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Briefing paper

Broadband: Broadening Horizons, Not Just Bandwidth

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The Death of Narrowband

Public service telecommunications networks (PSTN), as they stand, are narrowband – the core functions residing in the switching software and the associated intelligent network modules and databanks. OFTA's definition of narrowband, namely everything beyond 144 Kbps (ISDN¹ = 64B x 2 + 16D), makes good sense because digital compression techniques allow more and more data to be pumped down the bandwidth that is available.

In other words, technology is once again playing havoc with definitions based upon existing network-specific data speeds.² Or to put it another way, it is difficult to take aim and regulate a moving target. It is even more difficult to predict where to aim at an emerging target. While digital compression techniques enable telcos to pump ever-increasing amounts of data down twisted-pair copper wires, the capability of the network to transmit high-speed multi-frequency traffic streams is determined at the switching level. In modern PSTN terms this currently means Asymmetric Transfer Mode (ATM) switching. ATM, or cell relay, switches small packets of voice 'data' at guaranteed quality of service levels (99.99%) which is the bread-and-butter business of telcos. Local and long-distance voice traffic is the very *raison d'être* of telcos.

But as a business model it is rapidly coming to an end.

ATMs offer telcos the advantage of also being able to support X.25 (an old International Telecommunication Union (ITU) standard for packet switched data, especially for e-mail); frame relay which has largely replaced X.25 in modern corporate networking (an updated ITU standard for switching larger packets without autocorrection functions, so more data travels faster); and IP (Internet Protocol) which is 'connectionless' packet switching, meaning that individual packets do not follow predetermined routes but rather get routed along whichever network transmission paths are available. Voice traffic is circuit-switched, meaning that a circuit is established between the calling and called parties and is kept open for the duration of the call. Because IP protocol is connectionless, Internet Service Providers (ISPs) do not require the support of ATM switches, routers being the means of Internet switching. Voice over IP (Vo/IP) will eventually become as reliable in quality as over ATM, but although this is as certain as anything can be in telecoms, it has no interesting business implications apart from offering callback operators one more technology to choose from, and callback in Hong Kong is now irrelevant on all routes open to international simple resale. *Vo/IP is not interesting because voice traffic over public networks will soon become, to all intents and purposes, 'free'.*

This signals the end of the narrowband era.

¹ ISDN = Integrated Services Digital Network.

² For example, the ITU's definition of 'a service or transmission channel capable of supporting rates greater than the primary rate' to which OFTA adds 'i.e. 1.544 Mbps in the North American hierarchy or 2.048 Mbps in the European hierarchy' (T1 or E1) would, if interpreted at the time, exclude GPRS two-and-half generation mobile.

Falling Costs and Diminishing Prices

Although narrowband transmissions will be around for a long time to come, revenues from them will diminish towards a marginal cost of zero. A combination of technology, market liberalization, and competition on a global scale is pushing retail prices towards marginal costs, and marginal costs towards zero. Of course, to get marginal costs down towards zero requires vast sums of money spent on R&D, mass production and the commoditization of telecommunications equipment and customer premise equipment ('access devices' in the new terminology), not to mention the construction of networks which have to be depreciated at much faster rates today than ten or twenty years ago. Somehow that money has to be recouped, but how? This is the dilemma for current business models in the telecommunications business.

The standard answer is, of course, 'data traffic'. But what does this mean? We all know that the 80:20 voice:data ratio of the mid-1990s is forecast to reverse by around about the end of 2000. In fact, we all know that voice traffic will become subsumed into the data traffic stream, so that voice itself will become a free-rider on non-voice traffic. Most of the models currently emphasize the growth of mobile traffic, and again 'data over mobile'. At one level this simply means edging voice traffic from a flat-rate monthly subscription model to a 'flat-rate plus' model, where the 'plus' includes not just extra minutes of talktime, IDD and roaming traffic, but also 'value-added' add-ons, such as call waiting (a real 'value-minus' for the calling party who still pays if calling from a mobile phone!), call-forwarding, caller line identification, short messaging service, and so on. But the truth is that data traffic will become as non-chargeable as voice traffic if it is simply seen as 'traffic', (voice is now a kind of data traffic!) and already the so-called mobile 'value-added' services of yesterday are fast becoming part of the 'basic' package of services today.³ Such is the competitive pressure in mobile, that charging for services has become increasingly dependent upon service innovation. Innovation is replacing pricing as the principal market driver, although price may influence market share, and price may act as a quality of service differentiator where, as in Hong Kong, a certain level of market segmentation can be accomplished.

Mobile Revenues

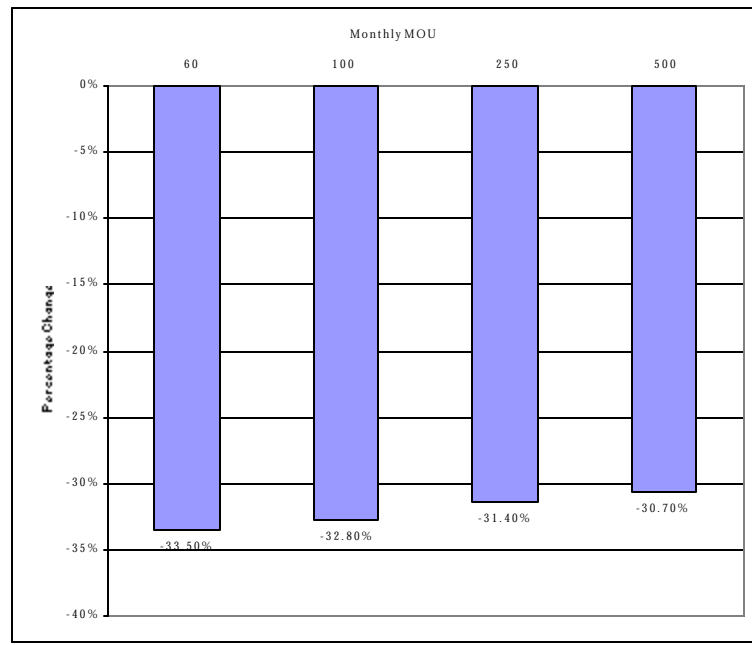
The trend for mobile revenue growth to slow, or even reverse, is worldwide. The reasons are various, including cyclical issues such as the economic recession which probably reduced revenues from cellular around Asia by about one-third over the past two years (and sent many cellular operators in developing Asian economies deep into the red); the higher-than-anticipated costs of network rollout, maintenance and upgrade; equipment and equipment-supply problems; and, more importantly longer-term, market penetration into lower income segments of the market. Average revenues per subscriber (or average revenue per unit, ARPUs, as they are

³ In their latest *World Telecommunication Development Report* (October 1999), the ITU notes that the "features available on mobile handsets – such as caller identification, voice mail, call forwarding and transmittal and reception of short text messages – are typically made available free of charge. On fixed-line telephones, these features generally cost extra or are not available" (p.1).

known) have been falling as a result, which would not matter if the marginal costs were negligible, which they turned out not be when quality of service issues, coverage, and handset and service innovation issues were addressed. An additional problem that plagued the analogue industry especially, was fraud and bad debt. Pre-paid has been a market response to this problem, and reloadable pre-paid a response to the dangers of churn and loss of customer loyalty.

The following graph from the Yankee Group suggests that tariffs on monthly minutes of usage across the Asia region for cellular mobile have fallen by over 30 per cent on average since 1996.

Graph 1: Asia Regional Decline in Wireless Prices, 1Q99 vs. 4Q96



Evidence of falling ARPUs can be found in security analysts reports such as Credit Suisse/ First Boston. For example, their report on SmarTone (Hong Kong) 20th October 1999 showed the combined monthly ARPU falling from HK\$657 in 1997 to an estimated HK\$451 by the end of

1999. In the case of SK Telecom (S. Korea) monthly ARPU fell from US\$68.3 in 1996 to an estimated US\$25 by the end of 1999. However, the end of the Asian economic recession is forecast to recover some ARPUs in developing economies, for example, the ARPUs for AIS and TAC (Thailand) are forecast to rise from Bt 1,114 and Bt1,010 to Bt1,168 and Bt1,052 respectively by end 2002. But in mature markets the trends are downwards.

The following table illustrates the fall in Earnings Before Interest, Taxation, Depreciation and Amortization (EBITDA) in the US cellular market from 1995 to 1998 of over 40 per cent.

Table 1: US Narrowband-cellular EBITDA, 1995-98

1995	US\$235
1996	US\$204
1997	US\$137
1998	US\$133

Source: Strategis Group, Herschel Shostick Associates; CTIA: McKinsey analysis.

The Death of Distance

Revenues from the other prime source of narrowband profitability, international voice traffic or IDD, are falling even more precipitously. Market liberalization (opening the market to new entry), deregulation (permitting callback, resale and other forms of price competition) and pressure from the USA to lower accounting rates and from the WTO's Basic Agreement on Telecommunications to open to foreign direct investment and introduce more transparency and 'national treatment' in regulation, have combined to 'globalize' the international telecommunication market. By this we mean transform the market from one dominated by lone national carriers, to one where every international telco has the opportunity to enter the market of an open economy and offer end-to-end services. The effect is to stimulate investment in international bandwidth, creating both new wholesaling 'carriers' carrier' markets and bandwidth exchange markets along the way. These developments have not simply challenged the old narrowband regime, but have effectively undermined a system under which bandwidth wholesaling and wholesale pricing was determined by a 'world wide web' of bilateral cartel-type arrangements.

Technology, enabled by these competitive and regulatory developments, has also played its role. Terrabyte speeds are replacing gigabyte speeds which only yesterday were state-of-the-art. At these speeds the requirement for repeaters to boost the signals over long distances simply disappears. Dense Wave Division Multiplexing (DWDN), a 'rainbow' spectrum technique offers simultaneous transmission of traffic using the entire spread of frequencies. This is multiplexing with a vengeance. And, of course, lurking in the background the seemingly

inexorable Moore's Law⁴, driving up the processing power of micro-transistors on a single silicon chip on average by 100% every 18 months, thereby halving the cost of processing by roughly 50% over the same period. The result? Competition drives prices towards cost, and technology drives marginal costs towards zero. Another way of saying the same thing, because it is implied: transmission costs become distance-insensitive.

International Revenues

If International Simple Resale (ISR) had replaced accounting rates on all Hong Kong routes in 1995 the weighted average IDD tariffs would have fallen from HK\$6.70/min. to HK\$1.40/min and IDD revenues fallen 80%!

(See 'The era of international simple resale: not waving but drowning?' www.trp.hku.hk)

These results are not confined to international. Once IDD traffic becomes subject to the rigours of competition, so does domestic long distance. First, the same pressures apply. Second, there is a demonstration effect. No one will accept stubbornly high trunk calling charges if IDD call charges are falling like stones off a cliff.⁵ This has serious implications for the cross-subsidy of the local loop. Liberalization and competition on international and long-distance necessarily implies either tariff rebalancing, or funding the cross-subsidy in some other way, for example by setting up a social fund, or from general taxation. Leaving the telcos with the financial burden will simply disincentivise investment in the local loop.⁶ That in turn will have carry-over effects into the building out of a local broadband access network, unless the broadband network is operated and priced along different commercial principles. In Hong Kong, recent local loop rebalancing removes the initial problem – the cost of providing the local loop service is estimated on average at HK\$120 per month. But this does not necessarily imply that building an alternative telecommunications broadband access network territory-wide will make commercial sense to the builder, although the benefits to Hong Kong of having a choice of fixed-wireline networks may be considerable, not least because it will promote customer awareness. On the

⁴ Not really a 'law' of course, but an observation.

⁵ There is questionable evidence that long-run price elasticity for trunk calling may be greater than 1 (meaning that minutes of calling rise by more than price per minute falls) although it seems to us that this is unlikely in most economies. Even the evidence for price elasticity on IDD is fraught with contradictory evidence. Ure's estimate for spot price elasticity on Hong Kong in 1994-95 is as low as -0.3. (See, *The Other Hong Kong Report 1995*, pp. 380-401)

⁶ This certainly added to the difficulties experienced in Hong Kong where local loop investment by the three new entrants has been minimal. The incentives all pointed towards offering IDD callback, which is what happened. (Although, that said, nowhere has local loop investment proved very successful. Where cable TV systems offer alternative access, as in many parts of the UK, penetration into the local telecoms market has been more successful. In the USA, under the Telecommunications Act 1996, competitive entry into the local loop by long-distance companies is to be triggered by entry into the long-distance market by the Regional Bell Operating Companies – with the original post-divestiture seven now heading for consolidation - but none have so far taken the leap.)

other hand, if cable TV, fixed wireless, 3rd generation cellular and digital broadcast SMATV or DTH satellite can offer effective alternative access networks, does it matter if CWHKT's broadband telecoms network is out there alone? What will matter however, is the wholesale market and the right of interconnect. But just who should have that right? And on what terms?

Broadband access: the cable option

In different markets different broadband access networks will be important. In Hong Kong, the telecommunications network is ubiquitous and therefore is likely to be the initial lead network, with the cable TV network coming in second. If the wholesale price of these two networks is sufficiently competitive there may be no commercial basis for the fixed wireless licensed networks to be rolled-out. By contrast, in the United States cable TV networks are extensive and are likely to play more of a lead role as shown in the following table.

US Television Sources

TV Source	Percentage of Households
CATV	64%
VHF/UHF	22%
DBS	6%
C-Band Satellite	2%
No. TV	2%
Chose not to watch	2%

Source: Paul Kagan Associates, *Statistical Abstracts of the United States (1997)*, as cited in A. Michael Noll 'The Impending Death of Over-The-Air Television' *info*, October 1999.

Broadband Economics

If the principal revenue sources of narrowband are disappearing, from where will the major revenue sources of the broadband world arise? There are three evident sources:

- Equipment Supply

Customer premises equipment, or ‘access devices’, such as telephones, PCs, TVs with set-top boxes, handheld computers and digital assistants, such as Palm Pilots, mobile phones, and so on.

- Network Access

Access networks, such as Discrete MultiTone (DMT or G-Lite) over twisted-pair copper wires, fixed wireless, cable TV networks, broadcast and Internet satellite DTH or through SMATV, 3rd Generation mobile cellular phone networks, etc.

- Services Applications

Internet services, applications, content, advertising-driven websites and portals, vertical selling, related activities such as web-hosting, server-farms, data-mining, and generically ‘electronic commerce’.

What will make this world tick, and how will traditional telcos fit in? Obviously, predicting the services that will be possible from what is effectively a paradigm shift – the transition from narrowband to broadband – is more art than science, but circumstantial evidence suggests that the ‘killer application’ of the moment will be nothing more sophisticated than ‘fast Internet’. For sure, large corporate customers will extend their use of video-conferencing and large fast file transfers. Streaming video is likely to spawn new business in both business-to-business (B2B) and business-to-consumer (B2C). But the earliest application to meet critical mass is likely to be a simple upgrading of dial-up ISP customers who are consumed with ‘computer-rage’ every time they have to spend five minutes booting up, closing down (because they have committed an “illegal operation”), booting up again, stoning, rebooting, dialling up, redialling, and when eventually they do get online, being reminded once again why the World Wide Web is better known as the World Wide Wait. Broadband offers ‘always-on’ at the touch of the on-off button, instant access to the home page, and after just a few years over which time Internet users have gone from periodic usage and occasional binges of web-browsing to daily dependence, a high percentage will be ready to take the step into broadband. This implies that the early adoption of broadband will be for mass-market applications, not restricted to premium services.

If this early mass market potential exists it is essential for the wellbeing of the industry, as well as for the economy and society, that the strategy of telcos adjusts to it. It is equally important for the policy-makers and regulators to get it right. Rarely can there have been a better example of a potential win-win situation than in regulations, policies and strategies that facilitate and promote broadband mass-market take-up.

A New Model

Before the telcos are convinced of this, they will need to see how they fit into the picture.

The traditional narrowband business model says

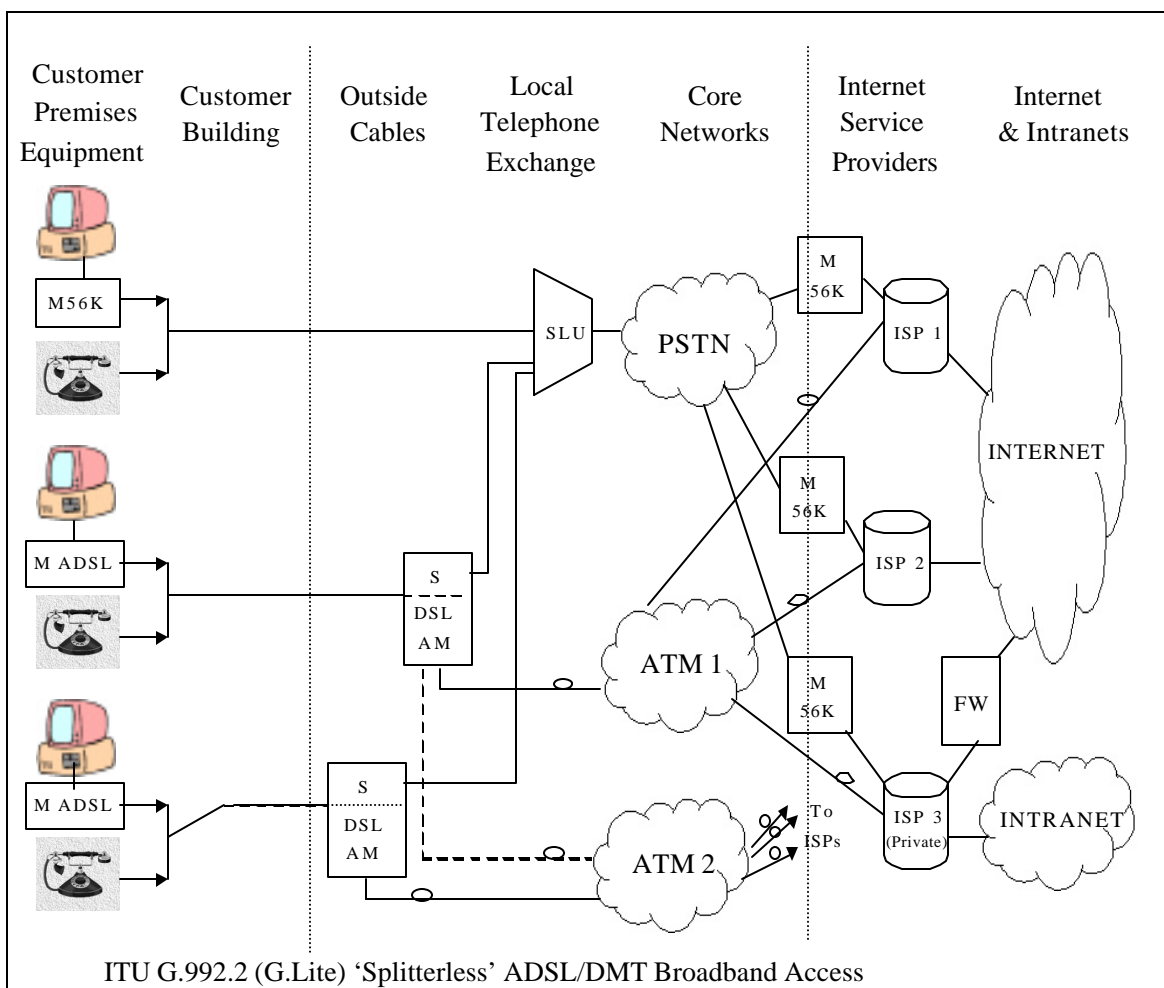
- introduce faster services as premium services,
- price them accordingly,
- don't cannibalize the existing leased circuit business,
- aim for the upper end of the market, the corporate sector, the specialist or niche SME involved in IT, and the high-income residential customer.
- It then says beware of interconnect, and
- privilege your subsidiary and associated companies in the Internet services, applications and content markets.

The broadband business model says the opposite. It says

- commoditize as soon as possible,
- treat the service as a mass market commodity from day one,
- drive the business,
- cannibalize the ISDN and leased-line businesses if necessary,
- promote open access and vertical interconnection to facilitate the value-chain between the ISP/IAP/ICP and the end user customer,
- treat the ISPs as your customers, and treat them *all* as your customers, or your potential customers.

Above all else, the broadband model says, see the demand for access as a derived demand, derived in the main from the demand for Internet and web-based services. In the narrowband world, the demand for access is also a derived demand, but derived directly from the demand for usage of the network's capability to relay voice traffic. In the broadband world the final demand may be several steps removed. In particular, the demand which gives rise to transactions over the Internet is not determined or influenced by the characteristics of the access network at all. This is not to say that access networks will become perfect substitutes for one another. Clearly, the function of mobility is different from the function of wide-screen viewing which is different again from the function of data processing over a PC. It is to say that the transactions over the Internet will be driven by the nature of the content and applications on the web, not in the network. This may be an overstatement insofar as intelligent network functions may themselves continue to command 'value-added' prices. While the competitive pressures of the narrowband world are rapidly obliterating the distinction between VANS and basic services, it is entirely possible that new network functions will arise to add value to access, but overall it is more likely that access will become a monthly flat-rate charge. The real money will come from the Internet end of the business. Wholesaling and

The Broadband Access Network



The New Value Chain: Linking Customer End-Users and ISPs/the Internet

Diagram 1 conceptualizes the use of asymmetric digital subscriber line (ADSL) 1.5 Mbps Discrete MultiTone ITU standard G992.2, known as GLite. GLite works by multiplexing voice (low) frequencies and data (high) frequencies simultaneously over twisted pair copper wire in the local loop. There are three components to the value-chain implied by the diagram: (1) customers and their use of access devices, shown here as a PC and a telephone; (2) the access network(s), shown here as the narrowband PSTN network and the broadband overlay ATM 1 network, and a second, competing ATM 2 network; (3) the ISP and Internet market.

When network ATM 1 upgrades the customer's subscriber line with G-Lite, the PSTN connection, which was previously directed through a subscriber line unit (SLU) to the narrowband switch, is now connected through a digital subscriber line access multiplexer

(DSLAM) at which point it is split (S) or separated off from the high frequency data circuit. The telephone circuit reconnects to the SLU and to the PSTN switch (in practice the ATM switch handles both sets of traffic), while the PC broadband circuit is directed through the ATM and along the optical fibre inter-exchange cables until interconnection is made with the ISP of the customer's choice.

A second network, ATM 2, exists and can offer the same service. However, in the diagram it is assumed that only the first network offers PSTN voice services, so the customer's voice circuit is again split and reconnected to the PSTN. The location of the DSLAM of network ATM 2 is shown here as being independent of network ATM 1, but it need not be so. It could be co-located next to the DSLAM of network ATM 1 in the same exchange building. Co-location could be 'virtual co-location' whereby network ATM 1 sells DSLAM capacity to network ATM 2 and network ATM 2 would interconnect on the exchange side of the DSLAM. (Shown as dotted line). Or, network ATM 1 could be required to unbundle the local loop, in which case network ATM 2 would interconnect on the customer side of the DSLAM of ATM 1. (Not shown.)

Finally, the second DSLAM need not be owned by a network at all. It could be installed by a building owner, located outside the exchange on private or publicly owned property. (See diagram 2.) In this case the question arises, should all public networks be allowed to connect to the DSLAM? Should, for example, property owners be allowed to sign exclusive or selective agreements with public network operators?

On the ISP and Internet side of the diagram, ISP 1 and ISP 2 are public service operators, and ISP 3 is a private ISP, for example a large company with its own intranet, and a firewall (FW) extranet connection to the Internet. ISP 1 and ISP 2 have interconnection with networks ATM 1 and ATM 2 and can therefore serve any customer, and any customer can access their services. Interconnection between ISPs is through the Internet, and therefore, by implication, all customers are interconnected through the Internet. Direct interconnection between ISPs and between ATMs is also feasible, but is it necessary? If Internet interconnection and ISP-ATM interconnection is assured, is this sufficient? Should network (ATM – ATM) interconnection be mandated or left to private commercial agreement?

retailing bandwidth will probably remain a business in its own right, as will service level and managed network agreements.

Driving the New Model

What will drive the New Model ? On the demand side, almost certainly the appeal of fast Internet. This has mass market potential from the outset because even in the corporate sector the likelihood is that the most popular applications of 'broadband-to-the-desktop' will become the use of fast Internet services. It is an application that will also make a lot of sense to small and

medium-sized enterprises (SMEs) who are reluctant to invest heavily in fixed capital. Fast Internet services, especially those associated with developments such as fat-server/thin-client business software applications, web-hosting and other means of relieving SMEs of significant and recurring capital expenditure on information technology, on repair and maintenance and upgrades, and on scarce IT-skilled human resources, would seem set to have a universal appeal.

Mindshift

It will not be an easy task to convince everyone brought up with narrowband business models to accept the ‘mass market from day one’ approach to fast Internet and the broadband business model. But perhaps the supply side will be even more controversial. The basic question is: who is the customer? In the traditional narrowband dial-up Internet model, the customer end-user deals directly with the ISP and, in principle, the telephone company providing the dial-up access network is only indirectly involved. In the broadband world the same customer-ISP relationship can also hold good. The customer applies for broadband service from the ISP, not from the telco, and it is the ISP who becomes the telco’s customer when requesting a broadband upgrade. In this model, the ISP bills the customer (end-user) for the broadband upgrade as well as for the Internet services provided, and it is also the ISP who pays the telco for the broadband access upgrade. This is no different in principle from the current arrangement in Hong Kong whereby the ISP pays the telco the public non-exclusive telecommunications network services (PNETS) charge⁷ and passes them on (or not, as they choose) to the customer.

Why is maintaining this commercial customer-relationship in the broadband world important? The fundamental reason is that it may be the only way to accelerate aggregate demand for broadband services. It is therefore in the interests of the telcos themselves to go along with it. Typically, a telco using the narrowband business model will want to ‘capture’ the customer either for its own network or for an affiliated ISP. The prospect of ‘losing’ the direct connection to a customer is, for example, a major reason why incumbent telcos are so resistant to local loop unbundling.⁸ But the question then remains: how to motivate the customer to start using broadband services?

Motivation will come through a variety of sources, typically from (a) the supply of attractive services, applications and content, (b) affordability and availability of access, (c) a perception of

⁷ 2.7¢ per minute since September 1999.

⁸ Under local loop unbundling, or LLUB, physical control of the wireline connection from the local exchange to the customer’s premises is handed over to the interconnecting network who seizes that line for as long as the customer has selected to use its network. Billing information, from which a tracking of that customer’s calling and expenditure is derived, is increasingly used to profile the pattern of the customer’s consumption.

the value of broadband services, (d) close contact with ‘innovators’ and ‘early adopters’, (e) facilitation and promotion campaigns by private and public sectors, and so forth. The telcos have a vital role to play because they can influence several of these factors positively or negatively. But it is in their own fundamental interests, *as well as* those of the community, they act positively. Failure to do so will delay the future growth of revenues at a time when existing PSTN revenues are about to rapidly diminish.

Making the Model Work

Customer motivation on the demand side, and the incentive to supply the market with services, applications and content go together. For that reason it is extremely important that customers are given access to the ISP of their choice, and that ISPs are given access to their customers – fairly, openly and without hijack. By this we mean

- that ISPs have the right to be interconnected on reasonable and non-discriminatory terms with all public broadband access networks
- that ISPs have the right to bill their broadband service customers directly, and that the default home page a customer accesses is that of their ISP. It is only too easy for a network intermediary (e.g. a telco) to hijack the customer end-user on the one hand, or the default home page on the other. In an advertising driven network model, the default home page is a major source of revenue.

Interconnection of ISPs with access networks is fundamental to achieving and maintaining an open and competitive broadband services market. Without it, the supply of services, applications and content, and consequentially the demand for these, will be retarded and eventually distorted.

The broadband access network operators need to,

- roll-out broadband as soon as possible on a commoditized basis from day one
- recognize that their customers are the ISPs; potentially all of them.
- use only internationally recognized industry standards wherever they exist, and to use interoperable standards under any circumstances

A Role for Property Owners?

The idea of ‘broadband-to-the-desktop’, especially if it is promoted as ‘free’⁹ or ‘ready-to-use’ is likely to become an attraction to companies looking for ‘intelligent building’ office rental space, to retail stores on the lookout for appealing shopping malls, or to professionals searching for high-end residential accommodation. A trend already evident overseas, for example in the USA and in Sweden, is for property developers and building owners to see the provision of high-speed local area networks as part of their strategy to increase occupancy levels, boost sales, and perhaps maintain rentals. In Hong Kong recent examples have been well advertised, but the thinking still remains at the *local* area network level. The next wave will be broadband or ‘local wide area networks’. Diagram 2 illustrates the possibility of locating the DSLAM equipment in the building premises, on the assumption that the building owner has purchased the DSLAM and installed it directly. A maintenance contract with a local telco or an authorized maintenance contractor would be involved, but the operation of closed-user group services, such as building security issues, management notices, tenant information systems, would be done in-house.

The advantages to property developers, owners and tenants alike are fairly obvious. In developing countries this could also be an important source of new money into the sector. It is estimated that the cost of the DSLAM equipment could be around 50 per cent of the total cost of building costs of broadband networks. From the perspective of both the industry and society, it could accelerate the take-up of broadband.

Public services into these buildings would continue to be offered by licensed public service operators, for example telcos and ISPs, across one or more access networks which would hook into the back of the DSLAM. A major regulatory issue here would be whether exclusive or selective agreements should be allowed between property owners and telcos? DSLAM equipment will be available with several ports for through which various operators could offer tenants a choice of access network. If, on the one hand, customers can access their chosen service provider through any access network because interconnection between access networks and ISPs is mandatory, it could be argued that exclusive agreements do not damage the customer’s right to choose. If, on the other hand, the access networks themselves offer a variety of competitive intelligent network services, then a customer’s right to choose would be damaged.

Building and telecommunications laws and regulations do permit this development. Under the current legislative proposals in Hong Kong, building owners would require a class licence to operate such a ‘local wide area network’ and provide services, although why it is necessary to licence at all is not immediately obvious. The building and operating of broadband ‘local wide area networks’ need not be restricted to private property development, but should also widen to public housing schemes, college campuses, hospitals, airports, etc.

⁹ ‘Free’ only in the sense that it is not separately billed. In practice the cost of installing and maintaining a broadband ‘local wide area network’ and offering closed-user group services could be recouped through higher floor-space rentals, faster sales at higher prices, management fees, and so forth.

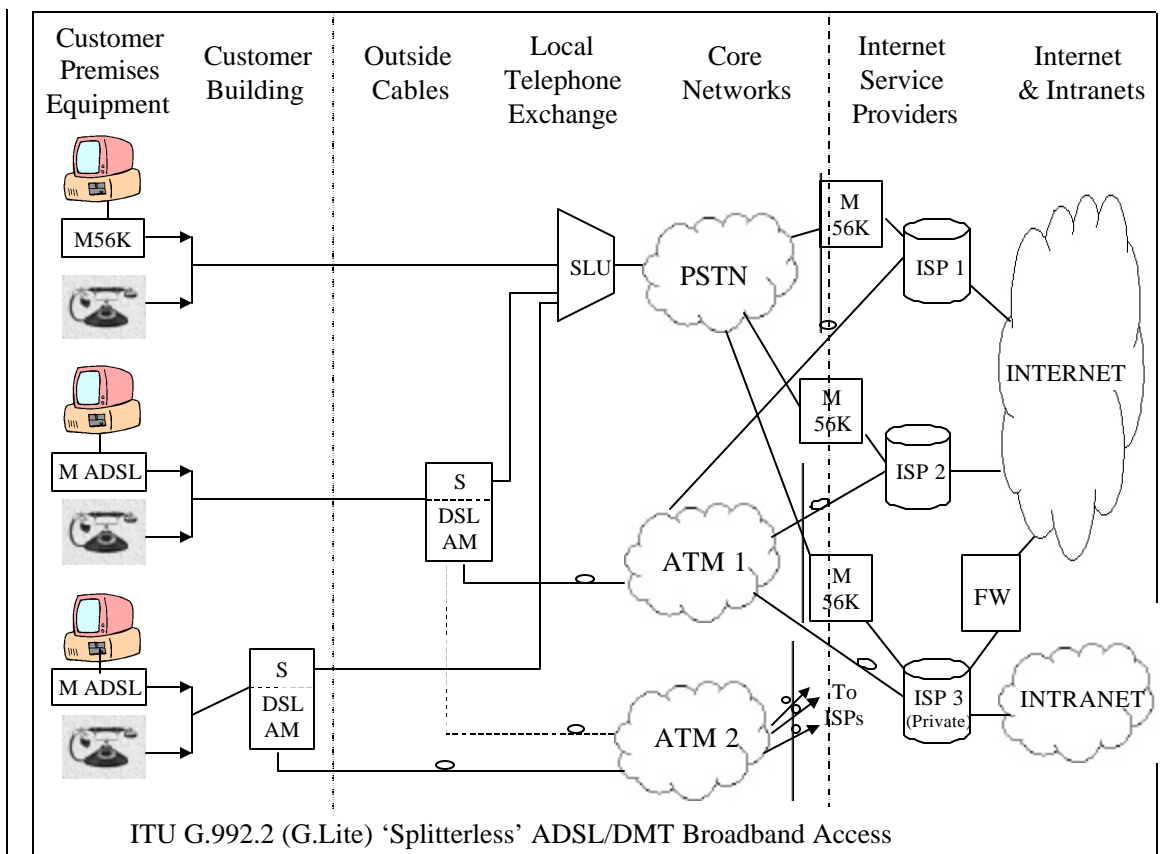


Diagram 2 replicates diagram 1 except for the fact that the DSLAM connected to network ATM 2 is shown located in private property. This private property could be a public housing scheme or a college campus as well as a private commercial development. It is a regulatory issue as to whether both access networks should have the right to interconnect with the 'private' DSLAM. As illustrated, voice calls are still routed through the PSTN of network 1.

Conclusions

- The narrowband business model is dying
- A broadband business model requires a mindshift on the part of the industry as a whole because it turns on their head many of the commercial practices of the narrowband world
- Revenue streams in the broadband world will, essentially, come from three sources: access devices, access networks and Internet business
- It is in the self-interest of the industry, as well as of society, that broadband services are seen as having mass market potential from day one, and are promoted and marketed as such. This includes the wholesale and retail marketing of access.

- To ensure customer choice and service provider access to the customer, interconnection of an ISP to any access network should be mandatory if the ISP requests it.
- All avenues should be explored to encourage the take-up of broadband, such as the encouragement of 'local wide area networks'.