Investment opportunities in communication infrastructure: digital connectivity and infrastructure are key to innovation & education

The growing need for fast broadband 'connectivity' in society and the economy requires a reliable, affordable, energy efficient and scalable state-of-the art communications infrastructure network. To accommodate this, considerable investments are needed to expand and upgrade today's communication infrastructure network. This opens up an attractive new asset class for institutional investors: passive telecommunications infrastructure assets – such as fixed-line cabling, mobile towers and data centers. An article by Primevest Capital Partners, a pan-European investment boutique with more than €2.8 bln AuM specialising in innovative real assets and already active in this field with the Primevest Communication Infrastructure Fund I (PCIF) and PCIF II to be launched in April 2022, outlines the communication industry's investment challenge and the window of opportunity it offers to institutional investors.

Long investment horizons

These communication infrastructure assets have lifecycles and utility-like characteristics with long investment horizons and can offer modest but reliable cash returns to institutional investors, backed by long-term lease contracts with telecom operators. Moreover, by introducing private capital to the world of communication infrastructure, institutional investors can play a vital role in the development of the 'digital economy', thus delivering important economic and social benefits.

However, investing in cable infrastructure nowadays effectively means putting one's money on one specific infrastructure asset: fibre-optics. That might seem a risky thing to do in an era of fast technological change and 'disruption', even if the exposure to technological developments is limited for institutional investors because they would not be investing in the telecom operators themselves. Can institutional investors invest in passive telecommunication infrastructure in the confidence that fibre-optic assets have the 'longevity' that not only provides investors with an attractive cash return during the lease term, but also maintains or even grows long-term capital value? Primevest explains that such confidence would be justified: fibre-optic technology has matured over the past two decades and is expected to provide the backbone for global telecommunications for most of this century, if not beyond.

Fibre-optics has become the key 'conductor' in the telecommunications infrastructure

The Internet and wireless communication's rapid penetration in modern society has led to explosive growth in demand for broadband transmission capacity. The share of the world's population with an Internet connection has risen from less than 1% in 1995 to more than 65% in Feb 2022. As people and businesses have become connected, more and more of their everyday life and work has gone online – from communicating via e-mail and videoconference, working from home, online shopping and watching streaming video to Cloud-based computing as well as business analysis based on 'Big Data'. In less than two decades, the lives of billions of people have increasingly come to depend on fast broadband 'connectivity', with continuously increasing needs by societies in transformation. Also, living and working under Covid-19 restrictions continued to drive demand for high-quality internet connections with rapid upload and download speeds.

To meet this demand, telecommunications providers have been switching to data transmission via fibre-optic cables, first at the core of their networks, and then gradually expanding fibre-optics ever wider. This steady development has been in progress for about a quarter of a century. Consequently, fibre-optics assets are now the indispensable backbone of today's hybrid communication network of fixed-line, mobile infrastructure and data centers. Moreover recent EU studies are confirming that the most climate-friendly transmission technology is fibre-optics consuming approx. five times less energy than VDSL copper networks.

Fixed-line infrastructure

In leading markets, much of the fixed-line network has already been replaced by fibre-optic cables to benefit from optical fibre's far better performance for broadband services than twisted-copper networks. Optical fibre has virtually unlimited capacity, low signal attenuation allowing long distances without amplifier or repeater, no exposure to parasite signals or crosstalk, and no electromagnetic interference (EMI). For comparison, while single-line, voice-grade copper systems longer than a couple of kilometers require in-line signal repeaters for satisfactory performance, it is not unusual for optical systems to cover 100 kilometers with no active or passive processing.

Mobile infrastructure

In mobile telephony and data traffic, radio signals transport voice and data to and from portable transceivers (mobile phones or other devices). This system relies on a network of 'cells', each of which is served by a fixed-location transceiver, such as a Wi-Fi access point, or a mobile 'base station', such as a communication tower. These fixed access points and base stations are in turn connected to a fixed-line cable network. As mobile traffic continues to escalate, the 'backhaul' capacity of the cable-based network which supports mobile communications also has to increase. Operators have already started using optical fibre to connect mobile base stations, but there are still many mobile base stations that depend on 'old' technology which needs to be replaced. And where a new connection is required, optical fibre is installed in view of its superior transmission speed, as well as its potential to expand transmission speed supporting 5G and also with respect to the positive impact on energy consumption.

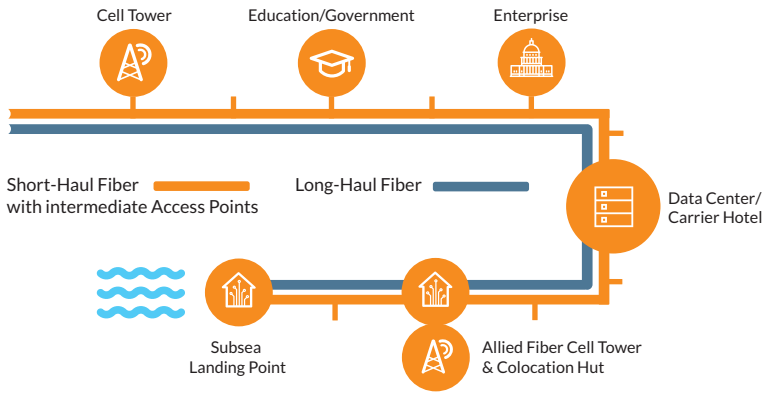
Data centers

With the convergence of service delivery to the IP protocol, more traffic is routed via the data centers using fibre optic technology. At the same time, there is an ongoing shift from local or corporate-managed applications towards cloud-based solutions, whereby users access the application via a web interface. As a result of this trend, data traffic between users and host servers is increasingly manifold. At the same time, new IT concepts (Big Data, Industry 4.0) are multiplying the volume of internet traffic, thereby driving the need to expand data center storage capacity as this has now become an indispensable part of today's hybrid telecommunication ecosystem.

Fibre-optics is the cable-based technology with the highest potential for transmission capacity

Internet Protocol (IP) traffic has been growing exponentially for years, as human activities are increasingly going online, and there is no let-up in this trend. Services such as HDTV, 3D TV, 4K, video on demand, video conferencing, and new online applications in every profession and business imaginable are all driving further growth in data traffic. So is the explosive growth in wireless communication – smartphones, WiFi, the Internet of Things. It is estimated that the number of devices connected to IP networks will be more than three times the global population and that the consumer segment will account for 75% of all these devices and connections by 2023. Also,

Role of fibre in broadband network connecting home, office buildings, communication towers & data centres



Machine-to-Machine (M2M) connections predominantly connected home will be half of the global connected devices by that time which brings the entire world's data traffic over mobile networks from one high to the other currently at around 60%. Ongoing technological developments in all kinds of areas – virtual reality, autonomous driving, the smart grid – will continue to boost data traffic. These developments make a state-of-the-art global communication network even more imperative. Fibre-optic technology has already become the backbone of modern telecommunication infrastructure, and it is highly likely to remain so for most of this century, for the following reasons:

- It is superior to any other cable-based alternatives
- The technology for expanding its transmission capacity through more advanced active components for signal transmission and reception is already being developed

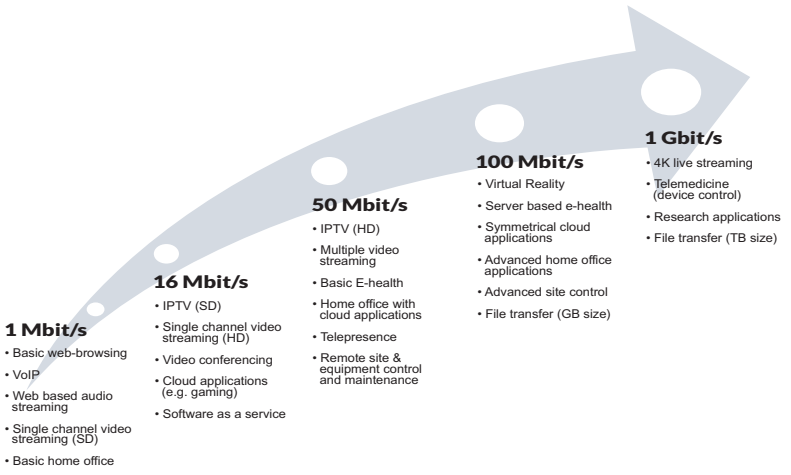
Fibre-optic technology is superior to any other cable-based alternatives

Optical fibre lines, consisting of cables of glass fibre, are currently used in most long-haul, high-speed communications systems. In terms of capacity for future broadband, fibre-optic technology is superior to existing copper as well as coaxial technologies because of its unique physical characteristics, allowing information to travel at speeds increasingly approaching the speed of light without interference between adjacent wavelengths. The interaction between glass and light allows low-loss transmission over a broad frequency range, which means the entire transmissible spectrum can be used. Thus, much more data can be encoded and sent with fibre-optics, and the effective bandwidths are always going to be larger. Current equipment based on Passive Optical Network (PON) technology is capable of speeds of more than two gigabits (2 billion bits) per second – 20 times faster than the best consumer broadband technology available in the world today. For example, a single optical fibre can carry over 3 million full-duplex voice calls or 90,000 TV channels, and a cable typically comprises many of these fibres.

Technology for expanding fibre-optic transmission capacity is already being developed

Optical fibre networks employ one of two basic architectures: point-to-point (P2P) systems, or point-to-multi-point (P2MP) systems, which are usually referred to as passive optical networks (PONs). P2P networks are usually Ethernet-based networks with download and upload speeds of 1 gbps. In experimental trials with advanced optical devices, transmission values of more than 69 terabits per second (tbps) over a single fibre-optic strand have been reached. Even more importantly, fibre-optic networks are highly upgradable should greater speeds be required in the future.

Growing need for broadband capacity



Source: Goldmedia

Once the basic fibre-optic infrastructure is in place, it can be rearranged, and the end-point electronics can be upgraded when necessary to deliver even higher capacity. Moreover, this can be done far more effectively than with existing wireless or copper-based systems. Offering an extremely high level of service, fibre-optics is the next-generation technology with capacity to meet the high bandwidth demands expected in the near future.

No credible alternatives to fibre-optic cable technology are in sight

Due to the combination of fibre and glass, fibre-optic technology has a transmission capacity far superior to any existing cable-based technology (copper, coaxial) as well as significant potential for future upgrades. However, could an existing or future wireless technology perhaps disrupt fibre-optic technology? Nothing suggests it could: existing wireless technology is no match; reported new technologies are still at the stage of fundamental research at best; and even if a technologically viable alternative emerges one day, it would probably take decades to make a dent in the incumbent technology of fibre-optics.

- **Purely mobile is not an option:** Wireless networks have become an essential part of modern communications. Nevertheless, wireless technology is not a potential competitor of fibre-optic technology, and it never will be.
- **Satellite broadband is no real alternative:** Satellite broadband is a high-speed bi-directional Internet connection made via communications satellites instead of a telephone landline or other terrestrial means, and received via a satellite dish on the rooftop. satellite broadband, like wireless broadband, is a complementary rather than an alternative infrastructure, even though in specific circumstances (e.g. very rural and remote/mountainous areas with limited number of users) it may be the only viable alternative.
- **Possible alternative technologies, if any, will take decades to mature:** Possible alternatives are only in the very early stages of development. If fundamental scientific discovery were to open the way to a new type of transmission technology, it would probably take decades to develop such technology to the point where it could be applied in the market.
- **Even if an alternative technology were ready for the market, substitution of fibre-optics would again take decades, if not longer:** It will probably take decades to move any new technology from the fundamental research stage to something that becomes practically relevant. But even if an alternative and practically applicable wireless transmission technology were available, it would still take many years and probably decades for such a technology to encroach upon the already existing (and expanding) fibre-optic networks in any meaningful measure.

These examples may serve to illustrate that it takes a long time for 'game changers' to overhaul an entire industry. To replace an existing technology in a market with high entrance barriers, such as telecommunications infrastructure, any disruptive technology will need to deliver a quantum leap in performance, a significant reduction in total cost of ownership, and an affordable migration path concept. As stated, it took 150 years just to move from fundamental research on fibre-optics to the beginning of the industry's transition. That transition has been ongoing for some 25 years now, and in Europe penetration is still less than 6%, largely because of the prohibitive cost involved in replacing the existing cable network down to the 'last mile'.

Considering that a deep fibre network is deemed essential for all future access technologies, Europe's catching-up strategy should be to extend fibre-optics deep into the network, thus providing many investment opportunities for institutional investors with a long-term investment horizon. Investing in communication infrastructure is attractive to institutional investors for several reasons:

- The asset class offers a stable investment with a long-term investment horizon
- The assets concerned have an attractive risk-return profile for institutional investors
- This advanced transmission technology enables more efficient energy use with higher performance and thus makes a substantial contribution to ESG targets and a carbon neutral world

Investments in fibre optics networks can be structured as core infrastructure investments similar to other core infrastructure asset classes based on long-term lease contracts with the network operator. This results in investments that can offer stable cash returns while limiting exposure to technological development by not investing in the network operator.

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