50G PON offers a solution for operators that are looking to move beyond XGS-PON

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Stephen Wilson

FTTP operators worldwide are increasingly upgrading their networks from GPON to XGS-PON. However, the desire to get as much capacity as possible from fibre networks means that there is significant interest in PON technologies that offer capacity beyond 10Gbit/s (such as 25G PON and 50G PON). This article focuses on the benefits and rationale for deploying 50G PON, which is the only version of the latest generation of PON technologies that is ITU-backed.

There are applications for 50G PON in the residential, enterprise, wholesale and mobile x-haul segments

50G PON deployments would provide significantly more capacity than today's XGS-PON systems, which can offer symmetrical 10Gbit/s capacity. The upgrade that 50G PON can offer to XGS-PON systems is similar to that provided by XGS-PON to GPON systems (these provide 2.5Gbit/s downstream capacity). The 50Gbit/s capacity delivered by 50G PON will be valuable to operators and end users in a number of ways.

The higher speeds that 50G PON can provide will be useful to consumers and the ability to download large files very quickly will always provide value. Operators must also consider the potential for new applications with high bandwidth requirements that 50G PON systems could address. Such applications do not yet exist today, but they could emerge in the next few years as operators begin their 50G PON roll-outs in earnest. For example, advanced virtual reality systems could potentially require very high bandwidths because they may need 16K video to be provided over the network. The higher speeds that 50G PON can provide will also support low latencies. Low latencies could be particularly useful for advanced virtual reality and gaming applications. Operators could also include very-high-speed offers using 50G PON as part of a product-tiering strategy, thereby creating a 'halo effect' in which the availability of a very-high-speed offer drives take-up of lower-speed plans.

Many similar arguments apply in the enterprise connectivity segment. Furthermore, greater use of the cloud will drive the demand for higher upstream bandwidth and 50G PON will be able to provide symmetrical 50Gbit/s capacity to meet this demand. 50G PON may also be useful for passive optical LANs in which fibre is deployed as an alternative to traditional Ethernet LANs. The extra capacity that 50G PON can provide will be particularly useful for passive optical LANs because there are likely to be a large number of concurrent users and devices competing for bandwidth in environments such as hospitality and higher education.

The mobile x-haul segment is an area in which 50G PON can provide clear benefits. The 50Gbit/s capacities that 50G PON can provide over a single wavelength may be especially valuable as operators deploy cloud RANs because of the need for very-high-capacity links between the remote radio units and the distributed units where baseband processing will occur. The extra capacity that 50G PON systems can provide may also enable bandwidth that is being used for mobile x-haul to be shared with other applications such as residential access on the same PON infrastructure.

Another important consideration is wholesale access with 50G PON. Wholesale fibre markets, particularly in Europe, are becoming increasingly competitive and wholesalers that can offer 50Gbit/s capacities and high-speed active access may be better-placed to attract wholebuyers onto their networks. This may be particularly relevant if such wholebuyers need residential/enterprise connectivity and mobile x-haul.

Operators worldwide are showing interest in 50G PON

There is considerable interest in 50G PON deployments among the global operator community. For example, the Lianyungang branch of China Mobile recently completed a successful test of the technology on its live network. This is significant because the scale of FTTP roll-outs in China means that 50G PON deployments in the country can deliver very large economies of scale, which may help to reduce costs for operators in other parts of the world.

Operator interest in 50G PON is not confined to China; major European operators such as Swisscom and Telefónica are investigating its potential. Telefónica has recently stated that it envisages deploying 50G PON in the mid-term following the initial step of deploying XGS-PON. Telefónica's interest in the technology is particularly important due to the operator's strong presence in Latin America and its extensive ultra-broadband footprint (154.7 million premises at the end of 1H 2021).

Operators' support of 50G PON worldwide also reflects the standardisation of the technology; this process started in 2018. The ITU officially published the first version of the 50G PON standard in September 2021 for single wavelength systems. Multiple wavelength systems remain under study.

Costs for 50G PON need not be prohibitive

The complexity of 50G PON systems is a little higher than that of earlier PON generations, but the greater deployment volumes for new PON technologies lead to significant cost reductions. This is demonstrated by how the costs for XGS-PON have fallen over time. Such a scenario is also likely for 50G PON. 50G PON systems can also make use of digital signal processing (DSP), which means that they will be able to use lower-cost 25G optical components. The cost of DSP can be amortised across growing deployment volumes and will be reduced over time due to Moore's law.

50G PON is an attractive option that some important operators will choose

XGS-PON deployments are becoming increasingly commonplace, but operators are now beginning to look at future upgrades to higher-capacity technologies. 50G PON is an option that some important operators are keen to use. We envisage that the first 50G PON roll-outs will occur in the next 2–3 years, and that operators will increasingly replace XGS-PON with the technology over time. These roll-outs will be driven by the value of 50G PON for various applications including residential and enterprise access, mobile x-haul and wholesale access.