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20 July 2006

David James

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The milestone of one billion people with access to the Internet was reached in late 2005 according to the firm eMarketer. Nearly a quarter of these had broadband access, enabling them to surf the Internet, download large quantities of data and engage in interactive sessions over the Internet. That implies that over 5.5 billion people still do not have access to the Internet. Governments and national regulatory authorities (NRAs) round the world are attempting to mitigate the 'Digital Divide' that has developed between those businesses and consumers that have access to the Internet, and those that do not. These actions are focusing around the rollout of broadband services. Narrowband dial-up is no longer sufficient to provide access to the enormous volume of rich multimedia content that is now available on the Internet.

Government incentives, regulatory intervention and/or competition are required to stimulate broadband rollout. In most countries the incumbent owns the access network, or 'local loop', that connects the customer premises (home or office) to the public telephone network. There is limited competition in access infrastructure available from cable operators, and as yet very little from wireless and satellite service providers. Hence, any other service provider that wants to provide broadband access is obliged to rent a wholesale broadband access service from the local loop infrastructure owner, usually the incumbent.

In this report we analyse the wholesale market for fixed broadband services. We do not address the subject of mobile broadband services beyond acknowledging that they may provide a means of increasing broadband deployment where there is little or no fixed local loop infrastructure.

Key messages

Governments and regulators are trying to encourage the market to make broadband ubiquitous. The carriers' belief is that broadband will provide a platform for higher value services, which will reverse the decline in line rental and usage revenues, and open up a range of opportunities for profitable revenue growth. However, providing broadband as a retail service is not the sole preserve of the incumbents. Components such as unbundled local loops or bitstream access can be key enablers for service providers to supply broadband retail products. Intervention has increased broadband penetration and revenues.

The evidence from around the world demonstrates that government and regulatory intervention has stimulated broadband rollout. Subsidies and loans in places such as Korea and rural US, and initiatives such as the Singapore government's ONE

(One Network for Everyone) have provided a powerful incentive for telcos to provide broadband services.

Additionally, where regulators have compelled incumbents to unbundle their local loops, as in Denmark, France and Japan, broadband penetration has grown faster than in countries where local loop unbundling (LLU) has only recently been implemented.

The wholesale broadband market is alive and kicking

As with any wholesale service, wholesaling broadband services facilitates differentiation, and hence choice, at the retail level. In several countries more than 50% of broadband connections are delivered via incumbents' wholesale service offerings. Whilst the price of wholesale broadband is lower than that for retail broadband services, they can still offer an attractive margin as the costs of provision are lower, and the volume of wholesale broadband take-up is a valuable source of revenues.

Co-operation rather than confrontation

Incumbents such as Deutsche Telekom and Telstra are following a confrontational approach with governments and regulators in an attempt to defend their retail broadband business from competition. However, others such as BT are demonstrating that more of a co-operative approach with wholesale customers and regulators can be beneficial: it takes a major shift of mindset to see retail competitors as valuable wholesale customers.

Differentiation is more than just slashing prices

Fierce competition and pricing pressure from regulators (who are under pressure themselves from their political masters to achieve wide broadband adoption) will affect wholesale prices. Broadband service providers are looking to incumbents to provide them with a range of broadband services and bundles. By doing so, the wholesaler has the potential to earn greater margins over the basic resale product, by providing the customer with the incentive to opt for more complex (and profitable) services.

Importance of systems and process that are up to the job

Too many of the disputes between wholesalers and their customers focus on the systems and processes for ordering, provisioning, managing and billing for wholesale services. This is particularly a problem for wholesale broadband where systems are required to handle bulk migrations, manage LLU installation and commissioning, and to ensure that faults are identified and fixed as quickly as possible.

Manual processes simply cannot cope with the volumes involved in many of these day-to-day transactions. In order to support round-the-clock operation wholesalers must provide their customers with online ordering, reporting and diagnostic tools.

Opportunities exist for second-level broadband wholesale

The cost of unbundling an exchange is considerable, with a breakeven point somewhere in the hundreds of unbundled lines. The capex involved, together with the operating costs of retail sales, marketing and customer support are leading a growing number of broadband service providers to change focus from the retail market to wholesale. By offering their unbundled lines directly to ISPs who do not want the expense of their own LLU infrastructure, these second-level broadband wholesalers have greater economies of scale and opportunities to recoup their investments.

What is wholesale broadband?

In contrast with narrowband (also known as dial-up) access, which operates at speeds of up to 56kbit/s, broadband typically offers downstream speeds ranging between 512kbit/s and 100Mbit/s, depending on technology and distance from the local exchange. Not very long ago, narrowband was sufficient for all but the most intensive users of the Internet. However, the rapid take-off of higher bandwidth applications and P2P file sharing has dramatically increased the demand for broadband access. *Figure 1* shows the bandwidth used by a range of current and emerging higher-bandwidth applications.

Figure 1 **Bandwidth requirements of current and future applications**

Higher-Bandwidth Applications	Estimated Bandwidth Required
VoIP	100kbit/s
Standard TV	3Mbit/s
High-speed Internet access	8Mbit/s
High definition IPTV	6-8Mbit/s (MPEG4), 20-25Mbit/s (MPEG2)
Super HD (SHD-TV)	32Mbit/s (MPEG4), 60Mbit/s (MPEG2)
3D HDTV	187Mbit/s (MPEG4)
Multimedia-rich Teleworking	Up to 20Mbit/s
Telemedicine (High Definition Images)	75Mbit/s and beyond

Source: Ovum, IDA

In most countries the incumbent owns the access network, or 'local loop', that connects the customer premises (home or office) to the public telephone network. In some countries broadband access competition exists from cable operators, and sometimes also from wireless and satellite service providers. Frequently, any service provider that wants to provide broadband access is obliged to rent a wholesale broadband access service from the local loop owner.

Incumbents have historically been reluctant to provide their competitors with access services because of the consequent loss of revenues and end-customer

business. This unwillingness to let go of the retail customer has been characterised by delays and seemingly endless wrangles over wholesale price regimes. Many governments have decided that the future competitiveness of their countries and the demands of their populations depend on the availability of inexpensive broadband Internet access. In order to achieve their goals for broadband penetration, governments and their regulators have decided to encourage broadband competition by compelling the local loop owner to provide direct access to the customer on a wholesale basis.

Hence, there is a growing range of wholesale broadband services available, using different technologies, providing different speeds and asymmetric or symmetric paths between end user and the network. Digital subscriber line (DSL) variants are the most commonly available broadband technology, although cable modems are used to provide broadband Internet access in a large number of countries.

DSL bandwidth depends on a number of factors:

- the distance from the local exchange
- the 'flavour' of DSL deployed (there are many flavours of DSL, with different bandwidth, symmetry and distance limitations)
- the conductivity of the metal used in the local loop infrastructure (for example, copper or aluminium)
- the amount of noise on the line or from the environment
- the specifications of the DSL access multiplexer (DSLAM) at the local exchange
- the capabilities of the customer premises equipment (CPE) used.

These factors are important because DSL is deployed on access networks that were originally designed solely to carry PSTN voice traffic, which has very different characteristics from broadband data traffic. In contrast, most cable networks were designed from the outset to carry large volumes of data. Hence, they provide a more consistent bandwidth than DSL access networks.

In some countries limitations in the availability of access infrastructure, whether cable or PSTN, necessitates the use of other technologies. Other broadband technologies include leased line, broadband fixed wireless access (BFWA), wireless local loop (WLL) and satellite broadband.

As ownership of both cable and DSL local loop infrastructures raises various competition issues, most incumbents have been forced to dispose of their cable operations in recent years.

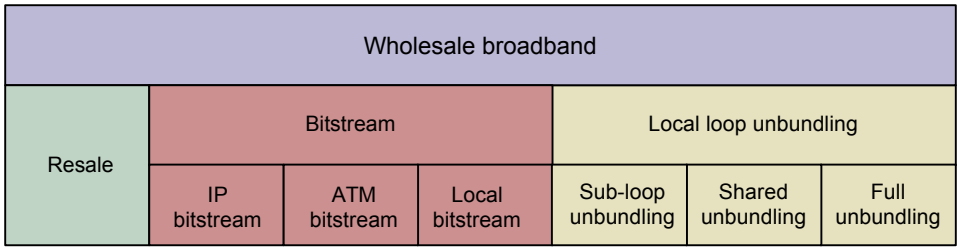
Differing wholesale models

The options for wholesaling broadband (as shown in *Figure 2*) fall into three major groups:

- simple resale
- bitstream

- LLU.

Figure 2 **Wholesale broadband options**



Source: Ovum

Simple resale

Simple resale, also confusingly known as 'wholesale broadband', simply involves the incumbent providing their retail broadband, as a wholesale service to an intermediary who markets it to retail customers. This form of wholesale broadband service is best suited to service providers who do not have their own network infrastructure, but who wish to provide a broadband service simply to fill a gap in their service portfolio. It is not suited to service providers who wish to roll out their own portfolio of differentiated services over their own network infrastructure.

Simple resale is usually priced on a 'retail-minus' basis, but the margin available to the service provider is lower than for any of the options. There is very little that the service provider buying resale can do to differentiate their broadband service from that of the incumbent which is actually providing them with the service – pricing and brand are the only significant differentiators.

The service provider using simple resale has the billing relationship with the retail customer for the broadband service (although the incumbent providing the resale service sometimes also does the end customer billing). But that retail customer will continue to receive a separate bill from the incumbent for their line rental and PSTN usage.

Bitstream access

Bitstream access differs from simple resale in one important regard – aggregated traffic is handed over by the access network owner to the wholesale customer's own network. In 2004 the European Regulatory Group (ERG) defined four different bitstream options, differentiated by the point of the traffic handover:

- **DSLAM handover**, where the service provider's backbone is connected directly to the access network owner's DSLAM in their local exchange
- **ATM bitstream**, where the handover occurs at a distant switch
- **IP bitstream**, where the handover occurs at a remote IP point of interconnect

- **Simple resale**, where there is no traffic handover (as described above).

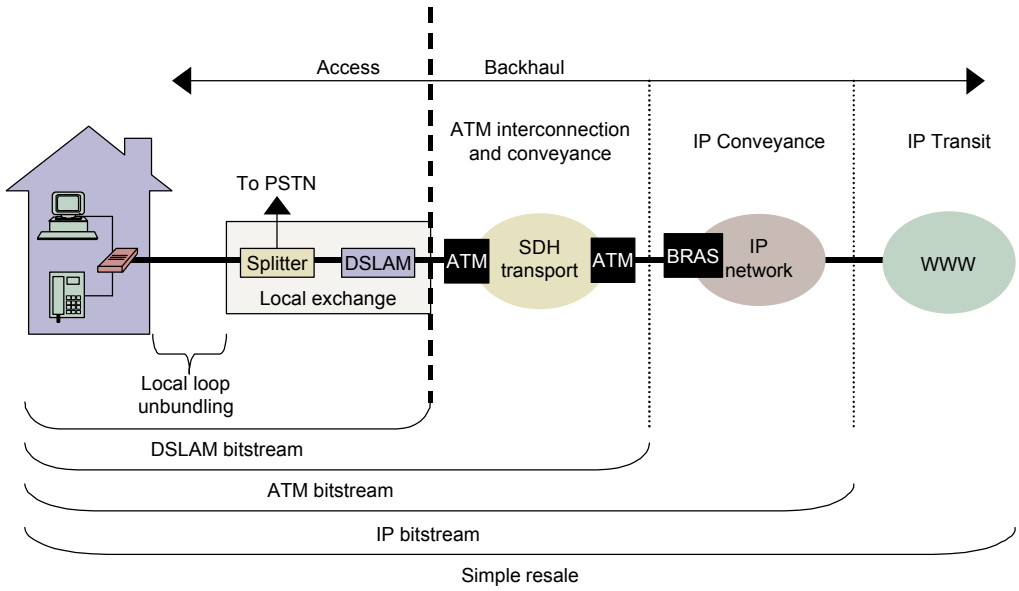
These bitstream services are ideally suited to competitive operators who have not built out their networks to the access network owner's local exchanges, and to operators that have, but have not deployed their own DSLAMs in those exchanges.

Although bitstream does not enable the competitive carrier to offer a different type of broadband service from the access network owner, it does provide the altnet with a greater margin, and hence greater pricing and bundling flexibility. The closer the point of handover is to the DSLAM, the less the altnet has to pay for the service and the greater the flexibility it has over pricing its retail service.

The altnet may provide additional services on its network, such as security, email or network storage. The ultimate retail customer will still receive separate bills for the access network from the access network owner, and for the broadband service from the altnet.

Bitstream is also a popular means by which altnets provide broadband to their customers where the local loop has not yet been unbundled, or as a stop-gap solution until the altnet can install its own DSLAMs in the local exchanges.

Figure 3 **Different wholesale broadband options**



Source: Ovum

Local loop unbundling

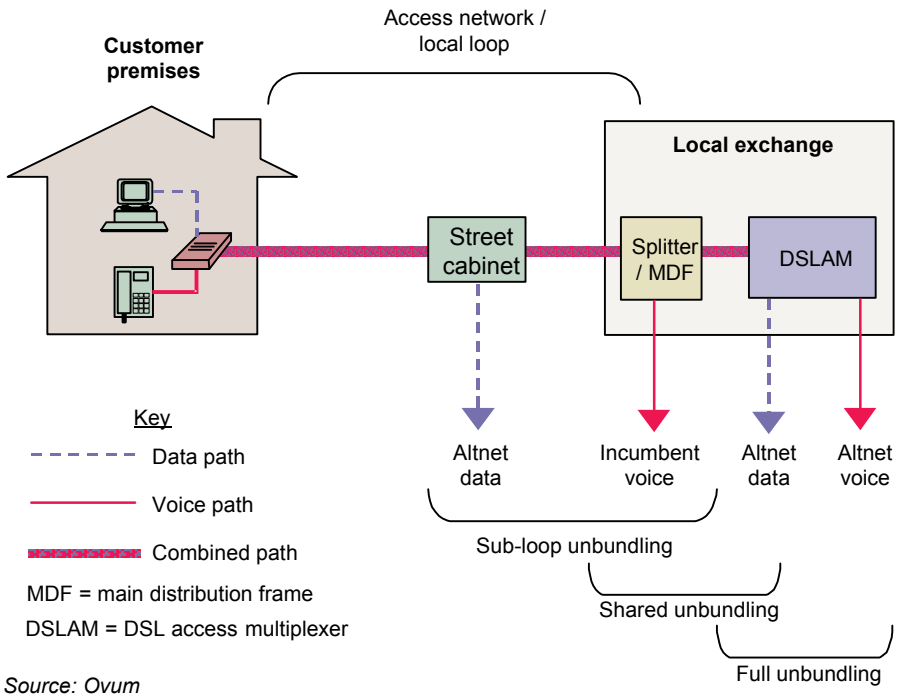
LLU involves the access network owner connecting the retail customer's local loop to the altnet's own DSLAM equipment, which may be on the access network owner's premises. The owner of the access network will make a one-off connection

charge and apply a rental fee (or unbundling charge) on an ongoing (usually monthly) basis to cover maintenance and repairs to the local loop. There will also usually be charges for locating altnet equipment in the local exchange, to cover power, ventilation, security and space.

There are three types of LLU service:

- **Sub-loop unbundling**, where the altnet accesses the retail customer's line at some point between the customer premises and the local exchange
- **Shared unbundling** (also known as 'partial unbundling' and 'shared access'), where the altnet only rents the broadband part of the line between the exchange and customer premises (i.e. not the voice channel)
- **Full unbundling**, where the competitive carrier leases the entire line between local exchange and customer premises, enabling them to offer voice and data services

Figure 4 **Local Loop Unbundling variants**



Source: Ovum

In all types of LLU, the retail customer receives a single bill from the altnet, covering the broadband line rental and broadband services. However, in the case of shared unbundling, they will be billed separately by the provider of the voice service.

Although it is by far the most capital intensive form of wholesale broadband, LLU provides the competitive carrier with the greatest opportunities for differentiating its broadband services from those of the access network owner and other

broadband service providers. By installing its own DSLAMs, the altnet can offer higher speed services, symmetric services (i.e. equal upstream and downstream bandwidth), and has much greater control over its operating costs.

Shared unbundling is a simpler option for altnets who may wish to provide VoIP as an alternative to switched voice.

LLU is the option preferred by altnets who cannot afford the risk and expense of rolling out their own access networks, but want the greatest opportunity available to differentiate their services. It is also preferred by regulators because it avoids duplication by using the existing access network infrastructure, while still providing a competitive broadband market to retail customers.

However, LLU is not cheap. The cost of equipping a local exchange with DSLAM and associated equipment, plus the ongoing operating costs mean that an altnet needs to acquire at least 500 customers per exchange in order to recoup its set-up costs.

In the past a number of incumbents have been decidedly slow in processing requests to unbundle their exchanges in a rearguard attempt to defend their retail broadband customer base. Understandably regulators have acted against such anti-competitive behaviour.

Naked DSL

Naked DSL (NDSL) is a DSL service without an accompanying PSTN line over the same copper pair. Naked DSL availability remains limited. At a retail level it is only available in selected Nordic markets and North America, and is being introduced in competitive broadband markets such as France and the Netherlands. The competitiveness of the markets at infrastructure level largely determines the appeal of NDSL. In markets with strong infrastructure competition (for example, through cable or LLU), NDSL is likely to be available and relatively attractively priced, whereas in most other markets (if it is available at all) it is offered at, or close to, the sum of DSL + PSTN services, offering little incentive to users or altnets to take up the service.

Other options available to competitive carriers

There are two other options available to competitive carriers who wish to provide broadband services to their customers that do not rely on services provided by the incumbent:

- building access networks themselves
- using a competitive provider's wholesale broadband service.

The option of building competing access networks is not common because of the expense and time involved. However, a notable exception is South Korea, where some competitive operators have built their own local networks. This is a legacy from facilities-based competition in other markets rather than a broadband-focused deployment. Another case is where the incumbent has little or no existing access

infrastructure, as may be the case in developing countries. In such situations, the competitive carrier is not limited by the type of existing access network, and can choose the most suitable technology to its purposes (such as broadband fixed wireless, WiMAX, FTTB – fibre-to-the-building, satellite, or even mobile networks).

Some competitive carriers that either have their own access networks, or use the access network owner's own wholesale broadband service, are providing alternative wholesale broadband services in competition with the incumbent. QSC in Germany, Covad in the US and Bulldog (now owned by Cable & Wireless) in the UK are examples of companies using this model. This 'secondary wholesale' may provide different or a greater range of broadband services than the incumbent, but it is most likely to resemble the bitstream and simple resale options that are already offered by the access network owners.

The access owner's point of view

Clearly, the retail arm of the access network owner sees all forms of wholesale broadband as enabling competitive broadband service providers, and hence a threat to business. However, as already discussed, many governments and regulators have taken the view that the widespread rollout of broadband technologies depends on effective competition between providers. This will enhance the role of wholesale broadband services since competitive access networks are likely to remain uneconomic. The opportunity for owners of access networks, particularly incumbents, is to earn revenues through wholesale to counter the loss of business at the retail level.

Simple resale is the most profitable and least risky to the wholesaler, and full LLU has the lowest margin and the greatest risks. These risks relate to loss of business to competitors and also to the perceived risks of having competitive carriers' equipment and staff in local exchanges.

However, there are also a number of advantages to access network owners of providing wholesale broadband services:

- service providers can target specific niches with bundles and brand, which may not be reachable by the incumbent's own retail broadband service
- the avoidance of higher SG & A costs, which are incurred by those serving the retail market
- others take the risk of trying new technologies, such as ADSL2+ or SDSL

Critical issues for fixed broadband wholesalers

Opening up other broadband networks

In February 2006 the Dutch minister of Economic Affairs Laurens Jan Brinkhorst said that Dutch regulator OPTA will force cable companies to open up their networks for competitors to offer TV services. This could be the start of a process

by which competitive access providers are eventually required to open up their access networks to other service providers.

Furthermore, cable operators are unlikely to voluntarily wholesale their access networks because they see it as a threat, as it enables competitors to launch their own services without having to commit to significant investment in infrastructure (much as the incumbent operators did with their access networks).

However, satellite and WLL broadband access providers are more likely to open up their networks in the form of wholesale broadband to existing service providers and brand owners that already have established retail customer bases. Broadband service providers that currently serve centres of populations may well use such services to extend their coverage into much less densely populated rural areas.

Operational separation of access services

In June 2005 the UK regulator Ofcom and the incumbent BT agreed the latter's proposal to create a new, and operationally separate, business unit to take over responsibility for BT's access services. The business unit, subsequently called 'Openreach', commenced operation in January 2006.

The agreement was a consequence of Ofcom's acknowledgement that 'years of intrusive regulation [had] not created the conditions for the sustainable competition necessary for long-term consumer benefit', and the threat to refer BT to the Competition Commission if it did not ensure equivalence of access for its competitors and own retail business.

The key features of the agreement were:

- **enforceability** – if BT went back on its undertaking, Ofcom could have referred it to the High Court
- **branding and identity** – the new business unit was to have a distinct new brand and identity, with separate management, locations, staff incentive schemes, and operating and trading systems from the parent group
- **product equivalence** – the business unit was to support all providers' retail activities (including those of BT Retail) on a precisely equivalent basis, with the same products, for the same prices through the same systems and processes
- **products and services** – the product set of the new business unit includes LLU, WLR and backhaul services
- **next-generation networks (NGN)** – providers who will depend on BT's NGN 21CN will not be placed at disadvantage compared with other parts of the BT group
- **board and governance** – the new unit is monitored by a new Equality of Access Board (EAB), independent of (but including representatives of) the BT Group board.

As well as reducing the need for intrusive regulation, and ensuring a fairer deal for competitors, separating out the monopolistic elements of a telco's business can

help the telco itself. This separation may be along the lines of wholesale versus retail, as several telcos have now done, or the more radical option of putting local access into a separate business *a la* BT. Such moves recognise that these functions not only have different competitive attributes, but are also essentially different businesses, with different underlying economics, different investment requirements, different skills and competencies and different customer requirements. Separation can help telcos not only to develop clear objectives but give them the means to achieve them.

Such forms of operational separation are likely to increase the availability of wholesale broadband services, and therefore the choice for the retail customer. We will be watching with interest whether other regulators will follow the UK example, and demand operational separation of the incumbent's access business from the remainder of the company. We already believe that the EU Commission is considering this form of separation, and in May 2006 Sweden's minister for communications and regional policy announced that the government was considering separating the fixed line access network of incumbent TeliaSonera.

Broadband as the Trojan Horse

Broadband enables the switch to VoIP

Always-on broadband services, and in particular broadband via LLU, can be seen as the Trojan Horse that will enable competitive service providers to offer VoIP services to retail customers. This could, at a stroke, cut off the incumbent's already declining fixed voice revenues.

For most incumbents, fixed voice revenues traditionally have been the cash cow of their business. They were the source of a large proportion of their revenues, and most of their operating profits. However, voice prices are falling, margins are getting squeezed, customers are migrating some or all of their calls to mobile networks, and VoIP now threatens what fixed voice traffic remains.

VoIP can be carried on the same network as data, with negligible incremental cost. It enables service providers to offer voice services that are more difficult or expensive to provide over PSTN, such as call re-routing and forwarding, conferencing, automatic redial and fixed–mobile convergence (FMC).

Disruptive retail broadband competition

In April 2006, Carphone Warehouse announced the launch of a free broadband service, based on wholesale products from the incumbent. Carphone Warehouse is already a big player in the UK market, with a strong retail presence (669 stores in the UK alone). Consumers know and trust its advice in choosing a mobile handset, service provider and tariff package. Carphone Warehouse also owns a fixed network (formerly Opal Telecom) that switches over 1.5 billion minutes each month. It now has 2.6 million TalkTalk customers in the UK, following the

acquisition of One.tel. The aim is to grow this to 3.5 million by March 2009, with half using the Carphone Warehouse broadband service.

For customers, Carphone Warehouse's offer is clear and compelling. The pricing significantly undercuts everything else in the market. For a monthly fee customers can make unlimited local, national and international (to 28 countries) landline calls, and receive an 8Mbit/s broadband service. Broadband is provided free unless a customer is not connected to an unbundled exchange, in which case they pay a small premium. For customers who can't be served using local loop unbundling (LLU), Carphone Warehouse will use BT's broadband resale service as a stop gap measure.

By using a wholesale broadband service to offer a 'free' retail broadband service, Carphone Warehouse is expecting to attract customers away from other service providers' retail broadband offerings, including those of the incumbent. Its success will depend on its ability to meet customer expectations promptly, and the availability of the incumbent's new automatic bulk customer transfer system.

This was followed in May 2006 by the launch of Orange's combined mobile-broadband offer. If new and existing customers commit to a monthly mobile contract, Orange will supply them with free broadband and a modem that will enable them to make VoIP calls from home. Offering a 'free' broadband service to its mobile customers will act as a powerful retention tool in a mobile market with limited and half-hearted retention strategies. Using this base, Orange eventually plans to launch a range of converged products and services to further increase its ARPU. It is already including security, email and web server space.

Both Orange and Carphone Warehouse contracts are for a minimum of 18 months, which is rather longer than usual for broadband-only services. Carphone Warehouse also levies a large disconnection fee for customers wishing to terminate their contracts. This is to ensure that they recoup the initial costs of unbundling lines or otherwise buying wholesale broadband from the incumbent.

The 'free' broadband element of these bundles is what attracts consumers, even though committing to such a bundle from Carphone Warehouse, Orange or some other service provider will almost certainly result in a higher spend with that provider. Such 'free' broadband competition is disruptive at the retail level, but it does stimulate increased take-up of broadband services and therefore increased use of wholesale broadband services.

Defence through customer service and bundling

The incumbents' armoury of defences against LLU is getting increasingly sophisticated. Some unbundlers, such as Cable & Wireless' Bulldog in the UK, have been unable to maintain customer service standards in the light of the demand for their services. In contrast, the retail arms of incumbents can point to their existing customer service infrastructures, systems and processes that routinely handle large numbers of customer requests, and play up the number of broadband customers returning after less than satisfactory experiences.

Incumbents need to show that they are innovating and rolling out new broadband services and service packages in order to retain existing customers. For example, by utilising rate adaption a carrier can maximise the available speed on a particular DSL line dynamically. Furthermore, by bundling broadband access with value-added services such as email, VoIP, IPTV, spam filtering, anti-virus and other security functions a carrier can make its offering more attractive than those of its competitors.

To counter the threat presented by LLU, many access network owners are already offering their own bundles of broadband, fixed voice, IPTV and sometimes mobile services to consumers. This is putting incumbents in direct competition with the cable operators. However, the limitations of DSL when deployed on existing access networks mean that such bundles depend on the characteristics of the local loop. This is one of the drivers of US RBOCs' rollout of FTTx access networks.

Next-generation broadband networks

Is LLU going to halt development of the local loop?

The rollout of LLU in local exchanges reduces the incentive for incumbents to upgrade the local loop. They may be able to secure greater wholesale revenues for higher specification local loops, but any upgrading of local loop infrastructure is unlikely to pay for itself in the short to medium term. Hence, the possibility that LLU will stymie developments in the local loop, such as fibre-to-the-node (FTTN), or the use of alternative access technologies, such as BFW or WiMAX.

Furthermore, LLU is only a practical choice for competitive operators who already have a backbone network, and pockets deep enough for the capital expenditure necessary to unbundle and exchange. LLU is much less likely to catch on where population densities are low, and too far from the local exchange for high speed DSL to be effective. Hence, the incumbents can see the cream of urban broadband customers being tempted away by competitors, while they are left with the more expensive to serve rural population.

DSL technologies simply fail to deliver broadband over a certain distance from the local exchange, so providing broadband to customers with longer local loops will necessitate alternative technologies. For those countries where this issue exists, there is really only one solution - shorten or remove the copper loop length. To do this means the deployment of access fibre or a wireless local loop (BFWA or satellite) to the node or to the home. Some have already made this decision - Belgacom, KPN, Deutsche Telecom, Swisscom are just four such examples from Western Europe. Others prefer to wait until the market demands for services such as IPTV, and hence the business case, becomes clearer.

Incumbents threaten to throw their fibre out of the pram

Telcos such as Deutsche Telekom and Telstra are threatening to abandon their plans for new broadband networks if their regulators insist that they provide access

to competitors from day one. No-one wants to make the huge investments involved if they cannot see sufficient return on that investment.

In November 2005, the German incumbent, Deutsche Telekom announced plans for a high-speed 50Mbit/s VDSL (FTTN) project, as the basis for its 'conquer the home' triple-play strategy. Deutsche Telekom is pressing the government to be granted exclusive access to this broadband network. The European Commission, the German regulator Bnetza and the alternative operators in the country all oppose this move.

In May 2005 the German government agreed to exempt Deutsche Telekom's €3 billion investment from 'regulatory actions for a certain period of time' (no specific time stated) to ensure adequate returns. However, the European Commission has expressed worry over this agreement as it also includes a clause making the new fibre network exempt from regulation. EU law forbids such an exemption. Deutsche Telekom states that it is unable to make any profit from this investment in fibre without the exemption. An association for alternative operators has expressed worry about the exemption, stating that it will send bad signals to foreign investors, as well as dampen competition.

At the same time, Australian incumbent Telstra is planning a A$3.5 billion FTTN broadband network, but is pressuring the regulator not to impose 'excessive restrictions on pricing' or to compel Telstra to open the network to competitors on an equal basis. The debate with the ACCC is particularly tense as Telstra approaches the sale of the final tranche of the state's shareholding, known as T3. Telstra's Chief Executive Sol Trujillo is insisting that the company be allowed to charge access to the new network to competitors at what it sees as a commercial rate in order to secure a competitive rate of return on its investment. Telstra is threatening to postpone plans for the new network if it does not get the regulatory guarantees it is seeking.

In early June 2006 a group of CEOs and senior executives from European incumbents met to lobby the EU telecoms commissioner, Viviane Reding, to reduce and even lift access regulation. The companies pointed to US initiatives to upgrade and replace access networks now that operators are no longer required to unbundle as an argument in favour of a lighter regulatory touch.

The picture is not so simple

However, the picture isn't as simple as these telcos are painting it. By deploying fibre in the local loop, they may well be able to get higher ROI than from the existing ageing copper access network. High capacity networks will enable service providers to carry bundles of services, such as triple play, which will generate more revenues. The danger of such fibre deployment being sheltered by the umbrella of regulatory forbearance is that it entrenches the position of the incumbent as dominant in local loop.

In contrast, BT has engaged its competitors and wholesale customers in a forum, called Consult21, to consult and inform them on the direction the BT is heading in

with its £10 billion ($17.6 billion) NGN, 21CN. As well as fostering good relations with customers by involving them at an early stage in the development of the network, it also may discourage them from developing their own competitive NGNs. Furthermore, Consult21 is a means of helping wholesalers and customers alike in determining how and where they define the interfaces between them in what is supposed to appear as a single, seamless network.

Meanwhile, in April 2006 six of Australia's competitive carriers proposed a plan to develop the new NGN co-operatively with Telstra. Macquarie Telecom's Chief Executive David Tudehope said 'Under our proposal, Telstra would be joined by other telcos and Internet service providers in making the necessary investment to upgrade the existing copper local loop into a high-bandwidth fibre-to-the-node network'. The proposal has received a positive response from the Communications minister, who is looking forward to seeing the group's detailed proposals.

While spreading the cost and risk across several companies, such co-operation would reduce their ability to differentiate the most basic services they offer over that network. Instead, differentiation will have to depend on bundles of higher level services, the quality of customer service and targeting of specific market segments.

Systems requirements

Wholesale broadband necessitates automated systems and processes for ordering, provisioning, tracking and fault reporting. Manual intervention is error prone, can introduce delays and is costly. Initial DSL provisioning systems were not capable of supporting the volumes of transactions required by tier 1 providers. However, many of the software solutions have evolved to meet the requirements of retail and wholesale carriers.

Wholesalers provide a range of online tools to help their customers to test end user connections, circuit ownership and available broadband bandwidth. BT Wholesale's 'WOOSH' application is such a tool, which has significantly reduced the number of faults that wholesale customers have reported to BT Wholesale, and has helped to increase wholesale customer satisfaction.

Once the initial contract has been set up between the wholesaler and an ISP, simple resale can be executed using a simple automated tool. However, LLU is rather more complex because it necessitates installation of equipment in the wholesaler's exchange and physical interconnection of networks. For this reason wholesalers require advanced notice of LLU orders so that they can plan the physical work that needs to be done before a single line can be unbundled. This installation, housing and connection of wholesale customers' equipment in the incumbent's premises is called 'co-mingling'. Competitive carriers often complain about the delays this can impose on their rollout.

Service differentiation

Wholesale@Ovum's annual Wholesale customer survey demonstrates that although price is still important a number of other factors are increasing in importance to different wholesale customer segments. These include service level factors (such as quality of service, service availability and the ability of wholesalers to support back-to-back service levels for end customers), long-term relationships (demonstrating the benefits of partnership and inter-dependency, co-operative product development and proactive account management) and repair response times.

Some wholesale customers, particularly those in the non-telco intermediary and xSP space, find their best suppliers are those that help guide them in their retail strategy. According to one reseller this is about 'bridging the gap from a wholesale product to a retail offering'. This necessitates understanding the customer's customers' requirements, and providing the wholesale service bundles will help to satisfy those requirements.

Buyers of resale products are looking to the wholesaler to help them differentiate their retail service offerings, in terms of bundles, service levels and responsiveness. In contrast, companies buying LLU have the means to develop their own differentiated services – the wholesaler needs to have the processes and systems in place to enable the customer to order, provision, manage and maintain the necessary equipment for the end customer.

Segmenting wholesale customers and offering the appropriate wholesale broadband products and accompanying services for each segment is a necessity.

Opportunities for second-level wholesalers

As broadband becomes a mass market service, there will be increasing opportunities for alternative players to provide wholesale services on top of incumbents' offerings. These second-level wholesalers will install their own LLU equipment in the incumbents' exchanges, and act as intermediaries between the incumbent and a range of specialist service providers.

For these service providers, being able to buy wholesale services from companies other than the incumbent is a real boon, tapping into a pent-up demand for higher speeds, greater control and more innovative service offerings. Buying wholesale is a relatively low-risk, low-capex strategy compared to rolling out their own LLU infrastructure. In the words of Lee Strafford, PlusNet's CEO, the approach 'gives our customers the benefits delivered by LLU, without us having to make the costly LLU infrastructure investment ourselves'.

Easynet, Tiscali and Bulldog have all made public their plans to provide wholesale LLU services, and we expect others to follow. In Italy Tiscali only serves the retail market, in Germany it has retail and wholesale broadband customers, and in the UK it has an entirely indirect (wholesale) business model. After much publicised customer service problems, Cable & Wireless' subsidiary Bulldog announced in

early June 2006 that it was revising its LLU capabilities to offer a wholesale product to broadband service providers and withdrawing from the retail broadband market for new customers. At the time of writing (July 2006), Bulldog is seeking a buyer for its retail customer base.

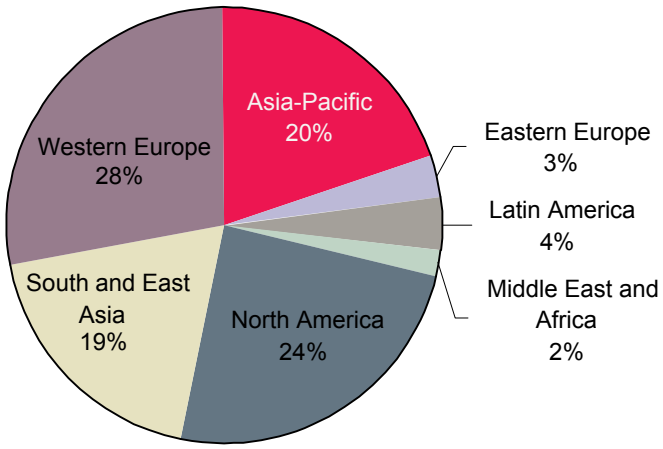
For these operators, selling wholesale (as well as retail) helps to build the scale required to make the economics of unbundling exchanges viable. For the wholesale sector in general, these players will inject competition and new service offerings (including higher speeds), which in turn will keep the incumbents on their toes.

Geographic summary

This section provides a summary of the current state of wholesale broadband deployment across the globe, taken in three super-regions: Europe Middle East and Africa (EMEA), the Americas and Asia-Pacific. There are developing countries in all of these regions where broadband penetration is very low. This may be because there is little access infrastructure, because there is no effective competition at the infrastructure level, or because wholesale broadband services that would enable retail broadband are not available. Further details of the retail broadband services available across the globe can be found in the Broadband@Ovum advisory service.

At the end of March 2006, there were about 229 million broadband lines across the globe. This was an increase of 36% compared with the previous year. However, there is considerable variation between, and within, regions. *Figure 5* shows the share of broadband lines by region at the end of March 2006. Western Europe had the largest share of broadband lines, but the regions with the greatest growth were the Middle East and Africa (MEA) and Eastern Europe. The individual country with the largest number of broadband lines was the US, with over 48 million

Figure 5 **Global share of broadband lines by region, March 2006**



Source: Point Topic

In addition to the country-specific wholesale broadband offers outlined below, there are also a number of regional providers of retail and wholesale satellite broadband services, including Inmarsat, Shin Satellite and MenaSat. Inmarsat provides satellite broadband in EMEA, Asia and Western Australia. Inmarsat will extend its coverage to the Americas later in 2006. Shin Satellite, based in Thailand, serves broadband markets from India to New Zealand, and Japan to Australia. MenaSat provides North Africa and the Middle East with broadband satellite services.

Europe, Middle East and Africa

Regional overview - EMEA

The European Commission (EC) considers broadband to be crucial in developing and maintaining European competitiveness. As a result, the EC has been very active in promoting broadband developments and deployment in the 25 member countries (the EU25). It has developed the EU regulatory framework for electronic communications, which is 'intended to encourage competition in the electronic communications markets, to improve the functioning of the internal market and to guarantee basic user interests that would not be guaranteed by market forces'.

This regulatory framework includes two wholesale access markets:

- wholesale unbundled access (including shared access) to metallic loops and sub-loops for the purpose of providing broadband and voice services

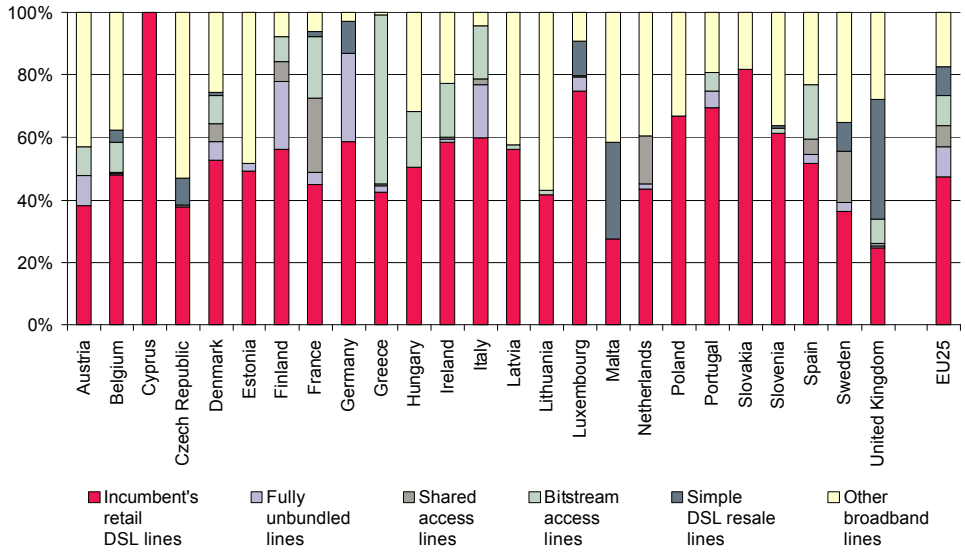
- wholesale broadband access – covers 'bitstream' access that permits the transmission of broadband data in both directions.

The EC also monitors and reports on broadband availability across the EU25. In its most recent report it noted that nearly half of European wholesale customers are supplied by alternative service providers, although the exact balance between incumbents and alternative providers varies considerably between countries. In Cyprus the incumbent still has 100% broadband market share, whereas in the UK the incumbent has around 25% market share.

The EC concluded in the same report that 'while there are many factors that contribute to broadband rollout and take-up, competition is one of the most important'. Where broadband competition is greatest, there is a healthy market for wholesale broadband services, such as bitstream access or LLU.

Figure 6 shows how much of the broadband market is served by the incumbent's retail services, by alternative providers' use of the incumbent's wholesale services, and by alternative providers via other means, according to the EC's eleventh Implementation & Enforcement Report.

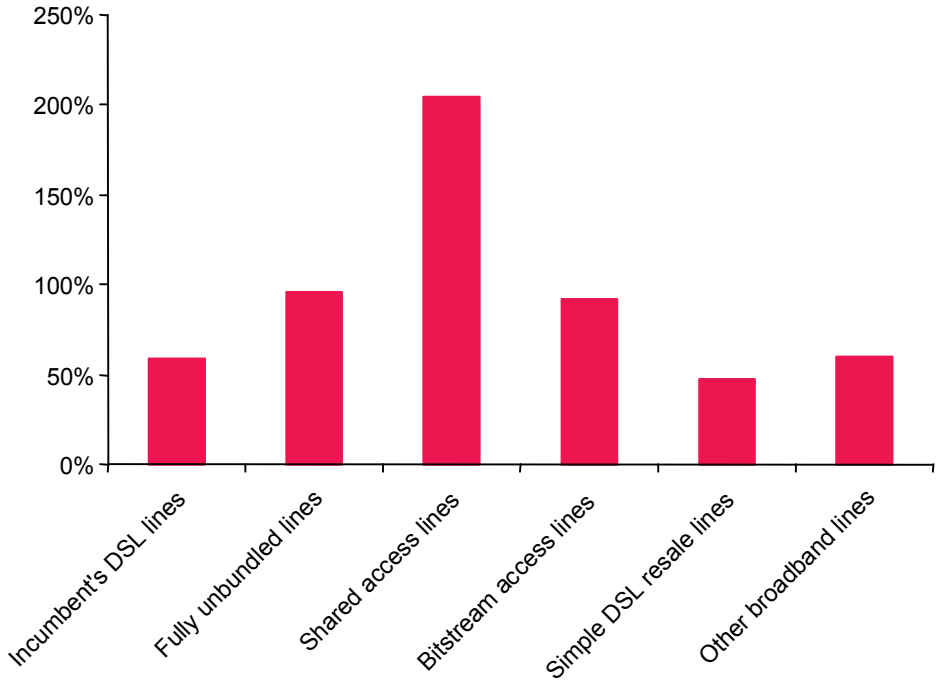
Figure 6 **Broadband competition in the EC, October 2005**



Source: EC 11th Implementation & Enforcement Report, Ovum

At the end of October 2005 43% of the 196 million DSL lines in the EU25 countries were wholesaled by the incumbents to alternative suppliers. These were roughly equally divided between the four types of wholesale: fully unbundled, shared access, bitstream and simple resale. The same report shows that in the 15 months to October 2005 shared access was the wholesale broadband option with the highest growth rate across the EU as a whole, as shown in *Figure* 7.

Figure 7 **Growth of broadband options across the EU25 (2004-2005)**



Source: EC 11th Implementation & Enforcement Report, Ovum

Austria

The incumbent, Telekom Austria, has the most extensive access network in Austria. The NRA, RTR, has required Telekom Austria to provide access to its local loop since July 1999. Full LLU was followed by partial LLU in 2001. By the end of 2005 58% of broadband access lines used DSL and 40% cable modems. About half of Austrian DSL lines had been unbundled. One feature of the LLU services available in Austria is the breaking down of the elements involved in LLU, so that new entrant operators can rent parts of the local loop, as opposed to the standard rental of the entire loop. LLU is regulated, with cost-based pricing.

No regulation has been defined by the RTR for wholesale broadband access services. Currently, bitstream services are offered to competitors and ISPs on the basis of a private law agreement reached between the incumbent and the Austrian Internet service provider association.

A number of alternative access technologies are still at experimental or early deployment stages – they include satellite broadband, FTTx, Wireless LAN and Power Line Communications (PLC).

Belgium

The Belgian regulator IBPT directed Belgacom to provide access to its local loops from 2001. Since then, the IBPT has put a lot of effort into providing a stable framework for unbundling. As the operator with SMP, Belgacom is required to publish a broadband reference offer each year that determines the tariff for its wholesale broadband products. The Belgacom Reference Offer for Broadband Access (BROBA) is assessed by the IBPT to ensure that it is cost efficient, and to ensure that Belgacom is not abusing its SMP status. Full and shared LLU access is made available at cost-oriented prices.

Denmark

LLU has been mandated in Denmark since 1 July 1998, with cost-based pricing. Denmark has the lowest prices for full and shared access LLU of all the Nordic countries.

The incumbent TDC also provides ADSL products via bitstream access and has an obligation to offer bitstream to other operators under the same terms as those used for sale to its retail division. Bitstream access is available from the parent ATM switch. Its price must be cost-oriented based on historic cost, but there is no formal price regulation.

DSL accounts for two-thirds of all broadband access lines in Denmark, cable modems make up a quarter and the remainder is provided via a range of technologies from PLC to WLL. DSL is the fastest growing broadband access technology.

The Danish government announced its broadband strategy in March 2005. This strategy primarily focuses on the growing convergence of telephony, TV and Internet and the development of IP network. It is aimed at promoting broadband by focusing on developing broadband infrastructure and content-rich digital services.

Finland

LLU is mandated in Finland, and prices are set by commercial negotiation. About 30% of DSL lines in the country had been unbundled by the end of 2005. At that point Finland had nearly 1.2 million broadband lines, 79% of which used DSL. TeliaSonera has less than half the market share. Competition comes mainly from Elisa, an alternative DSL operator.

France

France Telecom started offering wholesale access services in February 2000. Since then, the telecommunications regulatory authority (ARCEP) and the Competition Commission in France have made several interventions related to pricing and promotions.

DSL resale has lost both customers and market share in favour of LLU, and particularly shared access LLU, which is very popular in France because of the flexibility and opportunities it provides for service differentiation.

In 1999 the then French regulator ART identified LLU as a means to stimulate competition in a public consultation. France Telecom's first reference offer was rejected in 2000. LLU became available on a commercial basis in 2001 following the acceptance of the incumbent's third reference offer.

Since the EU unbundling regulation came into force in January 2001, French regulator ARCEP has actively intervened in order to obtain effective implementation. ARCEP opened access to the local loop in France with its Decision 00-881 of 12 September 2000. Since 1 January 2001, all operators have had access to the part of the network situated between the main distribution frame and the termination point located on customer premises. The access can either be exclusive or shared with other operators. Access to the local loop also includes associated services, such as co-location of equipment and the supply of information necessary for the implementation. Prices for access to the local loop must be cost-oriented.

In October 2001, the LLU process in France entered its first phase of commercial deployment. For the first time, operators were permitted to co-locate their equipment with France Telecom's equipment in local exchanges. By the end of November 2001, alternative operators had submitted 116 applications for co-location space.

In 2005 ARCEP focused on stimulating many aspects of the LLU market, including geographical extension, wholesale LLU, growth of full unbundling, and the publication of performance measures by France Telecom.

Japan and France have some of the lowest shared access costs in the world and the highest DSL competition. Over 90% of broadband lines were DSL lines at the end of 2005. At the end of March 2006 ARCEP reported that there were 950,000 fully unbundled French broadband subscribers, and 2.2 million had been partially unbundled.

Germany

The process of unbundling the local loop of the incumbent's PSTN began earlier in Germany than in most other EU countries. The first requests for LLU were made in 1996, and RegTP (the regulator) made LLU mandatory in May 1997. Prices for unbundled local loops are cost-based, although the standard charge is a national average of the costs in the various regions, which are higher in cities and in areas where local loops are particularly long.

Unbundling was introduced in Germany in January 1998. However, the incumbent operator, Deutsche Telekom does not face much competition from cable modems because the German cable TV networks are technically backward and are largely

controlled by Deutsche Telekom itself. At the end of 2005 97% of broadband lines in Germany used DSL.

Deutsche Telekom offered a wholesale DSL option in early 2002, but DSL resale did not take-off in Germany until late 2004. It now accounts for nearly 20% of the DSL market, totalling about 1.5 million lines.

Bnetza (the current regulator in Germany) is analysing market 12, the wholesale broadband service market, to determine if regulation is necessary. The regulator has almost completed the first phase, but still needs to decide on what action to take; for example, whether to force Deutsche Telekom to give alternative providers access to its DSL network. This is almost a unique situation in Europe, where most other countries have already forced their incumbents to provide competitors with access to the DSL network under regulated terms, conditions and pricing.

A few competitive carriers, notably QSC and Colt, have built up a significant unbundling business, particularly targeting the business community, but together they still have a total market share of around 2% in terms of the number of lines. Deutsche Telekom is required to provide line sharing as well as fully unbundled local loops, but it is not required to offer bitstream access.

Greece

In Greece, the incumbent OTE provides IP bitstream, a DSL wholesale access link and a backhaul service, and hands over the traffic to the entrant at an IP point of interconnection. At the end of 2005 DSL was used to provide 99% of Greek broadband access lines. Only about 3% of these lines were unbundled, but over 50% were provided via bitstream products.

Ireland

The Irish incumbent Eircom first provided its competitors with unbundled access to local loops in April 2002. However, unbundling is proceeding slowly, with around 2% of DSL lines unbundled by the end of 2005.

Eircom's first bitstream service was introduced in May 2002. A wide-ranging suite of bitstream products is now available, from 512/128kbit/s up to 4,095/256kbit/s, at both IP and ATM level. Backhaul options are available at 2Mbit/s, 45Mbit/s and STM-1 from over ten points of presence (PoPs). Bitstream now accounts for over 20% of DSL lines in Ireland.

Italy

The Italian wholesale broadband access market has been subject to regulation since the end of 1999. Telecom Italia offers DSL resale, bitstream access and LLU (full and shared access). IP bitstream and ATM bitstream are both made available for competitive carriers and ISP customers. Relatively low prices for LLU and wholesale DSL have resulted in a good uptake of these services. LLU pricing is cost based.

Italian altnet FastWeb, which was founded in 1999, was the first in the world to build an all IP network to enable it to deliver triple-play services. It uses LLU to connect off-net customers.

The Telecom Italia service 'ADSL Wholesale' is a DSL resale service. It includes the delivery of virtual circuits at the customer end, and the aggregation of these circuits in a single virtual path, which is made available to OLO/ISP networks at an ATM PoP. However, DSL resale currently has a very small share of the Italian DSL market.

In Italy full LLU and bitstream access are roughly equal in terms of popularity, having just less than 20% of the DSL market each. However, shared access is the fastest growing wholesale DSL service. At the end of 2005 DSL dominates the Italian broadband market, with a 95% share.

Luxembourg

There is no effective bitstream product (at the ATM level) available in Luxembourg because there is no coherent ATM network that would allow a full bitstream product to be provided. The IP DSL product offered to ISPs and other operators does not allow differentiation from the retail offer of the incumbent and its subsidiaries, so it is effectively a resale product.

DSL accounts for 90% of broadband access lines in Luxembourg, but only about 5% of those lines are unbundled. Luxembourg is the only EU country where simple resale of DSL is growing faster than other wholesale broadband options

Netherlands

DSL is the dominant broadband technology in the Netherlands, accounting for 62% of the market. The Netherlands has one of the highest cable modem penetrations in Europe, providing 38% of all broadband lines.

At the end of 1997 the Dutch regulator OPTA made full LLU mandatory. Following consultation with incumbent KPN and other players, fully unbundled access became available in June 2000. By the end of 2005 about 28% of Dutch DSL lines had been unbundled. However, the majority of these were provided using shared access LLU, rather than full LLU.

Currently, there is no regulated bitstream product, but KPN does offer an ATM bitstream service to wholesale customers.

Norway

Fewer statistics are available for Norwegian wholesale broadband because the country is not a member of the EU. However, DSL is the dominant broadband technology in the country. Norway's LLU pricing is the highest in Europe. LLU prices are high, but retail prices are also high, so competition can and does make a business. LLU is now the main form of network competition.

Poland

There is currently a lack of loop-unbundling regulations for broadband access in Poland, which limits any serious threat to the incumbent TP from alternative DSL providers. The Polish regulator URTiP is currently undertaking market analysis to decide whether LLU regulation should be extended to bitstream. Currently, TP is the only operator that could provide wholesale services. Poland introduced LLU regulation in 2005.

Portugal

Portugal Telecom (PT) made its first bitstream offer available in 2000. Both IP bitstream and ATM bitstream are currently provided to alternative carriers. PT started offering its ADSL services to other operators on a wholesale basis after the Portuguese local loop market was unbundled in July 2001.

The price of the wholesale broadband access at IP level in Portugal is based on a 'retail-minus' approach which is used as a reference for all the retail broadband access services offered by companies within PT. The price of the wholesale broadband access at ATM level is cost-based, since a 'retail minus' approach alone would not be sufficient to ensure a reasonable level of pricing.

Spain

The obligation to provide bitstream access, or wholesale xDSL services, was incorporated into Telefonica's reference unbundling offer (RUO) in January 2001. Later that year CMT (the regulator) opted for a pricing regime based on a retail-minus price control. The ATM bitstream offer is accessible by altnets at any of the 109 regional ATM PoPs in Telefonica's network.

Telefonica provides three types of access to the local loop: indirect, shared and full unbundling. New measures introduced by the CMT facilitate the move from bitstream to shared or fully unbundled access.

Applications for massive migration are only available for the following migrations:

- bitstream to shared access
- bitstream to full unbundling
- shared access to full unbundling.

These measures are designed to encourage alternative operators to migrate when they may have been discouraged in the past. If Telefonica does not follow the timetable for migration set by the RUO then it will be fined by the CMT. While progress with LLU has been slow, the incumbent has been rolling out ADSL at an increasing pace.

About 10% of DSL lines in Spain had been unbundled by the end of 2005, whereas over 20% were provided using bitstream services. Only 20% of broadband access lines were provided using cable, the remainder uses DSL technologies.

In June 2005, the regional government of Catalonia and Localret (a consortium of 782 municipalities) jointly planned to launch one of the world's largest municipal broadband networks, investing €542 million in the project. The project is aimed at improving competition between the broadband service providers and increasing market opportunities through equal access to low cost broadband infrastructure.

Sweden

DSL is the fastest growing broadband technology in Sweden. However, network competition in Sweden is still quite strong, with other types of broadband access making up over 35% of the total market, including cable modem and FTTP. Although LLU prices are reasonably high compared to the rest of Europe, LLU take-up is ramping up. LLU price regulation is cost-based.

Although TeliaSonera introduced a bitstream in 2004, it has not been rolled out yet because of ongoing negotiations between the incumbent and the regulator.

At the end of December 2004 the Swedish competition authority accused TeliaSonera of price squeezing in the wholesale broadband market - i.e. squeezing the margin between what it charges for wholesale DSL and what its retail arm charges the end customer.

Nearly 30% of Swedish DSL lines had been unbundled by the end of 2005.

Switzerland

Although in Western Europe, Switzerland is not in the EU. Hence, LLU has not yet been mandated yet. A decree on LLU was passed in February 2003. It requires Swisscom to provide four variants of unbundling:

- full unbundling of the local loop
- shared line access
- bitstream access.

However, Swisscom appealed against the ruling to the Federal Court and, in December 2004, the Court ruled that current telecommunications law does not provide a clear path to LLU.

In a departure from the approach common to most other countries, Switzerland plans on launching infrastructure-neutral LLU, imposing it both upon the dominant PSTN and cable operators. As the new telecoms law is currently being debated in the Federal Parliament, it is not likely that a resolution will be agreed before the second half of 2006.

Ukraine

Pressure on the Ukraine government to regulate wholesale pricing policies better is rising, which should enable new players to compete more effectively in the long-run. The incumbent operator, UKR Telecom, serves Ukraine's wholesale broadband access market. Whilst this enables a degree of competition, there is currently a

lack of effective regulatory controls on pricing. Anti-competitive behaviour by UKR has put pressure on the government to make the necessary changes.

United Kingdom

BT Wholesale's broadband service portfolio includes DSL resale, two bitstream access products (with ATM and IP points of traffic handover) and LLU. LLU was made available in July 2001, and DSL resale was launched in 2003.

However, the process of implementing LLU was complex, with the regulator Ofcom (and its predecessor Oftel) issuing multiple directions and determinations as a result of complaints and its own investigations. The UK is alone among the larger EU countries in having more DSL wholesaled by simple resale than through any other route – a consequence of the UK's earlier opening up of the broadband market to competition.

Having recognised that the UK had fallen behind other EU countries in LLU, Ofcom made it a priority to tackle the issue. The independent Office of the Telecoms Adjudicator (OTA) was appointed in July 2004 to deal with issues surrounding the LLU process, with the aim of delivering 1 million unbundled loops per annum by January 2006, or over 4,000 loops per day. The result was that the number of unbundled DSL lines increased by over 158% from 12,000 at the end of May 2004 to 31,000 at the end of January 2005. In June 2006, BT reported over 500,000 unbundled lines. OTA estimates that 2-3 million lines will be unbundled by the end of 2006.

In January 2006 BT launched its Access Services Division, branded Openreach. Openreach was established with the objective of providing the equivalence of access and transparency that BT's rivals had long been calling for. As a result, the UK broadband market is moving to a period of greater certainty for altnets and increased competition between broadband service providers. As a result we can expect to see the rise of second-level wholesalers, installing their own LLU equipment in BT exchanges, and acting as intermediaries between the incumbent and a range of specialist service providers.

At the end of 2005, 73% of UK broadband connections used DSL (the remainder almost all use cable modems). The incumbent retails only 38% of DSL lines, with all others being wholesaled to competitive broadband suppliers. In October 2005 simple resale of DSL accounted for over 50% of these lines, but since then LLU has taken off, reaching over 500,000 unbundled lines by mid-June 2006. At the time of writing BT Openreach unbundled almost 1,000 exchanges, and was fulfilling over 20,000 LLU orders each week.

Americas

Regional overview – the Americas

In North America most broadband subscribers use cable modems, although DSL is catching up. Other broadband technologies, such as fibre-to-the-home, WLL and

satellite, have a very small part of the market. In contrast, in Latin America DSL dominates the broadband market.

Latin American DSL subscriptions grew by over 80% in 2005, albeit from a very low base. Low overall penetration rates are due to a combination of high prices for broadband, compared with per-capita incomes, and limited availability of broadband services across the region. About 90% of broadband subscribers in the region are in Argentina, Brazil, Chile or Mexico. Brazil has the largest Internet market, followed by Mexico, Argentina and Chile.

Brazil

Local markets have been open to competition since January 2002, with operators being obliged to lease lines to new entrants. The initial stance of regulator Anatel was to recommend that incumbents offer bitstream access. We expect the regulator to intervene to ensure that competitive operators have access to the incumbents' local loops. However, it may be some time before the procedures set in place are effective and enable competitors to provide services.

Although LLU has been available in principle for some time, Anatel only set a price ceiling for shared local loops in May 2004. This move should make it easier for other operators to enter markets outside of their concession areas. Brazil Telecom and Telesp have announced plans to open up their local networks to competitors, in order for them to offer fast Internet services through xDSL technology.

In Brazil, residential Internet penetration was 28% of households in December 2005. The total number of broadband subscribers at this date was 2.5 million, of which 2 million were residential. The vast majority of these are DSL, but fixed wireless and cable are exhibiting considerable growth.

Canada

In 1999, the Canadian regulator CRTC decided not to regulate the Internet. However, it did decide that cable operators should be required to make available for resale their retail high-speed Internet services and set a resale discount on retail prices. Since then, DSL services have also taken off.

By December 2005 broadband penetration in Canada had reached about 22% (67% of households), evenly split between cable and DSL technologies.

Bell Canada offers a wholesale solution that allows other ISPs to lease DSL access and offer their own broadband services. All wholesalers and resellers are required to register with the CRTC to be able to resell Internet services. Over 90 resellers of Internet services registered with CRTC.

Chile

Although it has the fourth largest broadband subscriber base in Latin America, LLU regulations have not yet been approved by the government and so are not in force.

The Chilean regulator Subtel is currently establishing regulations for wholesale broadband services.

US

In 1996 the American regulator, the FCC, placed requirements on the incumbent local exchange carriers (ILECs) to unbundle their local loops. However, the DC Court of Appeal revoked these rules in June 2004. In February 2005, the FCC issued a new set of unbundling rules, which lifted some of the unbundling requirements on the ILECs, especially in competitive markets. As a result, competitors relying on the unbundled network element platform (UNE-P) to provide services will now have to transition to commercially-based arrangements with the ILECs in order to continue to provide service.

The new framework also obliges competitive carriers (CLECs) to increase their investments in their own broadband access infrastructure. The new rules exclude fibre in the last mile from unbundling, which gives an incentive to ILECs to upgrade their local networks. Bitstream access is currently only available on a commercial basis for alternative operators in the US.

The US Agriculture Department has provided more than $870 million in loans to encourage broadband service providers to provide broadband to communities with populations below 20,000 under its Broadband Access Program (BAP). However, the cable companies are objecting to the scheme because it is subsidising competitors in some areas already served by cable networks. However, the US Government Accountability Office estimates that only 19% of households in rural areas of the country have broadband access.

The FCC reported that at the end of June 2005 there were nearly 43 million broadband access lines across the country (a 32% increase compared with the end of June 2004). Of these, 56% used cable modems, 40% used DSL and the remainder used fibre, satellite and other technologies. The FCC also reported that there were over 1,200 broadband service providers in the US (up 162% on the previous year), and 60% of US Zip codes had four or more broadband service providers.

Asia-Pacific

Regional overview – Asia-Pacific

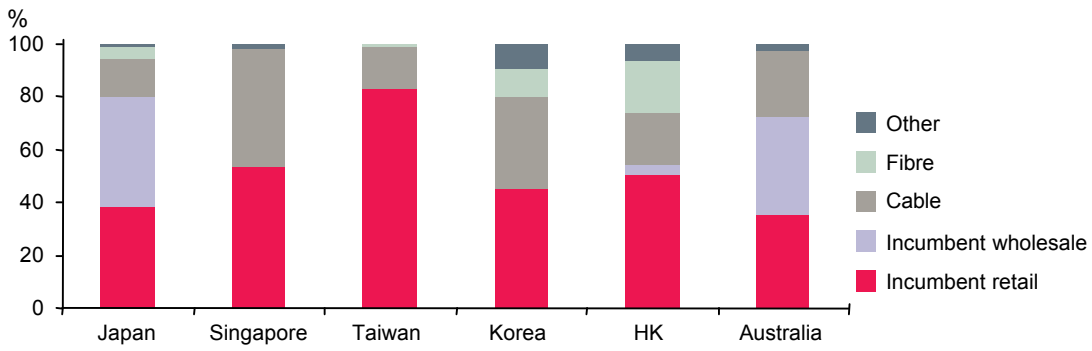
Asia-Pacific is a region of great contrasts when it comes to broadband. Fierce facilities-based competition from low cost LLU, cable and fibre operators means Asia-Pacific leads the world in the highest speeds at the lowest prices. However, it also includes a number of countries with very low teledensities, and even lower broadband penetration.

In Asia-Pacific, competition is generally linked to the government agenda. While Hong Kong has a fully liberalised approach, markets such as Taiwan, Japan and Korea have a more managed agenda where the government sets broadband

targets, the technology roadmap and investment expectations for operators. Facilities-based competition was viewed as a means of driving early broadband adoption, which in turn would further economic and technology export development. Incentives, loans and tax breaks have been used to facilitate this, which has led to intense competition, rapid growth and high-speed bandwidth.

Figure 8 shows the degree of broadband competition in six of the most advanced markets in the region.

Figure 8 **Broadband competition by market**



**Note: Japan's wholesale market share is primarily unbundled local loop. In Australia, Telstra's wholesale DSL services are a mix of line sharing, ULL and resale services. This has an impact on the degree of competitive pressure.*

Source: Ovum, company results, Point-Topic

Broadband development varies substantially across the regions of China, India, Hong Kong and Taiwan. China and India have the two largest population bases in the world and are gradually gaining momentum in broadband deployment. Hong Kong and Taiwan have developed, relatively small markets, with well-established broadband networks. In Japan, Korea and Taiwan, government policy will continue to be a driving force in broadband and home networking deployment. Hong Kong and Australia will be more market-led.

Australia

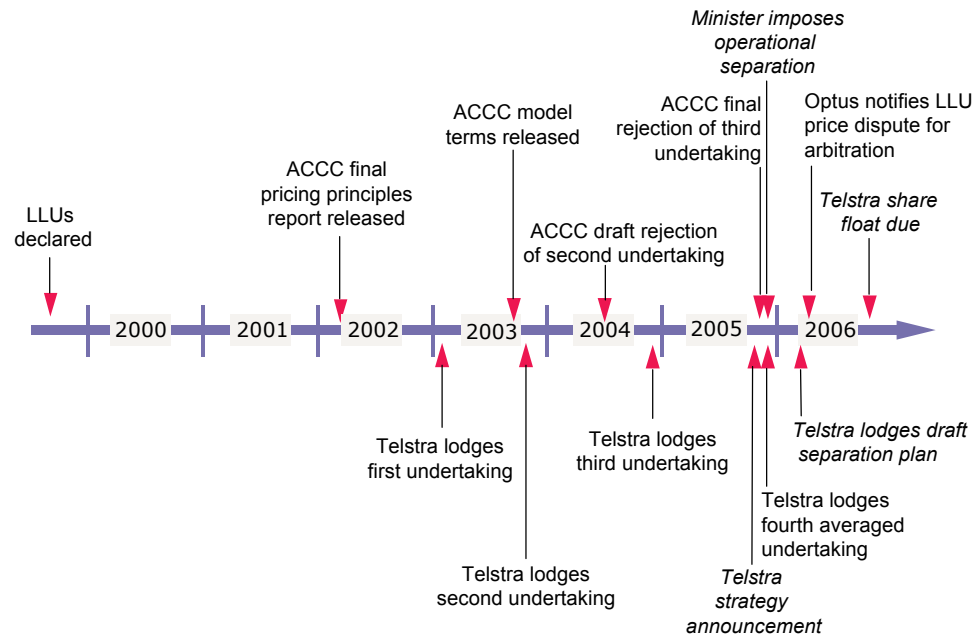
Telstra, the Australian incumbent, has offered DSL resale since 1999. It now has a range of asymmetric and symmetric DSL resale and bitstream services suited to consumers, SMEs and larger enterprises. Until 2004, Telstra had capped wholesale DSL speeds to 1.5Mbit/s, leaving alternative operators limited scope to compete on either speed or price.

ULLS (unconditioned local loop service = LLU) was 'declared' by the Australian Competition and Consumer Commission (ACCC) in 1999, imposing a legal requirement on Telstra to provide access to competitors. LLU has been widely available in Australia since 2002. However, the pricing of LLU has been a matter of

constant dispute. At no time has there been a settled, approved tariff for LLU access in the market. The result has been ongoing uncertainty: not enough to stop DSLAM investment, but enough to discourage some investors. However, alternative operators are now heavily pushing LLU, using the higher speeds of ADSL2+ and service bundling to differentiate their offerings. This competition is stimulating higher speed deployment: growth in LLU deployment of ADSL2+ is pushing Telstra to FTTN deployment.

An important point of difference between Telstra and the ACCC is their treatment of the fixed costs of LLU deployment. The ACCC distributes these costs over the whole of the copper network. Telstra maintains that these costs should only be distributed over the metro/suburban network where DSLAM investment is happening. The timeline for LLU regulation is shown in *Figure 9*.

Figure 9 **Australian LLU regulation timeline**



Source: Ovum analysis. Events not directly related to LLU regulation are in italics

Broadband competition is stepping up as competitors such as Optus, Primus, PowerTel and iiNet roll out national DSLAM networks based on Telstra's LLU offering. These investments are focused on Australia's metropolitan areas, particularly suburban areas outside the central business districts (CBDs), but they also extend to some larger regional towns. In June 2003 the Australian government launched its National Broadband Strategy with a budget of over A$142 million over four years, aimed at enabling service providers to offer broadband services to rural and remote areas at prices comparable with those available in urban areas.

DSL overtook cable as the most popular broadband technology in the middle of 2004. Other broadband technologies deployed in Australia include FTTx, WLL and satellite – the latter targeted at the most remote communities.

At the end of June 2005 Telstra has 856,000 retail DSL subscribers, and another 888,000 wholesale DSL lines. Figures published by the ACCC show that, of the 1.28 million broadband connections that were added in the twelve months to December 2005, 85% were DSL connections. This demonstrates that, rather as in the UK and Germany, where the incumbent has a less than 50% share of the retail market, Telstra still has considerable wholesale market power.

Hong Kong

Hong Kong adopted a policy of full liberalisation of the telecoms market at an early stage. It granted five fixed licences in 2000 then opened the fixed market completely in 2003, with no pre-set limit on the number of licences and no foreign ownership caps. The incumbent PCCW is fully privatised and Hong Kong now has ten local fixed network operators, one fixed wireless operator and two network operators distributing domestic free TV programme services, serving a market of just 2.48 million households.

All of the fixed network licence holders are permitted to provide broadband services. According to Point Topic, in April 2005, there were 186 licensed ISP providers offering broadband services. These services are provided through DSL, cable modems, FTTx and Local Multipoint Distribution Service (LMDS) technologies. LMDS is a broadband fixed wireless service, which provides access to subscribers in a five-mile range.

LLU is currently a mandated wholesale service in Hong Kong, priced on a historical cost basis. However, the regulator OFTA has decided to withdraw LLU (referred to as Type II interconnection) by June 2008, in order to promote infrastructure-based competition. The regulator believes that this will stimulate more innovative offers and technologies in a market where over 50% of households already have a broadband connection. This does not mean that unbundling will cease to be possible, but its mandatory requirement will terminate and so will the price regulation for PCCW unbundling services. Any agreement after that date will have to be negotiated commercially at market prices.

At the end of March 2006, Hong Kong had a total of 1,659,000 broadband users, representing a 66.1% household penetration. DSL lines accounted for almost 54% of the total broadband users and the cable modem accounted for the remaining 46% in March 2005. We have been unable to determine the size of the wholesale broadband market in Hong Kong.

India

India's government still owns majority stakes in the two incumbent domestic fixed carriers (BSNL and MTNL). However, it has encouraged private operators, resulting in the emergence of the Reliance, Tata, and Bharti telecom groups. However, there

have been no governmental initiatives targeted specifically at increasing broadband penetration. While this is disappointing, a number of individuals within the government and industry have spoken out in support of the development of wireline infrastructure, particularly broadband, and linked it to future economic development.

Telecoms infrastructure is very limited in India, with an overall teledensity of just 12% in February 2006. Hence, wireless broadband technologies are expected to gain momentum in future. Other major brakes on the deployment of broadband are the relatively low penetration of PCs, and the poverty of much of the rural population.

In India the estimated number of broadband subscribers was 941,000 in December 2005. Based on Ovum's definition of broadband, this amounts to broadband growth of around 274% from 2004 to 2005. In India, the top four providers hold an estimated market share of around 81%. Over 60% of broadband customers use DSL technologies, while less than 22% use cable modems. The remainder use a mixture of FTTx and WLL. Wholesale broadband has yet to develop as a significant market in India.

Japan

Japan's broadband market is among the most advanced in the world with the third highest subscriber base and the highest available speeds. Policy-makers have successfully promoted both service-based and facility-based competition. As a result, Japan has a growing range of wholesale broadband services.

NTT was forced to upgrade exchanges beyond metropolitan areas in 2000 and was forced to offer wholesale DSL in June 2001. The Japanese Ministry of Internal Affairs and Communications (MIC) required NTT to provide LLU services in 2000, and set the conditions and interconnection fees for the unbundling of NTT's facilities at that time. The regulator established rules for mandatory unbundling of subscriber copper cable in September 2000, including rules regarding co-location in the NTT building. MIC established rules enforcing the unbundling of optical fibre in April 2001.

The initial take-up of DSL was slow in Japan, with cable modems leading broadband penetration. However, the majority of subscribers now use DSL technologies. Now, the market is shifting from DSL to FTTx. The government agenda for fibre deployment coupled with NTT's next-generation network strategy is driving growth in FTTN and fibre-to-the-premises (FTTP). Although more than 70% of broadband access is implemented through DSL, fibre has shown rapid growth in recent years due to increased demand for converged multimedia services. FTTx now accounts for some 15% of broadband connections.

The Japanese government has aggressively promoted LLU. As a result the shared access local loop price in Japan is one of the lowest in the world. At the end of 2002 there were nearly 50 operators offering ADSL services. Competitive carriers

have introduced value-added services at competitive prices through use of a combination of build or buy options.

Competitive carrier eAccess is the largest wholesale provider of DSL services in Japan. Founded in 1999, it has focused on achieving high profitability through partnership with more than 30 ISPs.

There were 22.1 million broadband subscribers in Japan as at December 2005. This equates to a 46% household penetration rate. NTT's market share at the end of December 2005 was 39%, with a majority of the remaining DSL users receiving broadband access through LLU-based operators.

Korea

As a result of the aggressive deregulation of telecoms in South Korea, the country now has the highest broadband penetration in the world. In March 2006, the South Korean broadband subscriber base was around 12.5 million, which equates to 78% household penetration. DSL technologies are used by 52% of the subscribers, and cable modem by 33%.

The South Korean government's broadband policy, known as the Korea Information Infrastructure (KII) Plan, included incentives for infrastructure-based competition and a light regulatory touch. This lowered the barriers to entry: by 2002 there were over 100 cable TV providers, plus six main broadband network operators. However, it also fragmented the market, with intense competition pushing down prices and destroying scale benefits, leading to market consolidation.

The incumbent KT offers a range of DSL resale options. An LLU regime was introduced in 2001 in South Korea. Currently, there are two forms of LLU available: full unbundling and line sharing. The wholesale charges for providing LLU have been set on a cost basis. So far, the performance of the LLU regime in South Korea has been poor with only around 1,000 lines unbundled by May 2006.

New Zealand

The incumbent Telecom New Zealand (TNZ) offers DSL resale and bitstream services to ISPs and competitive carriers. Although pricing for the bitstream service was set out in the 2001 Telecommunications Act, the commercial launch of the service was not until 29 September 2004. DSL resale was launched in September 2005. There has been a lengthy debate over the introduction of LLU in New Zealand. Initially the Commerce Commission (CC) ruled against compelling TNZ to offer LLU to its competitors. Following lobbying from business and continued requests by alternative ISPs and a leak, the CC confirmed in May 2006 that TNZ will be forced to unbundle its local loop.

Other broadband technologies deployed in New Zealand include cable modem and FTTH. There is very limited wholesaling of these services.

New Zealand has a comparatively low broadband penetration level, reported by the OECD to be 8% at the end of 2005. According to Point Topic TNZ had 215,628 residential DSL subscribers and 63,495 residential wholesale DSL subscribers.

Singapore

In 1998 collaboration between the Singapore government and telecoms industry launched ONE (One Network for Everyone), to enable the rollout of a nationwide broadband network. As a result, Singapore was the first country in the world to have a nationwide broadband network. At the end of April 2006 54.8% of households had broadband. The majority of broadband connections used DSL.

Singapore has a liberalised but managed approach to competition, in order to avoid network duplication and oversupply in a very small market. This has led to a competitive duopoly, with SingTel and cable operator Starhub controlling 54% and 45% of the retail broadband market respectively. As a result there is no wholesale broadband market.

Taiwan

Taiwan was one of the first Asian economies to embrace broadband - by 2002 it was ranked fourth, globally, and today has a household penetration rate of over 41% according to Taiwanese regulator, the DGT. However, unlike western economies where broadband growth has been driven by competition, Taiwan does not have a strongly competitive fixed market. In May 2006 the regulator said that it plans to end Chunghwa’s local loop monopoly and open it up to competitors by the end of the year.

Due to the virtual monopoly of Chunghwa Telecom in fixed networks, all companies offering broadband lease Chunghwa's network to deliver DSL services. These are believed to be predominantly DSL resale, charged with an access connection fee, plus network rental. LLU has been limited, while the cable market was fragmented by cable TV licences, which were broken down to 51 regions. As a consequence, incumbent Chunghwa continues to dominate with 84% retail market share in broadband access, with little change from the 86% share recorded in 2003. Development has been driven by the government's ownership of Chunghwa, which has been required to meet broadband goals, rather than competitive pressures.