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Gigabit Networks

The future of G.fast & XG-FAST Services

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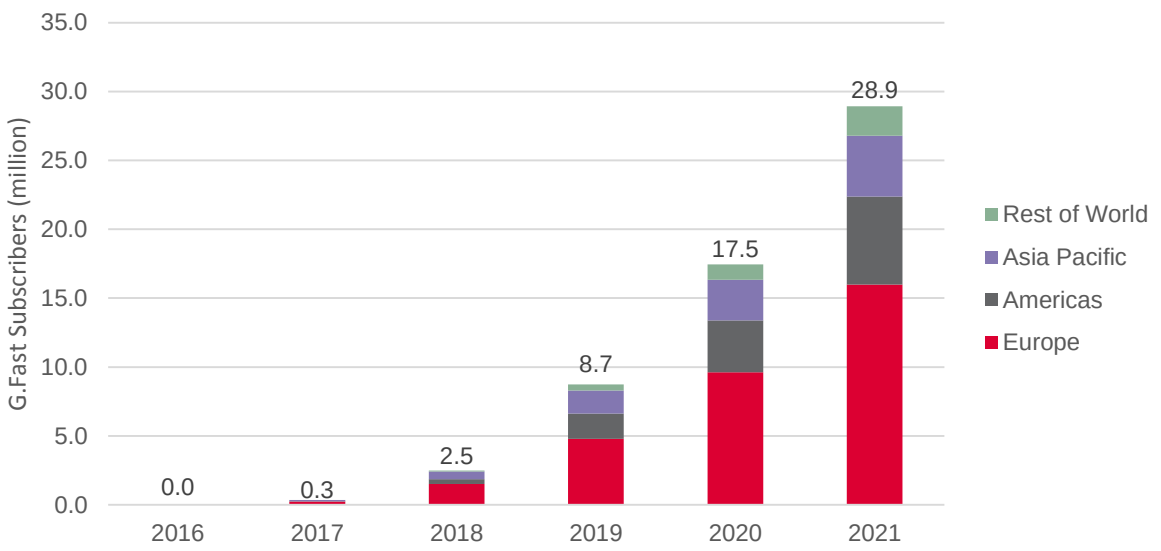
Summary

G.fast is the latest standardized evolution of Digital Subscriber Line (DSL) technologies, delivering broadband services over standard telephone lines. As broadband speed requirements have grown DSL capabilities have also risen, with G.fast services set to enable throughput of up to 1Gbps.

G.fast remains a relatively new technology with standards agreed in 2014, but momentum is rising this year as early proponents translate trials and field tests into rollout announcements. **BT** is leading the market with the announcement that G.fast will be used to service a footprint of as many as ten million homes and businesses by 2020.

In 2021 Ovum expects G.fast to be supporting nearly 29m subscribers, representing 3% of the global fixed broadband market. As an emerging technology the growth in annual subscriber additions is expected to accelerate in each year, rising from 330,000 in 2017 to nearly 11.5m in 2021.

Chart 1: G.fast Subscribers by Region



Source: Ovum

About 11% of broadband services in Western Europe may be delivered via G.fast within five years, with a number of major markets already including the technology in their upgrade plans. As well as BT, Swisscom, Deutsche Telekom, Telekom Austria and Proximus all have plans to include G.fast in their technology mix. As these incumbent operators retain 45% of their respective markets, this represents a substantial pool of services that may now feature G.fast in their upgrade roadmap.

G.fast will continue to grow beyond 2021, absorbing an increasing share of the 250m remaining xDSL services at that point.

With no change in the underlying network, the gains in speed have been accompanied by a reduction in range, with signal attenuation limiting most G.fast services to existing lines of under 300-400m. This constraint has seen G.fast developed specifically for deployment in fibre-to-the- node, -distribution point and -building configurations.

For carriers with legacy DSL network assets, G.fast is positioned to meet service requirements as a competitive alternative to gigabit capable fibre to the premises or coaxial networks. This includes as a solution for high bandwidth demanding business customers and in multi dwelling units where the cost of new fibre runs is very costly. Importantly G.fast and future XG-FAST services give additional options to carriers to progressively extend fibre deeper into the network to meet customer demand.

XG-FAST

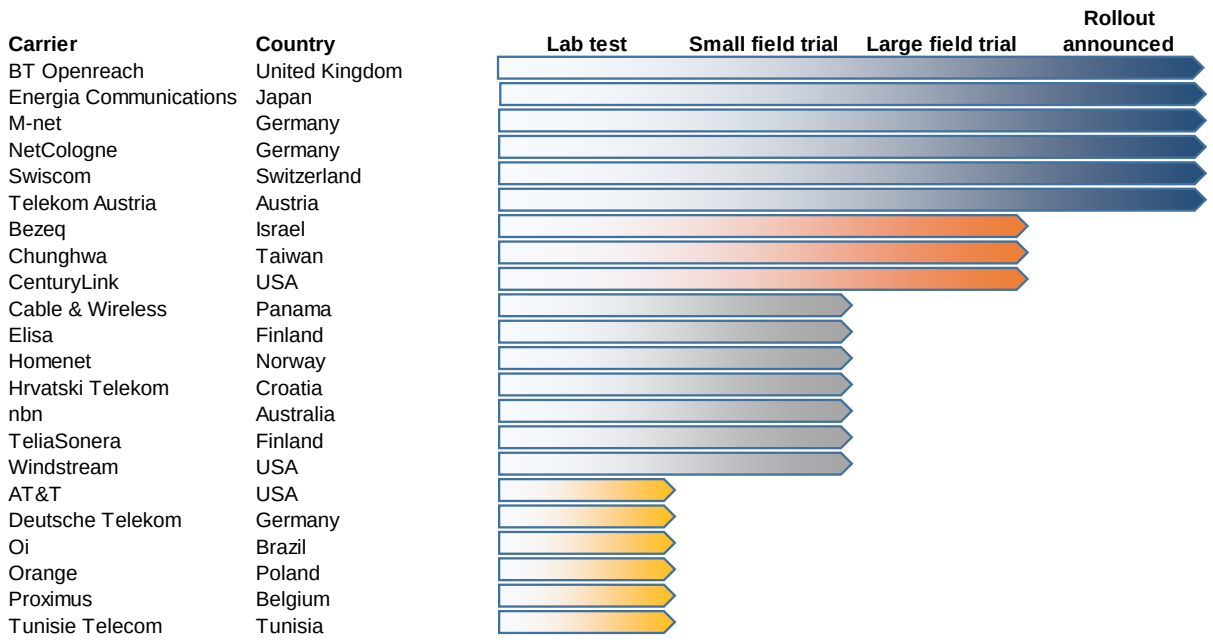
Beyond G.fast, the evolution of broadband technologies continues with XG-FAST. Developed by Nokia Bell Labs, XG-FAST is targeting throughput of up to 10Gbps over very short bonded lines. In order to achieve these multi gigabit speed the target line length is constrained to 100m, frequency utilization is further extended to up to 500MHz and bonding, phantom mode and two-sided signal coordination utilized.

The use cases for XG-FAST are focused on in-building solutions including connecting an ONT on the side of a building or in a building's communications cabinet to the end-user, although it may also be used in FTTN builds where the final twisted-pair run is short. This effectively positions XG-FAST as a fibre extension solution which avoids the cost, and often logistical challenges, of accessing the premises.

For operators, the roadmap for further enhancements to DSL solutions permits confidence that they will be able to continue to compete with investments in fibre and upgrades to cable networks.

This report reviews the status of G.fast development and deployments, overviewing specifications and capabilities, and its role in broadband upgrades. Case studies review the status of leading G.fast proponents illustrating how advances in DSL technologies are being used to provide superior product performance and deliver revenue growth in an environment where traditional fixed-broadband services are facing increased competition.

Figure 1: G.fast announcements



Source: Cable operator and vendor announcements

Ovum was commissioned to produce this report by **nbn** and BT in order to provide an overview of G.fast, including carrier plans to introduce the technology and its further evolution in the form of XG-FAST.

nbn is actively evaluating G.fast as a component of its national multi technology mix strategy, having tested G.fast in late 2015, and XG-FAST in 2016.

The **nbn**'s MTM strategy is aiming to enable every home, business and community across Australia to receive high-speed broadband by leveraging existing infrastructure to ensure the project is completed faster and more cost effectively.

Openreach, BT's local network division, is expected to be one of the first operators in the world to launch commercial G.fast services with a launch expected during 2017.

It is aiming to make ultrafast speeds available to 12 million premises in the UK by the end of 2020 – using a mix of G.fast and Fibre to the Premises (FTTP) technologies.

Openreach is already working with its communications provider customers to conduct the largest G.fast field trials in the world, delivering speeds of up to 330Mbps.

The company recently announced an extension to its pilot which will see around 140,000 homes and businesses across the country given access to G.fast by March 2017.

G.fast's role and business benefits

G.fast has the potential to help broadband providers

- Deliver fiber-like speeds over the last meters of existing DSL infrastructure
- Reduce capital expenditure by deferring the cost of extending fiber to every building and home
- Extend ultra-fast broadband to locations where fiber deployment is difficult
- Eliminate the need to enter and rewire homes and buildings

Broadband service providers are facing relentless demand from subscribers for more bandwidth along with reluctance from subscribers to pay higher tariffs for more bandwidth. Although bandwidth alone does not guarantee a better user experience, subscribers are attaching importance to bandwidth offerings. Some service providers are responding, going beyond 1Gbps with 2Gbps and even 10Gbps bandwidth service offerings. The bandwidth upgrade decision process faced by service providers is complex – especially for providers in competitive and/or highly regulated environments. The decision is not simply influenced by technology but also the trade-offs between upgrade options and capex, opex and competitiveness, in the short- and long term.

G.fast promises to enable service providers to connect homes with superfast broadband faster and at lower cost than by using fibre alone - and without alienating potential subscribers. G.fast enables CSPs to supply bandwidth upgrades to customers in specific areas where local loops are short. This provides an immediate solution in situations where CSPs risk losing subscribers. In other areas, service providers may decide to push the fiber deeper, thereby shortening the existing local loop and enabling G.fast deployment.

G.fast can be seen as both an end solution and a stepping stone in network evolution. With speeds of up to 1Gbps and flexibility to offer symmetrical speeds (e.g. 400/400Mbps), G.fast will support the requirements of all but the most bandwidth hungry residential and business customers, today and into the future. For these customers G.fast will provide the speed and reliability required but avoids the costs of fibre deployment to premises. Where end-user demand continues to rise in the future, the selective further extension of fibre to individual residential and business premises becomes a more efficient, commercial proposition.

Benefits

Beyond the gains in raw download speeds, the benefits of deploying G.fast offers service providers can be summarized as follows.

G.fast improves existing networks ability to compete with fiber

G.fast enables service providers to offer more bandwidth over the existing network, improving the ability to compete with bandwidths offered on fiber-to-the-premise (FTTP) network deployments. It is not surprising that G.fast is being tested by numerous service providers and that several have announced deployment plans, particularly in Europe and North America.

Useful for addressing existing coverage gaps

As a solution designed to address a relatively small number of end user premises, G.fast is well suited for addressing holes in existing coverage resulting from long line lengths or gaps in legacy deployments. Scenarios that can be resolved include

- running fibre to a small number of more remote customers and using G.fast in the last 500m rather than either deploying VDSL via a new cabinet (that would not offer the speed gains, and
- Using existing network to access premises that were not address in the initial deployment of HFC services

Flexible deployment alternatives

Distribution Point Units (DPUs) are the size of a shoe box, enabling considerable flexibility of deployment. The small size allows a DPU to be mounted of a pole, located in a small underground pit or installed in a building communications closet. Importantly this gives several implementation options and allows continued use of existing poles and pit assets, reducing the degree of civil construction cost and inconvenience.

Self install CPU

Like other DSL services, end-users can install the G.fast modem themselves. This allows for the cost of individual truck rolls to be avoided, and removes the need to coordinate premises access with the resident.

Remotely Powered

Fiber nodes can be remotely powered from the central office or reverse-powered by a subscriber modem where the final run to the customer is less than ~200m. This eliminates the need for service providers to obtain power and cabling from a utility during the rollout of each DPU. This leads to substantial savings in time and cost.

Rapid deployment

The avoidance of deploying new cabling into the premises allows for a more rapid deployment of services, with the associated reduction in costs. Using G.Fast allows end-users to get the benefits of ultra-fast broadband much sooner than if an operator were attempting a wide-scale FTTP rollout. This means people get the economic benefits of ultra-fast broadband sooner.

Stepping stone

G.fast is a central component of a FTTdp deployment architecture, with fibre deployed deep into the network and the VDSL tail reduced to under 400m, and in many instances, under 100m. With appropriate planning this will facilitate the move to a full fibre runs to meet future requirements as and when the initial investment is recouped.

Symmetrical speeds

One big advantage of G.fast is that it enables service providers to offer symmetrical speeds - meaning that with 1Gbps of bandwidth, a service provider could offer speeds of 500Mbps both downstream and upstream – a feature missing from other DSL acceleration technologies.

Selective deployment

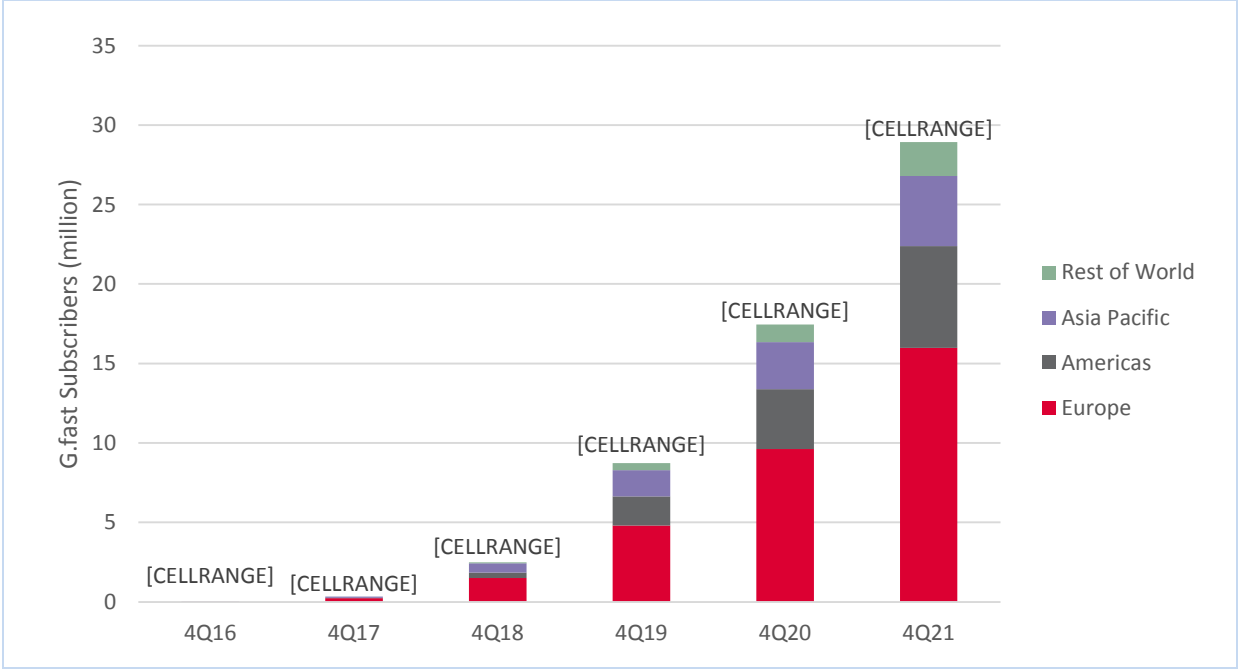
G.fast can be selectively deployed across the existing network to meet end-user demand or remediate locations where existing services are not sufficient. This matching of requirements with investment allows existing assets to be leveraged, lowering or deferring investment in upgrades and removes the risk of over capitalising the network which can only be recovered through higher retail prices.

The State of the Market

In 2021 Ovum expects G.fast to be supporting nearly 29m subscribers, representing 3% of the global fixed broadband market. As an emerging technology the growth in subscribers is expected to accelerate in each year, rising from 330,000 in 2017 to nearly 11.5m in 2021.

Shipments of G.fast capable equipment only began in 2015, with a wider range of vendors offering solutions this year. For most carriers the availability of several vendors is a required precursor before launching procurement for a full rollout. Thus, many carriers continue to evaluate G.fast as one option in their network upgrade path and with a focus on potential scenarios of commercial deployment.

Chart 2: G.fast Subscribers by Region



Source: Ovum

G.fast is expected to be most prevalent in Western Europe as the incumbent carriers follow network upgrade paths to counter competition from cable broadband services and meet the speed targets of governments and regulators.

About 11% of broadband services in Western Europe may be delivered via G.fast in five years, with a number of major markets already including the technology in their upgrade plans. This includes BT, Swisscom, Deutsche Telekom, Telekom Austria and Proximus. The home markets of these five incumbents contribute 45% of broadband subscribers in Western Europe.

The relative earlier adopt of G.fast in Western Europe reflects…..

- European Commission broadband targets including 50% of households having subscriptions of 100Mbps or higher
- Existing high penetration of suitable connections allowing upgrades while avoiding the cost of fibre to the premises

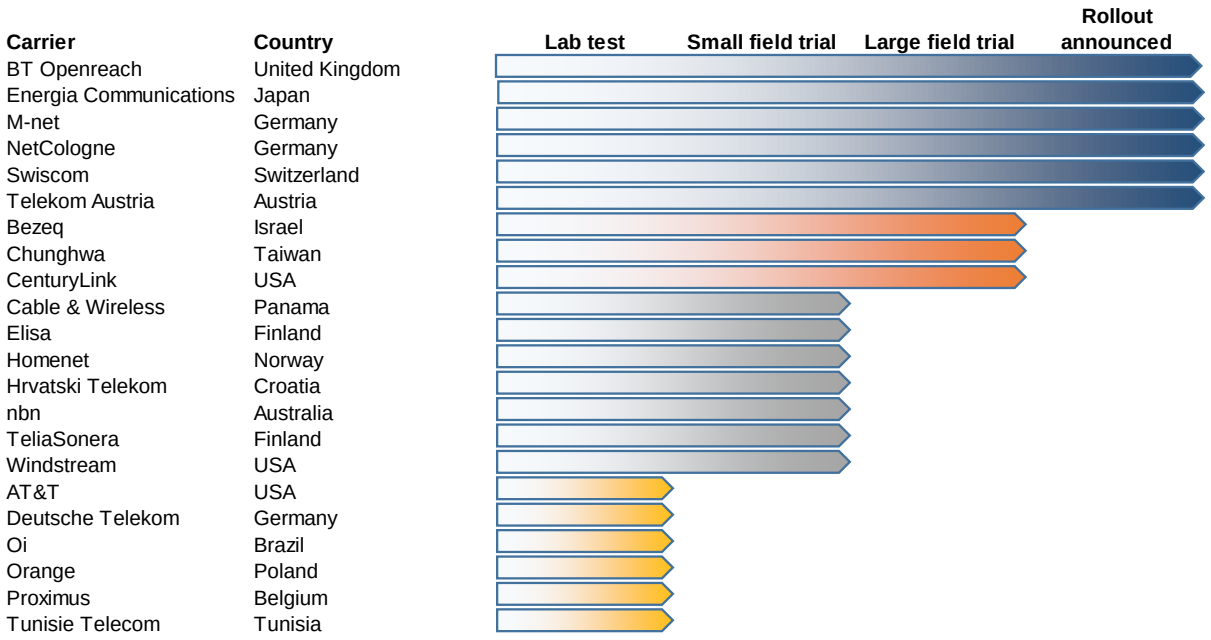
- Competitive pressure from cable operators which are deploying gigabit speeds by upgrading to DOCSIS 3.0/3.1

Other regions are expected to less aggressive in deploying G.fast, with only 3% of broadband services in other market migrating to the platform. Across these regions the share of fixed broadband subscribers will range between 1% and 4%.

Carrier plans

Carrier plans are evolving from lab trials to field testing, with early adopters announcing deployment plans. While a large number of carriers have undertaken lab tests, most carriers are waiting for the technology to develop a wider ecosystem ahead of setting deployment targets.

Figure 2: G.fast announcements



Source: Cable operator and vendor announcements (Small field trial reflects a deployment in a small number of buildings, while a large field trial is used to indicate rollout of G.fast in a locality, town or suburb.)

It is not only G.fast that is of interest to carriers, with several testing Nokia's XG-FAST prototypes.

Vendors ready

Since the standardization in December 2014, vendors have moved quickly to add G.fast solutions to their product portfolios. The first IEEE plugfest took place twelve months later and featured products from fourteen hardware and chipset vendors.

The leading hardware providers with solutions in market include:

- Nokia (40 carrier trials)
- Adtran (60 carrier trials)
- Huawei
- Calix
- ZTE

Operator Case Studies

The following case studies illustrate operators at the forefront of implementing G.fast solutions in their networks.

United Kingdom – BT Openreach

In May 2016 the UK government extended its target for the availability of superfast broadband (at least 24 Mbps) from 95% of premises in 2017 to 97% in 2019. Openreach's fibre to the cabinet (FTTC/VDSL2) rollout is well underway with more than 90% of premises already able to access broadband speeds of up to 80 Mbps. Over 25m premises have fibre based broadband with coverage expanding at over 27,000 each week.

Beyond government targets, Openreach is facing rising competition from cable operator, Virgin Media and a number of small direct fibre deployments. Virgin is investing £3bn expanding its network reach from 13m to 17m premises and is enabling gigabit speeds through the implementation of DOCSIS 3.

Openreach targets and progress

BT's ambition is to offer Ultrafast broadband (speeds of over 100Mbps) to 12m premises by 2020, with 10m of these premises serviced via G.fast. The remaining 2m premises, mainly new developments, apartment blocks, business parks and high streets, will receive fibre to the premises. It is expected that customers will be able to access speeds of up to 300Mbps initially, with speeds of up to 500Mbps within ten years. This initial plan will cover approximately 40% of the country, with a further ambition to provide most of the country with ultrafast access by 2025.

Trials and pilots

Plans for the G.fast build program moved forward in September 2016 with the selection of Nokia and Huawei as equipment suppliers for the G.fast deployment. With this announcement, future BT deployments will use commercial production rather than pre-commercial technology featuring second generation chipsets and improved vectoring capabilities.

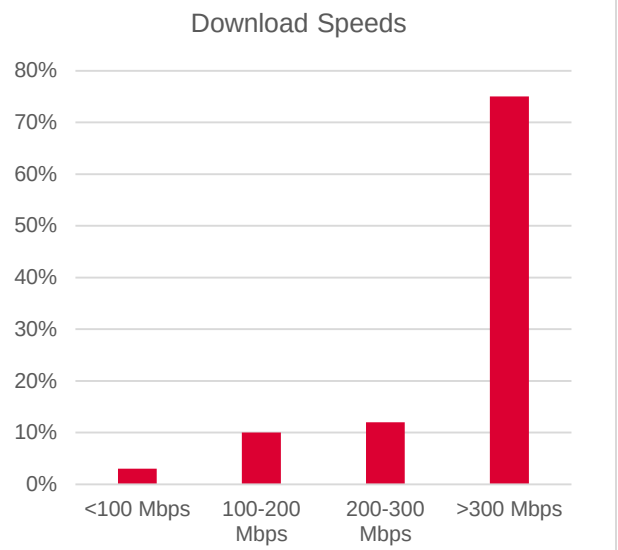
This follows a number of trials to evaluate the technology and deployment solutions.

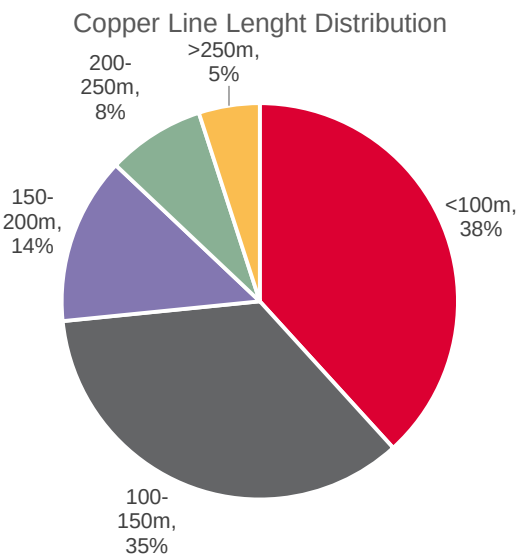
- Huntingdon (Cambridgeshire) – field trial of 2,000 premises commenced in August 2015 to assess the technical performance of the technology across a large footprint, involving eight retail partners
- Gosforth (Newcastle) – 2,000 premises in an area previously without upgraded broadband services
- Swansea – technical trial of deployment to around 100 multi dwelling units (MDUs) and business premises
- Cherry Hinton (Cambridgeshire) and Gillingham (Kent) – 12,500 premises each, pilot commenced in March 2016

BT has also announced it will further expand trials to a further twelve locations in January 2017, including Bolton, Derby, Glasgow (Langside), Luton and Sheffield. This will bring the total number of homes and business able to access a G.fast broadband service to around 140,000. Customers in these pilot areas will be able to two speed tiers, up to 160Mbps/30Mbps and up to 330Mbps/50Mbps.

Results from the completed trials (Huntingdon, Gosforth, Swansea) were encouraging with over 75% of lines able to deliver more than 300Mbps download and 30-50Mbps upload speeds. A range of vendor hardware was tested including solutions capable of supporting reverse powering the DPU.

Chart 3: BT G.fast trial results – Download speeds and Line Length





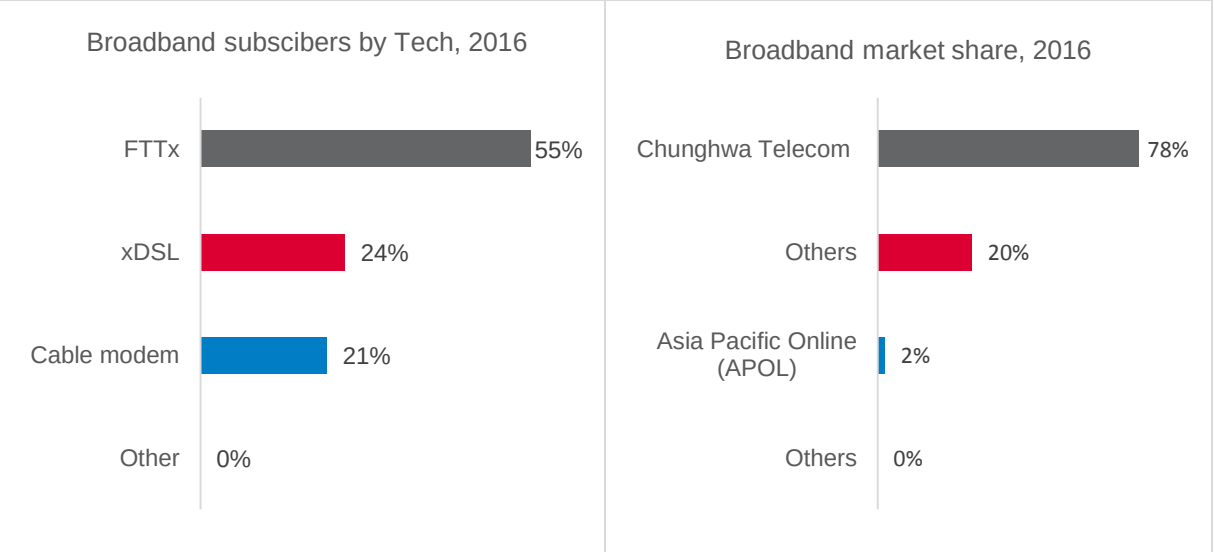
Source:

Taiwan – Chunghwa Telecom

Chunghwa Telecom was the first carrier to announce G.fast was to be a component of their network upgrade plans. In September 2015, Chunghwa and Nokia announced the first deployment of G.fast on a commercial basis.

Chunghwa's broadband service arm, HiNet, offers DSL and FTTx services throughout the country, dominating with a market share of 78%. Sustained investment in fibre and ongoing efforts to upsell customers to faster speeds has seen ADSL as a share of broadband customers fall to 21%, and one third of FTTx customers taking speeds of 100Mbps or higher. These FTTx services are delivered via a mix of VDSL, PON, Ethernet and now, in small numbers, G.fast services.

Chart 4:Taiwanese Broadband Market



Source: Ovum WBIS, Chunghwa Telecom

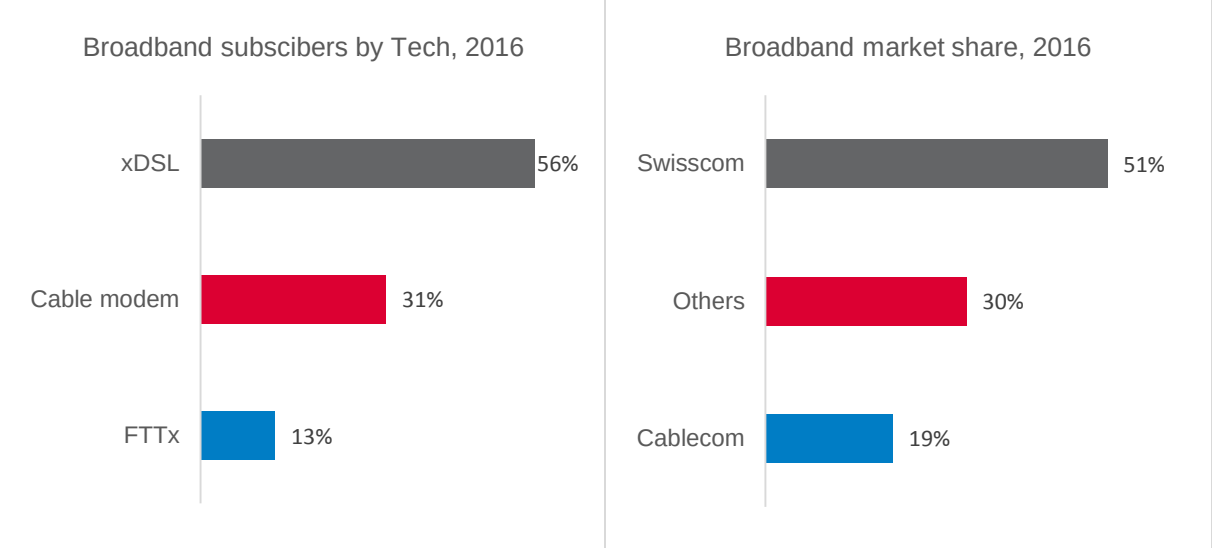
Deployment progress

The current G.fast deployments have utilized a single-port unit with line lengths kept under 200m, and so enabled speed tiers of up to 500/250Mbps to be supported. G.fast is yet to be a central component of the current deployment program but is seen as a potential solution for providing ultra-fast services into the many high rise MDUs. With many of Taiwan's 8.4m homes and businesses located in low and high rise buildings, this is not only a substantial market, but a market that will be targeted by the cable providers with their DOCSIS upgrades. The option to offer faster speeds is also essential for Chunghwa as it looks to offset price retail deflation imposed by the regulator. Expansion of the use of G.fast is expected with the broader availability of commercial multiport solutions and lower hardware pricing.

Switzerland – Swisscom

By 2020 Swisscom is aiming to provide 85% of homes and businesses in Switzerland with access to broadband speeds of 100Mbps or more. This will put the country ahead of the targets established in the EU's Digital Agenda.

Chart 5:Swisscom Broadband Market



Source: Ovum WBIS

Deployment progress

Swisscom has announced that G.fast will be central to achieving its broadband speed targets, with all new fibre to the Street and Fibre to the building connections to utilize the technology. The FTTS deployments will bring fibre to within 200m of the end-user.

The first customers will be enabled by the end of 2016, allowing speeds to be lifted from up to 100Mbps to up to 500Mbps.

Swisscom has accelerated its rollout, with 2016 capital expenditure increasing nearly 40% to CHF 2.4 billion. This investment builds on the good momentum previously achieved in the deployment of VDSL2 services which have been in build since 2013.

Trials and Pilots

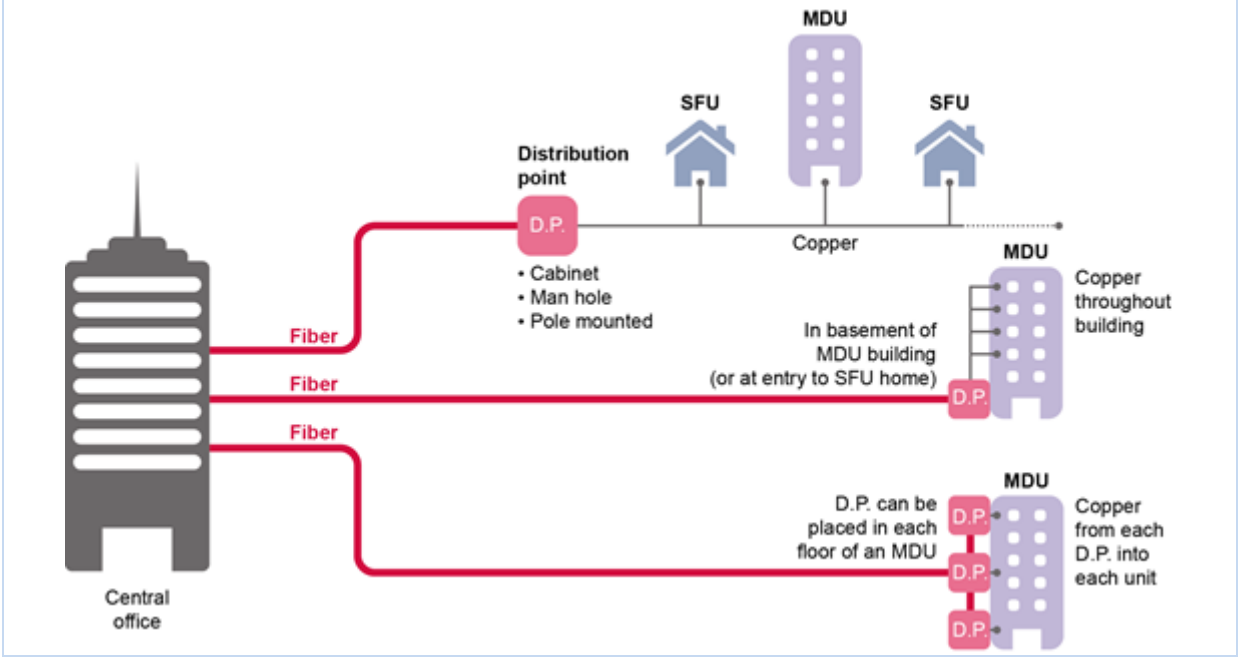
Swisscom first launched trials of G.fast in April 2015 in the village of Bibern in the canton of Solothurn. In a field trial including approximately 100 customers, speeds of between 285-402 Mbps downstream and 85-109 Mbps upstream were achieved. Previously these customers could only access ADSL speeds.

Technology Overview

G.fast is an ITU DSL standard finalised in December 2014. The standard was developed as a component of FTTdp (fiber-to-the-distribution-point) architecture with the goal of delivering fibre like speeds of up to 1Gigabit per second over existing telephone wires.

Figure 3 illustrates several possible implementations. G.fast supports bandwidth upgrades to both SFUs and MDUs. For MDUs, service providers may choose to pull fiber into the basement or up the riser and into each floor.

Figure 3: G.fast architecture



Source: Ovum

Phase 1 of the ITU standard specifies 500Mbps at 100 meters, 250Mbps at 150 meters, and 200Mbps at 200 meters. Already G.Fast chipset vendors and equipment vendors have shown performance far beyond the Phase 1 specification, including supporting longer loops.

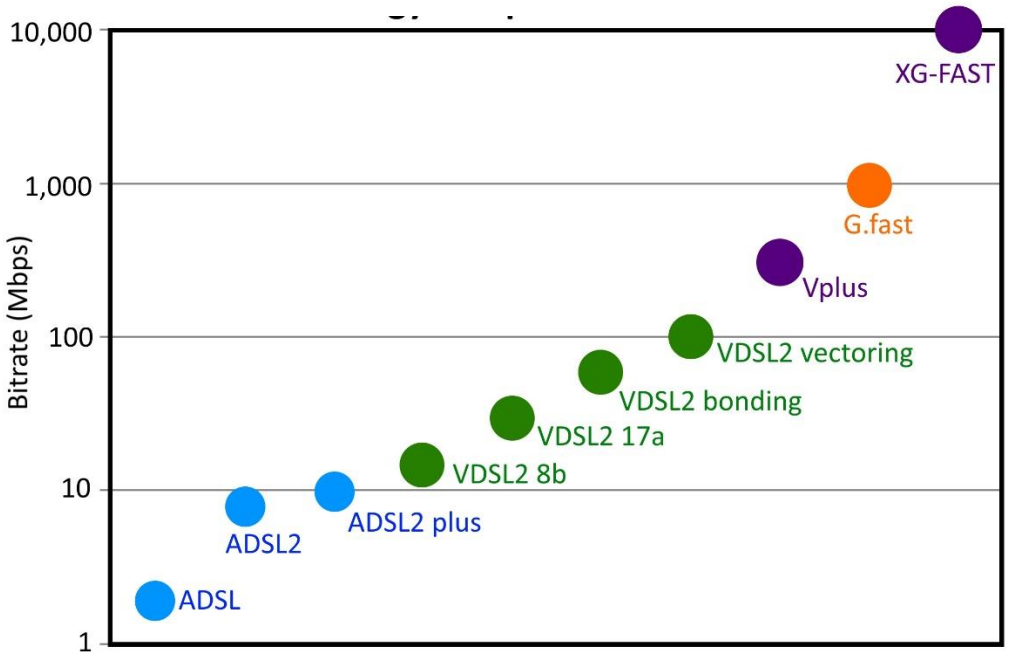
Advances in broadband capability- ADSL to G.fast

Since their introduction in the early 1990s, wireline broadband networks based on traditional telephony networks have continuously evolved to keep pace with consumer demand for reliable, high-data-rate connectivity. In the early 1990s these networks carried just a few Kbps using dial-up modems. Today, Digital Subscriber Line (DSL) technology offers rates exceeding 100 Mbps over that same infrastructure. This evolution has been achieved by introducing new generations of DSL technology that leverage the higher capacity of these shorter network connections.

ADSL technology was the first step up towards broadband access using the traditional network, providing up to 8 Mbps downstream speeds. Following ADSL came ADSL2+t, offering up to 24 Mbps download speed by extending the signal frequency band from 1.1 MHz to 2.2 MHz.

VDSL technology further improved the download/upload speed and enabled symmetric broadband access using the legacy network. However, the first evolution of VDSL was not compatible with ADSL2+. To resolve this issue VDSL2 (working on 17 MHz and 30 MHz frequency bands) was developed allowing coexistence with ADSL2+ while boosting download speeds to as high as up to 100 Mbps.

Figure 4: DSL Technology Evolution



Source: Nokia

However, crosstalk between active lines makes it unrealistic to achieve 100 Mbps using VDSL2. Vectoring solutions were developed to reduce crosstalk and allow these faster access speeds to be achieved.

To help enable DSL access speeds to reach 1,000 Mbps data rates, G.fast technology, based on the latest VDSL technology including crosstalk cancelation and retransmission, has been developed and will transition current access networks into the gigabit era. G.fast technology makes gigabit-level aggregate data rates possible by using more spectrum within the access lines. Current VDLS2 lines use spectrum up to 17 MHz. G.fast widens this spectrum to 106 MHz (Phase 1 of the ITU standard). Anticipated developments will use frequencies up to 212 MHz and take data rates to 1Gbps and beyond. However, the high frequencies of G.fast can't be sustained over long distances. The best approach is to use a mix of technologies. G.fast is ideal for applications that bring fiber closer to the home and use very short existing loops to cover the last few meters. VDSL2 vectoring remains the best technology for longer access lines.

G.fast is the obvious candidate to become the next major technology in service providers' DSL acceleration arsenals, after VDSL2 vectoring. There has been a flurry of announcements about G.fast throughout the telco ecosystem, concerning such matters as technology advancements, product

availability, and early deployments. G.fast will find its place in the broadband upgrade toolkit. It will be deployed for both the multi-dwelling unit (MDU) and single-family unit (SFU) markets, enabling DSL-based bandwidth upgrades when local loops are short.

Furthermore, a fifth generation technology referred to as XG-FAST is emerging to provide data rates up to 10 Gbps to the end user over very short existing lines

Table 1: DSL Technology Performance Comparison

Technology	ITU Ratified	Downstream Max	Upstream Max	Frequency Band	Max Distance
ADSL	1996	8 Mbps	1 Mbps	1.1 MHz	3000m
ADSL2	2002	12 Mbps	3.5 Mbps	1.1 MHz	2500m
ADSL2+	2003	24 Mbps	3.3 Mbps	2.2 MHz	2500m
VDSL	2004	54 Mbps	16 Mbps	12 MHz	1000m
VDSL2 17a	2006	100 Mbps	50 Mbps	17 MHz	750m
VDSL2 30a	2006	100 Mbps	100 Mbps	30 MHz	300m
VDSL 35b	2015	300Mbps	100Mbps	35 MHz	300m
G.fast	2014	500 Mbps	250Mbps	106 MHz	500m
G.fast (Phase 2)		1000Mbps	250Mbps	212 MHz	500m
XG-FAST	-	1Gbps	500Mbps	500 MHz	50m
XG-FAST with bonding	-	10Gbps	5Gbps	500 MHz	50m

Source: Ovum

In addition, the rapidly developing ecosystem supports the market adoption of G.fast. In June 2015 the Broadband Forum conducted the industry's first G.fast equipment plugfest, focusing on testing the interoperability of remote distribution point units (DPUs) and customer premise equipment (CPE). The participating companies included well-known communications chipset vendors such as Broadcom, Ikanos, Intel (Lantiq), and Realtek, and start-up Sckipio. In addition, numerous tier 1 and tier 2 wireline broadband equipment vendors participated, including Alcatel-Lucent (now Nokia), Huawei, Adtran, and Calix.

Limitations

G.fast requires much higher frequencies to achieve higher data rates. Because of strong signal attenuation caused by high frequencies, G.fast can't be sustained over long distances - a maximum of about 250 meters (and significantly lower than this for the highest data rates).

Moreover, G.fast is more prone to crosstalk interference compared to prior ADSL/VDSL technologies due to the higher frequencies used by G.fast and this has the potential to degrade performance.

As a result of crosstalk interference between the lines, which could drastically decrease data rates compared to prior ADSL/VDSL technologies, G.fast requires advanced vectoring technology. For

instance a G.fast connection capable of 1 Gbps data rates with vectoring, could end up supporting only 200 Mbps or less without vectoring.

With vectoring cross talk interference can largely be overcome, but this is premised on a single infrastructure owner implementing a single vectoring solution. If multiple line users (carriers) are injecting interference into the same cable and this is not managed holistically, performance across the providers may be negatively impacted. This is an ongoing concern in markets where unbundling of the current network gives access rights to service providers other than the owner.

Furthermore, frequencies used by G.fast may interfere with other services such as FM Radio. To avoid such interference service providers could 'notched out' certain frequency bands while deploying G.fast.

Continued evolution – XG-FAST

In 2014 researchers from Bell Laboratories proposed system concepts for a further acceleration of broadband capability under the name of XG.FAST. This concept paper has since developed into a prototype solution which has been tested with a number of leading carriers.

XG-FAST is yet to be standardized by the ITU, but the key features of the two variants of XG-FAST proposed by Bell Labs are as follows.

Table 2: XG-FAST potential performance

	G.fast	**XG-FAST**
Frequency range	Up to 500 MHz	Up to 500 MHz
Max distance	400m	100m
Implementation	▪ Single twisted pair	▪ Two twisted pairs bonded
		▪ Phantom mode
		▪ Two-sided signal coordination
Max data rate (aggregate)	1 Gbps at 100m	10 Gbps at 30m

Source: XG-FAST: Towards 10 Gb/s Copper Access, Bell Laboratories

While most implementations will utilize traditional telephony networks, XG-FAST may be used with any cable type with sufficient capacity. This opens up implementations in corporate environments where CAT5 cabling is available, and in HFC areas where the coaxial cable can be the medium.

nbn was the third carrier to test Nokia's XG-FAST prototype under lab conditions, joining BT and Deutsche Telekom. The results that emerged from these trials were as follows. (Aggregate speed is the total of download and upload speeds supported.)

Table 3: XG-FAST Trial Results

	Distance	Aggregate speed
BT -	35m	5.6Gbps
	100m	1.8Gbps
Deutsche Telekom	50m	8Gbps

Source: Nokia

Conclusion and nbn Positioning

Central to **nbn's** multi-technology approach is balancing the goal of enabling superfast speeds across the network with speed of deployment and cost considerations. G.fast and XG-FAST add flexibility to the implementation of these objectives. These considerations apply to most carriers upgrading their network plant to provide super-fast broadband services.

nbn's rollout of FTTH in brownfield areas is effectively complete, with FTTN and FTTdp now the priority. On 28 September nbn announced the degree FTTdp is an integral part of the network build. 700,000 premises are now set to be accessed via FTTdp, putting them in line for G.fast services. These premises had previously been designated to receive FTTN or HFC via the Optus network.

There is scope for these premises receiving G.fast services to continue to grow as nbn extends FTTdp to meet customer demand and, as the technology matures, G.fast's effective range is extended. By using FTTN to achieve rollout targets, nbn retains long term flexibility to deploy upgrades as needed in the form of G.fast from the node, FTTdp or even FTTH.

The addition of G.fast to the technology portfolio addresses several challenges facing the company.

- Meeting the government minimum speed targets across the footprint, particularly in locations with long line lengths. The use of FTTdp will assist in meeting the commitment that all end users will be able to access a service with download speed of at least 25Mbps
- Enhance the available speeds in many locations, including in MDUs. G.fast is particularly attractive for addressing the enterprise market in both city centers and business parks
- Simplify the sourcing of network power through the use of reverse powered solutions
- Address gaps in coverage, particularly in areas predominantly designated to receive HFC
- Reduce the need for fibre upgrades under the Technology Choice program
- Defer extended fibre deployment to the premises until demand is confirmed

The further evolution of access technologies, including the potential of XG-FAST, will also give carriers such as **BT** and **nbn** future options for gigabit services.

Methodology

For this report, Ovum drew on interviews, presentation announcements by vendors and operators, and desk research. We also used data from Ovum's *Fixed Broadband Subscriptions Forecast: 2015–2020* and World Broadband Information Service.

Further reading

Market Share Report: 1Q16 FTTx, DSL, and CMTS, TE0006-001237 (22 Jun 2016)

SDN/NFV in Residential Broadband Networks - Part 1: Going beyond hype to adoption, TE0006-001247 (14 Jun 2016)

2016 Trends to Watch: Wireline Broadband Access - Virtualization, QoE, and more bandwidth are key themes as wireline's importance grows, TE0006-001143 (07 Dec 2015)

Alcatel-Lucent announces G.Fast - win at Taiwan's Chunghwa Telecom, TE0006-001124 (15 Sep 2015)

G.Fast: Gaining Mindshare - Adoption based on business analysis, TE0006-001091 (13 Jul 2015)

BT outlines bold ambitions with G.Fast, but not without caveats, TE0009-001395 (05 Feb 2015)

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We hope that this analysis will help you make informed and imaginative business decisions. If you have further requirements, Ovum's consulting team may be able to help you. For more information about Ovum's consulting capabilities, please contact us directly at consulting@ovum.com.

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