

White Paper

The Future of Fibre *The Emergence of PON*



Background

I recently wrote a **whitepaper** claiming that Singlemode fibre was the future. In this follow up whitepaper, I will outline and provide further justifications for that claim.

The premise of the first paper was based upon a spate of standards publications and developments around higher bandwidth. Of the seven applications for 200Gb and 400Gb published in IEEE 802.3bs only one involved Multimode fibre and the other six were focused on Singlemode. This was quickly followed in March 2018 with the publication of IEEE 802.3cc 25Gb Ethernet over Singlemode fibre.

The background of the latter was to provide network operators a cost-effective upgrade path to 25 Gb/s that minimizes network design, installation and maintenance costs by:

- Preserving current network architecture
- Addressing the requirement in metropolitan networks, where the core operates at 100 Gb/s for tributary feeds at rates higher than 10Gb/s
- Enabling extended 25Gb/s reaches

As with all technologies that start off in this manner, it is not long before it finds its way into the Enterprise and Data Centre markets.

This paper will look at other aspects that are fuelling this drive to Singlemode, such as Fibre to the Home (FTTH) and more specifically Passive Optical LANs (such as PON and GPON) that are the driving technology behind it.

FTTH

The FTTH Council Europe published a report at their conference in February 2018, looking at the socio-economic

benefits of FTTH based on the results of an online survey, which was conducted with a representative sample of 1018 consumers in Sweden between 29 September 2017 and 2 October 2017 by the international market research institute YouGov.

The two key findings were:

1. For the majority of FTTH users, fibre is about higher speed and better value for money

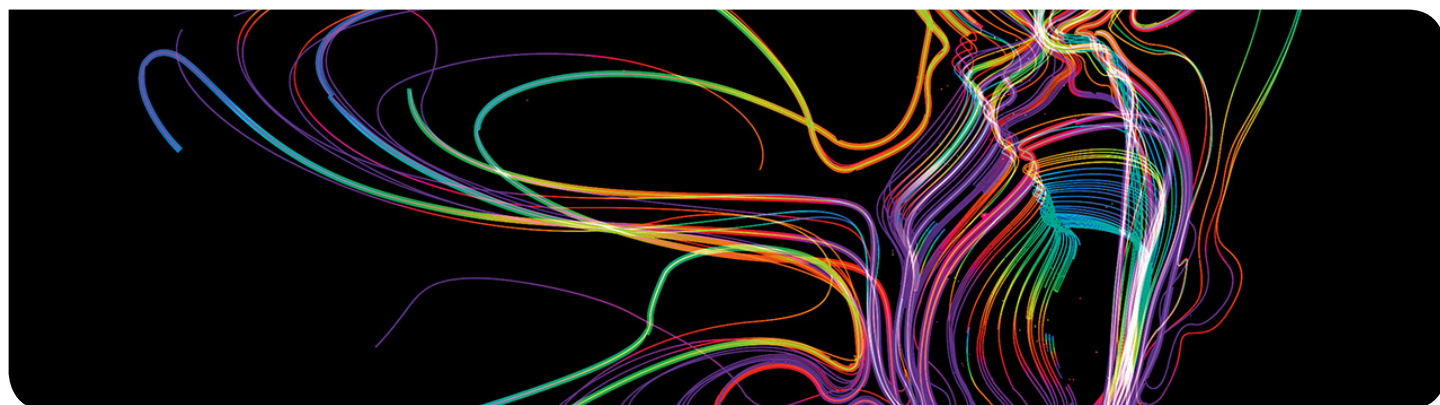
- 87% of the FTTH subscribers mention high bandwidth as the primary reason for purchasing a FTTH connection
- 62% are satisfied about the higher range of services they get with FTTH
- 51% are of the view that fibre provides for a better value for money

2. The more telling factor were satisfaction levels

- Fibre reaches 83% whereas other technologies such as DSL or cable are respectively reported at 52% and 72%
- It is also worth noting that 94% of non-FTTH users would consider subscribing to FTTH if it was made available in their area

Furthermore, in another report from the FTTH Council it states legacy copper networks are currently being de-commissioned in Spain, Sweden and the UK and being replaced by fibre. What's more, fibre subscriptions have increased in Spain by 36% and France 34% in just one year.

Finally, FTTH still has massive growth potential as only 33% of European homes have access to Fibre Connectivity.

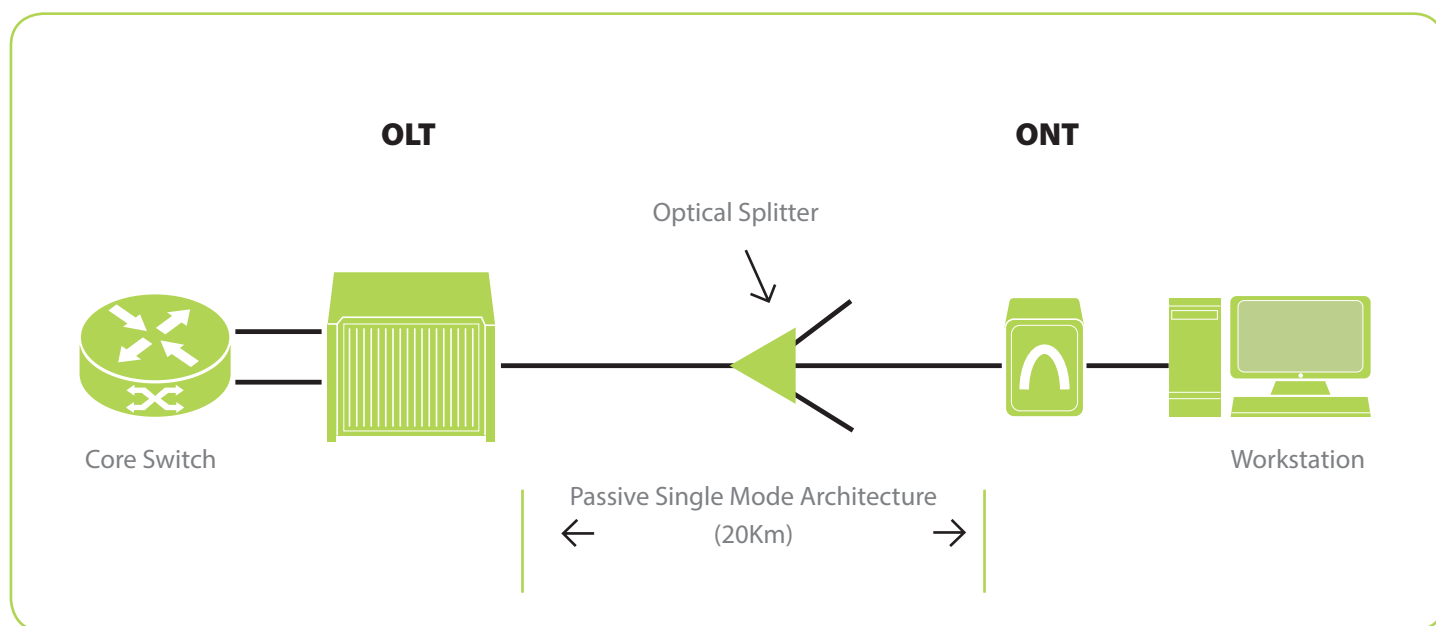


Passive Optical Networks

The technology that is driving this revolution is not just limited to FTTH. It is being used in a wide range of commercial applications, but more examples will be given later in the paper. To start with, understanding the technology and how it works is important.

Passive Optical LANs use Access Networks grade or Telecoms grade technology to flatten the LAN using 3 key components:

- Optical Line Terminals (OLT)
- Passive Optical Splitters
- Optical Network Terminals (ONT)



The Optical Line Terminal (OLT) resides in the Data Centre or core network. It connects to the core switch using traditional Ethernet core connectivity.

- Consists of modular PON cards
- Provides redundant switching, control, and power capability
- Each PON port typically connects 32 ONTs

Passive Optical Splitters connect to each PON port and replicate traffic downstream (to the end user's ONT) while combining end user traffic in the upstream direction.

- Requires no power or cooling (hence the word "passive")
- Can be placed anywhere in the midspan of the fibre network
- Typically deployed in above-ceiling fibre break-out boxes near end user work areas
- No need to perform cross connects after initial installation (networks are logically assigned)
- These are typically 16 or 32-way splitters, hence each OLT port being able to support up to 32 ONTs

The ONT serves as the end user interface to the network.

- Consists of modular PON card
- Typically powered by a low voltage
- Converts the single mode fibre optical signal to RJ-45 Ethernet interfaces
- Various models provide anywhere from 1 to 24 Ethernet Ports
- Therefore, one OLT port could support up to 768 devices/users
- Various models support Power-over-Ethernet (POE)
- Supports VLAN, 802.1x, and QoS
- Can be deployed on the desktop, wall-mounted, or rack-mounted

Economic and Technical Benefits

Passive Optical LAN provides substantial savings in CapEx and OpEx compared to legacy LAN designs.

- Can eliminate wiring closets
- Eliminates the need for midspan electronics, power, and cooling infrastructure
- Uses smaller, lighter, less expensive cables to reduce pathway and space requirements
- Virtually eliminates the need to refresh cabling infrastructures
- As technology evolves, only the active endpoints need a refresh
- And does not suffer the distance limitations of the traditional twisted pair network
- Management is from the centre and does not require a multi-layer network administration

Typical Installations

As discussed earlier do not think of this a purely a FTTH technology; there are references across almost all sectors. The list below highlights just a few of them.



1. Texas A&M University installed a Passive Optical Network solution at its 102,000 seat stadium, Kyle Field, for both the LAN and DAS network which included connectivity to IPTV, IP Phones, more than 1,200 Wi-Fi access points, along with security cameras and ticket scanning system.



2. Madinat Jumeirah Resort and Residences in Dubai, uses a Passive Optical Network to provide services and security to all the rooms and suites and residences at the resort, these include IP CCTV, Guest Services, Access Control, IPTV, Wi-Fi



3. US Marine Corps has moved to a Passive Optical Network for their major bases, for both Data Security and performance reasons.



4. 4 Seasons Hotels, one of the world's premier brands have chosen to standardise on Passive Optical Networks for their future developments, primarily due to ease of use, ease of re-configuration and the 'guest experience' the system can offer. One of the first to change over to this is the London City hotel close to Tower Hill. Other major Hotel chains are following suit.

Conclusions

Hopefully all the evidence provided so far across these two whitepapers gives a clearer understanding why the use of Singlemode fibre and the use of Passive Optical Networks is on the rise.

The cost of Singlemode fibre is already lower than most Multimode fibres; it is just the cost of the Electro-Optics that is currently the big differentiator. However that is changing almost daily as the cost of single-mode devices comes down, this rate could potentially speed up if the 'Open Compute Project' have their way with the promotion of low-cost, short reach Singlemode transceivers intended for use in the Enterprise and Data Centre markets rather than the Telecoms space.

Whilst some Industry Commentators make the claim that we will see the key change to Singlemode fibre in around 5 years' time, with the rapid adoption of Passive Optical Networks and the move by Data Centre operators to standardise on Singlemode. I for one contend it may come a lot sooner.



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