

# White Paper

## The Future of Fibre - The Rise of PON



It is very difficult to predict what will happen in 2019 in such an unpredictable industry. This last year has seen so much change already, however one hint came from the Opinion Piece that was published in the December 2018 Edition of Inside Networks, when some commentators discussed the emergence of Artificial Intelligence (AI) being a driver for Industry 4.0. It led to the consideration of the wider aspect of the topic and highlighted some of the findings of the recently published IEC whitepaper 'Artificial intelligence across industries'.

This looked at four key areas:

- i. Smart Homes
- ii. Smart Manufacturing
- iii. Smart Transportation
- iv. Smart Energy

The two key takeaways for our industry is the forecast that this will lead to the number of connected devices installed worldwide in 'Intelligent Networks' growing from over 23 billion in 2018 to approximately 75 billion in 2025, which illustrates the impact of the IoT on data acquisition. This unprecedented growth in global connectivity and networking is generating massive amounts of data, and the rate of this generation is accelerating.

This leads to the question of connectivity; whilst at the individual device that is used to collect the data the bandwidth will almost certainly be very low, when we get into the backbone this is going to build up in line with the increased

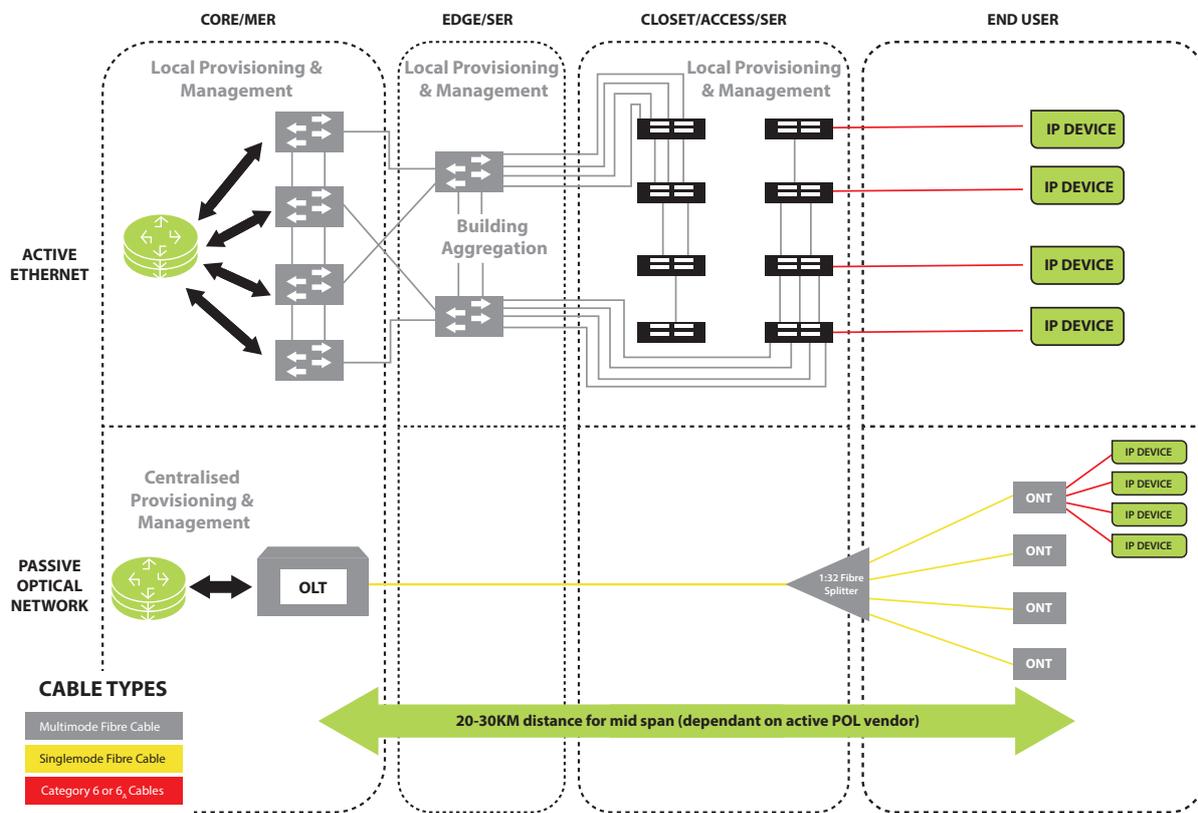
number of devices, bringing different challenges. One technology is going to assist in handling this is Passive Optical Lan (POL). This is becoming mature in the residential and hospitality space and is increasingly common for large multi-dwelling developments. Some hotel chains have standardised on them due to the fact they provide quick ROI, they are easy to deploy and manage as there are no active devices in the mid-span, space for IDFs/SERs is greatly reduced or eradicated, it is inherently secure, and they provide excellent scalability.

The next stage is for POL to step over into the Enterprise space, and there are now early signs that this is being accepted as a plausible technology with some major corporate organisations starting to look at POL as a serious alternative to the traditional LAN approach.

Whilst some of the arguments are not as strong across the board, it should not be ruled out. A recently published whitepaper from one of the leading vendors of PON equipment that some Enterprise customers are looking at the opportunity of saving up to 30-50% of their Capex costs, 50-70% of their ongoing Opex costs and a whopping 90% of their rack space. On further investigation of these claims, some stack up quite well, the latter really depends upon the building layout and final design.

We will therefore look at each one of these areas in isolation, but first we need to consider the two models for a traditional LAN approach and that of POL.





## Capital Expenditure (Capex)

The first one relates to the first and third points made - the 30-50% reduction in Capex costs along with 90% in rack space - this mainly relates to, but not solely, the reduction in space requirements for IDFs/SERs. This argument purely depends on the nature of the design. If it contains all the elements of the traditional network shown above, then yes this makes total sense, however if it is fibre-to-the-IDF/SER rather than fibre-to-the-user, you still have the requirement, for an IDF/SER to house all the ONTs and then distribution using copper to underfloor or overhead outlets. Admittedly, in some designs it is going to be almost impossible to remove the IDFs/SERs from the equation completely, however the size and complexity of them can be reduced. In this sense, any reduction in the size of the SERs becomes very beneficial, especially when you consider that the average costs of building just 1 sqm of office space in London in 2018 was £2,900 according to Statista, therefore if you can reduce the IDF/SER requirements by 1,000 sqm on a project (50 sqm x 20 rooms), which is not a vast amount on some of the current day projects in the City of London, it equates to a £2.9m saving! That alone will get a few people's attention.

One area where there are clear space savings is in the MDF or MER, with the traditional copper-based approach utilising 48 port Ethernet switches it would require 42U of rack space to support 2,016 users. With the relevant management and patching fields this would require a minimum of 3 racks in total. On the other hand, a typical POL OLT can support 7,700 users due to the greater port density and the intelligent use of optical splitters downline, all of which requires just 9U for the OLT and potentially a further 10U for fibre distribution and management, immediately producing both space,

containment and equipment cost savings.

If you were to think laterally using a combination of Fibre-to-the-IDF/SER and Fibre-to-the-User, these sort of space savings could be greatly increased. Provisioning for an IDF/SER these days we have to consider the future and with the advent of IEEE 802.3an 4PPoE with the much greater power and cooling requirements, most being built are not 'fit for purpose' on day two. It makes a great deal of sense to go down the route of a hybrid approach to place some of the load closer to the requirement where impact will be far less than if it was concentrated in one single room.

## Operating Expenditure (Opex)

One very major benefit of POL is at the management and security levels, where everything - including any software updates - is centrally managed. The ONTs are effectively 'dumb devices', therefore once the SER has been deployed and configured and devices are connected up, they can remain 'dark', with no need for any members of the IT or Networks team to go into them. This is where some of the Opex savings come into play.

The other is the upgrade path and the bandwidth capability without major future cost upgrades. Currently the lifespan of an Ethernet Switch without software upgrades or replacement is anywhere between 3 and 5 years, on top of which there are the usual annual maintenance and software licencing fees.

POL on the other hand extends the network life to 10 years or more enabling a more strategic approach and predictable costs for bandwidth upgrades, along with limited ongoing costs due to being fibre-based and easy upgrades to higher bandwidth capabilities. Singlemode fibre has been demonstrated to

support more than 100Tbps of full duplex bandwidth, which most Enterprise implementations are not going to require anytime soon.

## Redundancy and Security

POL allows for a varying level of redundancy or resilience very easily. The very nature of its telecoms heritage makes it an integral part of the system. A single OLT can be configured with a redundant PON port or card servicing one ONT via two routes, allowing for single OLT resilience. This provides different routes to the splitters which can be either 1 x 8, 1 x 16, 1 x 32 or 2 x 8, 2 x 16, 2 x 32 etc. depending upon whether they have one or two inputs.

There is also an opportunity to almost go for a completely redundant solution with geographically dispersed OLTs, having them in two different locations and from different PON ports configured using the central management to support the one ONT. This approach is said to provide 99.9999% ("six-nines") availability.

## Summary

In conclusion, it is important to highlight a couple of additional points. Firstly, a number of enterprises are now starting to see the benefits and potential of POL, however it will still have to overcome some of the old ways of thinking. The old statements of 'You never get fired for buying brand X' or 'This is the way we have always done it' still haunt our industry at times and it will take some 'forward thinking' by those who can see the benefits.

Additionally, one test equipment manufacturer - Fluke Networks - has already recognised the growth potential in this sector and has added additional features to the Optifiber Pro to assist installers testing through splitters which is not a straightforward task with a standard OTDR.

It will also take a better understanding of the design principles of POL by a wider audience including some leading consultants, however it is not 'rocket science' once you understand the basics - it all falls into place very quickly. To this end APOLAN as well as Excel will be launching training courses on POL in Q1, 2019 - more details to follow.

One final point some may consider an important additional factor is that Fibre Optic cabling is inherently secure. Physically 'tapping' fibre is extremely difficult and effectively impossible from any distance. POL also uses certain monitoring protocols that will detect any abnormal or rogue intrusion anyway.

POL uses an Element Management System (EMS). Not surprisingly, it is 'Telecoms Grade' and establishes role-based access for users through strict authentication and authorisation. The EMS is where secure global profiles are created for ONTs, ports, connections, and other network elements. It must be noted that all configuration is carried out solely at the OLT and that is where all the intelligence is. ONTs are a thin client device and hold no data. They can therefore be moved around the network, or even sent back to the supplier without user data being compromised.



### About the Author:

Paul Cave is a 30+ year veteran of the cabling industry and sits on various standards sub-committees at BSI as well as being a member of the **APOLAN** Technical Committee. (Association of Passive Optical LAN).

#### European Headquarters

Excel House  
Junction Six Industrial Park  
Electric Avenue  
Birmingham B6 7JJ  
England

T: +44 (0) 121 326 7557

E: sales@excel-networking.com

#### Mayflex MEA DMCC

Office 22A/B  
AU (Gold) Tower  
Cluster I  
Jumeirah Lake Towers (JLT)  
Dubai  
United Arab Emirates  
PO Box 293695

T: +971 4 421 4352

E: mesales@mayflex.com

[www.excel-networking.com](http://www.excel-networking.com)

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