N°10 WhitePaper

MultimediaConnect

FTTx: EXPLANATION OF OPTICAL FIBRE NETWORKS AND DETAILED LOOK AT FTTH

Optical fibre is the preferred medium for long-distance networks. Due to low losses per kilometre, this medium is now used on all sections of the telecommunication network.
There are different FTTx (Fiber to the x) fibre network configurations, such as FTTN, FTTC, FTTB, FTTH, FTTD.
The current form is FTTH. With fibre to the home, the infrastructure network becomes more efficient and can be used to offer new services to customers and subscribers.
The constraints associated with use of single-mode fibre in the home have put the spotlight on the new ITU-T G657 optical fibres, which are less sensitive to bending.

NETWORK TYPE

N.O.C Network Operation Centre
This is the control station for wide area networks.

FTTN Fiber to the Node
Fibre to the telecommunications patch panel. This is the first technology to have been used to streamline transmissions between operator rooms.

FTTC Fiber to the Curb
With this method, the fibre goes as far as the pavement. The Street cabinet can be active and the last metres of connection are implemented using coaxial or twisted pair copper cables (FTTLA – Fibre to the Last Amplifier).

FTTB Fiber to the Building
The fibre goes up to the building (very often a tertiary sector site), then terminal distribution is provided by a VDI copper cable network.

FTTH Fiber to the Home
The fibre network goes up to the home. Inside the home, the distribution is implemented using copper.

FTTD Fiber to the Desk
Optical fibre distribution technology up to the desk.

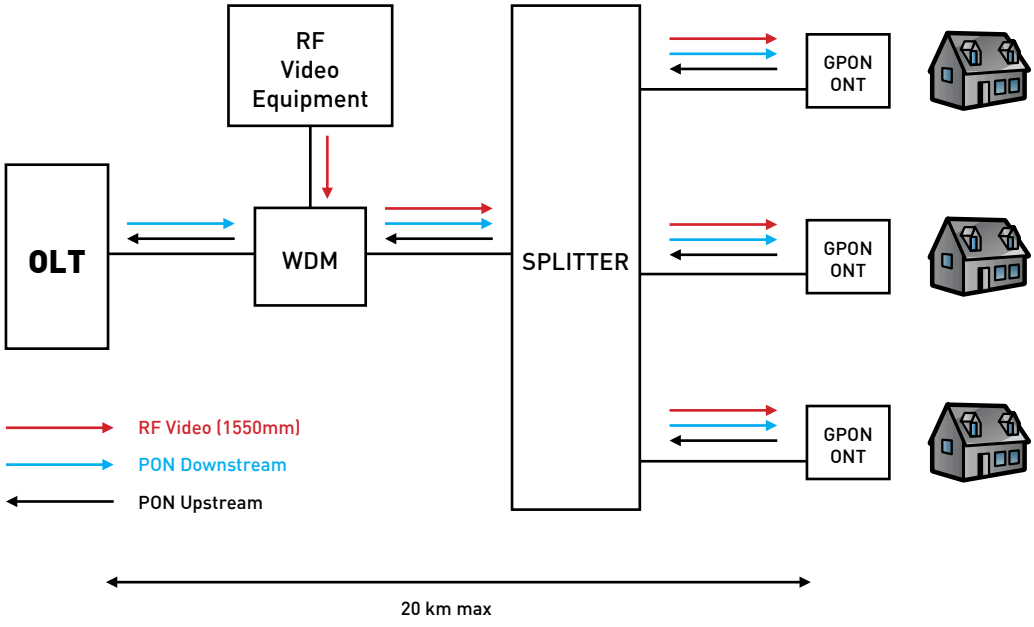
DETAILED LOOK AT FTTH

CONNECTION ARCHITECTURES

Point to Point: With this architecture, a dedicated fibre is used to connect each user. The bandwidth does not depend on the number of users.

PON: Passive Optical Network
A single optical fibre arrives at the patch panel in which a passive optical splitter allows distribution with several optical fibres. This architecture, used widely with FTTH, can be divided into two types: GPON (Gigabit Passive Optical Network) and EPON (Ethernet Passive Optical Network).

PON NETWORK



OLT Optical Link Terminal
Active Equipment in the operator room, which creates the Transmit/Receive signal.

WDM Wavelength Division Multiplexing.

Splitter Passive flow splitting element.

ONT Optical Network Terminaison
This item of active terminal equipment is very often the fibre optic modem present in the home.

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END CONNECTOR

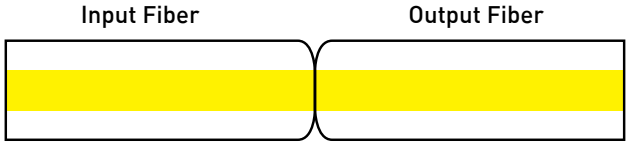
Number of fibres

A single strand may be sufficient to transmit all the data using WDM (Wavelength Division Multiplexing) type modulation technologies by which several signals with different wavelengths are transmitted over the same optical fibre. If data transmissions according to the Ethernet protocol are envisaged, the connection is implemented using a minimum of two strands.

Connection type

FTTH networks are demanding in terms of performance because they are composed of many cut-off points. In order to ensure that loss is minimized, the connectors and feedthroughs used are of the APC type (Angled Physical Contact).

SIMPLEX SC CONNECTOR
STANDARD PC FERRULE



PC (Physical Contact)

SIMPLEX SC CONNECTOR
8° APC FERRULE

APC (Angled Physical Contact)

OTD = OTP
Optical terminal device
Optical termination point

CP
Connection point

OMP
Operator mutualisation point

Connection topology

In the building, the external network connection is implemented using the operator mutualisation point, corresponding to one or more boxes located in the shared areas of the building. From this point, the optical fibres are assigned to each of the users.

Example of mutualisation point

Connection box, containing up to 48 splices and 16 SC connectors.

Distribution is then implemented as in a tertiary infrastructure, except that there is no active equipment in the floor connection points.
At the end, the optical fibre arrives at a OTD or OTP separating the operator network from the private network for residential use.

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G657 FIBRE TECHNOLOGY

For applications in the home, optical fibre cable has to adapt to new mechanical constraints: bonded, stapled, bent, etc. The cable must be resistant and composed of bend-insensitive single-mode fibre as is the case with ITU-T G657 fibres.
ITU-T G657 fibres were standardized in 2006. Category A fibres are compatible with ITU-T G652 fibres, which are used widely in access networks.
Category B fibres are not compatible with G652 but are more insensitive to bending than category A fibres.

TECHNICAL CHARACTERISTICS OF ITU-T G.657 FIBRES: CATEGORY A VS CATEGORY B

PARAMETERS	ITU-T G.657	ITU-T G.657
	CATEGORY A	CATEGORY B
Attenuation according to bending		
1 turn of 15 mm diameter at 1550 nm	Not specified	≤ 0,5 dB
1 turn of 15 mm diameter at 1625 nm	Not specified	≤ 1,0 dB
1 turn of 20 mm diameter at 1550 nm	≤ 0,75 dB	≤ 0,1 dB
1 turn of 20 mm diameter at 1625 nm	≤ 1,5 dB	≤ 0,2 dB
10 turns of 30 mm diameter at 1550 nm	≤ 0,25 dB	≤ 0,03 dB
10 turns of 30 mm diameter at 1625 nm	≤ 1,0 dB	≤ 0,1 dB
Properties		
Nominal Mode Field Diameter at 1310 nm	8,6-9,5 µm	6,3-9,5 µm
MFD Tolerance	± 0,4 µm	± 0,4 µm
Cladding Diameter	125,0 ± 0,7 µm	125,0 ± 0,7 µm
Core-Cladding Offset	≤ 0,5 µm	≤ 0,5 µm
Cladding Non- Circularity	≤ 1%	≤ 1%
Chromatic Dispersion Slope	≤ 0,0092	Non spécifié
Zero Chromatic Dispersion Wavelength	1300-1324 nm	Non spécifié
Cable cut- off Wavelength	≤ 1260 nm	≤ 1260 nm
PMD (PMDQ (ps/√km) [M=20, Q=0,01%]	≤ 0,20	Non spécifié
Proof Test	100 kpsi	100 kpsi

MDIC cable from Multimedia Connect, the residential optical fibre solution.

This cable has been developed especially for use under residential constraints. 'Micro Drop Installation Cables' are flat optical cables that can be bent by up to 90°.