BACKHAUL BOTTLENECK?
COPPER TO THE RESCUE!

Copper to the Rescue

The mobile telecommunications industry is in the throes of another generational change. As 3G networks are superseded by 4G, operators around the world are looking with an ever greater sense of urgency at their backhaul infrastructure. Whereas many in the industry have assumed that fibre and high-bandwidth microwave systems will be the only viable solutions, it is likely that copper – a resolutely 20th century technology – will provide a lasting solution to a 21st century challenge.

4G or Not 4G?...
..No Longer a Question

The deployment of 3G network infrastructure was a major challenge for mobile operators. Not only was spectrum often prohibitively expensive, but also, there were many technical and commercial challenges. Device battery life was materially inferior to 2G handsets; consumer awareness of mobile data and internet access was stubbornly low; and compelling services were, initially at least, few and far between. It took many years for 3G networks to generate material returns for the majority of operators.

Not so with 4G. More than a decade on from the first 3G launches, and consumers around the world are using mobile data like never before. Data volumes have surged, driven in part by the emergence of smartphones and tablets with large screens that are ideal for viewing content, and in part by the explosion in the number and variety of applications. Add to these an apparently insatiable appetite for video, and it is little surprise that global mobile data volumes have almost doubled every 12 months.

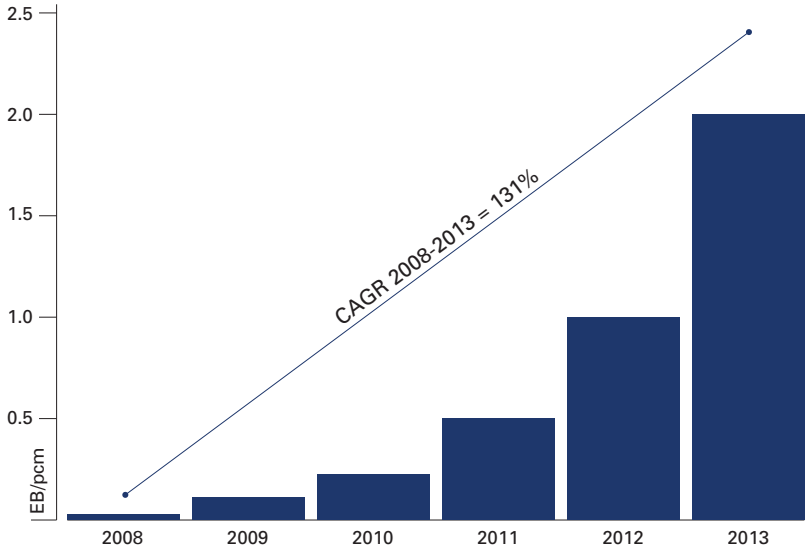

FIG.1
MOBILE DATA VOLUME GROWTH

Source: Based on Cisco Visual Networking Index, 2013

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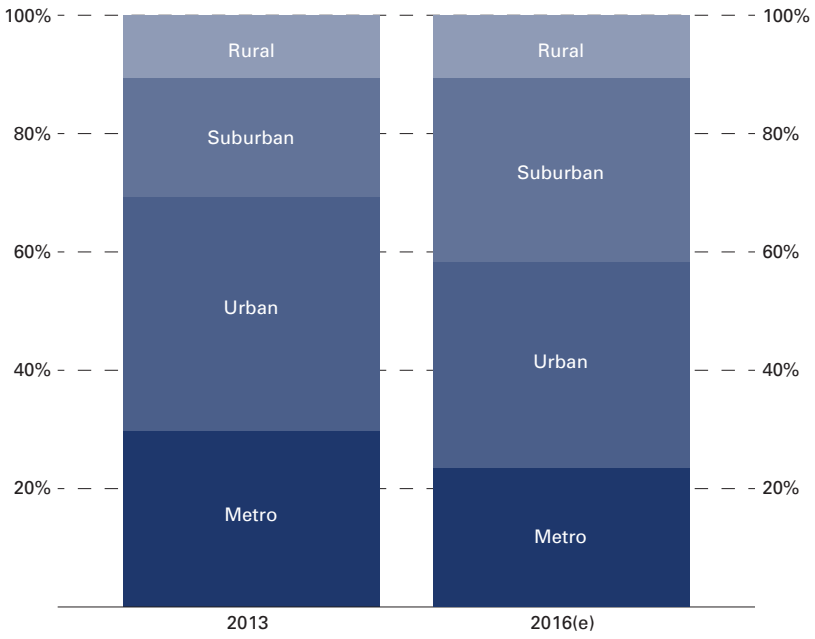
The Shape of Things to Come

During 2014, data volumes are expected to reach 2.8 Exabytes per month, with growth to 2017 continuing along an exponential curve. This growth is likely to be underpinned by a continued surge in the penetration of mobile broadband subscriptions and smart devices – from portable PCs through to tablets, smartphones and connected TVs. It is estimated that a typical laptop generates over 350 times as much data traffic as a mobile feature phone.



The changing mix of devices and services is also leading to new patterns of use, and equally importantly, new locations for heavy data usage. Whereas in the voice market, mobile is all about mobility, this is not necessarily the case in the data market. Data usage is nomadic, and centred on a small handful of locations – the home being amongst the most important.

As a result, an increasing proportion of mobile data traffic is issuing from suburban areas. Within just two years, it is forecast that approaching one third of all mobile data traffic will derive from suburban locations, compared to less than one fifth today.

This shift is logical: devices such as PCs and tablets are increasingly being connected to mobile networks, as mobile broadband prices and network speeds align with – and in many cases outperform – fixed. Such devices are increasingly used at home. And the transition to 4G is encouraging ever-greater usage. Data from the first countries to launch 4G – South Korea, the US and Japan – suggests that 4G subscribers consume more than double the data that average 3G subscribers use.

FIG.2
MOBILE DATA USAGE BY LOCATION

Source: Based on Ericsson Traffic & Market Report, June 2012

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Suburban Architecture

Adapting mobile network architectures is a challenge, even at the radio access network layer. Whereas historical coverage, even in a 3G environment, was dominated by macro cells, future coverage will be very different. In metro and urban areas, operators are increasingly relying on small-footprint cells, including femto, pico and micro variants, to provide high-performance 4G coverage at street-level. Indeed, during 2013, the number of small format cells exceeded the number of large cells for the first time.

But in suburban areas, the reliance on macro cells will likely have to persist. Apartment blocks and houses need reliable in-building coverage, and this is best provided by large calls – albeit in greater numbers.

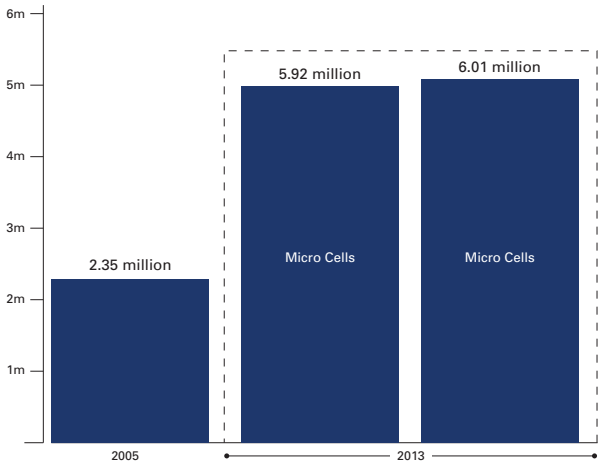

FIG.3
SMALL VERSUS LARGE CELLS

Source: Based on Informa Telecoms and Media, February 2013

The Backhaul Bottleneck

Providing backhaul to individual cells is becoming an ever-greater challenge for mobile operators (and indeed for the fixed operators who often supply them). Backhaul was already a challenging issue within the 3G world – 4G RAN deployments only serve to amplify that challenge. In an ideal world, the obvious way to provide backhaul for all mobile data networks is fibre. With the ability to provide virtually unlimited data throughput, fibre can readily provide all the capacity required. But the world is far from ideal, and fibre – though desirable – is difficult to justify financially and commercially.

Fibre is not only expensive to deploy, but also disruptive. It often requires substantial civil works, which typically cost many times more than the fibre itself. In the developed world, fibre deployment can cost between US $40,000 and US $250,00 per kilometre.

More commonly, mobile operators lease fibre from a fixed operator. Where it is available, it solves the backhaul problem – albeit at a cost of up to US $7,500 per month, for an OC-3 lease of 155 Mb/s capacity. The key issue here is “where it is available”. Fibre penetration remains stubbornly low. Across the OECD group of countries, fibre broadband reaches just 15% of homes – suggesting that outside metro and urban centres, fibre is comparatively scarce.

Where topography allows, operators have relied heavily on microwave backhaul. Though high-bandwidth microwave solutions are increasingly capable, they are expensive, and importantly, are only a viable solution in settings where there is line of sight. This is often not the case in urban and suburban areas.

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Copper: The Third Way

Copper-based connectivity has been the mainstay of many backhaul solutions. With the exception of Sub-Saharan Africa and India, copper connectivity is available in the majority of metro, urban and suburban locations. However, in its most basic form – typically leased E1 / T1 lines offering symmetric 2.048 / 1.544 Mb/s – copper is well past its sell-by date. An E1 / T1 lease can cost as much as US $750 per month, and a heavily trafficked 3G cell might need 40 or more such lines. The provision of backhaul for 4G networks via E1 / T1 leased lines is unlikely to be practical or commercially sustainable.

But solutions now exist that make far more intelligent and flexible use of legacy copper infrastructure. Copper bonding is amongst the best examples. Bonding is a technique whereby multiple twisted pairs of copper are reconfigured to become a single "fat pipe". Genesis Technical Systems mBond™ solution can reliably provide over 150 Mb/s downlink capacity over 1.5 kilometres, on copper which configured as E1 lines, was previously only capable of delivering 24 Mb/s (12 pairs).

Why Copper?

Copper is very widely available – especially in key suburban areas where data traffic volumes are growing rapidly. In many cases, copper is already the medium for cell backhaul provision, but legacy E1 / T1 services have proven an ineffective and expensive means of keeping up with demand. The business case for bonded copper is therefore very clear. There is no cost or disruption relating to civil works – the copper is already in the ground. There is no capex for fibre or new antennae – just an mBond rack-mountable unit at the cell and the local exchange: the cost is less than US $15,000 per cell, including installation.

No one is suggesting rolling new copper. Clearly the world has moved beyond that, and any new ducting being constructed is destined to house fibre. But in all those locations where copper already connects a cell, or is available to connect a cell, it makes sense to consider the use of bonded copper. Capable of delivering the same bandwidth as an OC-3 line (up to 1.5 km out), bonded copper can do the work of fibre, at a fraction of the cost – and can be installed in a tiny fraction of the time.

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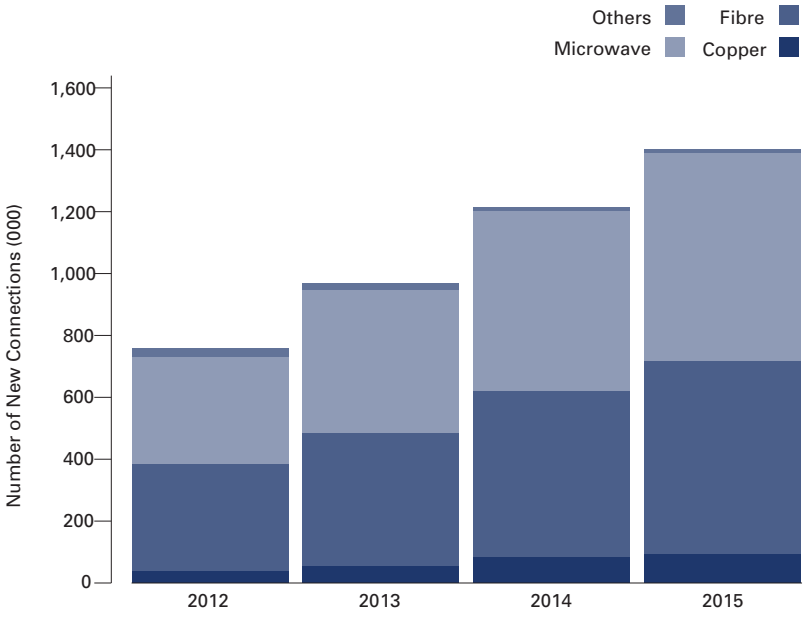
Why Now?



Uptake of smartphones, tablets, 4G subscriptions and wireless modems is not going to abate. Doubtless, 20 years from now, most cells will be connected by fibre. But in the here and now, fibre is too costly and disruptive for all but the most heavily trafficked (and therefore profitable) cells.

Copper backhaul may always represent a minority of total backhaul connections.

In most countries around 15% of macro cells connect to legacy copper backhaul.

But as awareness of the potential offered by bonded solutions grows, it could come to represent a greater and more important proportion of the total backhaul bearer mix.

FIG.4
BACKHAUL CONNECTION MIX

Source: Based on Infonetix Research, 2012

Make Copper Do the Work of Fibre

Bonded copper solutions like those of Genesis Technical Systems can allow operators to delay investment in fibre for a decade at least: essentially for as long as the copper lines are serviceable and functioning – without any performance compromise.

Capable of delivering fibre-like throughput, bonded copper solutions can provide enough capacity to more than accommodate data traffic volume growth – especially in suburban areas where growth is strongest, and copper readily available. It is in these very same suburban areas that the business case for fibre backhaul is at its weakest. Conversely, re-use of existing copper, with a bonding solution, is amongst the least expensive backhaul options available.

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About mBond™

Genesis Technical Systems' mBond solution is designed specifically as a bonded copper solution for cell site backhaul. A 1U rack-mount unit is placed at CO and CE ends, and copper pairs between the two are connected. Available in 12 pair configuration at present, additional units for 24, 48, 8 and 4 pairs are planned.

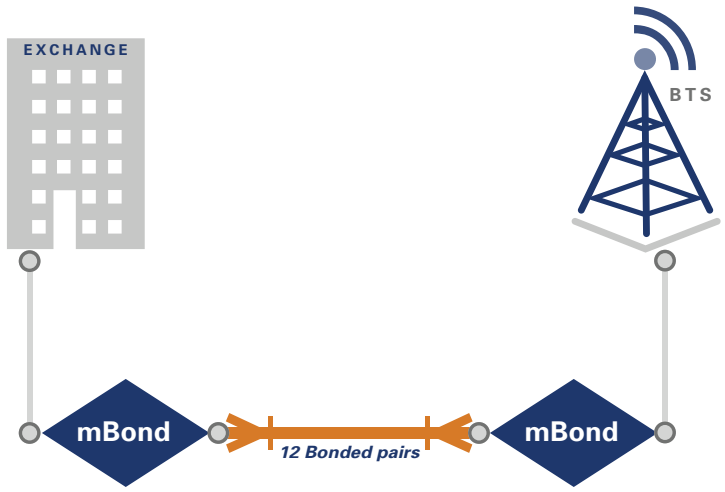

FIG.5
MBOND SCHEMATIC

Going the Distance

mBond is more than a concept. It is available for purchase today, and has already been tested in the field, on live networks. The results of field trials have been nothing short of astounding.

"Telcos that recently trialled mBond were delighted with the results that speak for themselves," said Stephen Cooke, President and CTO, Genesis Technical Systems, *"Achieving 157 Mb/s at 1450 metres with 12-pairs and 77 Mb/s at 1300 metres with 4-pairs is a revolutionary solution for operators."*

About Genesis Technical Systems

Genesis was founded by telecom pioneers who believe there is a better way for telecom carriers to thrive in a rapidly changing competitive landscape, by re-using their existing infrastructure.

In parallel to its work on mBond solutions, Genesis Technical Systems is developing the ground-breaking DSL Rings® technology that provides high speed internet bandwidth of up to 400 Mb/s over a phone company's existing last mile infrastructure at very low cost. DSL Rings changes the competitive landscape for voice, video and data telecommunications services by enabling superfast internet bandwidth to rural and urban customers at a fraction of the cost and deployment time of other solutions.

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Contact Us

For further information about Genesis Technical Systems or mBond, please:

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Customer Experience

- Materially improved data throughput on enabled BTS
- Minimal impact on latency
- Reduced impact of high network load on user experience

Revenue Generation

- More users, more uses, more frequent use
- High speed broadband capacity even on BTSs at network margins
- Allows for accelerated LTE deployment in non-fibre areas

BTS Economics

- No need to deploy fibre or install microwave equipment
- Potential opex reduction (fewer copper pairs required)
- Uses existing copper stock
- Can be used for primary or secondary redundant connectivity
- Minimal capex impact - less than 10% of the cost of fibre

Competitive Advantage

- Quickly address network performance weak spots
- Selectively address traffic hotspots with no fibre access
- Increase overall network KPIs
- Improve customer satisfaction
- Drive data adoption in areas poorly served by competitors
- Minimal capex impact - less than 10% of the cost of fibre

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Installation & Maintenance

- Minimal installation time - single rack unit per BTS
- Minimal disruption to service during installation
- Rapid swap-out model for fault resolution
- Full support for all DSLAM / MSAN architectures

Tactical Advantage

- Rapid response to growing traffic volume
- Targeted on a cell by cell basis
- Match competitors' fibre upgrades with a more financially sustainable solution
- Drive suburban advantage

Network Agnostic

- All GSM-derivative technologies to LTE and beyond
- All wireless technologies including WIMAX and CDMA
- Works equally well in fixed network settings
- Vendor agnostic - major DSLAM and MSAN brands supported

Technical Advancement

- Single rack unit per BTS - no additional hardware
- Exchange gateway controller for central management
- Best combination of performance and price
- Near-zero provisioning effort - works out of the box

Endnotes / References

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