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Research Viewpoint

G.fast: an assessment of the value proposition for operators

January 2015

Stephen Wilson

About this report

- This report provides an assessment of the value proposition of G.fast.
- Analysys Mason has examined various deployment scenarios for G.fast as part of a wider assessment of fibre beyond the cabinet.[1]
- This report considers several technology options that have emerged recently, such as 30MHz vectoring and frequency division vectoring.
- It considers the following four factors that affect the business case for G.fast:
  - **speeds:** download and upload
  - **costs:** capex and opex
  - **timeline:** when the technology will become commercially available
  - **technology coexistence:** with other access technologies and POTS.
- The report considers the business case for G.fast from the standpoint that operators could choose to deploy a number of alternative technology options.

Figure 1: Summary of report coverage [Source: Analysys Mason, 2015]

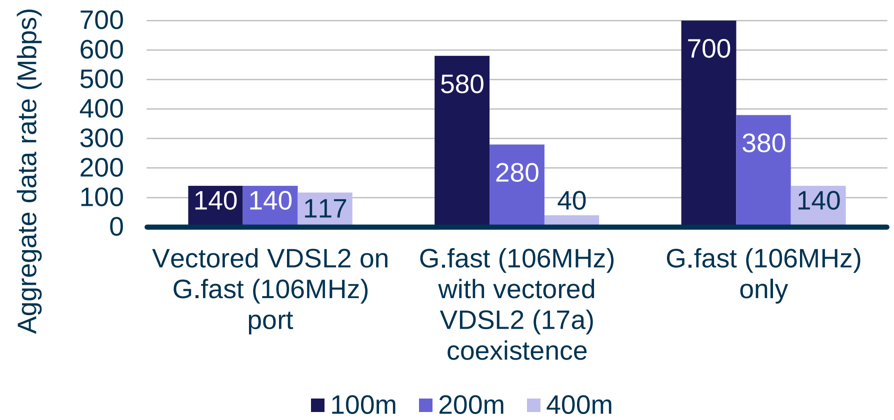
Technologies covered	Factors considered
▪ G.fast 106MHz ▪ G.fast 212MHz ▪ XG-FAST ▪ G.now ▪ Frequency division vectoring ▪ 30MHz vectoring ▪ VDSL2 vectoring ▪ FTTH	▪ **Speeds:** download and upload ▪ **Costs:** capex and opex ▪ **Timeline** ▪ **Technology coexistence:** other fixed broadband technologies and POTS

[1] For further details, see the report *Fibre beyond the cabinet: an assessment of operators' deployment options*.

G.fast rates will exceed ITU targets, but actual speeds will depend on factors such as notching of frequencies used for VDSL2

- The ITU has a number of target aggregate data rates for G.fast: 1Gbps at loops of less than 100m, 500Mbps at 100m, 200Mbps at 200m and 150Mbps at 250m. In practice these target rates refer to the lower limit of what vendor systems will be capable of delivering. An example of higher-than-target bit rates is from Swisscom, which expects G.fast will be able to provide aggregate speeds of 700Mbps at 100m and 380Mbps at 200m.
- The technology also provides the option for configurable upstream and downstream bit rates with mandatory support for ratios of 10% upstream and 90% downstream to 50% upstream and 50% downstream. The constraint is that users served from the same distribution point unit (DPU) will need to use the same ratio.
- Vendor systems will be able to deliver higher-than-target bit rates in the field, but several factors will constrain performance. In order for G.fast to coexist with vectored VDSL2 it will not be able to use the spectrum used for VDSL2 plus an additional guard band. In practice this means that G.fast will lose a significant amount of bandwidth.
- The guard band could extend to various frequencies such as 20MHz or 23MHz. The higher the frequency the greater the loss in performance for G.fast although the difference between the end points of the guard band is not as significant as having to notch the 17MHz used for VDSL2.

Figure 3: Net data rate expectations on 0.6mm cable, by technology and loop length [Source: Swisscom, 2015]



- Swisscom expects that G.fast using all the spectrum up to 106MHz could deliver 700Mbps aggregate speeds at 100m. Without using the spectrum used for 17MHz VDSL2 this figure would decline to 580Mbps, a 20% loss.
- Losses through notching become proportionally more significant as loop lengths increase. With 400m loops notching of frequencies used for 17MHz VDSL2 means G.fast can only provide 29% of the bandwidth that would be possible with the full 106MHz.

Notching for radio and the presence of bridge taps will reduce G.fast bit rates significantly

- Another constraint on performance are **bridge taps** in the home network. These could be removed with an engineer installation but this would negate one of the advantages of G.fast in that it has been designed to be self-installable. Bridge taps create notches in the frequency spectrum meaning the signal-to-noise ratio is frequency dependent. To combat this issue G.fast uses DMT modulation, which allows for adaptive bit rate loading as a function of the frequency-dependent signal-to-noise ratio. G.fast also uses time division duplexing so it is less sensitive to impedance mismatches than VDSL2, which uses frequency division duplexing.
- Losses in aggregate bit rates from a single bridge tap at loop lengths of 125m could potentially be around 20%, according to Alcatel-Lucent. A double bridge tap is likely to increase the loss to around 25%.
- **Impulse noise** picked up on in-house wiring can also reduce the performance of G.fast. However, G.fast has several features that can help resolve these issues. G.fast will use physical layer retransmission technologies, similar to G.INP with VDSL2, to protect against impulse noise.
- Another factor that will reduce the performance of G.fast is implementing notching to protect **FM broadcast radio as well as amateur radio**. In these notched bands the transmit power of G.fast will have to be reduced.
- Alcatel-Lucent notes the losses as a result of notching for FM broadcast radio for G.fast using 23–106MHz could be 15–20% for loops of 100m and less, with the higher losses on the shorter loops. The losses from notching in the amateur radio bands are likely to be less significant with a 3–4% loss on loops of less than 100m.
- The losses as a result of notching for VDSL2 using 17MHz, FM broadcast and amateur radio as well as bridge taps could halve the bit rates that G.fast could deliver at loop lengths of 100m, reducing performance from around 700Mbps to 350Mbps.

About the author

Stephen Wilson (Senior Analyst) contributes research to our *Fixed Networks* research programme. He joined Analysys Mason as a Senior Analyst in November 2012, having previously worked for Informa Telecoms & Media. Stephen has more than 5 years of experience covering the telecoms industry and specialises in analysing fixed broadband access technologies and strategies, as well as developments in European telecoms markets across fixed and mobile sectors. He has produced reports on DSL acceleration technologies as well as regular updates on European markets, notably in Central and Eastern Europe. Stephen is a graduate in Politics, Philosophy and Economics from St Catherine's College, Oxford University.

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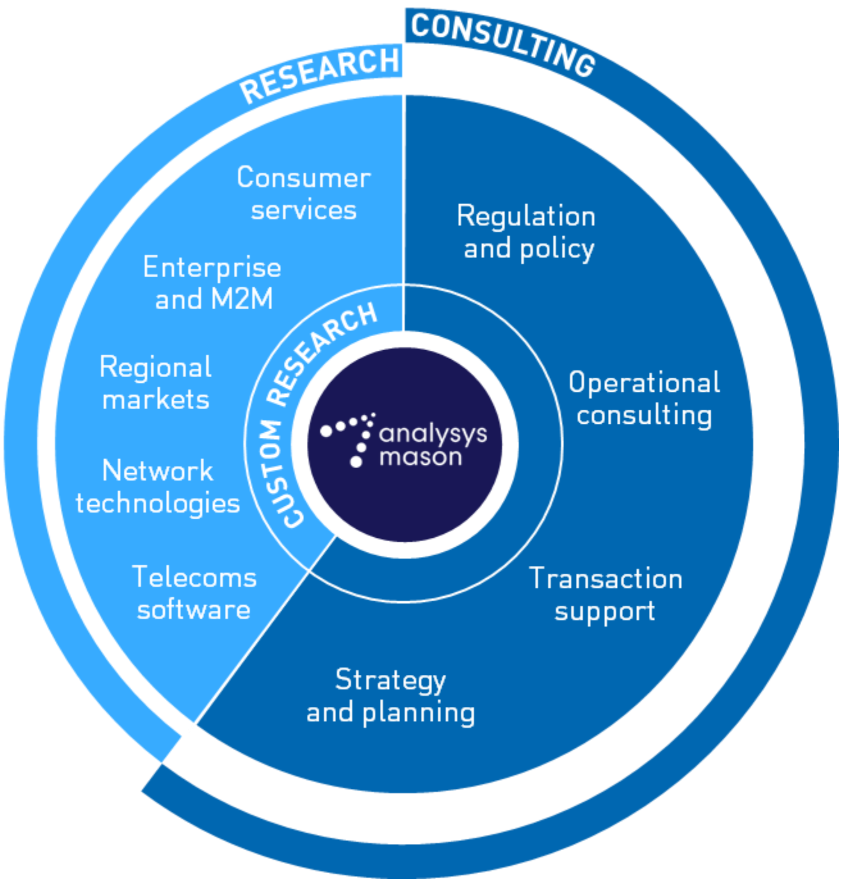

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Tel: +44 (0)20 7395 9000 • Fax: +44 (0)20 7395 9001 • Email: research@analysysmason.com • www.analysysmason.com/research • Registered in England No. 5177472

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