



Creating a brighter future

FTTH: Shaping the Future of a Content-based World

Content & Applications Committee

White Paper

FTTH: Shaping the Future of a Content-based World

Telecom operators, application and content providers have come a long way in building relationships with each other in recent years.

Yet the next major investment in Europe's broadband networks will demand even more: The future of Europe's broadband infrastructure depends on further collaboration between application and content providers and telecom operators and a deeper understanding of how they interplay to each other's benefit.

The last decade illustrates how a mixture of innovation in broadband communications and IT can rapidly reshape how society communicates, works and entertains. But we are on the brink of much greater change. Ongoing innovation in the fields of nano technology, biotechnology and computing promise to radically alter the way we use, design and distribute goods, health care, education, entertainment and communication services.

After all, few people building power stations in the early 20th century could have imagined the extent to which electricity networks would drive new industries for domestic appliances and revolutionize housework: Fortunately the creators of yesterday's power generators laid an infrastructure that could accommodate a century of growth.

Today's investors in broadband need to take a similar leap and create a sustainable, flexible infrastructure that can accommodate new, unexpected services and ways of doing business.

In this white paper we will look at how very high-speed FTTH access is needed for innovative and diverse services and create the potential for new businesses and mutually beneficial interaction between diverse sectors.

Back to the Future

Internet history reveals a strong correlation between how much bandwidth consumers have at their disposal and the development of content, service and device ecosystems. Whole new communication and business models have been made possible by increases in broadband access speeds.

Back in 1996, CEOs from major software companies, including Oracle, put forward the idea of network computing, which is the storing and running of applications on a server in a network. The idea was great, but dial-up Internet speeds were not. The concept of network computing was shelved.

Fast forward over a decade and the accessing and sharing of resources on servers in a network – or cloud computing -- is becoming a reality for users equipped with very high speed broadband.

Striking changes in communications usage have also taken place in the home. Over a decade ago, receiving a phone call when online usually resulted in a dropped connection.

Consumers today would balk at such levels of service. Instead their requirements are growing in line with the simultaneous use of several residential broadband applications. And there is every sign that consumers' demands will grow, with the next stage in delivering content and interactive video broadband services requiring more capacity than today's legacy networks can provide. If service providers are to avoid their customers cancelling their subscription and going to competition, then they will need to invest in infrastructure that can cope with huge capacity requirements from both fixed and wireless usage.

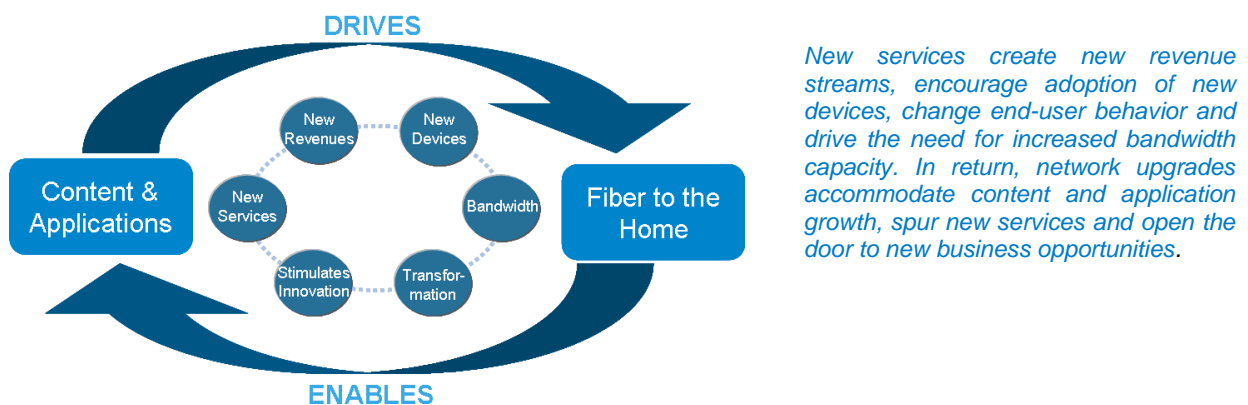


Figure 1. The evolution of services and bandwidth is closely connected

People have also benefited when on the move. Clever marketing and design helped put smartphones where they are today, and a mini mobile computer would be much less practical without the last decade's constant rise in wireless network speeds. But mobile operators cannot squeeze capacity from their networks, indefinitely: continuing growth in mobile data usage places constraints on wireless networks, which need to be alleviated by local fibre access networks. Not only does fibre provide backhaul from base stations, Wifi, 3G and 4G can be integrated with an FTTH installation to provide full wireless coverage throughout the home. In this way consumers can connect several wireless devices running HD or 3D video via Wifi to the FTTH network, allowing mobile operators to lift the strain on their mobile infrastructure and offer a sophisticated array of broadband services. FTTH takes residential users far beyond simple triple-play and opens the door to the concurrent use of multiple high-bandwidth applications.

New Investors in Infrastructure

Today most consumers' upload capacity is a small fraction of their download speeds. A large jump in two-way bandwidth capacity in the form of FTTH promises to unlock a raft of new applications that will benefit consumers, businesses and the suppliers of content, health and education services.

Practically unlimited capacity enables several members of the family to use high definition video applications simultaneously, whether they are watching TV, playing a 3D video game, making a low latency video call to

a friend, consulting with a doctor, or posting film clips to social networks. Residential fibre networks will also open up new uses of cloud computing and enable a more flexible and creative approach to work. Not only will home-workers be able to quickly access shared enterprise applications, high upload speeds will make it practical to send, store and share large files of video, music and photos in the cloud. Meanwhile, small businesses will be able to work collaboratively online with suppliers and customers around the world in ways that are today only possible for larger enterprises equipped with fibre access.

FTTH represents a genuinely new platform for creating a real change in broadband usage, which in turn can spur service innovation that leads to socio-economic benefits. This is the reason why municipalities and utility companies across Europe have been among the first investors in FTTH networks. Municipalities see FTTH as an opportunity to lower the cost of providing key services such as healthcare and education to their citizens, while improving their quality and reach. Municipalities also realize that FTTH attracts companies to set up in their region.

Utilities, meanwhile, see in FTTH an opportunity for additional revenue streams by complementary investment to prime business and become the unique wholesale broadband provider to residential dwellings. Not only are utilities used to making long-term infrastructure investments, they also have experience in providing open access to third parties. In addition, utilities already provide services such as water and electricity to apartment blocks and individual dwellings, making them well placed to negotiate access to buildings with landlords and building managers.

Meanwhile, FTTH benefits property owners, who will be able to improve the rental or sale value of dwellings that are hooked to future-proof fibre networks. They can also use FTTH networks to increase security, by installing the video-based surveillance of communal spaces, such as hallways, car parks and stairwells. Recent investments in FTTH come amid an increasingly competitive broadband environment. Europe's cable operators, for example, are busy equipping their networks with Docsis 3.0, which provides downstream speeds of between 100Mbps and 300 Mbps. Yet even cable and DSL network operators that are making upgrades to prolong the life of existing networks see fibre as the target solution. So it comes as little surprise that a number of European telcos are starting to up the ante on FTTH deployment. Deutsche Telekom, for example, announced in August 2011 the establishment of an FTTH unit, with a budget of €1.5 Billion, approximately 1500 employees and an objective of connecting 160,000 households by the end of 2011.

Investing in Innovation

Players with little or no experience of investing in infrastructure are also showing interest in developing FTTH delivery platforms. Content and application companies, big and small, are fully aware of the business potential of a two-way very high speed broadband network. In April 2011 Google announced it would build and trial an FTTH network that delivers speeds of up to 1Gbps and involve as many as 500,000 subscribers, starting in Kansas City, Kansas. In July 2011, the first users were already being connected. Like many telecom operators, Internet companies combine a powerful brand with a large user base. They and other forward-thinking companies that see their future in two-way high speed video usage could potentially pursue FTTH investments which disintermediate operators.

Equally they could choose to continue to play to their strengths and instead partner with network operators on delivering new services. Today's telecom operators combine a billing infrastructure with IT expertise, a large, national customer base and a reputation for safe-guarding end-consumer privacy, which make them well placed to work with health authorities, insurance providers, schools, universities and content and application companies alike.

Home Networking

FTTH allows operators to enrich their triple-play offerings today, while laying the foundations for the entertainment and home management network of the future. The ongoing moves to develop e-education, e-health and e-administration services, combined with the increasingly intelligent home devices creates new business opportunities for telecom operators, energy companies, electrical goods and device manufacturers, broadcasters, film distributors and content and application service providers. To date telcos such as Orange in France have collaborated fruitfully with content providers on video-on demand and television services, as digital downloads become an increasingly important channel for film distributors. The market for transactional movies grew by 38% year-on-year in 2010, with digital rental increasingly becoming consumers' favored way of consuming films, according to the film and broadcasting research company, Screen Digest. FTTH will serve to strengthen the relationships between the producers of video content and network operators and provide the bandwidth capacity to investigate new business models. Service providers, for example, will be able to offer 3D video-on-demand and television programming, or semi-immersive online gaming.

In addition, FTTH's large upload capacity opens up the potential to offer new low-latency, high-quality video services, alongside home management and surveillance services, as well as e-health and e-education.

Already a number of major Internet companies are busy providing video-conferencing platforms to consumers.

In June 2011 Facebook and Skype, announced a tie-up to provide a social-networking video application. The companies initially will make a low-quality video calling facility available from within Facebook, which will encourage video communication between Facebook users. The move follows Google's development of an online multi-user video-conferencing application, called 'Hangout', which is part of its social network Google+.

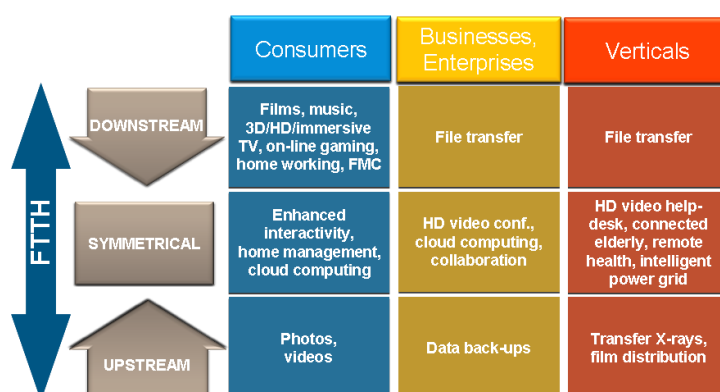


Figure 2. Technical Requirements for Next Gen Services

Bandwidth requirements for all segments of end-users are set to grow rapidly, in line with the availability and adoption of new services. Cloud based applications; video streaming, large file sharing etc. are pushing today's bandwidth boundaries both in upstream and downstream direction. Although available bandwidth is an important network requirement for next gen services - it is not the only one. In cloud computing, where information can be stored anywhere in the world, low latency is one of the critical requirements. Only fibre to the home fulfils these requirements and future-proofs operators against a cycle of network upgrades.

Google and Facebook will not be the last word in consumer video-conferencing, Telcos could look to make the most of their strong brands and reputation for high quality of service to offer high-quality video-conferencing over FTTH, either alone, or in conjunction with third parties. Further possibilities for new business ventures will open as screen prices fall to levels where they can be placed liberally around the home, enabling instant photo downloads to screens, or video-conferencing facilities in multiple rooms.

Telcos' direct relationships with a large client base make them attractive partners for content and application companies, as do telcos' existing billing platforms to charge for premium programming, games and applications. Secure fibre networks can also help protect content from piracy and telcos can make available their retail outlets, as well as their national customer support systems for both sales and resolving enquiries related to third-party services. In return, telcos gain access to premium, differentiated content and services, which allows them to win new customers and grow revenues.

Workplace revolution

Of course the transformational effects of broadband reach far beyond an individual's personal sphere. Today's broadband infrastructure already enables individuals to connect and do business with a global network of companies, from home or the office. The resulting flexibility in working practices benefits employers, employees and contractors alike.

Yet the next step change in how companies and workers collaborate will require FTTH.

Very high-speed fibre broadband, for example, lets companies and individuals use shared cloud computing resources to remotely access heavy-duty enterprise applications. This not only further facilitates home-working, it also opens new ways for knowledge workers around the world to interact with large companies

and each other. Cloud computing also creates cost-effective methods of sharing huge computational resources for research and development projects, regardless of where participants are based.

Many application, telecom and service companies have already developed cloud computing applications. However, it is still early days for cloud computing, leaving open opportunities for innovative cross-sector collaboration between software companies, systems integrators and others, in order to better serve customers.

In addition FTTH will give companies of all sizes the means to use secure, private, high quality video-conferencing facilities. As a result employees and contractors will be able to communicate with multiple parties in various locations around the world.

Again, no one company holds all the pieces that will create the new working environment of tomorrow. Telcos, however, have built strong reputations for providing enterprise-strength applications making them well-placed to collaborate on offering the next generation of secure remote enterprise services.

Transforming healthcare

Security and reliability will be key to another important role for FTTH, this time in the distribution of health services.

Governments' faced with ageing populations are looking for cost-effective ways to use IT and telecom networks to provide care and monitoring to the growing numbers of the chronically sick and elderly.

This shift means private companies, including telecom operators, software firms, health equipment suppliers and insurance companies, are working with health authorities to create e-health applications that greatly improve efficiency without dehumanising, or reducing the quality of patient care.

Low latency high quality video-conferencing, for example, allows patients to interact directly with care-givers, doctors and nurses, without having to undertake long journeys.

In Sweden, the nurse Gudrun care channel provides patients with online video consultations over their TV sets, thereby reducing out-patient visits and saving both patients' time and public money. As such e-health applications develop, FTTH will allow HD quality video-conferencing, regardless of whether others in the home are using online applications. A telepresence-like HD video connection not only maintains the caregiver-patient relationship, it offers key visual clues of a patient's state of health. Such services are of particular benefit when patients may be far from specialist care. But video services are also of use to patients who prefer to return home to recover from a medical intervention, yet still need to consult face to face with their doctor.

And as e-health services evolve, FTTH's almost unlimited capacity can allow for an increasingly sophisticated video exchange between a patient at home and multiple health service providers, in addition to an exchange of patient data.

In addition hospitals, which are already equipped with fibre networks, will be able quickly share huge files, such as scans with general practitioners equipped with FTTH, while discussing a patient's diagnosis via a

video-conference. E-health applications mean working adults suffering from chronic diseases such as diabetes, can conduct check-ups online, rather than taking precious time off work to wait for consultations in doctors' surgeries, or hospitals.

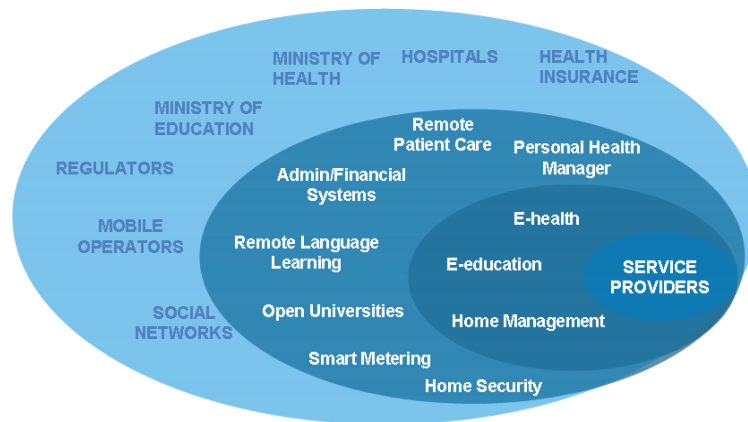


Figure 3. Collaboration between service providers and different stake holders will further drive richness of Next Gen Services

Although e-health is still an emerging service in most markets today, many agree about its benefits: cost efficient, enhanced quality of care, tailored to the individual, educational, extending the geographical boundaries... And this is just the beginning. In order to fully enjoy the benefits of e-health, more collaboration will be needed from different health care players to provide secure internet-based technologies and services that support remote patient care, medical records and decision support tools. Stakeholders will need also to work together to improve computer literacy of e-health consumers and enforce laws to protect the privacy and confidentiality of data. Once hospitals, insurance companies, health and education government institutions join in offering comprehensive e-health service, it will become clear why "eHealth is the single-most important revolution in healthcare since the advent of modern medicine, vaccines, or even public health measures like sanitation and clean water" (Silber, 2003).

Similar changes could be expected in e-education. One vision is that in the future students could follow individual classes from different Universities and lecturers all over the world. This type of educational system is tailored to fit personal and professional individual interests, but would require the involvement of government educational institutions to address questions such as education program recognition and diploma certification.

Other video-based health care applications include physical rehabilitation systems that run over high-speed broadband, which allow patients to practice movements while imaging sensors pick up any mistakes.

Telecom operators equipped with both FTTH and a trusted consumer brand are well placed to partner with health service providers and insurance companies to deliver health services.

Video exchange brings health benefits that are less direct, but important nonetheless: Elderly tech-savvy baby-boomers will be able to use HD or even 3D video conferencing and other communication tools that enable a real time experience when keeping in touch with each other and their families. The independence that a very high speed broadband infrastructure offers means elderly people could stay longer in their own homes, particularly when the benefits of video social networking are bolstered by personal, professional health care.

Home Study

FTTH will power other positive social changes, which in turn will spur new business opportunities. Very high-speed networks, for example, have a clear role to play in providing interactive e-education.

Bill Gates forecast that *“five years from now on the web for free you’ll be able to find the best lectures in the world,”* when speaking at the 2010 Techonomy conference. *“It will be better than any single university.”*

But it won’t stop there. E-education can take several forms. Students may simply cherry-pick the best online lectures from top university teachers around the world. Equally, parents may opt for distance-learning when seeking to home-tutor secondary school students.

High-quality interactive video transmission could open new possibilities for teaching the practical elements of science. Or e-education could provide the means to access over-subscribed workshops, lectures and visits run by leading arts schools, or museums. In the meantime, entrepreneurs are already busy setting up companies that combine elements from the fields of education, entertainment and gaming in order to create new forms of engaged, interactive learning. None of this can be done by one company alone. Instead, educational services create fertile ground for several actors to come together to deliver their expertise across very high speed FTTH networks.

Collaborating for the Future

As Google’s FTTH investment in Kansas illustrates, in order to fully understand the potential of FTTH, it is necessary to consider what happens once more than 20% of a sizeable population has access to two-way, very-high speed broadband access. Yet revenue pay-offs can come long before network expansion is complete. At the end of 2010 Verizon in the US reported ARPUs increase for its FTTH FIOS service, up 4% from the previous year. The operational benefits of fibre network and richness of services that creates additional revenues resulted in an overall annual rise in FIOS revenues of 26.8% and Verizon confirmed it plans to continue expansion of its FIOS network through 2011¹.

In Europe, larger-scale deployments of FTTH by private operators are only now getting underway.

However, municipalities in Sweden, the Netherlands and France have built FTTH networks, which already offer a glimpse of what can be done once enough subscribers exist to encourage innovation by content and application companies.

The town of Nuenen in the Netherlands, for example, is home to one of the world’s highest FTTH densities and has linked its elderly population over high-speed networks to create a video-based platform of community exchange. The social benefits to Nuenen’s elderly of reducing solitude by fostering exchange are

¹ Verizon’s Q4 2010 quarterly earnings

http://www22.verizon.com/idc/groups/public/documents/adacct/2010_4th_pre_earnings.pdf

immeasurable. The platform also gives an inkling of how social video networks could develop once two-way bandwidth is almost unlimited.

Widespread FTTH networks not only offer a wealth of new service opportunities, they also promise to reduce operators' maintenance and operation expenditure. Nevertheless some of Europe's telcos today are approaching FTTH investment cautiously. Although telecom operators recognize fibre to the home as the network of the future, some still question the extent to which they will benefit directly from their investment in tomorrow's very-high speed broadband networks.

Despite concerns over how actors will share both the cost of infrastructure and the benefit of new revenue flows, it remains in everyone's interest that FTTH networks are built. Telcos will be able to offer new, differentiated products and reduce the congestion on their networks that the growing consumer demand for HD video streaming and fixed-mobile convergence brings. Content, Internet and application companies will be able to create truly interactive products and services. And not building FTTH networks puts today's owners of copper networks at risk of falling behind competing mobile and cable network operators.

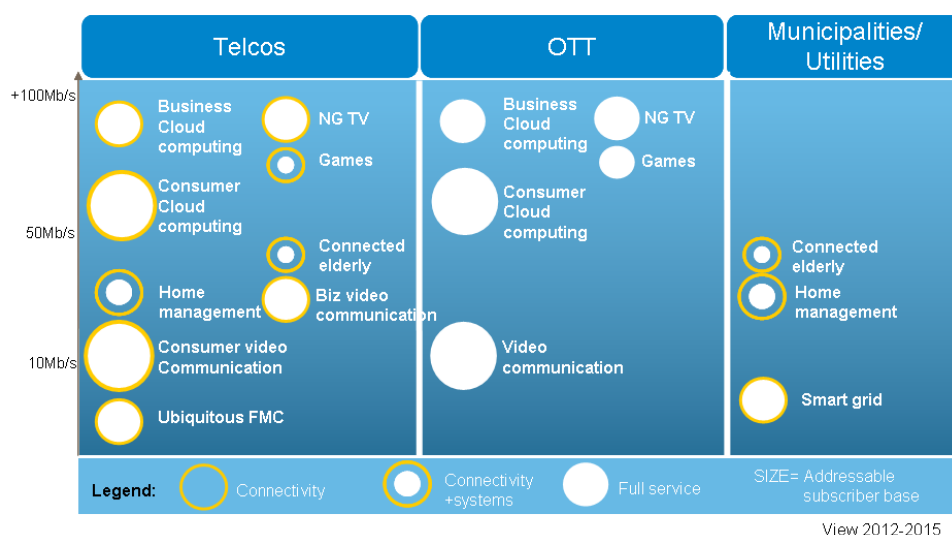


Figure 4. Next Generation Services Value Proposition

A new generation of content and applications opens opportunities for all players to engage on different levels in defining the best business model. The value proposition of different services is based on their market potential, revenue opportunity and end-user requirements such as security, privacy, reliance, cost vs. quality preference etc.

Despite concerns over how actors will share both the cost of infrastructure and new revenue flows, it remains in everyone's interest that FTTH networks are built. Telcos will be able to play on their strong customer relationships and branding to remain prime provider of new, differentiating products and at the same time reduce the operating costs. Content, Internet and application companies will see the opportunity for raising revenues and developing new services. Utilities will be able to get additional revenue streams from investments that complement their prime business. And not building FTTH networks puts today's' owners of copper networks at risk of falling behind competing mobile and cable network operators.

However, if telcos are to invest alongside utility companies and municipalities in building the content and application delivery infrastructure of tomorrow, then all potential actors need to collaborate on building a vibrant, mutually beneficial business model today.

It is Time for Change

Consumers and businesses the world over have been quick to view any new broadband capacity as an essential part of their social and economic fabric. Cloud based services and the internet of things – i.e. the communication between billions of sensors, which enable new and exciting applications – will accelerate broadband adoption. But the broadband adoption is not only fast and massive – it is also addictive: 84% of Germans in their 20s would rather give up their car or partner than their broadband connection ⁽¹⁾; 41% of UK internet users would rather keep Internet connection than TV ⁽²⁾. And consumers are not about to become less dependent on broadband. The social network revolution has re-shaped consumer broadband behavior; today's emerging generation of broadband users manage and conduct their social life around online connections. The next big changes will be in the online distribution of health, education and energy services, as well as the development of smart cities.

Today's increasing richness of new applications and its value for our way of living, puts the power to shape future broadband usage in the hands of consumers, rather than telecom operators. Today's networks need to be ready for rapid change. And operators and other stakeholders need to prepare for a future that is not just about providing telecom services, but building an engine for socio-economic development.

⁽¹⁾Bitkom 2011 - http://www.ehow.com/facts_5201693_types-broadband-access.html

⁽²⁾ <http://moneyfacts.co.uk/news/broadband/internet-users-willing-to-sacrifice-tv/>