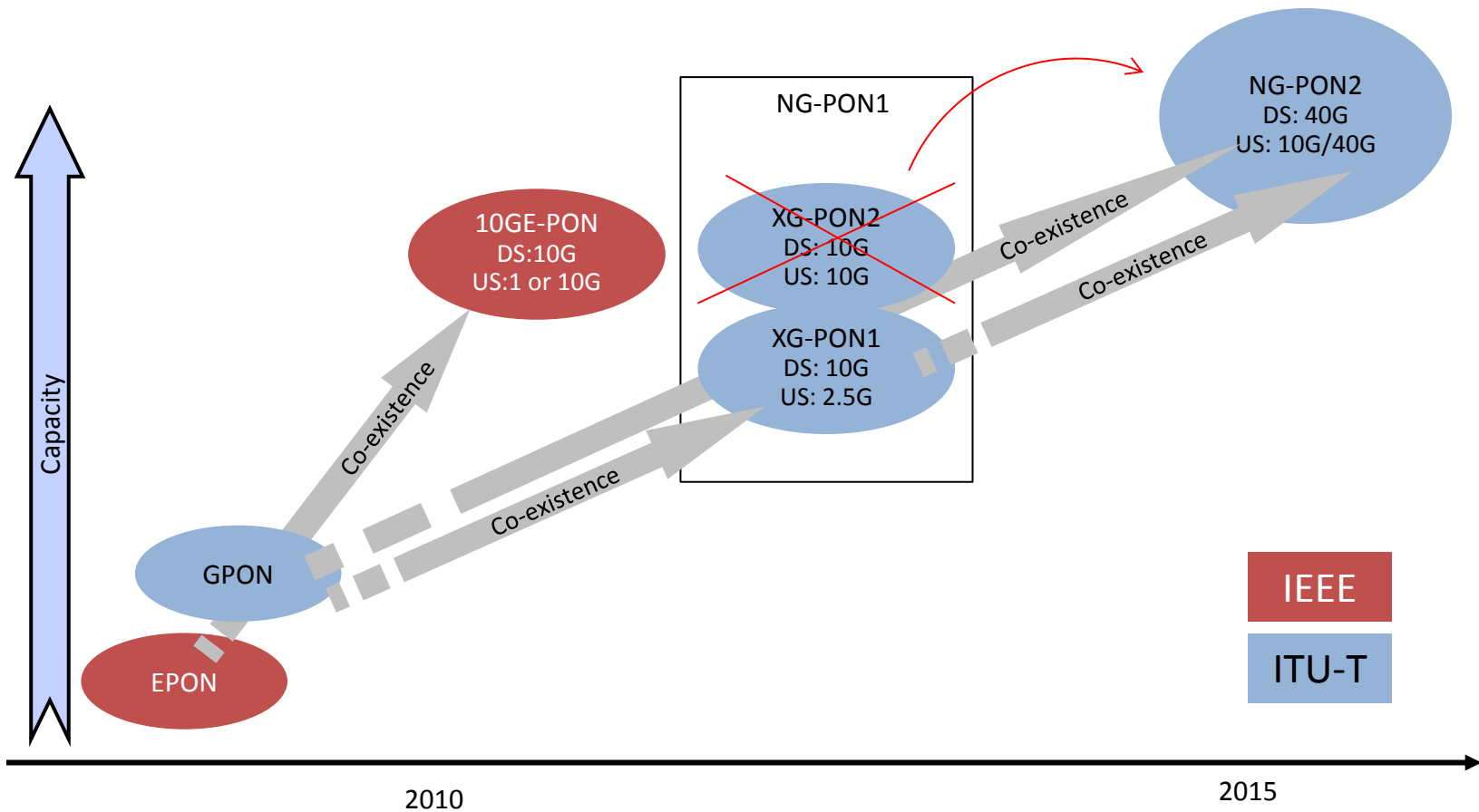
PON Technology Trends

- Existing optical access networks (mainly designed for residential market), need now to comprise business, cloud and mobile backhaul services in addition.
- Larger split ratios, increased range, wavelength availability and fibre reuse can enable operators to serve more customers with less investment while providing solutions for the entire access network domain.
- NG-PON2 will meet these requirements by providing higher bitrates and quality of service levels required by those new service customers.
- Seamless evolution from existing GPON to NG-PON2 (avoiding actual GPON bitrate constraints) will allow FTTx architectures to converge for a single, simplified and future proof access and metro architecture.



New FTTH Technologies

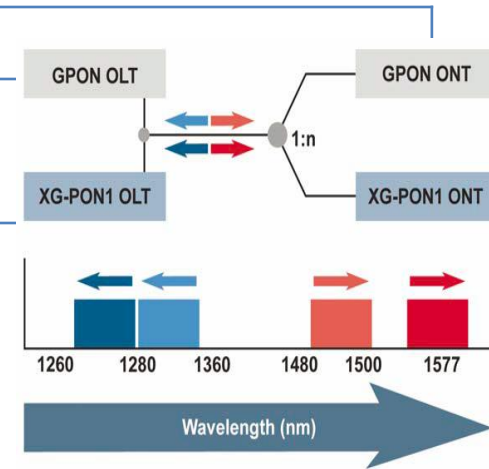
PON Technology Evolution



New FTTH Technologies

XG-PON1 (ITU-T G.987)

Optical fibre	Single fibre transmission, compliant with ITU-T G.652
Wavelength plan	Upstream 1260nm to 1280nm / Downstream 1575nm to 1580nm
Bitrates	Downstream: 10Gbps / Upstream: 2.5 Gbps Support for Dynamic Bandwidth allocation (DBA) Full QoS and Traffic Managements
Line rate	Upstream: 2.48832 Gbps / Downstream: 9.95328 Gbps
Split Ratio	At least 1:64, scalable up to 1:256
Fibre Distance	At Least 20 km with Logical Distance up to 60 km ; Extended GPON Under Consideration
Synchronization	Enhanced Timing and Time of Day Synchronization for Mobile Backhaul Apps
Enhanced security	Strong mutual authentication; Authentication to protect the integrity of the PON management messages and the PON encryption keys.

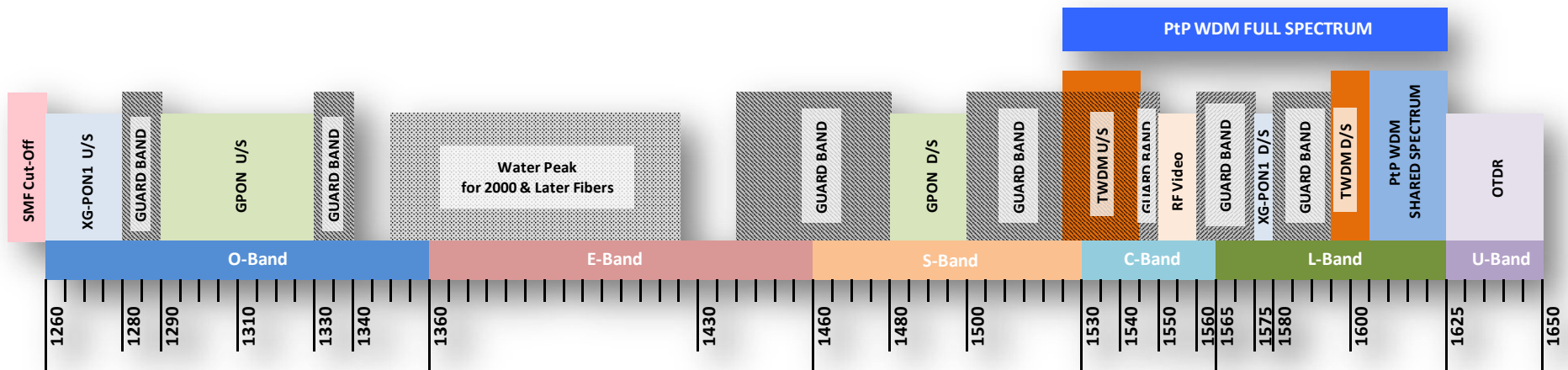


New FTTH Technologies

PON Future – NG-PON2 (ITU-T G.989)

NG-PON2 will support several 10G wavelength:

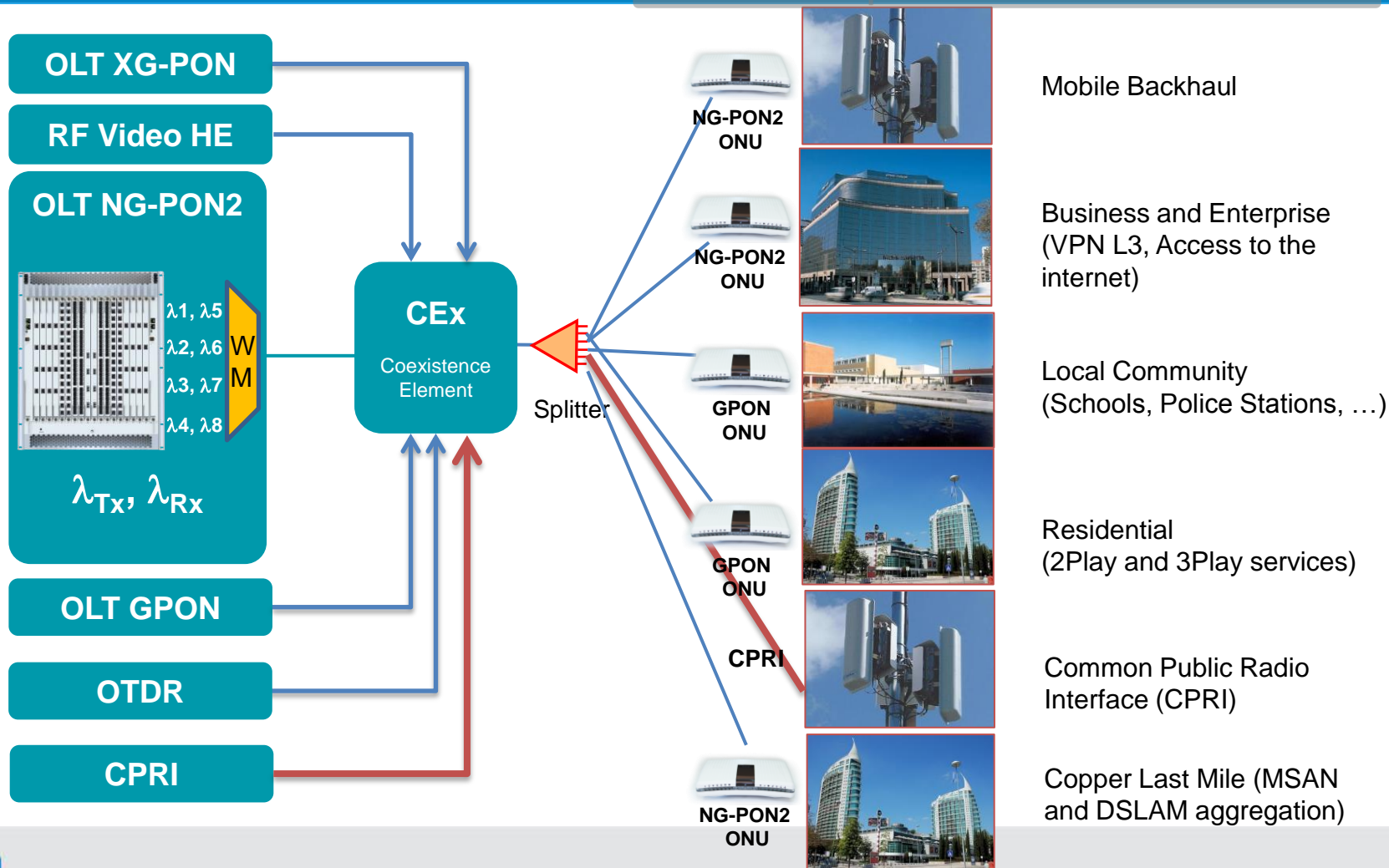
- PTP WDM and TWDM-PON
- Base configuration - $4\lambda \times 10\text{G}/2,5\text{G}$ (40G/10G)
- Two Optional Configuration - $4\lambda \times 10\text{G}/10\text{G}$ (40G/40G) ; $4\lambda \times 2.5\text{G}/2.5\text{G}$ (10G/10G)
- Options for 8 λ
- 1550nm RF Overlay will not be affected by NG-PON2 wavelength



New FTTH Technologies

Seamless Transition

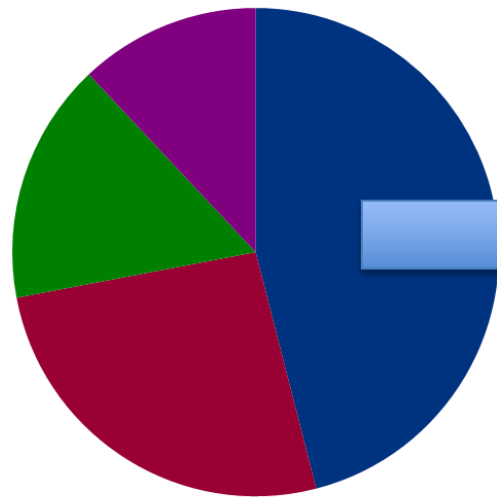
One platform for all services



Innovative Deployment

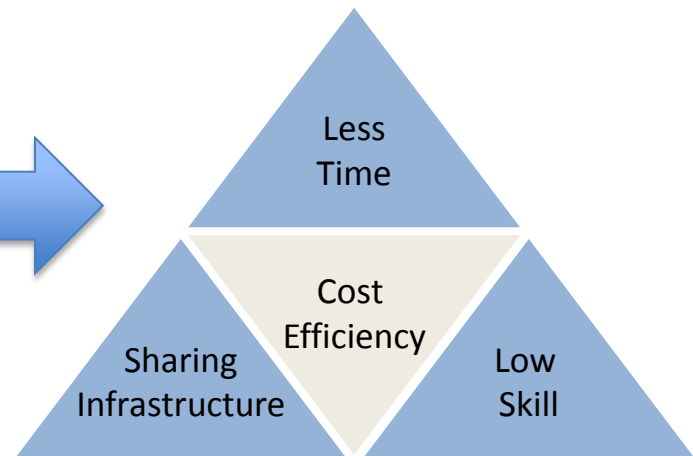
Cost Efficiency

Cost Breakdown of an FTTH Project (*)



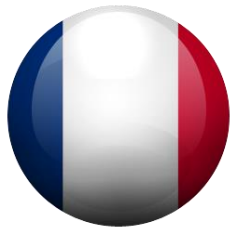
■ Deployment ■ CO Active
■ Subscriber Active ■ Material

Deployment Cost Efficiency



* Source: FTTH Business Guide (Europe), 2013

Innovative Deployment Infrastructure Sharing



Duct Sharing



Sewer Pipe Installations



Water Pipe Installations



Residential Gas Pipes

Innovative Deployment Duct Sharing in France



Key Points

- Regulatory authority stepped in
 - Duct capacity was available
 - Disruption from new runs untenable
- Allows competitor access, whilst keeping cables separate
- Priced on cross-sectional area
 - Drives down cable size and deployment costs
- Use of rigid and flexible ducts
 - Maximise space



The use of flexible inner duct makes it possible to add more cables to this already congested

Saving €2.5Bn claimed over 5 years

Innovative Deployment Sewer Pipes in the Netherlands



Key Points

- Vast majority of the EU populations are connected
 - Instant route to subscribers
- Digging is limited
- Sewer pipes are spacious
- Sewers tend to be deep underground
 - Less susceptible to damage & temperature fluctuations
- Constraints
 - Toxicity, Aggressive cleaning techniques,
Must not impede flow
- Technology is developed and is licensed out
- Benefits to sewer owner
 - Networked sewerage management (data)



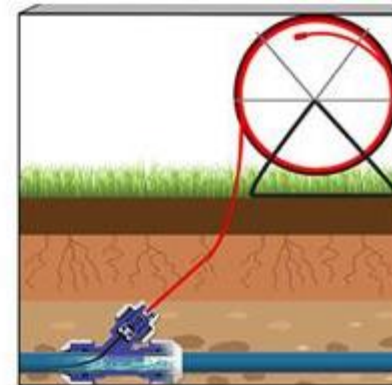
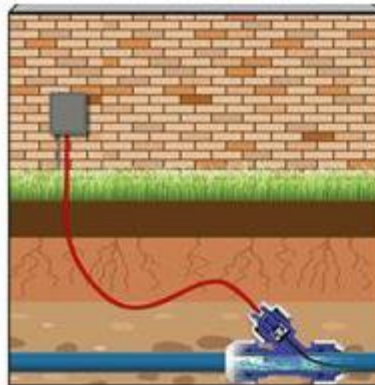


Innovative Deployment Drinking Water Pipes in Various

Key Points

Benefit: The existing route is already connected to end user

- Water Companies were already placing data cabling in pipes
Independents created adapters at each end
- Existing blowing techniques can be used
Cable and microduct
- Requires 2 holes at start and end
- Just add fitting, install microduct
Fibre can be installed when required
- Backhaul high count fibre
In distribution mains
- MDU's require only the hole at demarcation point



Innovative Deployment Gas Pipes in Germany



Key Points

- Again the route exists
Less of EU connected but still high at >50%
- Must be gas tight, not impede flow
- Requires 2 holes, exit must be external
- Materials must withstand gas
- Pressure can be modified
- Loss of flow, minimal



Innovative Deployment Decorating

Replacing Copper

- Copper infrastructure connected to customers
- Particularly legacy cabling
 - CaTV
- Technique developed to remove copper core leaving a microduct channel
- Two benefits
 - Copper value is high
 - No need to install new ducting
- Disadvantage
 - There is an obvious service disruption period as the cable that services the client is taken out.
 - The fibre will not be installed and commissioned instantly therefore customers left without service

Innovative Deployment

Benefit of Infrastructure Sharing

Reducing your “Civils” bill is paramount as fresh civils routing vary in cost

A low cost / metre is the goal

Cost/Metre

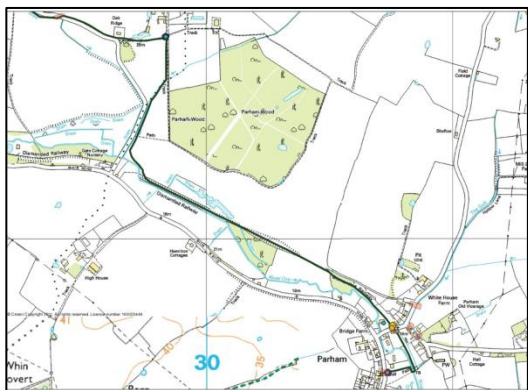
Open Trenching	Very High
Directional Drilling	High
Slot Cutting (with traffic calming)	High
Road Crossing / Road Closures	High
Mole Ploughing	Medium
Existing duct / Gas / Sewers / Water Pipes / Decoring	Low

Innovative Deployment

Deskilling and Speeding Up Deployment

The cable deployment using traditional methods requires lots of skilled labour

- The challenge of the last 100m



Point A to Point B (Backhaul)



Point A to Many (Last 100m)

- Cost efficiencies in deployment require the minimisation of skilled labour, one low skilled installer doing the job at the quickest speed = most cost efficient.

Innovative Deployment Installation Methods

Connect small cables, quickly, to many customers

- Smaller cables drive the market to smaller machines
 - Large machines and compressors no longer practical
- Simple, **low skill**, low cost devices required
- Drive to single handed use
- Fast deployment, 45m/min
 - Minimising cost of labour



1/4 of the price of a fibre blower, and only 1 operator required

Innovative Deployment

Pushable Fibre

Deskilled products and methods

- Last 150m, pushed cable is attractive
- Traditional cable ultra flexible but not pushable
- At least 2 players now offer stiff but flexible cable
 - Pushed manually or with small machines
- Deskills process
 - Rapid one person deployment
- Terminated cables can be used
- Tough cables require no further protection



Innovative Deployment Flat Microduct Systems

Innovative microduct

- Bundled microduct is popular
 - Prone to spiralling
 - Increased install time
 - Round form not best use of space
- Flat systems allow alignment to suit the project
 - Thick walled, rugged
 - Outer sheath is a management method
- Great for slot cutting, minimal impact on urban environment – quick and easy
- Remains straight
 - Maximising install time and distance



Innovative Deployment

Case Study - Project Parham, UK

Clever use of latest products to build a rural fibre network

- Service brought to the customers boundary all customers passed able to connect

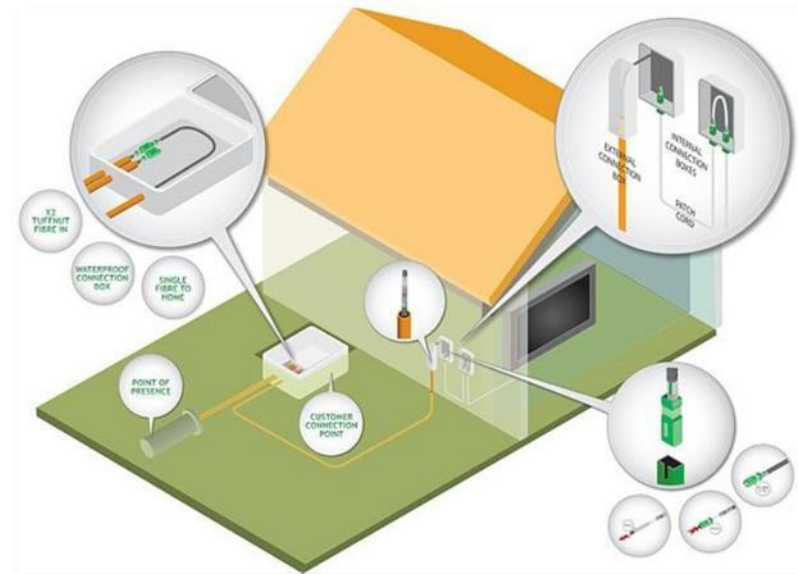
Customer connects themselves - plug n play kit
Kit is deskilled so that anybody can self install

- Keeping cost down

- No returning engineer to connect home
- Adding customers to network cost is zero
- User pays for cable and duct in pack

- Pole sharing and highways cost too high

- Planned “farmer friendly” field boundary approach
- Rugged products allows use or more agricultural plant



Innovative Deployment

Case Study - De-skill & Time Saving

Parham UK: Example of Cost Saving

Parham designed the deployment to incorporate pushable fibre to eliminate the need for blowing and reduce the number of splices by using pushable preconnectorised cable.

- **Pre-connector Cost Saving**

Reducing the number of Splices or Terminations by 75%. As each splice or termination was in different locations rather than in one place the setup and teardown costs are high resulting in at least a 50% estimated cost saving per customer connection.

- **Customer Self Install Packs Cost Saving**

Customers paying £250 for a self install pack saves the project cost of sending out an engineer when the end user wants to connect. The skilled installer has been completely designed out of the process, saving time and cost.

- **Hand Held Pusher Cost Saving**

Using a handheld Pusher increases the efficiency of the installer allowing a 100m run to be installed in just 2 minutes.

Source – White Papers

Written by the D&O Committee of the FTTH Council Europe

- **New FTTH-based Technologies and Applications**

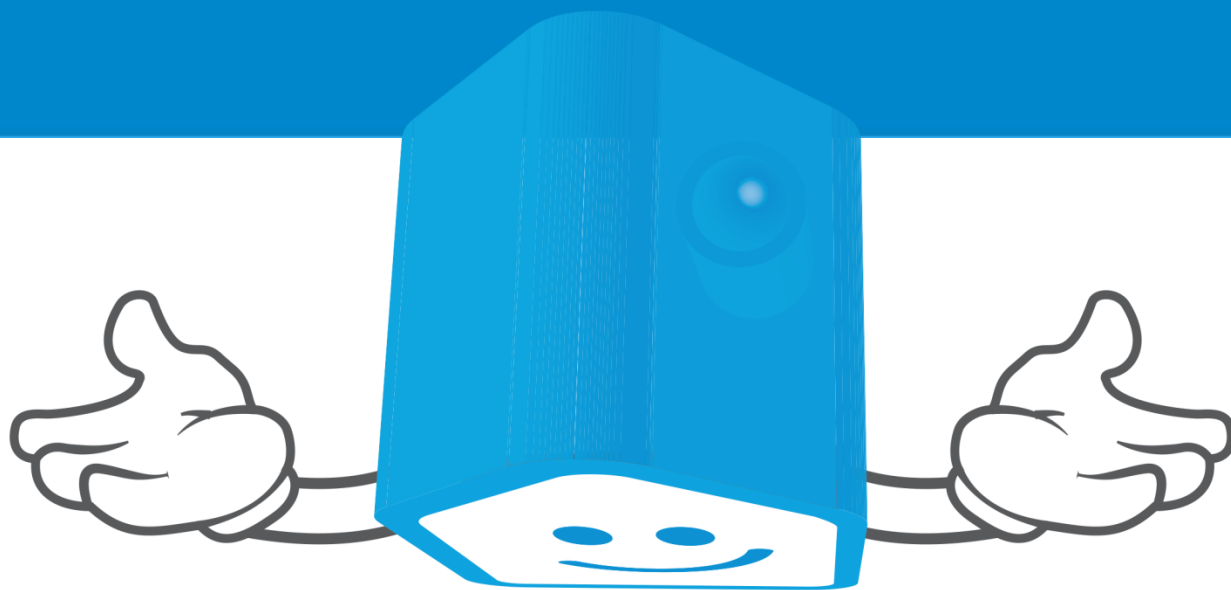
Contributors: José Salgado (PT Inovação), Rong Zhao (Detecon International), and Nuno Monteiro (PT Inovação).

Editor: Pauline Rigby

- **Innovative FTTH Deployment Technologies**

Co-ordinators: Tony Stockman, Condux; Rong Zhao, Detecon International

Contributors: Graham Dupree, Clearfield Inc.; Jan Dewinter, Maxcell Group; Tony Eaves, Fearless Digital; Andy Harris, Atlantis Hydrotec; Dan Jenkins, M2FX Ltd.; Erik Klein Nagelvoort, Jelcer Networks B.V.; Claus Nygaard, GM Plast; and Christoph Pauselius, Pauselius Consulting; and Pauline Rigby, Technology Writer.



www.ftthcouncil.eu

