



Asian Telecom Connectivity Market: Executive Summary
(Research conducted 2005)

The following is a summary of the findings of the
Telecommunications Research Project
University of Hong Kong

NOTE¹

The original research was undertaken for a private client in 2005 and the detailed report and recommendations are therefore not publicly available, but the following Executive Summary was made available at the time to companies who provided information and their opinions.

In respect of demand and supply, the research goes beyond the data and analysis provided by TeleGeography (an industry benchmark publication) by estimating various rates of growth of demand against estimates of capacity lit and capacity used, thereby projecting various dates of capacity exhaustion.

Unity Cable

Since this research the 10,000 km Unity Cable connecting Japan and the USA has been announced (2008) consisting of carriers SingTel, Bharti-Airtel and KDDI, together with Internet companies Google, Pacnet and Global Transit (subsidiary of Malaysian network exchange company, AIMS).

¹ This Executive Summary also appears as Appendix 2 in John Ure (ed.) *Telecommunications Development in Asia*, HKU Press, April 2008

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Between June and August 2005, the Telecommunications Research Project (TRP) at the University of Hong Kong undertook an extensive look at the regional bandwidth market. The research study was undertaken with intent to understand both the supply (and pricing) and demand sides of the equation, based upon feedback direct from carriers and experts, on the one hand, and from those directly purchasing bandwidth on the other.

It quickly became apparent that the supply and demand of bandwidth represent two distinct stories which, not only are not necessarily in alignment (obvious enough to anyone who has been watching the market over the last 10 years), but are at times quite seriously disconnected in their fundamental drivers. In the past this has all too often been lost in the secrecy that surrounds basic market information.

The supply and demand of bandwidth is difficult to determine because of the lack of publicly accessible information. This is a problem not only for researchers and outside observers, but for industry players as well. And, as such, this lack of transparency has contributed (and continues to contribute) to levels of uncertainty in the market and to boom-bust cycles resulting from inaccurate forecasting on both the level of capacity required and the level of capacity committed.³

The reluctance of carriers to divulge information about their networks is, in reality, to be expected. In many cases, secrecy simply reflects that on issues such as price and capacity, the same company may be offering different packages and discounts on a confidential basis to win customers. However, data at this level – at the level of cable route by cable route – is required if an assessment is to be made on when to light additional capacity or when new cables will need to be built.

To address this requirement, the TRP surveyed carriers across the region and then employed certain assumptions about activation rates so as to simulate capacity exhaustion using different scenarios of demand growth. In this way the TRP survey goes a step beyond TeleGeography, perhaps considered the benchmark reporting for the industry, as well as updating TeleGeography's data. To assess demand, the report relied on two major sources of information. First, the views of carriers and of customers, including MNCs and ISPs, were surveyed. Second, Web searching and interviews yielded two types of information, data from company sources and the opinions of experts.⁴

All of the major regional markets were covered in this manner, with additional fieldwork to conduct interviews undertaken in China, Japan, Taiwan, Hong Kong, Singapore and India. The timeline in surveys and interviews was limited to the near-term, 2-3 years – as this was one of the parameters of our sponsoring client. However, where valid, conclusions have been drawn stretching further than that.

² This report was produced by Dr John Ure, Dr Peter Lovelock, Dr Jenny Wan and Mr Terence Graham of the Telecommunications Research Project at the University of Hong Kong.

³ In this sense, company secrets may be considered an aspect of market failure, and reports such as the TRP's, TeleGeography and others help to lessen it, multi-client reports more than proprietary ones.

⁴ Evidence on pricing was mostly gathered from surveys of carriers, corporate users and ISPs. Overall it confirms the trends observed by others, that prices have continued to decline, and there are signs that the declines are lessening, with some suggestion that prices may even rise slightly on some routes.

This executive summary has been compiled for the information of participants in the TRP's surveys and interviews, so as to provide an overview snapshot of the conclusions that were reached. All individual responses have remained anonymous and only used in the aggregate. In this summary, a short overview of our research conclusions is provided, followed by a brief elaboration of the supply, demand and IP traffic components, as these were often represented by different constituencies in the primary data.

Overview

The average lit capacity of cable networks throughout the region is low. Lit capacity is less than 15 per cent of designed network capacity on the trans-Pacific route, less than 5 per cent on the intra-Asia route, and less than 5 per cent on the Asia-Europe route. But these averages are weighted downwards by the skewed distribution of capacity between the networks.

By simulating the effects of various cumulative average growth rates (CAGRs) on this lit capacity utilization, the research suggests that the three smaller cables on the trans-Pacific route will reach exhaustion by or before 2009. On the intra-Asia route only one cable, SMW-3, will reach exhaustion before 2010, and on the Asia-Europe route the capacity of SAFE and SMW-3 will reach exhaustion between 2007 and 2012, depending on the CAGR, but by 2006 Flag Falcon and SMW-4 will add around 3Tbps of capacity to the route.

In addition the overland TAE cable from China to Europe is available. On this basis it would seem that the trans-Pacific route may attract additional investment in a cable system, but only for strategic reasons, namely to reduce the dependence of Tier One carriers within the region on the Tyco (VSNL) cable system.

The intra-Asia routes can best be seen as west of Japan, east of Singapore and west of Singapore. Industry evidence is that the older smaller cables west of Japan, for example linking Japan to Taiwan or Hong Kong to Taiwan (HONTAI-2) and Hong Kong to Korea to Japan (H-K-J) are full to capacity, but other cables such as APCN-2, EAC, FLAG/Reach NAL and KJCN have considerable capacity still to be lit. East of Singapore capacity on the largest cable, C2C is being withheld from the market by Singapore Telecom while refinancing negotiations are under way with the banks. Withholding capacity is no great loss during a period of rapidly falling international bandwidth prices, but it does create what several industry experts have described as the only real bottleneck in the region, Singapore. West of Singapore there is a surfeit of capacity, but dominated by two cable systems, C2C and i2i (Singapore-India). Despite all the news of India's booming economy, the growth of an indigenous IT sector and of BPO/outsourcing a significant growth in demand for bandwidth has yet to materialize. By 2006 two new systems come into operation, SMW-4 and FLAG Falcon connecting to the Middle East and Europe. Supply looks set to outstrip demand for a long time to come. If there is a bottleneck it is between Mainland China and India and Europe. The overland TAE cable from Shanghai through Russia is an alternative route to Europe.

On the supply side very different business strategies are emerging. Gone are the days when dominant international carriers tried to build global networks with POPs in every major trading country of the region. Non-Asian carriers are mainly focused on following their corporate customers, and leveraging their strengths in providing managed network services. Companies like BT, France Telecom, Deutsche Telecom now lease capacity at

low prices rather than build or light their networks. These companies have essentially withdrawn from the market as wholesalers.

Asian carriers fall into several categories. Some, like SingTel and NTT are focused on corporate customers, some like SingTel and VSNL are focused on building regional networks, some like ANC are spreading their options between wholesale and retail. Smaller carriers in the region, such as Telekom Malaysia, are looking for ways to extend their overseas reach through leasing. Whenever they can, carriers are trying to exploit their vertical positions, such as Korea Telecom and Chunghwa Telecom, by connecting into their domestic markets and tapping the traffic generated by the spread of the Internet, of broadband and the new rich media industries.

Underlying all these strategies is the fact that international bandwidth has become a commodity, and this is reflected in its price and in low profit margins. For carriers it becomes a judgement call whether to light additional capacity and incur O&M costs or to lease from other carriers and/or to redirect their resources to their retail customers. The answers have less to do with the economics of lighting capacity (which are well known) and everything to do with the medium-to-long term strategy of the company.

The dilemma all carriers face is judging the growth rates of market demand and the future demand for capacity. On the retail side the key issues are how soon and how fast corporate customers will migrate from separate voice and managed data networks to IP-VPNs, and how soon the spread of fixed and mobile broadband services to SMEs and consumers and the growth of the new rich media sectors, including growing trends such as P2P file downloads and file swaps will impact on the demand for international bandwidth. TRP conclusions remains very cautious on these issues.

Fast growth rates are starting from a low base, so even the spread of bandwidth demand from multiples of STM-1s to STM-4 (from carriers) and for Ethernet over MPLS (in multiples of 10Mbps/ports) and for 50-100Mbps to the home (in Japan) will not make much of a dent in currently available international bandwidth. The more important calculation is what contribution to revenues do these various services make? The answer always favours the corporate customer segment. The survey of corporate customers shows very clearly the number one consideration is network reliability. Most corporate customers saw their demand for managed data services rising, and anticipated a slowing down in price falls of IPLCs or even increases over the coming two years.

The view of operators on wholesale prices on intra-Asia routes was of price falls decreasing from less than 20 per cent on average to falling slightly or even increasing. Estimating the growth of IP traffic is plagued with misinformation which has led to over-investment in the past. The report uses data that suggests growth rates will remain modest at less than CAGR 30 per cent on most routes despite the spread of domestic broadband, P2P, etc. For individual carriers the growth rates can be much faster, for example over 80 per cent, but when averaged over the region there is no compelling evidence of such rates.⁵

Finally, while survey results show Tier One and Tier Two carriers experiencing price falls of 20 and 15 per cent recently on IP transit, most ISPs are looking forward to

⁵ This could change with a 'paradigm' shift towards ubiquitous broadband and digital TV, movies, etc., but not within the two-three year time span of this report.

increased demand for transit. But there is one feature separating Hong Kong and non-Hong Kong ISPs. The former anticipates slightly or steeply increased prices and the latter (from India, Japan and Taiwan) steeply or slightly falling prices. This underlines the rather different dynamics of markets across the region, and the fact that although the cable systems are often the same, the operators are not.

Supply

FLAG Europe-Asia was the first private cable in 1997. Now owned by Reliance (India) it has a lit capacity of 10 Gbps and a maximum capacity of 80Gbps. Still to come to meet the rapidly growing potential of traffic associated with India and possibly China to the Middle East and Europe is the 1.28Tbp FLAG Falcon, originally opposed by minority stakeholders in FLAG such as C&W and FT suggesting concerns over bandwidth prices. Since then, regulatory liberalization is driving a demand for bandwidth within and to India, but upgradeable bandwidth capacity will have grown by well over 1,000 per cent since 2004 when FLAG Falcon does come on line.

When FLAG Falcon and the consortium-driven SeaMeWe-4 enter operation, the total upgradeable capacity serving intra-Asia will jump to 37Tbps, up from an existing 33Tbps (Table 1). A large portion of this recent bandwidth is serving South East Asia and India, for example through the Tata Indicom Chennai Singapore TICS cable (320Gbps lit, 5.12Tbps capacity), and the SingTel-Bharti cable i2i (160Gbps lit, 8.4Tbps capacity). The effect of the additional capacity on bandwidth prices to India is expected to be steeply down, despite strongly anticipated growth in traffic requirements. Prices are expected to fall sharply unless capacity is withheld from the market, which would appear to be difficult to coordinate between competing carriers.

The other major cables within the region are the FLAG/Reach North Asia Loop (120Gbps lit, 3.84Tbps capacity), Asia Netcom's cable EAC (80Gbps lit, 2.56Tbps capacity), the consortium cable APCN-2 (160Gbps lit, 2.56Tbps capacity) – although this cable is plagued with outages from cable breaks – and SingTel's C2C (160Gbps lit, 7.68Tbps capacity), but the capacity of C2C is currently being withheld from the market.⁶

⁶ C2C is undergoing financial restructuring, with SingTel and the banks.

Table 1⁷

Cable System	Network Capacity	Lit Capacity	Lit as % Net Capacity
Trans-Pacific			
China-US	80	80	100%
JUS	640	400	62.5%
PC-1	640	180	43.8%
Tyco	7,680	460	6%
Sub-Total	9,040	1,120	12.4%
Intra-Asia			
APCN	10	10	100%
APCN-2	2,560	160	6.25%
C2C	7,860	160	2%
EAC	2,560	80	3.1%
FLAG Falcon	(2,560)	(80)	na
FLAG/Reach NAL	3,840	120	3.1%
Guam-Philippines	40	5	12.5%
i2i	8,400	160	1.9%
KJCN	2,880	10	0.3%
SMW-3	70	20	29%
SMW-4	(1,280)	na	na
TICS	5,120	320	6.25%
TIS	320	30	9.4%
Sub-Total	33,660	1,075	3.1%
Europe-Asia			
FEA	80	10	12.5
FLAG Falcon	(1,280)	na	na
SAFE	130	30	23
SMW-3	40	20	50
SME-4	(1,280)	(160)	(12.5)
Sub-Total	250	60	24%
Total	42950	2255	5.3%

Utilization Rates:

With IP traffic occupying approximately 88 per cent of bandwidth and demand for IP traffic between Asia and the USA growing by around 50 per cent in 2004-05, bandwidth utilization growth was estimated at over 40 per cent during 2004-05 on the **trans-Pacific** routes.

Lit capacity for **intra-Asian** cable capacity has grown to 1,045Gbps, however it is skewed by the two large networks, C2C and i2i. Their lit capacity is only 2 per cent and, like PC-1, C2C is currently dormant. Discounting C2C, TRP's conclusions are that the weighted average utilization rate of lit capacity may be as high as 80 per cent.

Demand Growth:

On the **trans-Pacific** route, one source suggested that IP traffic would grow at around 50 per cent in 2005, but only at an average 29 per cent through 2005-2009. Another source suggested a 60 per cent growth in IP traffic on the trans-Pacific route 2004-2005.

⁷ Some smaller cables systems which may be upgraded to provide fill-in have been omitted from the Table. For example, cables from Hong Kong: H-J-K, HONTAI-2, Okinawa-Luzon-Hong Kong, Singapore-Hong Kong-Taiwan, and T-V-H., and the Dumai-Melaka Cable System from Indonesia to Malaysia.

By contrast, cable operators are expecting a significant escalation in **intra-Asian** demand. Three drivers for growth have been identified by carriers and observers: national economic growth (led by the booming economies of China and India) along with further industry liberalisation; fragmenting industry demand, or new areas of communications traffic growth; and the growth of IP traffic.

What does this mean for Lighting Capacity and Building New Cables?

On the **trans-Pacific** routes, the results suggest that new cables will be required to replace two of the three smaller cables by 2008, and the third by 2009 at the latest (Table 2: the 30 per cent CAGR is an unlikely scenario over the next 2-3 years). For the **intra-Asian** routes, even with a sustained CAGR of 80 per cent, only one cable (SMW-3) exhausts its capacity before 2010. And, if utilization rates along the **European-Asian** routes match the intra-Asian utilization rate, 2007 and 2010 at the latest would exhaust SAFE and SMW-3. However, with so much additional capacity coming soon from FLAG Falcon and SMW-4 these other cables are likely to be used for redundancy.

Table 2

Cable System	CAGR 30%	CAGR 50%	CAGR 80%
Trans-Pacific			
China-US	Capacity ends 2007	Capacity ends 2006	Capacity ends 2006
JUS	More lit cap. 2007; Capacity ends 2009	More lit cap. 2006; Capacity ends 2008	More lit cap. 2006; Capacity ends 2007
PC-1	More lit cap. 2007; Capacity ends 2012	More lit cap. 2006; Capacity ends 2009	More lit cap. 2006; Capacity ends 2008
Tyco	More lit cap. 2009; Capacity ends 2020	More lit cap. 2008; Capacity ends 2015	More lit cap. 2007; Capacity ends 2012
Intra-Asia			
APCN-2	More lit cap. 2007; Capacity ends 2017	More lit cap. 2006; Capacity ends 2013	More lit cap. 2006; Capacity ends 2011
C2C	Na	na	na
EAC	More lit cap. 2007; Capacity ends 2020	More lit cap. 2006; Capacity ends 2015	More lit cap. 2006; Capacity ends 2012
Falcon	na	na	na
FLAG/NAL	More lit cap. 2007; Capacity ends 2020	More lit cap. 2006; Capacity ends 2015	More lit cap. 2006; Capacity ends 2012
G-P	More lit cap. 2007; Capacity ends 2015	More lit cap. 2007; Capacity ends 2012	More lit cap. 2006; Capacity ends 2010
i2i	na	na	na
KJCN	More lit cap. 2007; Capacity ends 2028	More lit cap. 2007; Capacity ends 2020	More lit cap. 2007; Capacity ends 2017
SMW-3	More lit cap. 2007; Capacity ends 2012	More lit cap. 2006; Capacity ends 2009	More lit cap. 2006; Capacity ends 2008
SMW-4	na	na	Capacity ends 2018
TICS	More lit cap. 2007; Capacity ends 2017	More lit cap. 2006; Capacity ends 2013	More lit cap. 2006; Capacity ends 2011
Europe-Asia			
Falcon	na	na	na
SAFE	More lit cap. 2007; Capacity ends 2012	More lit cap. 2006; Capacity ends 2010	More lit cap. 2006; Capacity ends 2009
SMW-3	More lit cap. 2007; Capacity ends 2010	More lit cap. 2006; Capacity ends 2008	More lit cap. 2006; Capacity ends 2007
SMW-4	na	na	na

Demand

Demand is driven by carrier demand and Internet traffic demand. PSTN traffic takes up almost insignificant international bandwidth (3 per cent in 2003 compared with 23 per cent in 1999)⁸, and non-IP network data traffic (ATM, FR, dedicated data circuits) accounts for only 12 per cent of international bandwidth.

For this reason the data market remains highly significant to the business of international carriers. To date the business market is basically MNCs and similar large organizations, such as governments, but this is already beginning to change as SMEs become part of global supply chains and the cost of bandwidth and IPLCs falls. IP-VPNs are clearly the networks of the future (NGNs) but like so many technology-enabled changes that require the replacement of perfectly adequate legacy systems and a reconfiguration of management systems, including the merging of voice and data services that have been traditionally managed quite separately, their rate of adoption will be subject to many constraints, meaning that in the very near term (the next 2-3 years), IP-VPNs will still have only minimal impact upon demand for international bandwidth.

Carrier Strategies

Asian carriers enjoy the advantage of serving their own local emerging global companies. The traditional first tier carriers, like Reach and SingTel and NTT, are major investors in cable networks. The new first tier carriers like VSNL, Reliance, China Telecom and China Netcom are either taking advantage of distressed assets and buying major cable networks at low prices or trading cautiously towards their own international networks.

The traditional first tier carriers are facing a dilemma. Their networks were built at cost, not at distressed asset prices, and their core competence lies in sophisticated network management and corporate services. This would naturally push them towards the high margin corporate retail end of the market and away from low margin wholesale market, but there are other strategic considerations, such as a group of carriers banding together to lay a new cable purely for competitive purposes. For example, Reliance, SingTel and others may not like that they have to purchase all of their trans-Pacific capacity from one of their competitors, VSNL-Tyco.

It is public knowledge that NTT have plans to invest in another cable.⁹ The mirror image of this situation is that SingTel owns its own C2C behemoth and is withholding bandwidth from the market. SingTel is facing a delicate balancing act, between building and activating its own regional network system and maintaining bandwidth prices in face of SWM-4 and FLAG Falcon, which seems very much like trying to square a circle. Reach's solution is to withdraw from the circle.

In all regions, surveys conducted by the TRP show that carriers plan to lease before they light, and to light before they construct suggesting that overall capacity constraints are not yet seen arising. However, in the intra-Asian region where smaller networks are likely to exhaust capacity over the next 2-3 years, carriers are more likely to lease and to light than in the trans-Pacific region, but network construct is the same for both. Greater

⁸ *TeleGeography* (2005) p.37.

⁹ As reported by *America's Network*, v.109.2, 1 February 2005, a senior executive at NTT Communications Corporation 'told a submarine cable conference that Tyco was simply too dominant on the trans-Pacific route. And it wanted yet another cable built for diversity reasons.'

network construction, as expected, is planned for the Asia-India routes and for the Asia-Europe routes.

Markets

The TRP report examines three market segments, IPLCs and IP-VPNs, wholesale bandwidth prices and IP transit traffic.

Security is one of the concerns from the corporate sector regarding IP-VPNs, but another factor as noted by the Gartner Group is that on a point-to-point (route-to-route) basis, IP-VPN prices are two to three times IPLC prices. This may not be just a case of IP-VPN being priced high but also of IPLC pricing being unusually low. The Gartner group found IPLC (E-1) price declines from hubs such as Hong Kong, Singapore, Tokyo to have slowed during 2004, but they were still typically 20-25 per cent down. By contrast, in highly regulated second tier Asian markets IPLC prices were as high as \$7,000 and even \$11,000 per month. An additional influence in these markets will be the cost of the local 'tail' which can be typically 50 per cent of the total international connection which prices IPLCs out of the range of many customers.

The results of the TRP's carrier surveys found price declines for IPLCs and for wholesale bandwidth in all regions since 2004 although by smaller amounts than many analysts appear to be suggesting, especially on the trans-Pacific routes. It is worth noting that in some cases while corporate customers paid less for their bandwidth they also bought more of it, resulting in no change to their overall bandwidth expenditure. Their motive for buying more was less to take advantage of lower prices and more to respond to growing demand.

One interesting consequence of lower IPLC prices is longer term price elasticity, in the same way that falling broadband prices has driven residential demand for bandwidth, so falling IPLC prices may encourage a much wider adoption rate among businesses, both large (upgrading) and SME (adoption). But this demand is essentially derived from a belief that the commercial environment is improving, and capacity is bought either to meet increased business needs or in anticipation of future business requirements. Price elasticity in this context is really about bringing forward purchase decisions to take advantage of low prices, or to substitute IPLCs or IP-VPNs for other ways of communicating and transmitting data.

Looking forward, the TRP preferred to take a cautious view on overall IP transit traffic growth, citing warnings over past irrational exuberance, although the experience will vary significantly according to the carrier and to the primary domestic-international market it serves. In general, carriers on the intra-Asia route cluster around slightly falling prices, with more respondents seeing no change or even price rises than seeing a steep decline. This view was even more strongly expressed on the trans-Pacific route where a number of carriers see steep price increases occurring. A strong contrast was on the Asia-India route where the majority of carriers predicted steep price falls. On the Asia-Europe routes around two-thirds of the surveyed carriers forecast prices to continue falling, either steeply or slightly, and none saw prices rising.

Substantial growth in traffic is expected from and to India, especially on the Singapore route – which makes sense for regional and US-bound traffic which hubs through Singapore – and of steady but moderate growth on the Hong Kong route. The India-Singapore route only reaches 35G by 2009, but this is about one-third of all other intra-

Asia traffic combined which reaches 90G by 2009. Looking five-to-six years ahead is not a very reliable way to anticipate IP traffic growth without examining the underlying drivers. According to survey responses collected and collated by the TRP, the leading drivers of IP traffic will be the rapid spread of broadband, P2P file sharing, and broadband wireless and mobile networks.

One effect of commoditization of bandwidth, besides an increasing segregation between carriers highly focused upon a corporate clientele and carriers focused upon a mass market including ISPs and a carriers' market, is the disincentive to investment in submarine cable bandwidth R&D. As bandwidth supply exceeds demand and bottlenecks on key routes disappear, the incentive to invest in further enhancements to bandwidth throughout is reduced. A lot of commercially-focused R&D is bottleneck driven, and it will return only when bottlenecks return.