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6. Next Generation Access Networks: A Step Change in Speed

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Abstract*—Next generation access (NGA) networks, a fibre-based high-speed broadband infrastructure, are a general purpose technology with the potential to trigger productivity gains on a massive scale. These gains might take years to accrue, because new applications and new organisational and production designs that use NGA networks need time to be developed. They describes a significant upgrade to the Broadband available by making a step change in speed and quality of the service. This is typically thought of as asymmetrical with a download speed of 24 Mbit/s plus and a fast upload speed. Super-fast broadband is generally taken to mean broadband products that provide a maximum download speed that is greater than 24 Mbit/s. This threshold is commonly considered to be the maximum speed that can be supported on current generation (copper-based) networks.*

1. INTRODUCTION

NGAs or Next Generation Access Networks are access networks which have been substantially upgraded either wholly or in part, using existing local access infrastructures and technologies and/or using new optical fibre infrastructures, and which are capable of delivering broadband access services with bandwidths significantly above those currently widely available.

The use of open access networks is becoming increasingly popular in some situations to maximise the benefits from such investment and to comply with regulatory

requirements for competitive access and equivalence of access.

NGA networks can be deployed by using a number of different technologies and network architectures which will determine the maximum data speed which they will obtain. NGA network architectures currently being deployed include:

- Fibre to the cabinet (FTTC) using Digital Subscriber Loop (DSL) technologies on copper end user connections or wireless broadband technologies.
- Fibre to the home/premises using point to point fibre.
- Fibre to the home/premises using passive optic networks (PON).

A FTTC network retains some copper connectivity by providing fibre to street cabinets housing DSL electronics in order to access short end user copper connections. FTTC networks have financial merits but also have operational limitations on capabilities for delivering very high bandwidth services.

All-fibre networks offer a single infrastructure platform which has the capability of delivering very high bandwidth services. Extensive fibre networks are, however, more expensive and present a higher level of risk to the investing operator. This however significantly changes the structure of the access network and affects the services which can be provided at a wholesale level.

2. EVOLUTION

Next Generation Access (NGA) increases the bandwidth of telecoms access networks to match the capabilities of the NGN core and distribution layers using fibre or wireless technologies. This paper explores the motivation for NGA, the key technologies, and the positions adopted by government, regulators and operators.

BT and other UK operators have embarked on a major infrastructure change within the distribution and core of their networks. This programme is called 21CN (for 21st Century Network) by BT Group. It focuses on improved efficiency, flexibility and reduced operating cost in the network through a shift to a common packet-switched core, removing legacy platforms such as the circuit-switched PSTN in the process. Changes to the IT systems within the network (the Operational Support Systems (OSS) and Business Support Systems (BSS)) are also part of the transformation. By 2011, BT Group expects to have completed the migration to this NGN core and distribution network.

However for primarily economic reasons, the access network in being left largely unchanged by NGN. Households and businesses will continue to connect to their service provider over a copper pair, albeit broadband enabled through one of the xDSL technologies; this approach enables the sort of broadband Internet service we achieve today, with peak rates of up to 8 Mbit/s downstream (for subscribers lucky enough to be close to their local exchange).

NGN deals with this legacy access network and supporting the legacy services by deploying a Multiservice Access Node (MSAN), typically a Copper MSAN (CMSAN) in the local exchange building, which can support all of the legacy services through an interworking function.

3. APPLICATION IN VARIOUS FIELDS

While current ADSL deployments can achieve 2 Mbit/s to most subscribers over existing copper pairs, and 8 Mbit/s to those within a short distance of the local exchange, next generation applications such as High Definition Television (HDTV) require around 24 Mbit/s to each household. Other applications include peer-to-peer file sharing to support high quality pictures and video; although some of this is questionable sharing of copyright material, already legitimate application such as the BBC iPlayer are popular, and adversely affecting the

performance of existing broadband connections.

In much the same way that enabling of small businesses was a significant driver for ADSL deployment (from the regulator's perspective) several years ago, so enabling higher data rates cost-effectively for smaller businesses is an argument for NGA also; large corporate customers typically already have fibre connections to the Internet if required. A more widespread uptake of teleworking, and the ability to outsource IT functions more effectively are also arguments for NGA in the small business sector.

The use of NGA by central and local government, and for government services such as healthcare, is also proposed as a benefit, as is wider access to effective e-learning.

Whether these cases are strong or not is unclear at the moment; similar arguments were made for ATM deployment more than a decade ago, without ever achieving a sustainable business case for the investment necessary.

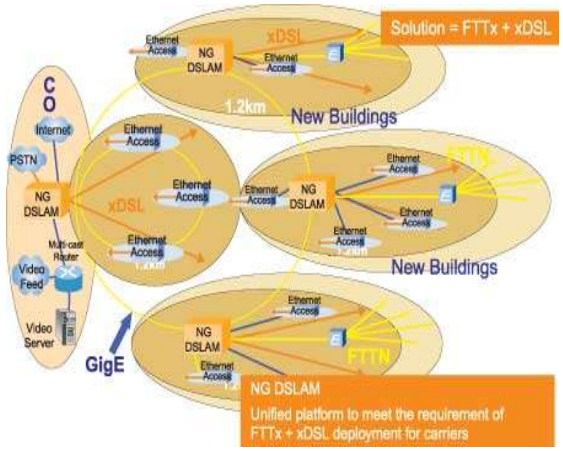

Figure 1. Caption Required

4. DEPLOYMENT

The investment necessary to replace the existing access network with NGA would be immense. A long-standing rule of thumb says about 80% of the capital cost of the overall telecoms network is in the access part. Ofcom in the UK conducted a policy review of NGA in 2007 and concluded that any move to NGA should be market led, and that there was insufficient evidence of demand to justify any other approach.

Telecoms operators have tended to deploy NGA when new access networks are being built, since the cost for a building on a greenfield site is similar to building using conventional copper plant. The migration of existing copper to a Fibre To The Curb (FTTC) network has large incremental cost, and has not been undertaken in the UK, although some other countries have started such deployments in large metropolitan areas.

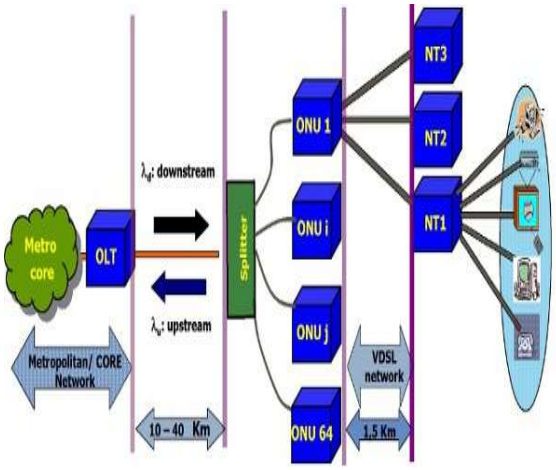

Figure 2. Caption Required

Although no country is deploying NGA on a national basis, many operators in various countries have embarked on a limited deployment, often for trialling purposes:

- BT is deploying NGA technology in a new development of around 10,000 homes at Ebbsfleet, Kent.
- Virgin Media (the consolidated UK Cable operator) deployed a trial of NGA in Kent during 2007.
- An operator in Paris has deployed NGA by using the sewers within the city to lay cabling.
- Verizon offer Fibre-to-the-Home (FTTH) in several cities.
- The most established NGA region is Asia, with a large percentage of broadband connections into homes using fibre in Japan and South Korea.

There are signs that FTTH is gaining momentum in certain well-developed metropolitan areas; Sweden is the most developed FTTH market in Europe, with around 650,000 of the total 1.3 million FTTH-connected households, according to data from mid-2007. Around 500,000 households are connected in Italy, but other countries remain at below 100,000 connected.

After a shaky start around 2000 - 2001, the regulation of broadband Internet access within the UK is broadly seen as a success. The combination of wholesale price intervention and the formation of Openr each to operate the BT access network in 2005 - 2006 led to a rapid acceleration of broadband uptake by consumers and of Local Loop Unbundling (LLU) by operators.

To enable and encourage NGA investment by competing operators, Ofcom carried out a consultation in 2007, and considered two options:

Passive competition would require operators to open up elements of their access network closer to the customer to competition, rather like the LLU approach popular at present; this would effectively allow operators to build their own backhaul network out to a cabinet close to the customer, and take over the BT copper pair for the final connection to customers.

Active competition would be rather like the bitstream services (such as IPstream) traditionally used before LLU became widely adopted in the UK; in this model the physical infrastructure remains under the control of the owning (incumbent) operator, and a wholesale product which replicates BT's own product is made available to other downstream operators.

Both approaches have essentially the same pros and cons considered when LLU was being introduced some years ago, and the way forward remains unresolved at the time of writing, although further consultation by Ofcom and the EU is expected during 2008:

Passive competition requires competing operators to share a physical equipment site, with the difficulties of control, access and space this causes; the situation will typically be much worse in the smaller-capacity cabinets likely to see deployment of NGA equipment.

Active competition limits the competitive offerings by other operators to being essentially replicas of BT's service, since the underlying infrastructure is just a wholesale version of BT's retail product.

5. CASE STUDY

Italian telecom operators have signed a deal to build up a high-speed broadband network. The agreement will pave the way for a final deal for the deployment of a countrywide fibre-optic infrastructure. The operators, which have signed agreements on the technical model for the transition from the current copper network to fibre, will plan a combined private and public partnership to launch the high-speed network. Earlier in 2010, Italy's alternative operators, Fastweb, Wind and Vodafone, had planned to jointly invest €2.5 billion over a five-year period to develop fibre in Italy's 15 largest cities. Telecom Italia will not join any group and will separately offer 100 megabits per second broadband to 50% of the Italian population by 2018 and will put €9 billion in its network infrastructure by 2012.

Figure 3. SaaS: Software as a Service: a service that provides software via a network

The Italian competitive telco trio's-FastWeb, Wind and Vodafone Italy-decision to abandon their open access Fiber to the Home proposal with Italy's Next Generation Network

(NGN) At issue are two open access FTTH proposals. In May, FastWeb, Wind and Vodafone Italy developed a $3.2 billion FTTH plan that would reach 15 of Italy's largest cities over the next five years. Telecom Italia simultaneously put forth its own $8.93 billion last mile proposal to bring 100 Mbps FTTH access to 50 percent of Italy's residents and businesses by 2018.

6. CONCLUSION

NGA networks provide the platform for delivery of end user services that have become to be termed superfast broadband. These services are essential to the delivery of sophisticated applications and content associated with high performance ICT services. Access to NGA network infrastructure and high performance ICT services is now becoming an essential requirement for enabling economic, commercial and social development.

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