

Counting 70 years of experience, Iskratel is the leading European provider of infocommunications solutions, with its own R&D and manufacturing centres, 900 employees and local presence in more than 30 countries. Iskratel delivers integrated telecommunications solutions for telco, transportation, public safety, and energy industries.

Executive Whitepaper

GPON vs. DOCSIS 3.1 in Six Simple Points

The truth selecting the right step forward

To keep up with growing demand for bandwidth and offer competitive broadband services, cable operators need to evaluate different options for upgrading their existing networks.

Mostly using DOCSIS 3.0 today, cable operators can (in theory) already deliver gigabits downstream, while limited upstream throughput remains a prohibitive factor, restricting them from delivering higher-value services and apps that require a more symmetrical throughput.

Faced with an increasing number of competitors offering gigabit fibre-to-the-home (FTTH) broadband services, the challenge for cable operators is ever-increasing. Should they upgrade to DOCSIS 3.1 to effectively compete with FTTH operators – or should they become FTTH operators themselves? Are the limitations and disruptions significant enough to consider replacing the coax network with fibre?

Summary

The whitepaper presents six key points (and a bonus one) that cable operators need to understand and consider when selecting the right step forward in upgrading their networks.

Point #1 – Investment and return

Fibre deployment yields lower TCO and better return – at about the same cost as migration to DOCSIS 3.1.

Point #2 – Sustainable investment cycle

DOCSIS requires a constant, unsustainable investment into weak future prospects.

Point #3 – Operating and maintenance costs

Maintenance and operating costs for DOCSIS are higher than for PON.

Point #4 – Services and revenue

PON enables a wider range of services than DOCSIS, and generates more revenue.

Point #5 – Migration to PON

Migration to PON is sustainable and non-disruptive.

Point #6 – Migration to DOCSIS 3.1

Migration to DOCSIS 3.1 is a continuous service disruption.

Bonus point – Customer perception

Customers' perception and experience should never be underestimated.

#1 Investment and Return

Fibre deployment yields lower TCO and better return – at about the same cost as migration from DOCSIS 3.0 to 3.1.

CAPEX per bit of bandwidth (i.e. cost per capacity) is lower for GPON than it is for DOCSIS 3.x. In effect, the throughput of GPON is less expensive than the throughput of DOCSIS 3.x. Recall that the downstream frequencies for DOCSIS are licensable. For example, to achieve 1 Gbps in downstream, 24 EuroDocsis channels (50 Mbps each) are needed, which yields 24 times the license (per optical node).

DOCSIS 3.x is problematic in terms of upstream throughput (DS:US ratio is 5:1) and cannot challenge the much better symmetry of GPON (with DS:US ratio 2:1). To overcome this inherent DOCSIS limitation and increase upstream capacity, a massive investment on top of DOCSIS 3.1 is required for more nodes and more active equipment.

GPON and DOCSIS may be comparable today; GPON's next evolutionary step (XG/NG-PON), however, provides indisputably better capacity than DOCSIS 3.1, reusing the same fibre infrastructure.

#2 Sustainable Investment Cycle

Sticking to DOCSIS is a constant, unsustainable investment into weak future prospects.

Due to licenses, DOCSIS 3.x requires a constant investment that delays return.

In addition, fibre is future-proof. This cannot be said for coax, with is approaching its theoretical capacity limit. The capacity of fibre infrastructure, meanwhile, may last for decades – with additional capacity only a wavelength away.

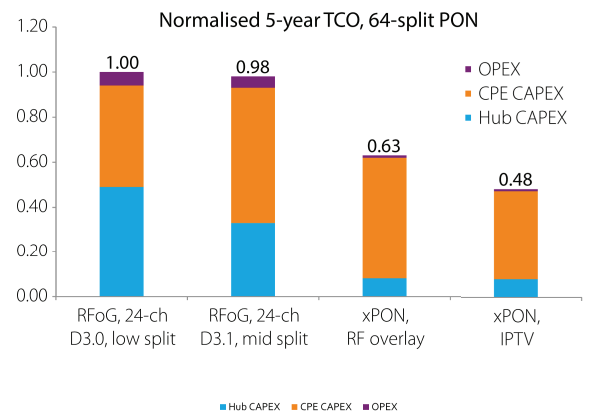
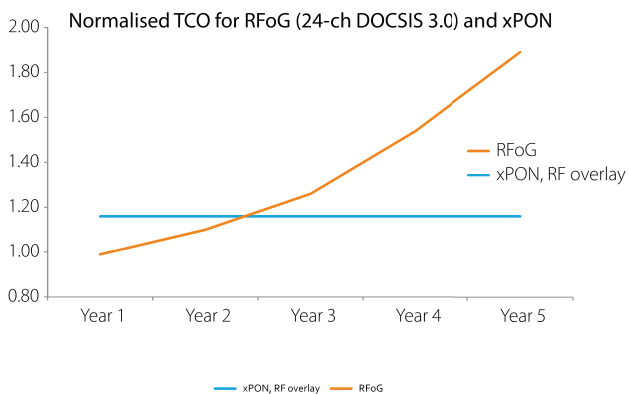
Today, DOCSIS 3.1 (10 Gbps/2 Gbps) may offer more than GPON (2.5 Gbps/1.25 Gbps) – but fibre infrastructure can be reused for XG/NG-PON, with better capacity than DOCSIS 3.1.

Furthermore, considering a co-deployment (of coax and fibre) does not necessarily prove to be a sustainable solution as it only delays the inevitable migration from DOCSIS 3.x to fibre.

Comparative TCO analysis proves the above two points. A comparison for active equipment can be done by comparing PON and DOCSIS 3.1 over the same fibre infrastructure; in other words, comparing PON and RFoG.

The analysis shows that from year 3 onwards, PON with RF overlay provides a significantly lower TCO than RFoG. The reason is the necessity of DOCSIS 3.1's continuous investment in additional channels to keep up with growing traffic consumption.

Ultimately, when compared with DOCSIS 3.1 RFoG a five-year TCO per household connected is 37 % lower for PON with RF overlay and 52 % lower for PON without RF overlay.



Source: Bell Labs Consulting, 2016

#3 Operating and Maintenance Costs

Maintenance and operating costs for DOCSIS are higher than for PON.

As copper coax is sensitive to temperature variation, DOCSIS requires repetitive maintenance of active amplifiers meaning that the tuning of signal amplifiers is required several times per year. In contrast, PON infrastructure is passive and requires no maintenance.

Similarly, DOCSIS requires a power supply for active amplifiers, as well as controlled (and cooled) locations for active amplifiers. Being passive, PON infrastructure incurs no operating costs.

#4 Services and Revenue

PON enables a wider range of services than DOCSIS and generates more revenue.

Growing demand for non-linear experience of TV (like unicast-based time-shifted TV and VoD) reduces the value of classical broadcast TV distribution over coax-based cable systems. TV is not the reason to keep them.

The high asymmetry of DOCSIS 3.x is an issue (DS:US ratio is 5:1 for DOCSIS, and 2:1 for GPON) that limits its use for higher-value services and apps that require a more symmetrical throughput (cloud, videocomm, CCTV, gaming, business services, IoT). This limitation can be overcome with full-duplex DOCSIS; alas, its rollout is not expected before 2019, and will also come with a need for massive investment on top of DOCSIS 3.1.

Unlike CMTSs, GPON OLTs evolve with SDN and NFV, inherently enabling new services (such as OTT, cloud, VoD, gaming) that facilitate new revenue and/or the introduction of new business models.

#5 Migration to PON

Migration to PON is sustainable and non-disruptive.

Migration from DOCSIS to PON can be a headache-free process and can be performed in a sustainable manner. Migration to PON with RF overlay for CATV protects cable operators' past/existing investments in the TV headend and helps to prolong its life. Similarly, existing OSS/BSS systems can be retained, integrating PON service provisioning with a provisioning proxy and gaining full end-to-end service visibility and provisioning.

Specifically, there are two major steps of migration from HFC to PON: in 2017, upgrade to GPON; and in 2022, upgrade to XG/NG-PON (assuming 2017 to be the start of migration).

#6 Migration to DOCSIS 3.1

Migration to DOCSIS 3.1 is a continuous service disruption.

DOCSIS 3.1 is incompatible with DOCSIS 3.0, and migration to it is not an evolutionary upgrade. It requires new CMTSs, new modems, re-segmentation of the network, as well as repetitively licensable frequencies, making the transition a perpetual investment.

Migration from DOCSIS 3.0 to 3.1 requires as many as six steps that all disrupt services and impact customer satisfaction: in 2017, segment the network and upgrade CMTS capacity; in 2018, upgrade to DOCSIS 3.1 for DS service capacities; in 2020, upgrade and rebuild for US service capacities; in 2022, shut down legacy RF TV and migrate it to IPTV (necessary due to lack of spectrum); in 2023, re-segment the network (node splits); and in 2025, face complete saturation of US/DS channels – and inevitably migrate to PON.

Bonus Point: Customer Perception

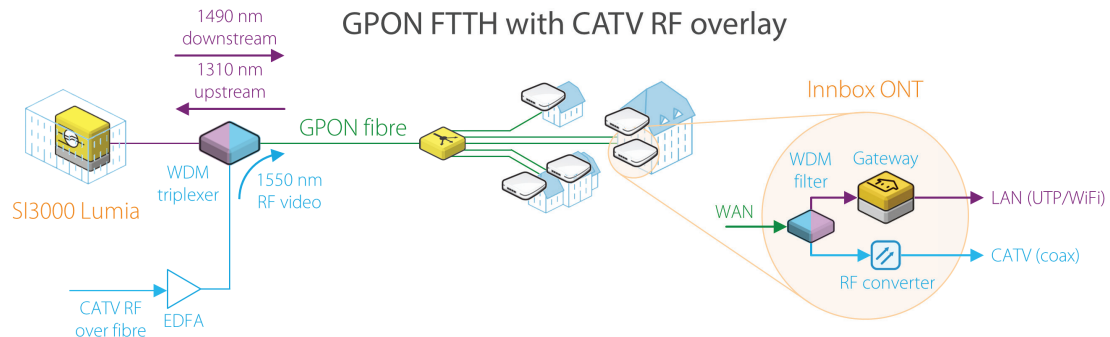
Customers' perception and experience should never be underestimated.

Customers' perception is simple: fibre is the future. Be it justified or not, they will always prefer fibre (to copper) if given a choice. They hear you and your competition which emphasises this too. Without fibre, you may get left behind.

If migrating to DOCSIS 3.1, also consider the perception of service disruptions. Any changes to frequency spectrum in order to improve data capacity affect existing services (for example, changed broadcast TV scheme, less analogue TV channels) – and negatively impact customers' satisfaction.

About Iskratel GPON solution

Iskratel provides point-to-point and GPON fibre-to-the-home solutions, which are suitable for all types of end users (residential, SME, enterprise), and are able to deliver all types of services for these users – from high-speed internet or premium IPTV to business VPNs or bandwidth-hungry services and apps from the cloud. GPON broadband solutions are available with or without CATV RF overlay.



About Iskratel GPON solution

At the central office, SI3000 Lumia – a scalable multi-service access and aggregation product – connects end users over all fixed-access technologies in a single, cost-effective platform. SI3000 Lumia is available for all deployment densities, from high-density urban to low-density rural areas. SI3000 Lumia is empowered with a unique, SDN-based awareness of services and apps that lets the operators justify their investment regardless of specific business models or regulatory requirements.

For customer premises, Iskratel provides an award-winning family of Innbox CPE products. The Innbox family includes universal home gateways, home gateways for fibre and copper access, and fibre-termination units. Support for GPON FTTH is provided in dedicated GPON ONTs and in universal home gateways. Innbox ONTs support the latest, standards-compliant GPON technology, while support for CATV RF overlay is provided with an integrated optical-electrical converter. Standalone fibre-termination units are available as well, with optional support for RF overlay.



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