

Overview of Triple Play Implementations over FTTx Networks

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Abstract — This paper presents an up-to-date overview of worldwide implementations of fiber-to-the-something (FTTx) networks and their potentials in offering triple play services. Analyses show that there will be over 75 million FTTH connections and over 50 million IPTV subscribers by 2012.

Key words — FTTH, FTTx, IPTV, Triple Play, VoD

I. INTRODUCTION

TELECOMMUNICATION carriers around the world are realizing that their access copper infrastructure is becoming unsuitable for the ever increasing bandwidth hunger of residential and business customers. The telecommunications landscape has evolved to a scene where network convergence and revolution of service integration have a major role. Peer-to-peer file sharing, e-mail, remote collaboration, Voice over IP (VoIP), teleconferencing etc. create inherently symmetric traffic streams in contrast to the highly asymmetric client-server type applications like video streaming or Web browsing. These demands can be fulfilled with deeper penetration of optical fiber in access networks and increasing deployment of fiber-to-the-home (FTTH) networks. As a result, FTTH is the fastest growing global broadband technology, with significant deployments in Asia, Europe, and North America.

Integrated voice, video and data services, known as triple play, are expected to grow in fast pace. Service providers are aiming to offer triple play and, adding the mobility, quad play services. Number of companies had success with offering triple play over xDSL (Digital Subscriber Line) networks, but with increased popularity of High Definition Television (HDTV) and high speed Internet above 20 Mbps, xDSL networks cannot keep up. To stay in the “triple play battle” Fiber-to-the-Something (FTTx) is becoming a must do investment.

In this paper, we present an overview of the most tremendous and successful FTTx networks worldwide in Section II. Section III briefly describes triple play services, followed by Section IV, which gives an overview of examples of triple play over FTTx networks. We conclude the paper in Section V.

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II. FTTH IMPLEMENTATIONS AROUND THE WORLD

FTTH is making a great progress and finally becoming commercially feasible. It offers virtually unlimited bandwidth, both upstream and downstream, which will enable interactive multimedia and video information to come into households, schools, businesses in all the needed ways. FTTH is considered the most future-proof of access network architecture and is believed to be the “final frontier” of access network transformation. More and more incumbents worldwide are announcing ambitious plans to “fiber-up” their legacy access networks and bring fiber closer to the user. The results are broadband speed and bandwidth beyond those possible with xDSL, and with that, any imaginable media-rich, interactive service and application, from remote surgery and team gaming to movies on demand.

Bigger demands for bandwidth, intensive converged applications and price decreasing of FTTH equipment have made the business case for FTTH networks stronger than ever. To local governments, FTTH creates digital communities that redound to economical growth and attract additional investments. The telecommunication carriers are facing the crossroads and within the next 12 to 18 months, numerous FTTH announcements are expected from various incumbent telecommunication companies around the globe.

FTTH in Asia has come in sight as a serious broadband platform. There are few major impacts that are conducting FTTH research, development and deployment in Asia: increased bandwidth demands with increase rate of 200% per year, reduced cost of optical-electronic components as result of technology enhancement, competition as driving force for application of any new technology, huge market of FTTx systems, equipment, devices, accessories etc. Researches suggest that FTTH subscribers in Asia will grow from 4.6 million in 2005 to more than 40 million by 2010, accounting for as much as 25% of all Asian broadband subscribers in 2010.

Hong Kong, South Korea and Japan are the world leaders in the percentage of homes that receive broadband communications services over direct fiber optic connections, according to a new global ranking of FTTH market penetration issued jointly by the FTTH Councils of Asia-Pacific, Europe and North America.

In Japan and South Korea, simple demand for Internet connections with higher speed has been the most important driver for deployment of FTTx architectures and has been more important in endorsement for moving to fiber than new video services. These countries are the leaders in terms of deployment. In 2006 there were around

7.5 million FTTH subscribers in Japan, making it the largest number of FTTH subscribers in the world.

An analysis provided by Nippon Telegraph and Telephone (NTT), the biggest provider of FTTH, stated that 89% of the users are looking to move to fiber cited "higher bandwidth" as the main reason for the shift. The investment for NTT's FTTH network to about half Japanese population, covering 30 millions houses and office buildings by 2010, is estimated to 36 billion €. NTT had 6.78 million FTTH users at the end of June 2007. It is aiming to boost those numbers to 9.476 million by the end of March 2008. Japan triggered 80% of the FTTH growth round the world last year. As a result of migration of subscribers to FTTH in record numbers the net additions of DSL customers in Japan went negative since mid 2006.

KDDI launched FTTH broadband early in 2005 in Tokyo, providing Internet, phone and video distribution. KDDI's Hikari-one FTTH service gathered 635,000 subscribers in the second part of 2007, targeting 900,000 customers till March 2008 [1].

KT, with 34% of the access network realized with FTTx is one of the world leaders in FTTx deployments. The goal is 90% FTTx coverage until 2010 and finally 100% FTTH in 2015-nationalwide coverage.

China has seen a rapid growth in broadband access. With the increasing requirements for bandwidth by new applications, FTTH has been drawing attention of both research and industry. In China, FTTH is regarded as attractive technology since 2003. China Telecom and China Netcom are the most active FTTH promoters. FTTH is set as priority in 2008 in China as part of the next goal: 20 million subscribers at end of 2010.

By 2010, 65% FTTH penetration is planned in Korea, resulting in 10 millions FTTH subscribers.

Taiwan, with ChungHwa Telecom as a market leader, predicts 4 millions FTTH subscribers at the end of 2010.

The FTTH situation in Europe is on a different level. For many European countries, the determination point for copper replacement with fiber has not occurred yet. Regarding the more densely clustered population, European networks feature shorter loop lengths between central offices and subscribers, which enable relatively higher data rates for xDSL. Additionally, without a real consumer demand for high definition video, there is no much inspiration to build out more than a DSL network.

The initial FTTH implementation in Europe was mainly carried out by municipalities and utility companies. Now, large incumbent operators are starting to announce their plans for FTTH deployments and are taking actions towards large FTTH penetration.

The current penetration of FTTH connections in Europe is about 0.4%. In Western Europe, FTTH holds 1.4% of more than 79 million broadband subscribers. Leading demand indicators for FTTH in Europe have seen significant improvement over the past 12 months. In general, there has been rapid growth in the ownership of equipment and use of services that drive demand for bandwidth. Among other things, Europe is seeing a boom in purchase of HD-ready television sets and displays, higher-specification personal computers, digital cameras, MP3 players, and use of associated Internet sites such as photo and video download and blogging sites. At the same

time, there has been a rapid transition to higher speed DSL services, paving the way to the next upgrade, including FTTH. At the end of 2006, the European Union's 27 member states, plus Switzerland, Norway, and Iceland, had about 820,000 FTTH connections, 83% of them in three countries: Italy, Denmark and Sweden. In 2007, more than 200 significant deployments of fiber cabling are occurring in Europe.

FTTH in Europe is planned to reach about 16.6 million homes by the end of 2011, representing about 8.2% of all homes in Europe (Figure 1).

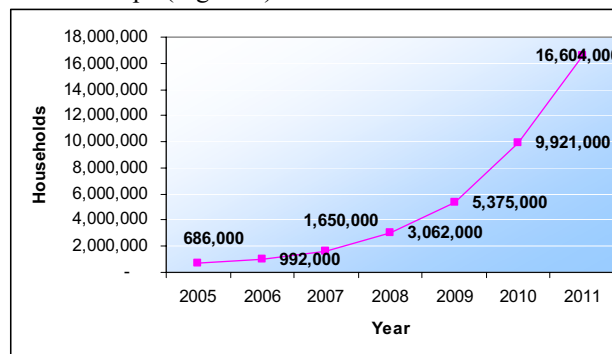


Figure 1. Households in Europe covered with FTTH

On the plus side, a whole range of new initiatives was either begun or announced in 2006. Construction of important municipal networks started in Amsterdam and Paris; Free announced ambitious plans to convert to FTTH in France; France Telecom's (FT) commercial FTTH trial was initiated; and Danish utility companies began connecting households throughout Denmark. A common characteristic for most of the European incumbents, except for FT, is that the change to fiber is not expected. Most envisage deployment of deep fiber and VDSL2, but none has set a timetable for FTTH.

The Orange FTTH service started in March 2007 in Paris and several neighbouring regions, with plans to be extended to a dozen of large and medium-sized cities. CAPEX for the program over the next two years is estimated at EUR 270 million €.

In Netherlands, there are over 40 local FTTH initiatives, connecting 111,500 homes or 2% of the households in the country. For the end of 2009, more than 580,000 homes or 10.4% are planned to be connected with FTTH [2].

Stokab, founded by the City of Stockholm, is among the first FTTH implementations in Europe and serves like a roll model to other Scandinavian municipalities. Its 1.2 million km fiber network contributed to economical growth and broadband services in the country.

Compared with Japan, where FTTH is primarily used to provide high-speed data service, United States (US) FTTH is targeted as a vehicle to provide triple play service delivery. Although there were plans for fiber deployment to over 12 million homes by middle of 2006, only 4 million FTTH homes were covered, of which, a mere 670,000 had become subscribers. The years of unrealised fiber projects have left the US trailing far behind Asia in the deployment of FTTH infrastructure in terms of both geographic penetration and bandwidth. Recent changes in US regulation, in the demand for high-speed broadband and for new entertainment media such as Internet Protocol

Television (IPTV) and in falling costs for FTTH deployment have improved the prospects for US FTTH.

In the US, after years of delayed projects, the telecommunication companies are finally deploying FTTH networks. Rapid growth of FTTH deployments started in mid 2006 when more than 230,000 homes are connected on monthly bases. At the beginning of 2007, approximately more than 1,000 communities were connected to fiber with yearly increase of around 100%, mostly as a result of Verizon's FTTH actions. All these actions led to a number of 7,919,000 homes connected in North America till March 2007. The number of FTTH subscribers, at the same period is 1,335,600 users or 1.2% of the US households. AT&T's deployment continues to be plagued by delays but is expected to pick up pace in late 2007 [3], [4]. The percentage of FTTH subscribers of all broadband subscribers in US is expected to grow from 7% in 2005 to 23% by 2011 [5]. According to FTTH Council Asia Pacific, there are around 1.2 million FTTH subscribers connected in US. Verizon is expected to add one million FTTH subscribers in 2007, AT&T will use a combination of FTTN for overbuilds and FTTP for new builds, while BellSouth is building-out an FTTC network. Bell Canada is deploying a Fiber to the Node (FTTN) network and supplementing it with VDSL and ADSL2+. Over the next 10 years, the US could catch up with Asia in FTTH deployments.

III. TRIPLE PLAY

To meet the evolving demands of today's media consumers, service providers must transform from traditional providers of access-based services to all-inclusive "experience providers". That means being able to offer voice+video+data, referred to as triple play, or even "quad play" when mobility is added. For conventional wire-line carriers embarking on this journey, IPTV is one of the most important aspects of this transformation.

IPTV enables the delivery of television and video content services to TV sets using digital streaming media through an IP network. Together with video-on-demand (VoD) service it is seen as a future of home entertainment applications and one of the cornerstones of Triple Play.

IPTV is a digital video solution that can be ideally performed over FTTx networks. IP multicast efficiently broadcasts a stream of digital video or audio to multiple subscribers. Pay-per-view (PPV) also travels the FTTx network as a multicast stream, securely delivering special programming to subscribers who have requested and paid for the program. VoD is a unicast video service that can be sent via the network to individual requesting subscribers. As the world upgrades its televisions, the network can also support multiple HDTV channels. For medium to long term, according to ITU-T recommendations, typical bandwidth requirements for support of residential triple-play services will be: 40 Mbps for 2 HDTV channels, 20 Mbps for one VoD channel, 16 Mbps for four videophone channels, 20 Mbps for high-speed Internet and 2 Mbps for high-quality voice service, resulting in a total bandwidth of approximately 100 Mbps. These recommendations lead to an evident conclusion: in the long run, building and

extending the fiber optics infrastructure to the end user homes is an indispensable option.

Video services, as the missing part of telcos triple-play consumer plans, are a key reason for the growing interest in FTTH. IP video probably offers telcos the best long-term solution for video and a source of potential competitive advantages against cable operators.

IV. WORLDWIDE EXPERIENCES OF TRIPLE PLAY IMPLEMENTATION OVER FTTx

The constant technology innovation brings natural selection in the telecommunications industry by replacing old services with new, more attractive offers. Due to the widespread implementation of new services and general loss of fixed telephone subscribers, incumbent telephone companies have to find new revenue sources outside of residential voice service. Here IPTV takes a great role. Predictions are, as shown in Figure 2, that by 2010, there will be 50.7 million IPTV subscribers in the world, compared with less than 10 million in 2006.

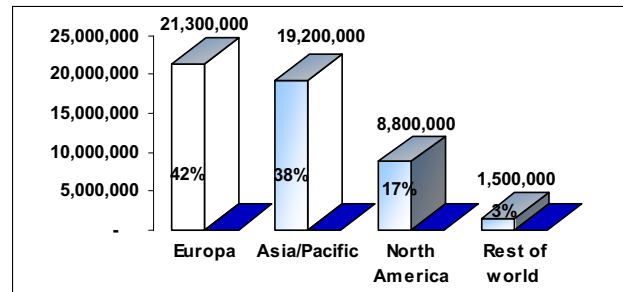


Figure 2. Predictions for IPTV subscribers in 2010

France Telecom (FT) had approximately 6.6 million DSL subscribers at the end of June 2006, 46% market share. After successful pilot testing of FTTH in Hauts-de-Seine, FT started FTTH deployments with final goal of having 180,000 connected customers by the end of 2008, or 20% of the of a potential subscribers base of 1 million. Currently, FT has 100,000 km of fiber installed and 11,500 households connected. The plans are to extend its IPTV service through the FTTH network, regarding the fact that FT IPTV subscribers have used up the whole bandwidth of the existing DSL network. At mid 2007 FT had incremental 872,000 IPTV subscribers. The FTTH service under the Orange brand was launched in March 2007 and the total investment is estimated around 270 million € [6].

The biggest current rival of FT, Neuf Cegatel has more than 3 million subscribers (nearly 23% market share) and to keep the market race also has FTTx fiber-optic based strategy. The FTTx deployment started at the end of 2006 and aims 1 million homes passed and more than 250,000 customers by end of 2009. The planed CAPEX in period for 2007 to 2009 is evaluated to 300 million €, giving 1,200 € investment per customer. It has launched its FTTx triple play service in April 2007 with maximum upstream and downstream speed of 50 Mbps.

Iliad, which is on third place of broadband penetration in France, also made the final broadband step – FTTH implementation. The plans of the Iliad Group's Free division for a prevalent rollout of FTTH in Paris began in September 2006 and lead to ambition to offer FTTH

services across France. Iliad envisions that building its own network will result in true independence from the incumbent operator (FT), and plans to offer the network on a wholesale basis to other operators. The project goal is to connect 2.1 million people in the first 2 years and 4 million till 2012, with an estimated investment of 1 billion € till 2012. Draka Comteq was selected to supply the two million km FTTH network. The triple play service through the FTTH network was planned to start in mid September 2007 offering a 100 Mbps downstream and 50 Mbps upstream broadband services, with TV services and free fixed voice calls within France, for the same price as DSL triple play service [7].

Deutsche Telecom (DT) offers its triple play service through VDSL and ADSL2+, claiming that 40-50 Mbps are quite enough for the customer. DT has committed to invest 3 billion € in 50 largest cities in Germany for FTTN network and bringing the DSLAMs closer to the customers. The network should connect 2.9 million households till 2007. HDTV IPTV service is planned in near future on top of the other services like online gaming, online bulletin board, IP telephony, free fixed line voice calls across Germany and high speed DSL access. Set target is 1.5 million IPTV subscribers at the end of 2010 [10]. A number of European national operators, such as KPN, Eircom, Swisscom, are following the DT example of FTTN+VDSL2 deployments. KPN is installing FTTH only in greenfield areas.

Sierre Energie, a Swiss cable operator, offers IPTV service to 30,000 customers through FTTH network called Vario. The IPTV service, including VoD, network-based Personal Video Recording (nPVR), time shifting, play and pause has been launched in February 2007 with plans of HDTV service in summer 2007 as part of Sierre Energie development roadmap.

FastWeb (Italy), often referred to as triple play pioneer, using a combination of FTTH and DSL to reach to the customers, holds the third place in Europe IPTV scale, right behind Telefonica Imagenio and FT's MaLigne TV.

In Japan, KDDI does not disclose the number of its IPTV subscribers, but it is assumed that 15% of the total FTTH subscribers or 90,000 are using KDDI's IPTV service [8]. NTT uses its strong FTTH network for offering nationwide IPTV service, called On Demand TV. KT uses its wide deployed FTTH network for services like IPTV, VoD, EPG, N-PVR, Internet access etc.

Corbina Telecom (Russia) is constructing FTTH network that in this moment is connecting 2.6 million homes in six cities, among which Moscow and St. Petersburg. Plans for the future are IPTV and VoIP deployment as triple play bundled services for an increase of the current 190,000 broadband internet subscribers.

Norwegian telco Telenor will start initial deployments of FTTH and FTTN network at the end of 2007 in order to transform the access network for advanced services like IPTV with HD content, VoD and high internet access.

Verizon (US) is one of the first telecommunication companies in the world that started offering IPTV service over FTTH. FiOS TV, the Verizon's IPTV service, was introduced in September 2005 and now is available to 2.4 million homes in 200 cities, and enjoys popularity among 687,000 subscribers. In order to provide better picture

quality, larger number of HD channels and to keep ahead from cable competitors, Verizon is aiming to pass with fiber 18 million household in US by the end of 2010 with estimated investment of 16.6 billion € [9].

Optical Entertainment Network (OEN), provider of IPTV and IP broadband services, started realizing the plans for FTTH deployment to 1.6 million households in Houston, Texas. The FTTH network is used as basis for successful deployment of integrated services: IPTV with more than 50 HD channels, 10 Mbps Internet, Voice, VoD, subscription VoD, PPV, home security, videoconferencing and telemedicine. OEN's FTTH network is known as one of the few all HD networks today. OEN's triple play service known as FISION is commercially available since February 2007 to residential and business customers and multiple dwelling units.

AT&T deploys FTTN for serving its broadband customers. For the end of 2008, 19 million customers are intended to be reached with only one million that will be connected via FTTH network. AT&T estimates that its FTTN network will also support HDTV service [10].

As a summary of this Section, Figure 3 presents the percentage of broadband services offered over FTTH networks in 11 countries at middle of 2007.

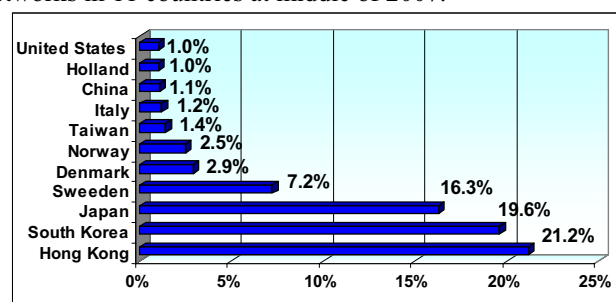


Figure 3. Percentage of broadband services over FTTH

V. CONCLUSION

In this paper, we have presented different trends, experiences and predictions in different regions worldwide regarding the implementations of FTTH/FTTH networks and triple play services.

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