6 INTERNATIONAL SHARING: INTERNATIONAL GATEWAY LIBERALIZATION

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6.1 The importance of liberalizing the international gateway

Broadband Internet access has become commonplace and increasingly affordable in many areas of the world, but that is not yet the reality for most residents of developing countries. Broadband services are either unavailable, or they are almost prohibitively expensive, constituting a barrier to meaningful entry into the global information economy.

Indeed, monthly costs, per 100 kbit/s, for broadband access still average about 30 per cent of monthly per capita gross national income (GNI) across the globe.[1] Moreover, this global figure masks a dismaying disparity between broadband costs in different parts of the world, which range from just 2.2 per cent of monthly per capita GNI in Europe all the way up to 96 per cent in Africa.[2] It is difficult to comprehend how large-scale demand for commercial broadband services can exist in any country where that service costs as much as the average monthly income.

Yet, without greater demand, the market for broadband services in many developing countries will remain stunted, crippling the broad-based social and economic growth that comes from joining the Information Society.

High prices for broadband access are tied to a lack of access to international network capacity. Historically, many developing countries have been connected to the global information grid by extremely thin pipes. Some have remained unconnected by any terrestrial submarine cable system, relying exclusively on expensive satellite links.[3] This scarcity makes itself felt in high prices for access to international networks – costs that are passed along to consumers in developing countries. High prices suppress demand, which then saps any incentive to invest in additional network capacity to and from these countries. It is a classic "vicious circle" of restricted capacity and high prices, leaving many potential broadband consumers cut off from access to key communications offerings.

One way that countries can cut through the capacity conundrum is through liberalization of international gateway (IGW) facilities. The international cable and satellite systems that link multiple countries reach choke-points as they are "landed" within each destination. These choke points are the facilities that aggregate and distribute international traffic to and from each country. Liberalizing access to these gateway facilities can lower infrastructure costs and promote infrastructure sharing, while multiplying the amount of international capacity available to operators. The result, as this chapter will explore, can be a rapid ramp-up of international traffic, coupled with lower prices for international communications.

6.1.1 What is the international gateway?

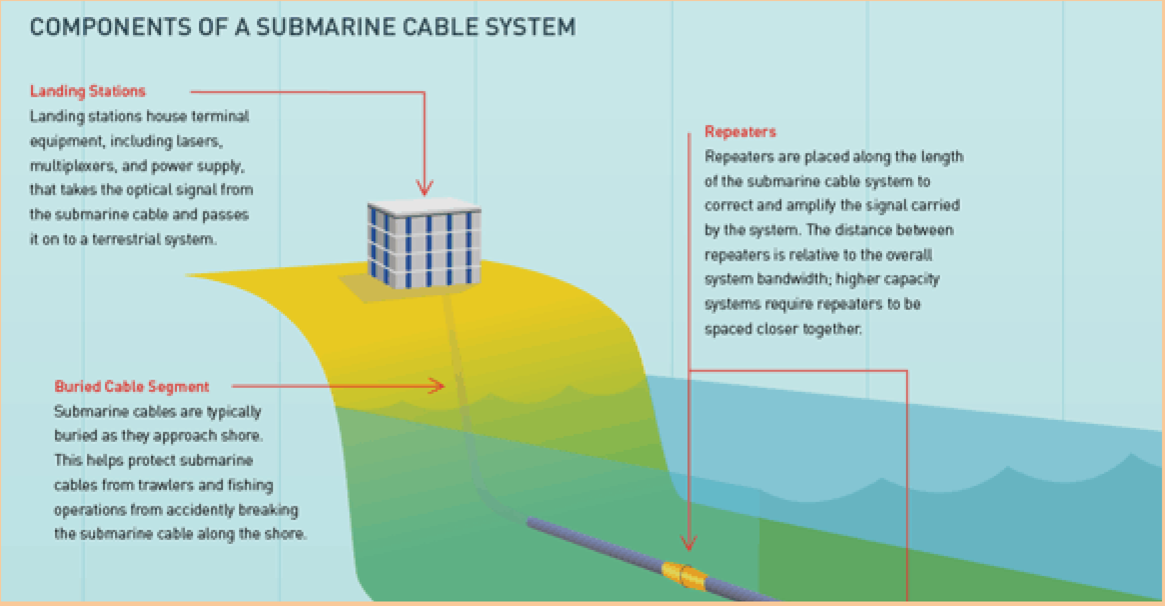
Put succinctly, the international gateway is any facility that provides an interface to send and receive electronic communications (i.e., voice, data and multimedia images/video) traffic between one country's domestic network facilities and those in another country. In practical terms, the IGW can be either the facilities linking domestic networks to an international (often submarine) cable system or the earth station facilities that link domestic networks to a satellite system. As the following subsections indicate, the actual facilities differ depending on whether the international facility is terrestrial or space-based. Despite these differences, however, the purpose is identical: to aggregate and distribute incoming and outgoing international voice and data traffic – traffic that is increasingly accessible only through broadband networks

6.1.1.1 Access to submarine cable networks

The physical components of IGW access to submarine cable networks include:[4]

- Backhaul facilities from the domestic POP to a submarine cable landing station (SCLS);
- Switching, digital cross-connects and other interconnection facilities within the SCLS;
- Beach manholes that provide the literal border between land and sea; and
- The undersea cable itself, as it transcends national waters to international ones.

Figure 6.1: The terrestrial option: Submarine cable systems

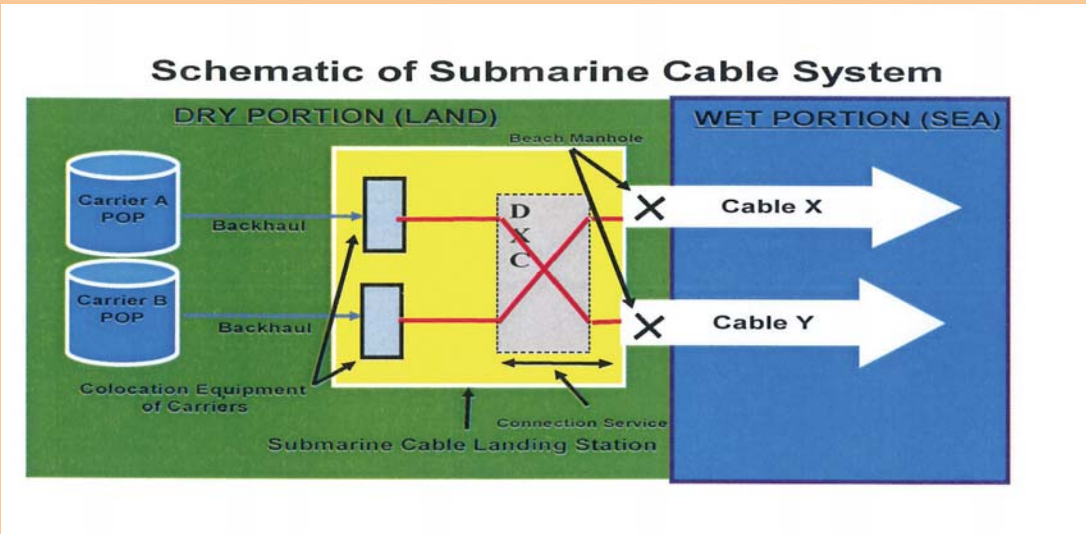


Source: TeleGeography, at: www.telegeography.com/products/map_cable/

The IGW for submarine cable systems encompasses both a "wet" segment and a "dry" segment. As one would expect, the wet segment includes the elements on the seaward side of the beach manholes, while the dry portion comprises the SCLS (with its connection facilities) and the backhaul networks to the domestic carriers' POPs (see Figure 6.2).

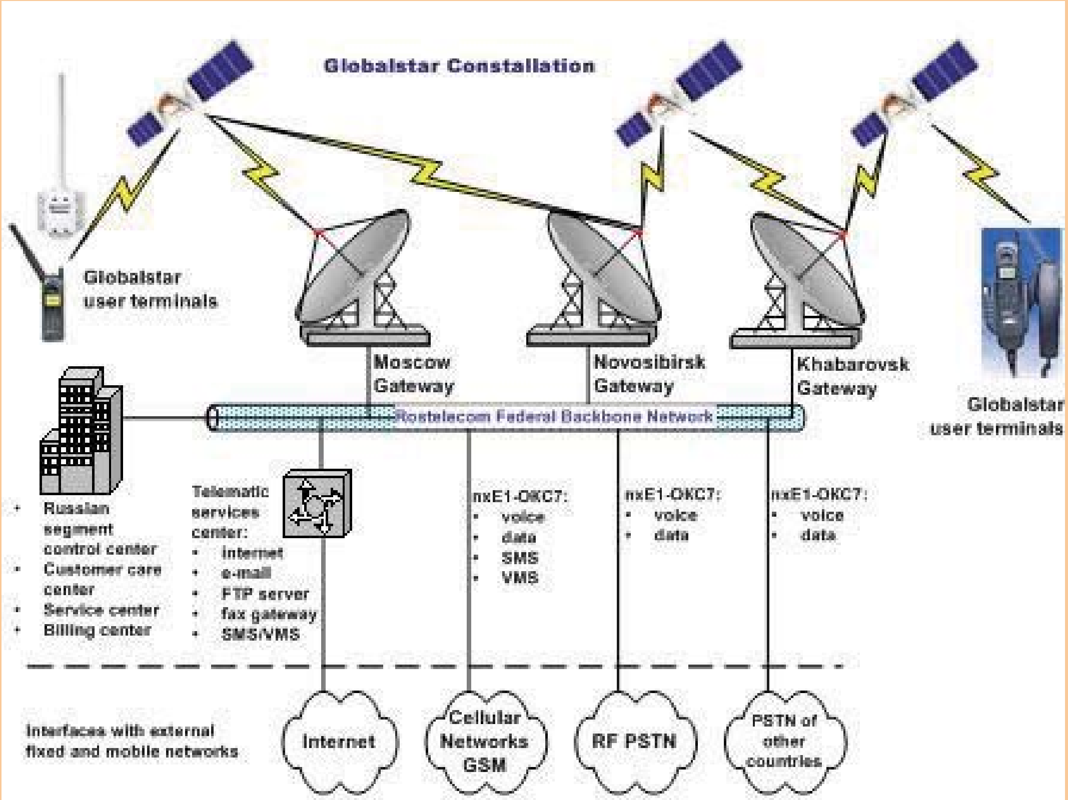
In the past, the national "flag" operator holding the exclusive authorization to provide international services owned and operated all elements of the wet and dry portions of the IGW, including the cable landing station. Even after additional operators were authorized to carry international traffic, it made little sense economically for each operator to build its own IGW facility. It is possible, however, to grant competing operators shared access to IGWs through interconnection at the cable landing station.

Figure 6.2: "Wet" and "dry" portions of a submarine cable system



Source: DXC or Digital Cross Connect is a switching system that routes signals among multiple paths or different operators' circuits in this case.

Figure 6.3: Access to Globalstar in Russia



Source: GlobalTel, at: www.globaltel.ru/english/i/about_globaltel/photos/about_globaltel_nail.jpg

6.1.1.2 Access to satellite networks

A satellite gateway earth station serves the same function in aggregating traffic, converting it to the proper format and transmitting it to (or, conversely, receiving it from) an orbiting satellite. As with undersea cable networks, satellite networks are divided into two segments: the ground segment, consisting of all earth stations (ranging from major "teleports" to hand-held terminals), and the space segment, consisting essentially of the fleet of orbiting satellites. Communications traffic is aggregated at major earth stations for transmission via satellite uplinks to a satellite. Often, the earth stations are clustered in "teleport" facilities. On international routes, the traffic is up-linked at the teleport and transmitted to a satellite transponder, which then downlinks it to another earth station in a different country (this is known as a "single hop") or (particularly in the case of non-geostationary satellites) transfers the signal to another satellite for down-linking.

Some satellite services provide for direct transmission to individual terminals. These include VSAT (very small aperture terminal), direct-to-home broadcasting and mobile satellite services. In such cases, earth stations serve as the venues where broadcasting content is uploaded to the satellite, or where traffic is handed off through interconnection to the public switched telephone network ("PSTN").

As with cable systems, the original model for owning earth stations was vertical integration. Within the global consortiums such as Intelsat and Inmarsat, each member country's designated satellite operator would own and operate the earth stations to link to the consortium's satellites. Thus, one entity (either a company or government agency) would control access to the satellites. Even for mobile satellite and direct-to-home (DTH) broadcasting systems, vertical integration was the rule, with satellite companies distributing terminals manufactured (often under licence) particularly for their discrete services. Thus, access to satellite systems was often just as controlled (or more so) than access to undersea cable systems (see Box 6.1 for the history of Comsat in the United States).

6.1.2 What services and applications ride on the IGW?

Prior to the development of the Internet and packet switching, international IGW facilities primarily served to transmit circuit-switched telephone calls (and, in the case of satellites, analogue broadcasting feeds). That environment has been eclipsed by the rise of packet-switched data transmission, which exceeds standard circuit-switched voice traffic internationally.[5] In fact, it is a misnomer to dub packet-switched traffic "data", because much of this traffic is clearly Voice-over-IP (VoIP) telephony.

Box 6.1 Comsat: The first satellite company

The world's first commercial satellite company was formed as a result of legislation in the United States Congress. The Communications Satellite Act, signed into law by John F. Kennedy in August 1962, represented a policy decision to engender private-sector participation in what was then the nascent field of satellite communications. Rather than name a government agency to pioneer the field, the Act established the Communications Satellite Corporation (Comsat), which in 1965 launched the first commercial geostationary satellite, known as Early Bird, to supplement the submarine cable capacity between the United States and Europe.

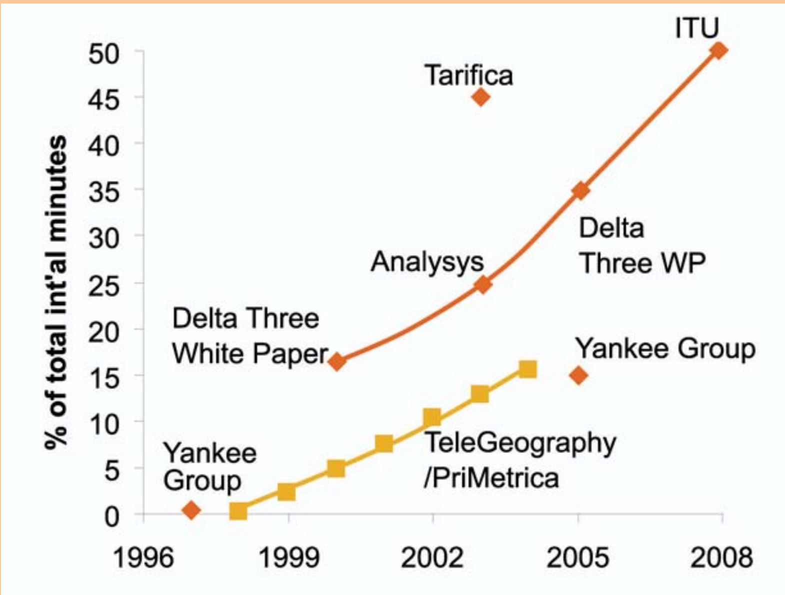
Meanwhile, Comsat became the US signatory to a 1964 agreement to form the first worldwide satellite consortium, dubbed INTELSAT. Comsat would later become the US signatory to Inmarsat, as well. During the 1970s, the US Federal Communications Commission (FCC) began issuing C-band licences for domestic satellites; by 1980, there were nine such "domsats" in orbit. The international satellite service market was kept separate, though, with Comsat serving as the exclusive provider of access to the international satellite consortiums.

Beginning in 1981, however, the FCC began to approve applications allowing the use of domsats for some international services, contingent upon coordination with INTELSAT and consistent with the provisions of the INTELSAT treaty. Later in the decade, so-called Separate Satellite Systems began to compete with Comsat/INTELSAT in the US market for international services – initially for traffic not interconnected with the public switched telephone network. By 1996, the FCC had erased all differences between the domestic and international satellite markets. It further liberalized the US market pursuant to WTO commitments, allowing non-US licensed satellites to provide service to US earth stations.

In 2000, as INTELSAT neared privatization, Lockheed Martin Corp. acquired Comsat, and, as part of the approval of that deal, Congress formally ended Comsat's exclusive access to INTELSAT in February of that year. Four years later, a privatized Intelsat Ltd acquired the former Comsat assets from Lockheed Martin, closing the final chapter on what *Newsweek* magazine had once called "the biggest new company ever created".

Figure 6.4: The global growth of VoIP traffic

Estimates of international VoIP traffic



Source: ITU, "The Status of Voice over Internet Protocol Worldwide," 2006.

Calls can either be originated as VoIP (in countries where this is permitted) or converted into IP packets at gateway switches (and reconverted to circuit-switched calls at the other end). IP-based transmission is more efficient and less costly. While there are many estimates on the percentage of international VoIP traffic, as shown in Figure 6.4, VoIP certainly continues to grow.

6.1.2.1 Circuit-switched telephony

The international correspondent system developed to account for circuit-switched telephony functioned well in a uni-polar world, in which all traffic routed to and from a country was carried by a single operator. As this chapter explores, however, that legacy paradigm has been largely supplanted by a multi-polar world, in which telephone calls are frequently carried over IP networks, where they are indistinguishable from "data". As reported in the 2007 edition of *Trends in Telecommunication Reform*, "The accounting rate system still exists, but on a far more modest scale than a decade ago."[6] ITU estimated at that time that only 20 per cent of international traffic was still subject to legacy accounting rate treatment. Even for circuit-switched calling, the large bulk of traffic was increasingly subject to alternative arrangements, such as call-termination charges.

The shift away from standard accounting rate practices has coincided with global trends toward privatizing government operators, liberalizing international service markets, and falling prices for international calling. In the past, monopoly operators and governments justified high international service rates by arguing that they were required to cross-subsidize lower domestic calling rates. Never mind that the inflated international revenues were often diverted to other, unrelated purposes – competition has largely trimmed the above-cost profits from many international routes. By and large, where access to international services is competitive, prices are lower for consumers.

6.1.2.2 Packet-switched data: IP and the Internet

Meanwhile, the growth of capacity on submarine cable systems has dovetailed with, and complemented, the shift toward packet-switched transmission.[7] Through IP networks, the data, voice and audiovisual transmissions are scrambled and intermingled. Indeed, there is no fundamental technical difference between packets containing VoIP conversations and those bearing e-mail messages.[8] Because packet-switching is more cost-effective, and VoIP traffic can be "hidden" within data flows, it represents an attractive mode for transmission of greater amounts of international data and VoIP traffic.

Consistent with the growth and greater balance of international cables and private-line circuits, innovations in aggregating and routing of IP-based traffic have helped to alleviate latency and capacity constraints in many developing countries. As *Trends* reported in its 2007 edition, Internet exchange points (IXPs) can serve as local, national or regional hubs for ISPs to exchange traffic, through transit or peering arrangements.[9] Liberalized IGW access can help backbone network providers to leverage IXPs as both domestic and international hubs.

One of the major by-products of the shift to IP-based telecommunications has been the growth of VoIP as a way to by-pass the circuit-switched accounting system entirely. Telephone calls that normally would be charged under international telephone rates – including settlement charges between carriers – can masquerade as data packets, allowing for cheaper (and increasingly reliable) international telephone services. This further erodes the revenue base for traditional international operators, adding to the effects of arbitrage on various routes.[10] Increasingly, the international operators that rely on the traditional monopoly IGW ownership paradigm are finding themselves lords of a declining market, watching revenues disappear through their hands like sand. Other operators, perhaps seeking to join the trend rather than fight it, are building next-generation networks (NGNs), employing IP technologies, and offering VoIP themselves as part of bundled service packages (see Box 6.2 on VoIP).

Box 6.2: Detecting the crime of VoIP

Acting on a complaint lodged by BSNL's Assistant Vigilance Officer, police in Chennai, India, arrested one resident of the town of Washermenpet in March 2007 on charges of violating the Indian Telegraph Act. What was the resident's alleged transgression? As *The Hindu* newspaper reported, he was suspected of working with another person to set up an unauthorized telecommunication network in order to provide VoIP access to international calling, thereby "causing revenue loss to the BSNL".

On a grander scale, only a month later, a new government initiative in neighbouring Bangladesh resulted in a crackdown on illegal VoIP businesses, according to reports from BBC Radio 4. Prior to the crackdown, estimates were that up to 80 per cent of international calls into Bangladesh were being routed through VoIP by-pass operations, resulting in massive under-collection of tax revenues on international calling.

Around the world, governments that forbid such packet-switched voice by-pass have grown more vigilant in attempting to stop the practice – and they have found private-sector companies willing to help provide detection technologies. One UK-based company, for example, marketed a solution to detect what it called "grey services" that use "GSM gateways" or "SIM boxes" to reroute VoIP calls onto domestic networks. These devices, apparently installed without the knowledge of mobile network operators, act to mask the source of the IP calls, making them appear to be local mobile calls. The boxes contain a mobile SIM card, connected to a PBX or a router, allowing them to become gateways between domestic mobile networks and data networks. The UK company said it had developed a "global detection network" to detect traffic patterns that would reveal by-pass.

Sources: "Unauthorized telecom network busted, one held", *The Hindu* online edition, 12/03/07, at: www.thehindu.com/2007/03/12stories/2007031214590300.htm; "Chaos in Bangladesh's 'Illegal' VoIP Business", Technologyinside.com, at: http://technologyinside.com/2007/04/11/chaos-in-bangladeshs-illegal-voip-businesses/; "Revector, detecting the dark side of voip", technologyinside.com, at: http://technologyinside.com/2007/03/05/revector-detecting-the-dark-side-of-voip/

In countries where traditional monopolies on IGW access remain, access to the Internet through broadband networks are often expensive and, therefore, are available to only a few residents. Liberalizing the IGW, then, is not just about making voice service more affordable, it is increasingly about opening the door to a wide range of affordable ICT services and applications, encompassing voice, data and multimedia content.

6.1.3 The benefits of liberalization

With the international telecommunication structure having changed over the past 15 years, regulators and policy-makers find themselves at a crossroads. Should they attempt to shore up the IGW exclusivity model, or should they opt instead for the kind of liberalization that has been applied successfully to domestic services (particularly mobile telephony)? Clearly, policy-makers must balance potential benefits against the risks, challenges and costs of liberalization. This section and the next take up the benefits and risks, respectively, based on the experiences of several countries that have pioneered IGW liberalization in recent years (see Figure 6.5, which shows the percentage of ITU Member States that have liberalized IGW markets).

6.1.3.1 Reducing prices for international voice services

As liberalization of domestic networks has shown repeatedly, the introduction of effective competition can force down prices that consumers pay for a wide range of ICT and telecommunication services. This makes those services more affordable and brings more consumers onto the network.

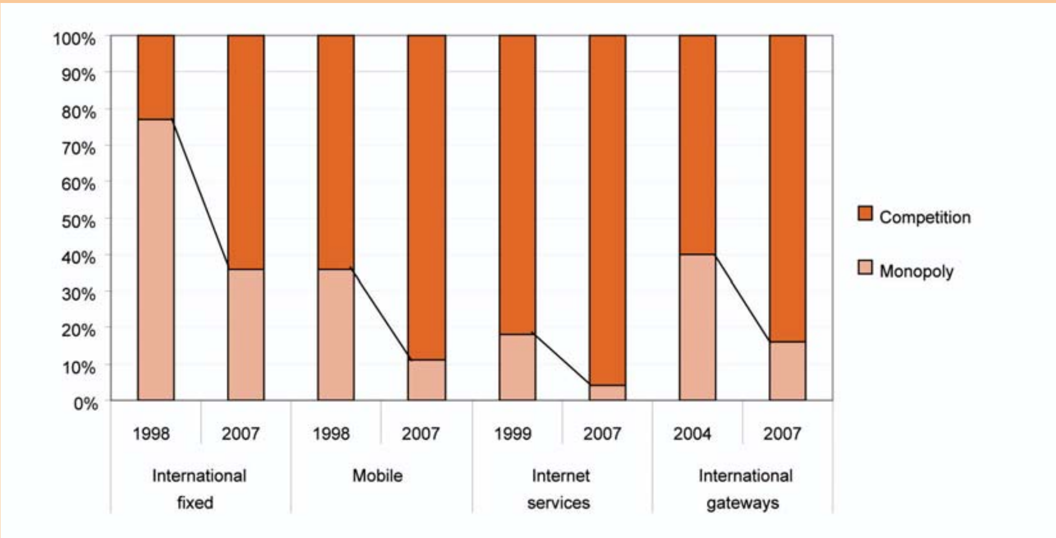
In Botswana, for example, the Government partially liberalized the IGW market in 2006, at the same time that it introduced a converged licensing scheme.[11] This allowed holders of converged licences to offer international services. Data for international traffic from 2004 to 2006 show that the number of minutes to and from Botswana increased, while at the same time, the average revenue per minute declined. This points to lower consumer prices caused by increasing competition.[12]

The GSM Association (GSMA) has produced research indicating that "average international call prices in countries which have liberalized decreased by 31 per cent with partial liberalization, and by as much as 90 per cent with full liberalization."[13] They particularly cited several African countries, including Kenya, where international calling prices dropped 70 per cent after mobile providers received IGW licences, and Nigeria, which achieved the full 90 per cent decline. In Tanzania, international tariffs dropped 57 per cent after IGW liberalization in 2005-06, and mobile international tariffs declined 68 per cent (see Figure 6.6).

In addition to evidence that introducing competition for access to international networks lowers prices, there also are indications that lower prices for international calling can stimulate demand and result in increased traffic levels. For example, the GSMA noted that after IGW liberalization in Kenya, international traffic volumes rose 40 per cent, while in Nigeria, international traffic was up 65 per cent five years after liberalization.[14]

Figure 6.5: Trends in liberalization of ICT markets, 1998-2007

Evolution of international tariff (fixed)



Note: This figure reflects what is legally permissible.

Source: ITU World Telecommunication Regulatory database.

The benefits of liberalization for consumers appear to accrue in cases where governments either (1) allow competitive IGW service providers to offer international access to domestic operators – including mobile service providers; or (2) allow domestic operators to "self-provide" IGW services through access to incumbents' gateways.

According to GSMA, when Sri Lanka allowed mobile service providers and others to obtain IGW licences in 2003, the number of fixed lines increased by 60 per cent, while the number of mobile lines ballooned by more than 400 per cent, from 1.1 million to 4.5 million.[15]

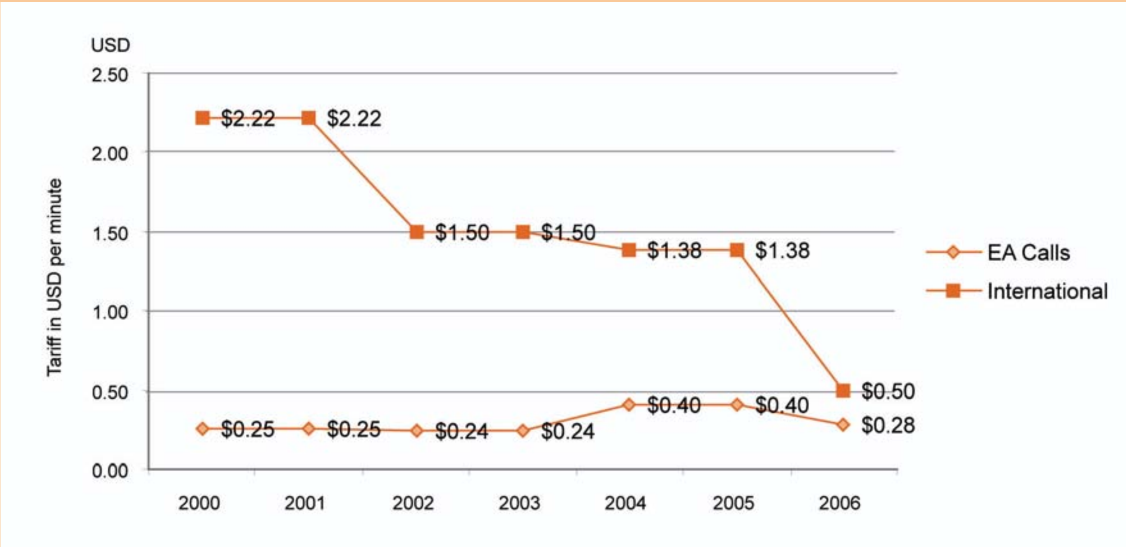
In Malta, the regulator's research on the need for tariff rebalancing found that cost-based rates for local and domestic long distance calling were only marginally above what they had been under cross-subsidization.[16]

Meanwhile, the reduction in rates for international calling, in response to competition in that sector, stimulated greater calling volumes and increased demand. In other words, eliminating the subsidies did not result in rate shocks to consumers in order to maintain the incumbent's financial health.

It is certainly not a painless or perfect process, but market forces can, over time, produce benefits not only for consumers but even for the operators themselves. Lower prices put pressure on operators to salvage their profit margins by reducing overhead and inefficiencies in their cost structures. Achieving greater efficiency and productivity can boost market share, which in turn produces heightened access to capital for network expansion and product innovation. The result is an engine for network growth and services finely tuned to consumer demand.

Figure 6.6: Tanzania's experience – Lower international calling prices

Evolution of international tariff (fixed)



Note: EA relates to East Africa.

Source: Tanzania Communications Regulatory Authority (TCRA), at: www.tcra.go.tz/publications/AverageTariffTrend.pdf

Box 6.3: The effects of IGW liberalization in Malta

Malta is a Mediterranean island nation with a population of fewer than 500 000 people and a GDP per capita of roughly USD 18 200. The country liberalized its telecommunication sector, including international gateway services, in 2003. Malta's largest mobile provider, Vodacom, was granted an IGW licence in return for having relinquished its previously exclusive mobile licence.

The immediate impact of liberalization was the mushrooming of Internet service providers that began offering international VoIP calling services. Malta's outgoing traffic volumes increased from 35 million minutes in 2003 (just prior to liberalization) to 53 million minutes a year later and an estimated 80 million minutes by 2006.

Similarly, during the initial period after liberalization, international calling prices (outbound calls) fell by about 13 per cent, driven by the advent of VoIP providers. In the second quarter of 2004, Vodacom installed a new gateway and cable to Italy, broadening international capacity to and from Malta. International calling prices then plummeted some 77 per cent, even as traffic increased. The Vodafone gateway has also lowered Internet transit and international leased line rates.

Source: ITU, Case Studies, 2008.

6.1.3.2 Reducing prices for Internet access

Similarly, the introduction of competition in the IGW market – as well as the market for international private lines – can lower prices for Internet access. Even in Africa, which has struggled to cope with high costs and lack of international capacity, a converged licensing network and the growth of ISPs in Tanzania has led to price decreases for Internet access in that country.[17] As international capacity increases to developing countries, the cost for transit on international lines can be expected to decrease, leading to lower costs that ISPs can pass on to their customers.

A policy of liberalizing the ISP and IGW markets can help position economies to take advantage of increasing international capacity as it becomes available. In Thailand, for example, the government established a consistent regulatory and licensing framework for ISPs in 2004 and liberalized the IGW market in 2006. Only a year later, international Internet bandwidth was increased by more than 2.5 times, as additional capacity came on line.[18] The number of Internet users increased steadily over that period, reaching 13.4 million (21 per cent of the population) by 2007. The number of broadband service subscribers increased accordingly, reaching 913 000 by 2007 (see Figure 6.7).[19]

By lowering costs for ISPs, competition in the mar-ket for gateway access to international networks can stimulate increased Internet usage. In order to compete in their domestic markets, ISPs will pass along lower gateway costs to consumers, making Internet access more affordable. The lower prices for Internet access can boost demand, stimulating overall revenues for ISPs and other providers (i.e., content providers) up and down the Internet value chain. The ideal result, over time, is more consumers, paying lower prices, taking advantage of greater network capacity to access more content.

Singapore has reported that effective competition in its IGW market has resulted in more players entering the country's international telecommunication service market. International direct dialling rates have fallen more than 90 per cent since 2000, and international leased line rates have been cut nearly in half (95 per cent). The mobile phone penetration rate is 116 per cent. There are more than 70 ISPs, and broadband penetration stood at 77 per cent in February 2008.[20]

Lower prices, increased demand and enhanced international capacity are therefore linked, in a so-called "virtual circle". All three forces may be needed for developing countries to reach their development goals. Properly approached, IGW liberalization can be a tool for governments to work toward attainment of their Millennium Development Goals, through closer and broader links to the global economy.

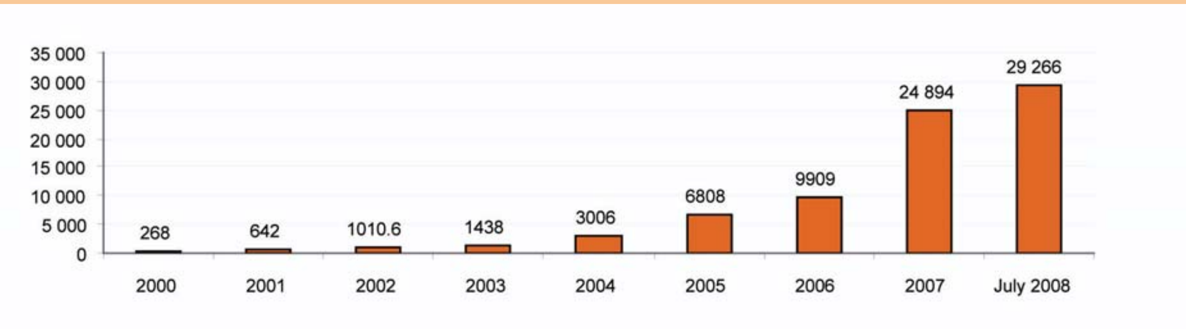
6.1.3.3 Boosting LDCs' ability to participate in the global economy

Opening access to IGW markets can have the effect of boosting investment in a country's telecommunica-tions sector – particularly in the infrastructure that connects the country to the global community. But its effect can transcend the telecommunication market, enabling greater investment and growth in allied sectors such as information technology and content generation.

Moreover, participation in the global economy depends largely upon international flows of information and capital. International trade, banking and financial sectors are now inseparable from international information flows. Greater capacity in IGW facilities opens up channels for heightened participation in the global economy, benefiting not only investors and major companies, but also individuals, through increased employment.

A primary example of this synergy is India's use of international telecommunication capacity to support "outsourcing" of call-centre and technical support services. Indian firms have been able to parlay the advantage of lower labour costs into increasingly value-added markets such as software development.

Figure 6.7: Evolution of international Internet bandwidth in Thailand, Mbit/s, 2000-2008



Source: ITU World Telecommunication/ICT Indicators database.

Success in exports up and down the value chain has been reliant on international service capacity reaching India. Moreover, the ability to compete internationally in the provision of engineering and tech-related fields has been essential to spurring India's domestic industries and providing an employment outlet for increasingly world-class educational facilities.

Large barriers remain for developing countries – particularly in the high cost and relative paucity of international links, whether by fibre optic cable or satellite. But the evidence is mounting that maintaining a monopoly chokehold on IGW facilities may compound problems with accessing the global network rather than alleviating them.

6.1.4 Risks and challenges in liberalizing the IGW

Even so, policy-makers must weigh the challenges and risks of IGW liberalization. Often, they confront issues and questions raised by key constituents, such as incumbent operators, legislators, labour unions, and industry groups. Incumbents, for example, may question the wisdom of reducing their control over international access. The loss of revenues from high prices for international traffic may lead to calls for tariff rebalancing – or fears that such rebalancing could dampen demand and affordability in local and national long distance markets.

6.1.4.1 Impact on the incumbent

The most direct impacts on an incumbent include the potential for loss of market share and downward pressure on prices for international calling and international leased lines (also known as "international private lines"). The loss of exclusive control over international gateway access can often deprive operators of their last remaining sanctioned monopoly, particularly in markets that already have legitimized competition in domestic mobile and fixed service markets. Incumbents frequently argue, for example, that competition can undercut their ability to acquire capital for investment in domestic and international network facilities.

Incumbent operators often retain significant advantages, however, even in liberalized markets. Because of the costs involved in constructing new IGW facilities, incumbent facilities often continue to function as the dominant infrastructure, even when access is mandated through regulation. Moreover, incumbents retain legacy customer lists and relationships, established billing and servicing operations, and longstanding links with operators in other markets. As Singapore reports, "Compared to 10 years ago, the dominant licensee's overall global revenues are three times more than pre-liberalization days."[21] Incumbents may have to alter their business plans to accommodate their loss of exclusivity, but the resulting changes can result in more productivity, new markets and increased shareholder value.

6.1.4.2 Impact on accounting rate revenues

As discussed earlier in this chapter, the traditional correspondent relationship among international operators, in which traffic was accounted for on a half-circuit basis, is in decline. There are multiple reasons for this, most of them related to – but not caused by – the introduction of competition in IGW markets.

Box 6.4: Evolution of the accounting rate system

The accounting rate regime is spelled out in the International Telecommunication Regulations (ITRs), an international treaty administered by ITU. The ITRs are augmented by the D-series of Recommendations, which are produced by Study Group 3 of ITU's Telecommunication Standardization Sector (ITU-T).

Traditionally, international operators employed the "accounting rate revenue division procedure", which involved:

a) Determining a net imbalance in traffic minutes between operators on any given route;

b) Multiplying those minutes by one-half of the accounting rate (a measurement known as the settlement rate);

c) Payment of the resulting sum to the operator that terminated the greater number of minutes of traffic.

ITU-T Study Group 3 began to review the traditional system in 1991 and produced Recommendation D.140 a year later. This document called for "cost-orientation" of accounting rates, a transition period to cost-oriented rates, publishing of global accounting rate changes and periodic review of rates. Despite this action, accounting rates dropped by a mere 4 per cent between 1992 and 1996, accelerating to a decline of 12 per cent over the next two years. Evidence indicated that international transmission costs, however, declined at a much faster rate over the same period.

In December 1998, ITU-T Study Group 3 revised ITU-T Recommendation D.150, introducing three new procedures for international calling: (1) asymmetric (but non-discriminatory) call termination charges, (2) cost-oriented and asymmetrical settlement rates for net traffic imbalances, and (3) any other termination arrangement that might result from bilateral negotiations. This allowed maximum flexibility in setting the financial arrangements for international services. ITU estimated that 20 per cent of international traffic still uses the accounting rates system, mainly for traffic originating and terminating in developing countries.

Source: ITU, *Trends in Telecommunication Reform 2007: The Road to Next-Generation Networks (NGNs)*, Chapter 6, page 137.

A decade ago, the international service market functioned in part as a transfer of wealth from consumers in developed countries to operators in developing countries. Prices for international calling were largely beyond the ability of many consumers to pay for outgoing calls in most developing countries, where direct-dialled calling remained the province of government and business elites. As a result, most international traffic flowed into developing countries from developed countries, resulting in settlement payments predominantly flowing toward the former. During the period between 1993 and 1998, ITU estimated that the net flow of settlement payments from developed to developing countries amounted to something like USD 40 billion.[22]

In the following 10 years, the picture changed significantly. Developed countries – in particular the US Federal Communications Commission – acted to prescribe limits on accounting rates that US carriers should pay to correspondents on international routes. In addition, when countries had liberalized their international service markets, the FCC acted to substantially de-regulate the arrangements between US operators and operators on those routes. As a result, there was a proliferation of different contractual arrangements and rates for termination of international calls. Operators began to route calls through countries where rates were lower, further undercutting the high settlement rates to countries that maintained traditional accounting procedures.[23] In December 1998, ITU-T Study Group 3 formally accepted three procedures for call termination payments (see Box 6.4 on ITU's reform of accounting rates):

- Government-set or operator-set termination charges;
- Cost-based settlement rates (which may be asymmetrical); and
- Bilaterally negotiated commercial arrangements.[24]

To the extent that opening access to the IGW markets promotes further competition on both ends of an international route, it is likely to put downward pressure on call-termination rates. National regulators can require that operators report or even make public their termination agreements with foreign carriers, allowing regulators to protect against preferential deals or price-squeezes that might endanger competition. Even with such regulation, however, the amount of circuit-switched traffic that regulators can "see" is declining, because of the rise of IP-based transmission. To the extent that IP networks compete with circuit-switched services, however, regulatory intervention often becomes less necessary.

6.1.4.3 Addressing VoIP and by-pass

The practice of converting telephone calls into IP packets and applying least-cost routing practices over international private lines is not new. Nor is the better-known business practice of marketing VoIP calling end-to-end over the Internet. Some countries have allowed and even tacitly encouraged IP transmission as a way to promote competition. In countries where IGW access remains exclusively in the incumbent's hands, however, routing calls over data networks is known as "by-pass" and is usually strictly forbidden.[25]

Criminalizing packet-switched by-pass of the monopoly IGW provider has the effect of forcing the practice "underground", where it can be nearly impossible to regulate or even monitor it. Conversely, legitimizing VoIP allows regulators to set standards for interconnection with the PSTN and adds to the benefits of competition for consumers.

Ironically, the initial spurt of success that international VoIP bypass operators enjoyed – roughly in the 1997-2001 period – stemmed largely from the arbitrage opportunity. As with re-filing traffic through a third-country, the profit margin was based on the differential between data termination costs and the high settlement rates for circuit-switched traffic. Once settlement rates began to collapse, the margins declined, and many observers now believe that some of the incentive for by-pass declined along with them.[26]

When settlement rates dropped, however, international traffic volumes increased. In addition, many operators decided to openly terminate VoIP calls. Worldwide, more than 60 countries have reported to ITU that they now allow VoIP calls from abroad to be terminated within their country.[27]

Those countries that continue to block VoIP have been able to do so partly because they control IGW access, as well as the dominant carriers in their domestic markets. Using sophisticated VoIP detection technology, they have been increasingly successful at excluding traffic they do not wish to be terminated in their jurisdictions. Liberalizing the IGW network will make that more difficult.[28] At the same time, however, legitimizing VoIP traffic and allowing multiple IGW and international service providers to terminate it will contribute to lower prices and increased traffic volumes.

6.2 Promoting access to submarine cables

One of the ways in which access to electronic communication capacity is changing concerns the submarine cables themselves. As with the accounting and settlement rate system, changes in recent years have signalled an evolution in ownership models, business plans and the level and location of new investment. All of these changes, which will be explored in this section, provide increased opportunities for participation in international network markets.

Figure 6.8: Submarine cable map

Source: TeleGeography.

6.2.1 Ownership models

The common paradigm of cable system ownership dates back many decades, and it reflects the traditional make-up of international telecommunication markets: each country had a single, "national flag" operator that held an exclusive licence to participate in international networks. Most often, the flag operator was either a government agency or government-owned operator. There were exceptions to this rule, as in the United States, where the government never owned the flag carrier (the original AT&T) but granted it an exclusive monopoly on all international routes. Increasingly, regulators have corporatized, privatized and liberalized their international telecommunication markets, resulting in new combinations of operators and new patterns of submarine cable ownership.

6.2.1.1 Consortium

Because of the high cost of initial capital outlays for manufacturing and laying international cable systems, the original ownership paradigm consisted of a consortium of national flag carriers, each of which would have an ownership share reflecting its level of investment. Ownership was expressed in "half-circuits", reflecting the accounting system established to keep track of call termination. Thus, on any given international route, the national operator of the first country would own half-shares matching up with the half-shares owned by its correspondent operator on the foreign end of the route. Traffic would be exchanged in both directions, and the discrepancy in flow would be resolved through settlement payments agreed to at the outset of a certain period. The agreements and settlement payments were reached through international negotiations.

The process was highly diplomatic, but in some senses it constituted an international cartel. Because there was no competition, there was no downward pressure on settlement rates. In effect, the consortium functioned as a kind of "gentleman's agreement" to maintain high international calling and settlement rates, both as an expression of government policy and to recover the capital investment in the submarine cable itself. There is some justification for this ownership model, of course – submarine cable systems always have been notoriously fragile and expensive to capitalize and maintain.

6.2.1.2 Private cable system model

During the 1990s, corporate ownership of cable systems, including hybrid terrestrial/undersea systems, began to emerge. These networks specialized in packet switching and many of them evolved to provide transcontinental (primarily transatlantic and transpacific) Internet backbone facilities. These companies attempted to fill a niche for seamless fibre optic facilities, and their rise was in some respects antithetical to the old-fashioned "club" ownership of the incumbent telephone companies (see Box 6.5 on the fortunes of private cable systems).

In an environment where multiple companies were vying to build terabyte-capacity systems, the industry encountered over-capacity and other financial growth pains in the early 2000s.[29] After going through those problems, many of the companies, such as Global Crossing and Level 3, survived as ISPs, based on diversified Internet service offerings. One major system, the FLAG (Fiber Link Around the Globe) network, was purchased by the Indian telecommunication conglomerate Reliance Communications, which is actively pursuing plans for global next-generation network (NGN) build-outs.

Ironically, over-capacity issues on major routes (i.e., transatlantic) belied the ongoing lack of capacity on routes linking the developing economies to Europe and North America. This occurred at a time when regional development of Internet Exchange Points (IXPs) was beginning to concentrate packet-switched data flows in areas outside the main transatlantic corridor. As a result, fibre optic cable projects have been spread more evenly across the globe in recent years.[30] In addition, the market has seen increased interest in repeater-less fibre optic projects, which are far less expensive to maintain than the repeatered long-haul links.

6.2.1.3 EASSy private/public partnership model

Today, the market offers a range of ownership options, from consortia to private ownership – and some hybrid models as well. One such model involves a partnership between public and private sectors. The best example is the "stakeholder" approach applied to constructing the Eastern Africa Submarine Cable System (EASSy). The project calls for a submarine cable system, with terrestrial backhaul, linking nearly two dozen countries in eastern and southern Africa.[31] The distinctive approach currently involves two groups of stakeholders:

- Financial institutions including the African Development Bank (AfDB), the development bank of France (AFD), the European Investment Bank (EIB), Germany's development bank (KfW) and International Finance Corporation (IFC).[32]
- Listed operators holding an International Gateway Licence, including international carriers[33] and the West Indian Ocean Cable Company (WIOCC), which was created as a special purpose vehicle (SPV) for participating in the system without huge capital outlays.[34]

During a July 2006 meeting in Nairobi, the stakeholders reached an agreement to organize the private-public partnership. The governments and the e-Africa Commission of NEPAD (New Partnership for Africa's Development) agreed to work toward establishing policy and regulations to enable the project to go forward. The operators will co-own the cable system, and the financial institutions will broker and sponsor international activities and provide financing assistance where needed.[35] The structure of the project reflected the need to augment the market in providing much-needed capacity on routes linking African economies – including several island nations that have been reliant on expensive satellite links. As the stakeholders stated in their joint press statement:

> All parties agree that the cable system is urgently needed. This project has the potential to dramatically improve the communication landscape of Africa and to serve as a catalyst for further private sector development, economic growth, and ultimately opportunities for the poor.[36]

The EASSy system will extend from South Africa's Mtunzini Landing Station to Sudan's Port Sudan Landing Station, a distance of 10 500 km (excluding an extension to Comoros Islands). The cost would amount to about USD 247 million, including USD 218 million for the system's supply and USD 29 million for project management. This excludes construction of the cable stations, ancillary services and backhaul networks.[37]

The EASSy access approach is based on a non-discriminatory model, calling for:

- Access limited only by national regulatory rules;
- Which has led to entry by even recently licensed entities;
- Proactive and extensive marketing efforts by EASSy to bring all eligible parties on board.

Meanwhile, the e-Africa Commission has, since 2007, branched off to develop its own, separate approach to infrastructure growth for the continent, dubbed the ICT Broadband Infrastructure Network. This project was formalized in an agreement known as the Kigali protocol, which was ratified by seven African countries on 13 February 2008.[38] The Kigali protocol sets out five following policy principles for the management of the proposed network:

1) Non-discriminatory open access;
2) Equitable joint ownership of the backbone infrastructure across the region;
3) Separation of ownership of the infrastructure from its use;
4) Use of special purpose vehicles (SPVs) to build, own and operate the broadband ICT network;
5) ICT broadband infrastructure to be viewed as a "public good" and operated on a cost-recovery basis.[39]

NEPAD's ICT Broadband Infrastructure Network is composed of a submarine component (UHURUNET) and a terrestrial component (UMOJANET) and is expected to cost USD 2 billion.[40] The submarine component would be managed by a holding company called Baharicom. Telecom operators will invest in a NEPAD SPV, which will be the largest single shareholder of Baharicom.[41] The NEPAD Submarine SPV will have to raise USD 600 million for its 30 per cent share in the Baharicom company. It is envisioned that 50 per cent of this will be equity, and 50 per cent debt.[42]

Box 6.5: The fall and rise of private cables in Malta

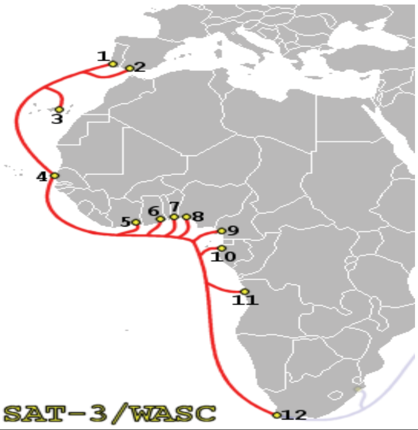
On 28 January 2002, Global Crossing and several of its subsidiaries filed petitions under Chapter 11 of the US bankruptcy law, allowing it to maintain operations as it implemented a financial reorganization. It was a difficult and public episode for a company that had been one of the most well-known private cable networks of the late 1990s. Ultimately, Singapore Technologies Telemedia (STT) purchased Global Crossing for USD 750 million, buying it out of bankruptcy. Today, Global Crossing continues to maintain a global network linking nearly 400 cities in more than 30 countries. It markets itself as an integrated IP services provider.

At roughly the same time, Indian conglomerate Reliance Communications purchased FLAG Telecom, operator of the Fiber Link Around the Globe (FLAG) undersea cable network, for a reported USD 207 million. FLAG Telecom also was emerging from Chapter 11 status. Yet with the revival of demand in the international telecommunication sector, the FLAG system has become a major backbone of Reliance's global expansion. By the end of 2006, Reliance was announcing a USD 1 billion investment in new undersea fibre optic cable systems, an initiative it dubbed "FLAG NGN". Reliance planned new systems linking India to Southeast Asia (Brunei Darussalam, Hong Kong (China), Indonesia, Malaysia, Philippines, Singapore and Viet Nam); countries on the east coast of Africa (Kenya, Madagascar, Mauritius, Mozambique, South Africa and Tanzania); eastern Mediterranean countries (Cyprus, Greece, Lebanon, Libya, Malta and Turkey); and the Pacific Rim (China, Japan and United States).

FLAG Telecom was one of the companies that had to cope with a serious cable breach in the Mediterranean, in February 2008, which the company blamed on damage from a ship anchor.

As the venerable private cable systems recover from over-capacity at the close of the 1990s, these and several others are doing so under new ownership – often expanding parent companies such as Reliance and STT from newly developed countries. These new systems often illustrate the shift of emphasis away from a North Atlantic dominance in cable traffic to a more equitable mix worldwide.

Figure 6.9: SAFE and EASSy? Some current and planned cable systems for Africa



SAT-3/WASC

The **South Atlantic 3/West Africa Submarine Cable** is a submarine communications cable linking Portugal and Spain to South Africa, with connections to several West African countries along the route. It forms part of the SAT-3/WASC/SAFE cable system, where the SAFE cable links South Africa to Asia.

SAFE

The **South Africa Far East** cable is an optical fibre submarine communications cable linking Melkbosstrand, South Africa, to Penang, Malaysia

EASSy

The **Eastern Africa Submarine Cable System** (EASSy) is an initiative to connect countries of eastern Africa via a high bandwidth fibre optic cable system to the rest of the world. EASSy is planned to run from Mtunzini in South Africa to Port Sudan in Sudan, with landing points in six countries. Expected completion date: 2010.

TEAMS (The East African Marine System) is an initiative spearheaded by the Government of Kenya to link the country to the rest of the world through a submarine fibre optic cable. It was first proposed as an alternative to EASSy, the East African Submarine Cable System. The Kenyan Government had grown frustrated with the ownership model favoured by South Africa, the time it was taking and what it perceived as an attempt by South Africa to control the cable. As a result, in November 2006, the Kenyan Government decided to partner with the Emirates Telecommunication Establishment (Etisalat) to build its own fibre optic cable. Expected completion date: 2009.

The growing variety of ownership models, ranging from traditional operator consortia, through private ownership and public-private partnerships, represents recognition that more effort is needed to extend capacity to developing countries. The more ownership models there are – and the more opportunities for investment at all levels – the more likely there will be a healthy profusion of regional and localized cable projects.

6.2.2 Securing capacity on cable systems

Meanwhile, the business models for participating in cable systems have been changing along with the ownership models. There are now a variety of ways to secure international capacity, ranging from ownership shares to leases. In general, these options include:

- Securing minimum investment units (MIUs);

- Purchasing indefeasible rights of use (IRUs);
- Negotiating capacity purchase agreements; and
- Signing long-term leases.

6.2.2.1 Minimum investment units

Traditional consortium-owned cable systems divide up the potential capacity into MIUs, which reflect each individual operator's cumulative stake in financing and operating the system. The MIU concept does not apply to privately-owned cable systems, which have become more prevalent in the IP era.[43]

6.2.2.2 Indefeasible rights of use

IRUs allow operators to purchase a defined amount capacity from the owners and operators of cable systems. The IRU model can be applied to either a consortium-owned or privately-owned cable system (or, indeed, to a hybrid model such as the EASSY system).

6.2.2.3 Capacity purchase agreements

The purchase of IRUs is typically governed by a capacity purchase agreement reached between the operators. Traditionally, these agreements were negotiated on a half-circuit basis, with one operator purchasing IRUs for sufficient half-circuits to deliver and terminate its traffic on its own end of an international route. At an imaginary half-point, the traffic is considered to be turned over to (or picked up from) the corresponding operator on the other end of the route. This model, while somewhat arbitrary, worked sufficiently well to establish a conventional order to circuit-switched telephony. It has not proved to be the model, however, applied to international IP backbones.

6.2.2.4 Long-term leases, peering and transit

As an alternative to purchasing IRUs, operators can sign long-term leases for international private lines. Some countries now allow operators to resell capacity in those leased lines for the provision of switched traffic, along with data traffic. Much of the VoIP traffic transmitted over international facilities is routed in this manner.

Meanwhile, Internet backbones function on a full-circuit basis. Rather then linking "half-circuits" on a cable system, ISPs connect in much the same way that they always have on domestic backbones. That is, if they are large enough, they will negotiate *peering* arrangements with other backbone providers and simply exchange traffic. If one ISP is smaller (for example, not a "Tier 1" ISP), it is commonly required to purchase *transit* through an agreement with the backbone provider in order to interconnect with the global network of backbones.

The international private (leased) line market is often regulated by national governments. But prices on many routes remain very high. For example, the Telecom Regulatory Authority of India (TRAI) felt compelled by complaints over high-priced international private lines to propose stepped up regulation in 2004.[44] A year later, TRAI issued an order directing the reduction of international leased line prices by 35 to 70 per cent (depending on capacity).[45] Increasingly, governments will view high prices for international service as barriers that are linked to the chances for successful opening of IGW markets and increased competition.

6.2.3 General trends in the submarine cable network market

It should be clear from the discussion in this section that the market for international services has become decidedly more diffuse and decentralized over the past 15 years. There are now myriad ownership models, ways to participate in submarine cable network systems and ways to transmit voice, data and multimedia traffic. Some general trends can be discerned:

- The traditional circuit-switched accounting system for voice traffic is rapidly declining and is no longer predominant, particularly on major routes between developed countries.
- Increasingly, voice traffic is becoming packet-switched and intermingled with data as next-generation networks (NGNs) take hold.
- Packet-switching is less costly and increasingly allows international operators to undercut traditional settlement rates.
- The advent of the Internet and privately-owned cable systems has diversified the international models for interconnection and termination of all kinds of traffic.
- Costs for developing, laying and maintaining submarine cable systems are declining, particularly for unreeatered systems on shorter routes (see Box 6.6 on unrepeatered cable systems and Table 6.2 on the economics of submarine cable systems).
- There are a growing number of submarine cable systems of all kinds, providing exponentially increasing capacity (now well into the terabyte range):
  - TeleGeography analysts say the risk of overbuilding in some markets, including Africa and across the Pacific, "is very real".
  - TeleGeography is tracking 12 cable systems either in planning stages or under construction in Africa that will have a theoretical capacity of over 13 terabits per second, and construction is estimated to cost more than USD 3 billion.[46]

Table 6.1: A rush to capacity[47]

Total number of undersea cables either under planning or under construction

Region	Number of cables	Total bandwidth	Bandwidth at launch
East Africa	7	Over 9 Gbit/s	Over 350 Gbit/s
West Africa	5	8.32 Tbit/s	Over 500 Gbit/s
Asia	6	Over 10 Tbit/s	Over 500 Gbit/s
Trans-Pacific	5	Over 10 Tbit/s	Over 600 Gbit/s
Europe-Asia	3	13.76 Tbit/s	n/a
Australia-South Pacific	6	Over 5 Tbit/s	n/a
Latin America/Caribbean	3	Over 2 Tbit/s	Over 100 Gbit/s
Mediterranean	4	Over 15 Tbit/s	Over 660 Gbit/s
Others	4	9.44 Tbit/s	200 Gbit/s

Source: TeleGeography.

- While some regions (including Africa) still lag behind – and other regions still require greater redundancy (the Middle East) – the number of regional systems is growing.
- Increasingly, where there is no competition among submarine cable providers, open access is becoming a regulatory requirement.
- Technology is allowing innovation, such as the potential for "repurposing" older systems by redeploying them on spur routes (i.e., to island points). For example:
  - Pacrim West Cable (connecting Guam and Australia) was repurposed to APNG-2 in 2006, connecting Sydney and Papua New Guinea;[48]
  - PacRimEast will be reused for links from Hawaii to American Samoa; and49
  - The former US-UK Gemini system is being redeployed to form the CB-1 redeployment to Bermuda.50

The question may now be whether these promising developments can be sustained through strategic liberalization and capital investment. Governments have a role in dismantling regulatory barriers to greater capacity development on international routes. The key is to find an approach that will allow greater competition in international service markets, lowering prices for international calling and Internet access, stimulating demand and providing a market basis for increased capital investment in capacity-building.

6.3 Opening the wet portion of networks

This chapter will now focus on what policy-makers and regulators might choose to do in order to open up access to international networks, beginning with the submarine or "wet" portion of terrestrial (non-satellite) networks. From a conceptual standpoint, the wet portion begins at the "water's edge" – that is, any portion of a submarine network that traverses international or littoral waters.

The first regulatory steps in liberalizing the wet portion of networks can be taken by addressing the laws and/or regulations that authorize and govern whether and how a cable system can land in a given country. In addition, governments can address the rules that determine whether, and on what terms, additional operators can gain access to submarine cables, either through ownership or through purchasing or leasing capacity.

6.3.1 Obtaining permission to land a cable network

Some countries, including the United States, grant specific licences for cable system consortia or private owners to land cable systems on their shores. In the US case, system operators are required to file a detailed application with the Federal Communications Commission (FCC).[51] The required information includes ownership information, contact information, and a full description of the entire cable system, including geographic details of the proposed US landing sites (see Box 6.7 on filing a US Cable Landing Licence application).

Table 6.2: Economics of submarine cable systems

Cable	Length [km]	Bandwidth	Date	Cost	Cost/km	Cost/Gbit/s /km*
Trans-Pacific Express (TPE)[52]	17 700	2.56 Tbit/s [up to 5.12 Tbit/s]	July 2008	USD 500 million	USD 28 249	USD 11.03
Europe India Gateway (EIG)[53]	15 000	3.84 Tbit/s	2010	USD 700 million	USD 46 667	USD 12.15
Unity Cable[54]	10 000	4.8 Tbit/s	2009	USD 300 million	USD 30 000	USD 6.25
EASSy[55]	10 500	30 Gbit/s [up to 320 Gbit/s]	Q2 2010	USD 247 million	USD 23 524	USD 784.13
TEAMS [Kenya to UAE][56]	4 500	120 Gbit/s [up to 1.2 Tbit/s]	April 2009	USD 82 million	USD 18 222	USD 151.85
African West Coast Cable (AWCC)[57]	13 000	320 Gbit/s [up to 3.8 Tbit/s]	mid-2010	USD 500 million	USD 38 462	USD 120.19
UHURUNET[58]	50 000	3.8 Tbit/s	2010/ 2011	USD 2 billion	USD 40 000	USD 10.42
TE North[59]	3 100	1.28 Tbit/s	2009	USD 125 million	USD 40 322	USD 31.50
Sea-Me-We 4[60]	18 800	1.28 Tbit/s	2005	USD 500 million	USD 26 596	USD 20.78
Columbus-III	11 000	10 Gbit/s	1999	USD 300 million	USD 27 000	USD 2 700
FLAG	27 000	10 Gbit/s	1997	USD 1.5 billion	USD 56 000	USD 5 600
TPC-5	25 000	5 Gbit/s	1996	USD 1.12 billion	USD 44 800	USD 8 960
CIOS	261	622 Mbit/s	1993	USD 10 million	USD 38 314	USD 61 598

* Cost/Gbit/s/km reflects the stated initial capacity and not the designed upgradeable capacity of the submarine cable system.

Source: 1992-1999 figures extracted from presentation from Hank Nussbacher, Undersea Cables, January 20, 2004, IDC Seminar Presentation; see: http://interall.co.il/presentations/undersea-2004.pdf

Box 6.6: Unrepeatered cable systems take root

Most undersea cable systems over 600 kilometres require the installation of submerged repeaters that must be maintained in order to provide service on the system. The need for repeaters adds to the costs for intercontinental, intra-continental and even most regional systems. Short-haul cables, however, can provide links at much lower costs because they do not require sea-based repeaters. Unrepeatered undersea cables have therefore proved to be attractive options for island regions and archipelagos – making them an important growth sector in the recovering undersea cable market.

Technologies such as forward error correction (FEC), Raman amplification, and remote optically pumped amplifiers (ROPA) have been used to extend the range of unrepeatered fibre optic links, along with improvements in fibre optic cable products themselves.

For example, Faroese Telecom selected an unrepeatered cable option, dubbed SHEFA-2, to link the Faroe Islands (an autonomous province of Denmark) with the Shetland and Orkney Island groups (under UK jurisdiction). Faroese Telecom specifically cited improvements in technology as the reason it could opt for an unrepeatered cable, avoiding excessive installation and maintenance costs.

Source: http://rfdesign.com/news/sub_transmission_amplifier/; http://goliath.ecnext.com/coms2/summary_0199-5962837_ITM; http://findarticles.com/p/articles/mi_m0EIN/is_2006_May_23/ai_n26871958?tag=rel.res3

Box 6.7: United States cable landing licences

The US system for licensing the landing of undersea cables dates back to 1921. Congress enacted a law that year (US Code 47 §§ 34-39) giving the President the authority to approve all submarine cable landings (in effect, the US Department of State exercised that authority). The President then designated that authority, through an executive order (Executive Order No. 3513), to the Federal Communications Commission (FCC). The Department of State, however, retains the right to review applications for cable landing licences, and it can "coordinate views" with other Executive Branch agencies, including the Departments of Commerce and Defense.

Cable landing licences must be obtained from the FCC by:

- Any entity that owns or controls a cable landing station in the United States; and
- All other entities holding or controlling a 5 per cent or greater interest in the cable system that is proposed to land in the US.

Licence applications must state, among other things, whether the cable system will be operated on a common carrier basis or a private-carriage basis. Full descriptions are required of the proposed cable system and its ownership structure, as well as the proposed landing sites and facilities. The applicant must also state whether it is a foreign carrier or affiliated with a foreign carrier that controls a landing station in any other countries where the system will land. The applicant must agree to abide by the Commission's rules and conditions pertaining to cable landing licences.

Once granted, the cable landing licence is non-exclusive – but it does not include authority to provide international service itself, which is covered by a separate authorization (the "214" authorization awarded pursuant to Section 214 of the 1934 Communications Act).

Applicants meeting certain criteria can ask for a "streamlined" review of their cable landing license request. Streamlined applications will be decided within 45 days of being placed on public notice as having been received. If the Commission decides that streamlining is not warranted, it will issue a public notice accordingly. It then has 90 days to consider the application, although it can extend that period multiple times (for 90 days each time) if the application raises unique or complex issues. Criteria for streamlining include:

- Certifying that the applicant is not a foreign carrier or affiliated with a foreign carrier in any of the cable system's destination points;
- Demonstrating that, if the applicant is a foreign carrier (or an affiliate of one), it has no market power; or
- Certifying that the foreign market is a member of the World Trade Organization (WTO) and agreeing to file regular reports on provisioning, maintenance and circuit status.

In addition, the application must disclose whether the applicant is affiliated with a foreign carrier (which is often the case) and whether that foreign carrier has market power in other countries. Applicants must state whether the cable will be operated on a *common carriage* or *private carriage* basis.[61] Finally, the FCC may require the applicant to file an assessment of potential environmental impact of its access to landing sites. In the United States, operators must also obtain separate authorizations to offer international services, apart from the right to land a submarine cable.[62]

Other countries' licensing frameworks do not contain specific cable landing licences. In some cases, licenses apply for operation of network facilities, up to and including all aspects of international gateways. Other licenses cover all network operations, whether domestic or international.

6.3.1.1 Multiple government agency approvals

In most cases, licensing by the country's telecommunication regulator is by no means the only governmental approval required to land a cable system. For example, approvals are often required by port and shipping authorities, utility authorities for power, sewage and water, environmental officials and security/law enforcement officials, all of which may see the physical construction and maintenance of facilities to land a cable system as touching upon their authority.

For example, submarine cable operators seeking to land their cable in Singapore face the need to obtain multiple approvals from several different government agencies. These include the Maritime and Port Authority of Singapore, on the wet side, and the Urban Redevelopment Authority and the Singapore Land Authority, for the dry portion. Altogether, the approval process can take up to six months.[63]

Realizing the extent of approvals required – plus the lack of familiarity that telecommunication operators would have with non-telecom-related rules and requirements – the Infocomm Development Authority (IDA) of Singapore has taken on a facilitating role for cable landing procedures. IDA coordinates the approval process and presents its offices as a "one-stop shop" liaison for operators with the internal Singapore landing authorization process.[64]

Box 6.8: Singapore's progressive IGW opening moves

In 2000, Singapore liberalized its telecom sector and revamped its regulatory framework. One of the most important aspects was establishing a Code of Practice for Competition in the Provision of Telecommunication Services. This established a framework for determining whether action should be taken to open certain aspects of the market in Singapore.

Using this framework, Singapore's Info-Communications Development Authority (IDA) determined that the dominant carrier, SingTel, should allow collocation at its submarine cable landing stations. This requirement was built into the mandated Reference Interconnection Offer (RIO) that SingTel was instructed to prepare, containing cost-based rates for collocation. Even as it mandated collocation, however, IDA left connection services to be negotiated commercially between SingTel and its competitors.

After feedback from industry, IDA went back and, in 2002, added connection services to the mandated offerings included (again, at cost-based rates) in SingTel's RIO. Yet, IDA was still not done. Two years later it implemented further IGW mandates, allowing operators to access capacity that is owned or leased on a long-term basis on any submarine cable at the submarine cable landing station (SCLS). IDA also gave operators more flexibility in accessing backhaul and transit services.

Source: International Sharing: Singapore's Experience, GSR discussion paper, February 2008.

In some countries, fees for approvals and access rights, levied by multiple agencies, can be costly. Along with providing liaison assistance to cable system operators, governments can help open up their IGW markets by combining and reducing the fees required to navigate landing rights.

6.3.1.2 Transparency of information on approval process

Other measures that can assist cable operators include establishing and posting clear rules and guidelines for the cable landing process. The US cable landing licence application guidelines and requirements, for example, are posted on the FCC's website. Combining such telecommunication rules, along with all other requirements (law enforcement or military access, environmental protection, etc.), in a single web-based loca-tion is ideal.

6.3.2 Regulatory reforms for cable system access

Aside from the landing aspects of the wet portion, governments can regulate the provisions for access to cable systems that are available in its territory. Generally, these requirements or mandates are imposed as a condition of offering capacity or landing a cable system in the country.

6.3.2.1 Non-discrimination policies

Governments may require cable system operators to provide capacity, either through sale if IRUs, or leases, on a non-discriminatory basis, to all legitimately qualified operators or other customers. As discussed in the previous section, US policy requires that cable systems be licensed as either common carriage or private carriage facilities – with the former carrying obligations to offer services with undue discrimination among different customers.

In India, the Department of Telecommunications (the licensing authority) has accepted TRAI's proposal to introduce resale of international private lines, which will allow entry of new players in the international "carrier's carrier" wholesale market.[65] TRAI also has established regulations for access to international capacity through cable landing facilities (see subsection 6.3.2.3). In general, India's policy includes explicit requirements for non-discrimination, including:

- Giving new operators access to capacity "in the same way as the consortium members"; and
- Ensuring that "charges are transparent and non-discriminatory to consortia member or non-members."[66]

Similarly, the French regulator, ARCEP, has established rules to prevent cable system operators from imposing a vertical price squeeze on competitive carriers by setting discriminatory rates in favour of their own affiliates or subsidiaries that may be consortia members.[67] In addition to rates, non-discrimination mandates may address the potential for provisioning delays, delays in maintenance or restoration of capacity, as well as quality of service.

6.3.2.2 Publication of information and tariffs

Cable system operators landing their systems in a country's territory can be urged or required to provide the kind of transparent information that any market needs for competitors or customers to make decisions. This information can include:

- The total number of cable systems accessible from any given IGW facility;
- Available capacity on cable systems, for IRU purchase or lease;
- Established rates and prices for capacity;
- Reference interconnection offers (RIOs) for incumbent operators that control access to cable systems through bottleneck IGW facilities or ownership shares.

Access to such information would empower new operators to make decisions among competing cable systems (in countries where multiple systems are landed). It would also assist competitive international providers to learn about available capacity where incumbents lack incentives to make such information available to would-be competitors (in countries where only one system is landed). Transparency of information on capacity and pricing will also negate the potential for incumbents to discriminate through inflated tariffs or by denying or delaying access.

6.3.2.3 Access for Internet service providers

One question regulators must address is whether to allow direct access to international cable facilities only through licensed international telephony providers or to any potential network operator or service provider, including ISPs. In June 2007, India's TRAI enacted regulations calling on cable landing station owners to provide access, on non-discriminatory terms, to any "eligible Indian international telecommunications entity" requesting access to submarine cable capacity.[68] The regulations define that term as including both international long distance operators, and:

> "(ii) An Internet Service Provider, holding valid international gateway permission or licence to act as such, and who has been allowed under the licence to seek access to the international submarine cable capacity in submarine cable systems landing at the cable landing stations in India."[69]

Thus, India has allowed ISPs to gain access to cable landing stations, in addition to establishing their own Internet gateways, as long as they obtain the requisite IGW licence. In Nigeria, the Government has created two separate gateway licences:

- An International Data Access (IDA) Gateway licence – For network-based ISPs employing soft switches to link data networks in Nigeria with the "global Internet highway" or other IP networks; and
- A Full Gateway licence – For circuit-switched information exchanges, with assignments of signalling point codes (pursuant to Signalling System 7 operation).[70]

Both Nigeria's IDA Gateway licence and Full Gateway licences allow holders to transmit data, voice and video signals, "either in their natural forms or in digitized formats."[71] IDA licensees are not "tied to any specific transmission medium" and can deploy "any transmission media", including VSAT terminals, fibre optic cables, microwave links or coaxial cables. IDA licensees can also resell bandwidth to smaller ISPs. The Nigerian Communications Commission stipulated that under its regulations, mobile operators could only carry international traffic generated from their own networks. In order to carry third-party traffic, they must apply for a Full Gateway licence. IDA licence fees were set at half the rate of Full Gateway licences.[72] Thus, Nigeria implemented a two-tiered gateway licensing framework, based on the difference between soft-switching and circuit-switching networks (see Box 6.9 on Nigeria's IGW licensing framework).

6.4 Opening the dry portion – the SCLS and backhaul

Providing access to international networks does not end, of course, at the water's edge. Significant parts of the key network elements are found on dry land. This so-called "dry portion" of the IGW include the submarine cable landing station (SCLS) and the backhaul links between the SCLS and the domestic operators' points of presence. This section explores how to open access to these key network elements.

6.4.1 Defining the SCLS as an essential facility

The term *essential facility* has come to define any network infrastructure or process that is necessary for viable provision of a telecommunication service. Put another way, the essential facility is a choke-point or potential "bottleneck" for stifling competition. If an incumbent controls exclusive access to an essential facility, it may have the effect of rendering market entry so costly as to prevent it entirely. The definition of any type of network element as an essential facility is usually fundamental to a regulator's decision to mandate open access or infrastructure sharing.

In the case of IGW markets, several governments have determined that submarine cable landing stations (SCLSs) are bottleneck essential facilities. In reviewing practices in India, the TRAI noted that:

> Discussions with industry sources suggested that establishing an international cable system including landing facilities in India not only requires a huge amount of investment but is also a time-consuming process involving numerous clearances, including security clearance, maritime clearance, and civil authorities permission, etc. Thus, the control of access to the cable landing stations makes it possible for the owner of the access facility to impose non-price constraints affecting competition.[73]

Without a standard, published arrangement for purchasing access, TRAI noted, new market entrants were commonly subject to delays or denial of service. Similarly, Singapore's IDA determined that "in practice, most of the submarine cable systems that land in Singapore do so in the dominant licensee's SCLS. Operators that compete with the dominant licensee to provide international telecommunication services usually need access to the dominant licensee's SCLS to connect to their own submarine cable capacity, and to backhaul this capacity to their own exchange."[74]

Box 6.9: Nigeria's IGW licence framework

According to ITU data, the percentage of sub-Saharan countries that maintain basic telecom service monopoly markets shrank from 87 per cent in 1998 to 48 per cent a decade later. The percentage of countries with monopolies for mobile services shrank from about 50 per cent to around 12 per cent. The percentage of countries with IGW market monopolies stood at 30 per cent in 2007. Still, multinational mobile service providers such as Celtel Africa (in 14 African countries) and Mobile Telecommunications Network (MTN) (Nigeria, Rwanda, South Africa, Uganda and Zambia) were pressing additional governments to either open up IGW markets or lower fees for IGW licences.

One of the countries that has liberalized its IGW market is Nigeria. Nigeria created two licences: (1) a Full Gateway licence, and (2) and International Data Access (IDA) licence.

The IDA permit is aimed at entities that seek to provide their own gateways to link to international packet-switched backbone networks; licensees can provide bandwidth "in small units" to customers such as cybercafés and smaller ISPs within Nigeria. The licence is technology-neutral, allowing the deployment of "any transmission media", including VSAT, fibre, microwave or coaxial cable networks. Applicants must have their own networks, but the IDA licence does not provide for numbering plan or frequency assignments.

The Full Gateway licence, by contrast, entitles holders to receive an international signalling point code, to transmit "direct voice signals" and to deploy Time Division Multiplexing and IP transport protocols.

Source: ITU World Telecommunication Regulatory database, according to responses received to the ITU annual Telecommunication Regulatory Survey.

In this respect, the SCLS is functionally analogous to the domestic network's central switching office. Whereas the latter can serve as a bottleneck for access to and from local service end users, the SCLS is essential for the gateway between domestic and foreign end users. To understand this analogy, one has to explore how the SCLS functions.

6.4.2 Defining the cable landing station

In the simplest terms, the SCLS can be thought of as a large train station or international airport. Signals (or packets, in the case of data traffic) come into the SLCS from international cable systems, entering the "dry" segment through the beach manholes. The cable systems consist of bundles of fibre optic cables, representing an international trunk line that serves multiple domestic cables. From there, the signals transit switches and cross-connects within the SCLS in order to be disaggregated and routed through the domestic backhaul links to the appropriate domestic operators' POPs for termination within the country. Alternatively, calls can transit through the SCLS switches to another international destination.

There are three main components that come together within the SCLS:

- The submarine cables, which connect to the submarine line terminal, where signal multiplexing and demultiplexing functions occur, along with signal amplification.
- The network monitoring and switching equipment, which transitions the submarine traffic data to the different international and domestic network technologies of various operators (increasingly, both the wet and dry networks are IP-based, allowing for less complex installations). The network monitoring equipment allows for efficient management of the system to ensure smooth operations.
- The outgoing domestic backhaul cables, which route the traffic to and from the domestic network POPs.[75]

Correspondingly, there are three kinds of interconnection services that the incumbent can offer to provide IGW access:

1) Collocation – provision of space, power and maintenance to the customer's equipment within the SCLS;
2) Connection services – provision of services connecting a customer's backhaul links, through collocated equipment, to the incumbent's equipment within the SCLS; and
3) Backhaul service – carriage on the incumbent's domestic backhaul links from the customer's POP to the SCLS.

In physical terms, open access to a submarine cable landing station can entail all of these services – often mandated and regulated by the national regulatory authority – for example, in a regulator-approved Reference Interconnection Offer.[76] Frequently, regulations requiring cost-based rates are applied.

Allowing access to interconnect to submarine cables at the SCLS enables a competitive provider to directly access the cable system of its choice, whether the incumbent or a competitive provider. The competitor may also provide its own domestic backhaul facilities or obtain backhaul links from another operator – either the incumbent or a third-party, competitive operator.

6.4.3 Mandating collocation

Collocation refers to the installation of interconnection equipment (i.e., switches, racks and cages, cross-connects and other cabling) by an operator within a facility (in this case, an SCLS) owned and operated by another operator. In practical terms, the SCLS facility owner is usually an incumbent operator – often one that has been found to possess market power or to control a bottleneck over an essential facility.

Among the collocation services that regulators commonly mandate are:

- Provision of space within the SCLS for installation of the competitor's equipment;
- Provision of electrical power sufficient to run the equipment and any needed cooling equipment;
- Access to the space for the competitor to install upgrades and perform maintenance when required.

Not surprisingly, incumbent carriers are not often in favour of collocation, for several reasons, some of them more obvious than others. For one thing, mandating collocation gives new competitors a relative head start in the market, allowing them to operate without investing in the costly facilities necessary to build out networks from scratch. Giving up space in their facilities may also be inconvenient or necessitate otherwise unneeded upgrades by the incumbents. There are also overhead costs associated with receiving, processing and provisioning collocation requests. Granting access to their facilities to representatives of other entities may appear to pose a risk to network security. Finally, of course, collocation enables competition, which threatens the incumbent's market share. Regulators can allay these concerns by approving cost-based charges for collocation services and allowing reasonable and non-discriminatory terms and conditions for physical access to SLCS buildings.

As with collocation in domestic switching centres, incumbents may delay provisioning collocation, either because they are struggling to comply with space (or other) requirements or because they may be trying to stall the installation of a rival operator's capacity. In reality, the amount of space needed to collocate equipment is not large and can often be accommodated. Regulators, such as Singapore's IDA, that have required certain operators to file reference interconnection offers (RIOs) may extend that requirement to the provision of collocation in SCLS facilities. Such RIOs often contain maximum periods for responding to collocation requests, including performing site surveys, power budget estimates and other preparations. They also may spell out maximum space allocations (e.g., 10 square metres) and procedures for building access and escort, etc. The RIOs also list prices for all collocation services, which are usually based on underlying costs.

Governments that do not require RIOs can establish *ex-ante* regulations or guidelines, or they can establish policies to review and/or approve collocation agreements. Terms and conditions, as well as price levels, mandated by the regulator should be fair to collocators but not confiscatory to SCLS owners.

6.4.3.1 Virtual collocation

In the case of some facilities, actual collocation – frequently termed *physical collocation* – is simply not feasible, due to space or other limitations. When this occurs, it may be possible to establish access through establishing a secondary facility nearby to the SCLS for installation of the collocator's equipment. Interc-onnection would then be achieved through a backhaul cable linking the two operators' equipment. This type of remote (but proximate) access is often called *virtual collocation*. Because it necessitates less disruption and reconfiguration within the incumbent facility, virtual collocation is often priced lower and considered a less-premium service than physical collocation.

6.4.3.2 Connection services

In order to fully provision a collocation arrangement, the incumbent must provide connection services establishing the interconnection between the international cable system and the collocator's equipment. This can include cross-connects and grooming service to route and transition from higher-capacity submarine cables to lower-capacity domestic backhaul lines.[77]

As with collocation itself, provisioning of connection services can be fraught with delays – intentional and unintentional – that practically deny effective access to collocators. Similarly, pricing and other terms and conditions can be onerous or even prohibitive if left to the market power of incumbents. While some administrations leave the details of connection service provisioning to negotiations between the parties, some others (including Singapore) have clustered connection services together with collocation in open access mandates.[78]

6.4.4 SCLS/backhaul competition

The competitive provision of backhaul links provides operators with options from which to choose, based upon price, availability, differences in technology and quality of service. One option is for operators to "self-provide" backhaul links from their own POPs to collocated equipment within the SCLS. This gives them a measure of control over costs and allows them to make decisions regarding capacity at their own pace. Another option is to secure service from a third-party operator that has extra capacity (including dark fibre) on backhaul links. The existence of competitive options often forces the incumbent to improve service, install greater capacity and lower prices for backhaul. Moreover, each time prices for connection service and collocation decline, the price of Internet access and international calls can be offered more cheaply by competitive service providers, benefiting consumers and sparking greater demand.

As with access to the SCLS itself, access to backhaul can be viewed as a network element in unbundled access to the IGW. As such, it can be included in mandated RIOs, as part of rules or regulations that require operators to unbundle their networks. In fact, similar or identical rationales that can be applied to domestic network elements can also be applied to unbundled IGW backhaul.

6.4.5 Applying competition/antitrust law to cable access

One question for regulators to address is whether to condition access to backhaul facilities – or any other IGW facilities – upon whether the operator has market power and can be deemed a dominant operator. In some regulatory structures, basic interconnection mandates may apply to all operators, whether they are dominant or not. Infrastructure-sharing or unbundling mandates, however, may be applied only when regulators determine that an operator controls or influences the market to the extent that it can hinder competition. In such cases, regulators may view backhaul facilities as a critical element to gain access to IGW facilities, which are in turn essential to gaining access to international capacity. Through market power, a dominant carrier may be able to delay or deny access, or raise private line circuit prices sufficiently to discourage market entry or inflate competitors' cost structures.

One way to decide whether an incumbent or other operator has market power is to apply the principles and techniques of competition (or "antitrust") law. This often involves determining first whether a particular market segment can be defined as distinct and separate from other market segments. If so, analysis then turns to whether there is excessive concentration of suppliers and whether any single supplier or group of suppliers can effectively dictate prices and control supply. In analysing the market, competition authorities ask numerous questions, including:

- Who are the suppliers?
- Who are the customers?
- Can any other goods or service be substituted for the one being provided in the defined market segment?
- Are there barriers to entering the market, or conversely, exiting it (e.g., high sunk costs for infrastructure or regulatory approval)?
- How much concentration exists in the market (i.e., are there multiple suppliers or very few)?

And, finally,

- Is any one supplier or group of suppliers capable of eliminating other suppliers and establishing an effective monopoly or dominant market position?

Frequently, exclusive control over an essential facility such as a backhaul network or SLCS is viewed as a tool by which a dominant carrier can exercise such market power, effectively driving competitors out of the market or forcing them to submit to a merger or other business combination to survive or go out of business.

The difficulty with many competition law frameworks is that they often tend to require mitigation only after a violation or anti-competitive action has occurred. Such *ex post* enforcement mechanisms are designed to provide a deterrent, but they rely on the presence of sufficient legal instruments, attentive prosecutors and aggressive enforcement. The principles of competition law, however, can be "borrowed" and applied to the drafting of *ex-ante* licence terms or industry-specific regulations (such as Singapore's regulatory codes).

Defining the international voice service market and the international Internet access market as a distinct market segment is often the first step to determining whether any single operator or set of operators has market power over access to international capacity. Regulators can then look at what kinds of levers dominant operators have (including control over IGW facilities) to preserve their dominant positions. Moreover, regulators should analyse how dominance in the international market segment can be employed (such as by cross-subsidization) to exert anti-competitive pressure on operators in other market segments.

6.4.6 Applying international trade agreements (WTO) to cable access

Not surprisingly, often the operators that are best positioned to compete with the incumbent international operator in a national market are other international operators – from other countries. In a global environment in which the old paradigm of national "flag" operators is rapidly fading, governments are under pressure to allow other nations' service providers to enter their telecommunications markets.

Many countries have now done so, pursuant to commitments made under the auspices of the World Trade Organization (WTO). From its inception in 1997, WTO's "basic telecom services agreement" provided an opportunity for countries to satisfy calls for open markets by allowing competition for IGW access, either immediately or (most often) in a phased-in manner.[79] Applying WTO trade frameworks to the international telecommunication service market has implications for fairness and equal treatment under "most-favoured nation" provisions. Thus, governments that allow competition but do not adequately address market-entry barriers – such as inadequate access to essential facilities – may incur complaints from other administrations at WTO.

The United States, for example, applies an open access policy to undersea cable licensees, through what is termed the "no special concessions" rule.[80] This rule governs the actions of the US licensee in dealing with operators that may have market power in other countries. Put simply, it forbids the US licensee from entering into any arrangement with the foreign operator that is more favourable than what is offered to other US licensees. This bars, for example, any exclusivity arrangement that would preempt the ability of other US-licensed operators from obtaining access to the cable facility. Notably, the policy applies to both common carrier systems (which are made publicly available to all potential customers) and non-common carrier (private) cable systems. Before allowing a cable to operate on a non-common carrier basis, the Federal Communications Commission will review the market to determine that there are enough other systems operating on the route to provide sufficient competitive alternatives.

6.5 Open access to satellite networks

Submarine cables have not been the sole type of infrastructure for international telecommunications. Since the early 1960s, communications satellites have provided links to communities and nations that would otherwise have been completely cut off and cut out of the global information infrastructure. During most of this period, the primary uses of satellite links were for international long distance telephony and transmission of global television feeds for news, entertainment and sports programming. In more recent years, these uses have continued but have been joined by global Internet and other IP traffic. For example, satellite links are often the best, if not only, means for disaster relief first-responders to download information and geospatial mapping resources, and to maintain communications with authorities in the countries where they are operating, as well as with their superiors and authorities in their countries of origin.

As with the submarine cable market, the satellite market has changed dramatically over the past two decades. Indeed, 25 years ago, not many observers would have used the term "market" to describe the international satellite system at all. At the dawn of the commercial satellite era in the 1960s, only two countries had the capability to launch satellites, and only a handful could build them. Now, many countries have their own satellite programmes, and increasing numbers of countries are developing launch capabilities (see Box 6.10 on India's home-grown satellite system). Moreover, the satellite market represents a mixture of commercial and state-owned entities, all vying for customers and jockeying to establish themselves in an environment of rapidly increasing demand and limited supply.

Prices for satellite access are often high around the globe, but particularly in regions such as sub-Saharan Africa, where there are few or no alternatives for international capacity. In 2007, the Nigerian Communication Satellite (NigComsat-1) and another satellite, Rascom-QAF1, were launched in the expectation that they would reduce satellite access costs in Africa.[81] It was perhaps too soon to tell whether the advent of new satellites would have an appreciable effect. There was some evidence that the extra capacity would simply replace other, soon-to-be-decommissioned satellites already operating in Region 1. Other observers suggested that, even with the new capacity, there would not be sufficient satellites to dent the growing demand. Another factor in keeping prices high appeared to be regulatory barriers, including high licensing fees and customs duties that have escalated prices for satellite equipment.

Some of the pressures that are forcing open access to IGW facilities and international cable access are also being felt by governments and earth station operators with regard to satellite access. This pressure takes two forms: (1) requests for "open skies" policies that allow access to multiple satellite systems, and (to a lesser extent) (2) application of collocation and other access policies to earth station facilities.

Box 6.10: India's home-grown satellite system

The Indian National Satellite System (INSAT) is a fleet of multipurpose geostationary satellites launched by the Indian Space Research Organization (ISRO), the centerpiece of India's space programme. INSAT birds are used for telecommunications, broadcasting, meteorology and other national needs. The first operational satellite, INSAT-1B, was commissioned in 1983.

Today, INSAT is the largest domestic satellite fleet in the Asia-Pacific region, with nearly a dozen satellites in orbit. Altogether, the system operates 199 transponders in the C-, extended C- and Ku-bands. INSAT is operated by a joint venture of the Department of Space, Department of Telecommunications, India Meteorological Department, All India Radio and Doordarshan, India's public television broadcaster.

The trend typified by India is continuing. Nigeria's first national satellite, NIGCOMSAT-1, was launched aboard a Chinese Long March 3B rocket in May 2007, and Bangladesh is reportedly considering initiating a programme to build its own satellite.

6.5.1 Open Skies

When communications satellites were first developed, the technology was pioneered by a handful of countries with active space programmes, such as the United States and the Soviet Union. In order to allow global access to satellite technologies, countries formed global consortiums to launch, operate and provide access to communications satellites. The first such consortium, Intelsat, was designed for geostationary fixed satellite service. It was followed later by Inmarsat, which offered mobile satellite service, opening the door to dramatic developments in maritime and land mobile communi-cations. This global model was later modified to develop regional satellite consortiums such as Eutelsat.

Primarily intergovernmental organizations, the satellite consortiums provided crucial links to remote areas and island nations and were essential to establishing a global telecommunication sector. Each country that was a member of the consortium provided representatives to the international governing structures. Meanwhile, domestically, the governments provided for exclusive access, often through a government-owned entity or (as in the case of the United States) through a commercial operator that was endowed with exclusive access rights. Thus, the satellite market resembled the traditional set-up for submarine cables: a single national operator providing the interface between a global system and various domestic customers and downstream providers.

6.5.1.1 Open Skies I: Commercial satellite systems

By the 1980s, however, this system began to strain to satisfy the demand of all parties. In developing countries, the global consortiums struggled to provide adequate bandwidth to remote areas, and access costs remained high. In the industrialized countries, meanwhile, growing demand for global capacity created pressure to allow the creation of a commercial satellite industry, which could meet that demand. The United States took the lead in developing what was called the “Open Skies” policy. Commercial satellite companies would be licensed and empowered to launch their own satellite systems, apply for earth station licences and create competition for space segment access – just as competition was beginning to develop in terrestrial service markets.

As this policy was implemented, a commercial satellite industry began to grow, not only in the United States but also in Canada, Western Europe and East Asia, as countries adopted the Open Skies policy in various capacities. Thus, by the mid-1990s, commercial satellites orbited alongside those of Intelsat, Inmarsat and other consortiums. During complex negotiations that took place during the late 1990s, the international consortiums underwent corporatization and then privatization, spinning off many of their assets and taking commercial forms, although still retaining “public service” access rights for many of the nations that still required affordable satellite links to be connected to the global economy.

6.5.1.2 Open Skies II: Access to national markets

Meanwhile, growing numbers of countries were gaining ground in the space race, developing their own capabilities to build and/or launch their own satellite fleets. A prime example is India, which aggressively pioneered a national space programme as well as a national satellite fleet. In order to protect their national satellite fleets from being undercut by commercial competitors – and to protect the needed revenue streams – India and some other countries restricted domestic customers’ access to foreign-licensed satellites, preserving a national monopoly over communications satellite operations.

Opponents of national satellite monopolies argued that they artificially capped the supply of satellite capacity, forcing up prices and limiting transponder access. Defenders maintained that national systems were integral to ensuring that previously under-represented nations would receive their fair share of orbital resources. Meanwhile, they scrambled to lease any capacity they could find on other satellite services to meet pent-up demand.

Among the proponents of Open Skies policies was the European Satellite Operators Association (ESOA), which called for transparent, non-discriminatory procedures for satellite system operators to obtain access to national markets (see Box 6.11 on ESOA’s Open Skies Manifesto). As ESOA argued, restrictions on which satellite systems can be accessed from a given country “inhibit the development of a global communications infrastructure, as well as the evolution of national communications infrastructure. Such discriminatory treatment directly affects the ultimate choice of services that distributors can offer to end users, as well as negatively impacting service costs to end users.”[82]

Among the arguments that commercial satellite operators have made in favour of Open Skies policies is that exclusive national systems cannot keep pace with growing demand for capacity. For example, in a presentation in New Delhi in March 2007, the Cable & Satellite Broadcasting Association of Asia (CASBAA) and the Global VSAT Forum predicted that India’s national satellite system, INSAT, would not be able to keep up with requirements for either Ku-band or C-band capacity, and the C-band demand would exceed supply by 2012.[83]

Box 6.11: The "Open Skies" manifesto

In contrast to policies that require use of national satellite systems, the commercial satellite industry tends to favour "open skies" policies, as expressed by the European Satellite Operators' Association (ESOA). In its "Market Access Principles and Open Skies Policy" document, ESOA defined the open skies model as one that:

> "Allows nationally authorized service providers to choose any satellite operator or satellite service provider to distribute the specific services to the specific service area(s) required for their end users (national and international)".

The Open Skies approach also:

- Does not treat foreign satellites any differently than national satellite systems;
- Does not impose "artificial" limits on market entry, such as excessive licence fees or technical requirements.

ESOA maintains that "an 'Open Skies' policy promotes the growth of satellite services and choices, lowers end-user prices through competition, expands economic growth as essential telecom services and Internet connectivity are deployed beyond the reach of terrestrial services, enhances advanced service development by creating inter-modal competition to terrestrial services, and stimulates investment in infrastructure."

Source: www.esoa.net

6.5.2 Open access to earth stations

The earthly analogue to allowing access to multiple space segment providers is mandating that operators of earth stations allow access, through collocation and/or provision of backhaul services, to their facilities. In Singapore and Malaysia, the earth station access mandate follows from the same regulatory logic that drives access to submarine cable landing stations. That is, earth stations are necessary facilities for domestic operators to access important networks for international and domestic network capacity.

In Malaysia, operators of facilities included in a published Access List Determination are required to provide access upon written request, unless they are unable to do so under terms of the Mandatory Standard on Access.[84] The Malaysian policy allows entities seeking access to either self-provide backhaul service – to a submarine cable or satellite earth station – or to acquire backhaul from another operator. The policy also allows collocation at a satellite earth station, as well as a submarine cable landing station.

In nearby Singapore, the dominant carrier SingTel has published a separate schedule (Schedule 8C) in its RIO, which spells out the terms and conditions for collocation at its three earth stations (Bukit Timah, Sentosa, and Seletar). The RIO stipulates that parties requesting collocation must already have obtained one or more satellite transponder lease agreements (or an Inmarsat land earth station operator agreement) with the satellite system(s) it wants to access. In addition, the access seeker must have obtained all required licences and be a facilities-based operator (FBO).

As these examples indicate, where the principle of mandating access to essential facilities has been established, it can be extended not only to submarine cable landing stations, but also to the satellite gateways that "land" in the country, as well. Several forward-looking governments have already moved to apply "essential facilities" labels – or to otherwise mandate access – on satellite ground facilities. There may not always be as compelling an argument, however, for access to earth stations. Submarine cables, after all, can only be accessed at a small number of SCLS facilities in each country. With satellites, earth stations can be duplicated in any number of locations, and in the case of some services (VSAT or DTH, for example), the locations can number into the scores or hundreds. Often, the main constraints are (1) regulatory prohibitions against competing in the market, (2) inability to obtain access to the satellite space segment, or (3) in some cases, cost. Large-scale teleport construction can be a steep and long-term commitment of capital.[85] Given this, perhaps the first step in promoting greater competition for satellite services would be to address the "open skies" issues and reduce other regulatory barriers (such as fees or customs duties for equipment), while examining whether other factors, including costs, render earth stations "essential" for access.

In many cases, regulators are likely to determine that they are essential, at least for some markets. In South Africa, for example, the ministry overseeing communications has indicated that it would direct ICASA to declare that electronic communications facilities connected to both submarine cables and satellite earth stations are essential facilities.[86] If other countries follow suit, the prevalence of collocation mandates for large-scale satellite earth stations and teleports is likely to increase, as well.

6.6 Conclusion

As countries pass the frontier from voice service to advanced broadband services, the IGW issue looms up as a massive border control station – and many countries are finding themselves without the means to cross over. Even as regulators and policy-makers strive to achieve universal access goals, many of them are now realizing that liberalization of access to international networks is also important

– and likely will boost overall demand for telecommunications and ICTs as a whole. In several countries that have mandated access to IGW facilities, these network elements have been seen as essential facilities, much in the way that local switching centres or cellular towers are. The potential benefits include increased market participation, bringing additional investment in domestic and international network capacity, as well as greater competition based on lower prices and improved service offerings.

There is increasing pressure to open up IGW markets, not only for policy reasons, but because new packet-switched technologies such as VoIP represent the inexorable logic of change. It is increasingly difficult and costly to preserve exclusive rights to international access, or to limit international voice traffic solely to circuit-switched networks. The NGN era is revving up, and it makes little sense to stop it at the border. Rather, the engine can be hooked up to drive lower costs for consumers, increased demand for services, applications and content, and growing supply of network capacity and global content. The future is about packets, with data, voice and multimedia all along for the ride. Why put up a roadblock at the international gateway?

[1] See ITU Background paper, "Creating an Enabling Environment for Investment", *Connect Africa* Summit, 29-30 October 2007, Kigali, Rwanda, page 5, Figure 3.

[2] *Ibid.*

[3] As this chapter will explore, recent years have seen renewed investment in the submarine cable market, offering relief to capacity problems in regions such as the Asia-Pacific region – and hope to areas such as Sub-Saharan Africa that still remain largely unserved.

[4] See International Sharing: International Gateway Liberalization – Singapore's Experience, ITU GSR discussion paper, February 2008, p. 6.

[5] ITU, "The Status of Voice over Internet Protocol Worldwide, 2006", Background paper presented at the *Future of Voice* ITU Workshop, January 2007.

[6] *Trends in Telecommunication Reform*, 2007, page 97.

[7] *Ibid.*, page 99.

[8] *Ibid.*, page 97. It is possible, however, to establish higher "priority" for certain packets – above and beyond the standard "best effort" transmission accorded to typical Internet traffic. Internet service providers (ISPs) are likely to continue pioneering various pricing models for customers to take advantage of such "gold standard" access. Meanwhile, packet-switched data is likely to continue its rise to predominance in international traffic flows.

[9] *Ibid.*, page 105.

[10] Interestingly, the US FCC foresaw the rise and effect of VoIP bypass on international routes more than a decade ago, when it implemented accounting rate benchmarks for US carriers.

[11] Partial liberalization can take several forms, including opening IGW markets to a small, restricted number of new competitors, or allowing competitive provision of some elements of gateway network services, such as backhaul, but not others.

[12] ITU Research, 2008.

[13] GSMA Comments on Draft GSR-08 Discussion Paper on: "International Gateway Liberalization", page 3.

[14] *Ibid.*

[15] GSM Association, "Gateway Liberalization: Stimulating Economic Growth", White paper, 2008, page 13.

[16] *Ibid.*, page 11.

[17] ITU Research, 2008.

[18] *Ibid.*, page 37.

[19] *Ibid.* The number of broadband subscribers would equal roughly 1.2 per cent of the Thai population, indicating that broadband service remained largely a high-end or enterprise/business market in the middle of the decade.

[20] International Sharing: Singapore's Experience, ITU GSR Discussion paper, February 2008, page 10.

[21] *Ibid.*

[22] *Trends in Telecommunication Reform 2007*, page 95.

[23] This practice was commonly referred to as "refilling" traffic. Rather than having a call accounted for as transit, which would result in cumulative transit rates for each country being applied, the traffic would be reported as originating in the third country, applying only the lower settlement rates for that route to the destination.

[24] *Ibid.*, page 96.

[25] One form of bypass is known as a "leaky PBX," which involves routing calls over leased lines from one location to another, then using a commercial PBX to "leak" traffic onto the local public switched network. See discussion in ICT Regulaton Toolkit, at: www.ictregulationtoolkit.org/en/Section.2176.html#Leaky_PBX

[26] Poe, R., "Will VoIP Join the Telco Counterrevolution?", at: www.voip-news.com, 14 July 2006.

[27] Source: ITU World Telecommunication Regulatory Database.

[28] *Ibid.*

[29] See McClelland, S., "What Now for Submarine Telecom?" in *Telecommunications International*, March 2004, downloaded at: http://findarticles.com/p/articles/mi_m0IUL/is_3_38/ai_n6170818, 10 June 2008.

[30] *Trends in Telecommunication Reform 2007*, page 99.

31 The countries are Burundi, Botswana, Democratic People's Republic of Congo, Djibouti, Eritrea, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Somalia, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.

32 Source: www.eassy.org/investors.html

33 Such as Communications Global Networks Services (BT), Saudi Telecom Company, Bharti Airtel India, Etisalat (UAE) /Canartel Sudan Consortium and France Telecom.

34 WIOCC is a company registered in Mauritius under the laws of Mauritius and whose shareholders are the following eleven (11) operators: Botswana Telecommunications Corporation, U-Com Burundi, Onatel Burundi, Djibouti Telecom, Telkom Kenya Limited, TDM Mozambique, Dalkom Somalia, Zanzibar Telecom Limited, Uganda Telecom Limited, Lesotho Telecommunications Authority, Gilat Satcom Nigeria Limited.

35 "Consensus on Eastern Africa Submarine Cable System (EASSy) Project Following Stakeholders Meeting in Nairobi", EASSy Joint Press Statement, 17 July 2006.

36 *Ibid*.

37 See www.eassy.org/project.html

38 "The Kigali Protocol for the NEPAD ICT Network Comes into Force", 2 April 2008, at: www.eafricacommission.org/whats-new/news/02/04/2008/kigali-protocol-nepad-ict-network-comes-force (see also www.presseafricaine.info/article-16815455.html).

39 www.eafricacommission.org/projects/126/nepad-ict-broadband-infrastructure-network

40 Ministers approve $2bn submarine cable to connect Africa – and call for speedy implementation, 3 February 2008, at: www.eafricacommission.org/whats-new/news/03/02/2008/ministers-approve-2bn-submarine-cable-connect-africa-%C3%A2%E2%82%AC%E2%80%9C-and-call-speedy-imp

41 http://forums.prophecy.co.za/f16/cables-cronies-45706/

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43 Telecom Regulatory Authority of India, Consultation Paper on "Access to Essential Facilities (Including Landing Facilities for Submarine Cables) at Cable Landing Stations", 13 April 2007, page 5.

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45 See TRAI, Telecommunication Tariff Order No. 6 of 2005.

46 http://gigaom.com/2008/08/17/can-undersea-optic-cables-predict-an-economic-boom/

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48 http://en.wikipedia.org/wiki/PacRimWest_(cable_system)

49 http://americansamoa.gov/News/samoa_talks_outcome.htm

50 www.fcc.gov/Daily_Releases/Daily_Business/2008/db0718/DOC-283802A1.pdf, July 18, 2008.

51 See 47 CFR §1.767, at: www.fcc.gov/ib/pd/pf/telecomrules.html#BM_1_767

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58 www.eafricacommission.org/faq/what-are-uhurunet-umojanet-and-baharicom

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61 In keeping with general FCC rules and US regulatory tradition, common carriage requires the operator to offer service to all "similarly situated" potential customers, on terms and conditions that do not unduly discriminate among them. Private or "non-common carriage" can be for private or internal use of the operator.

62 The international authorization is known as a "Section 214" because it is found in that section of the Communications Act of 1934 (as amended). Part 63 of the U.S. Code of Federal Regulations governs the Section 214 application and qualification requirements. See: www.fcc.gov/ib/pd/pf/telecomrules.html#Part63

63 International Sharing: Singapore's Experience, GSR discussion paper, February 2008, page 10.

64 *Ibid*.

65 TRAI Consultation Paper No. 5 (13 April 2007), page 2 and Annex 1.

66 *Ibid*., page 3.

67 *Ibid*., page 14.

68 Telecom Regulatory Authority of India, Notification, "International Telecommunications Access to Essential Facilities at Cable Landing Stations Regulations, 2007 (5 of 2007)" File No. 416-1, 2007-FN, Chapter II, Section 3(a).

69 *Ibid*., Chapter I, Section 2(l)(ii).

70 Nigerian Communications Commission, "Guidelines on International Gateway Access and Voice over Internet Protocol (VoIP) Issued by the Nigerian Communications Commission".

71 *Ibid*., Chapter 1, Section (3).

72 *Ibid*., Chapter 6.

73 TRAI, Consultation Paper No. 5/2007, "Access to Essential Facilities (Including Landing Facilities for Submarine Cables) at Cable Landing Stations", page 10, paragraph 2.10.5.

74 GSR Discussion IDA, "International Sharing: Singapore's Experience", page 8, Section 4.

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76 International Sharing: Singapore's Experience, GSR discussion paper, February 2008, page 9.

77 A digital cross-connect is a network device used by telecom carriers and large enterprises to switch and multiplex low-speed voice and data signals onto high-speed lines and vice versa. It is typically used to aggregate several T1 lines into a higher-speed electrical or optical line as well as to distribute signals to various destinations; for example, voice and data traffic may arrive at the cross-connect on the same facility, but be destined for different carriers. Voice traffic would be transmitted out one port, while data traffic goes out another. Cross-connects come large and small, handling only a few ports up to a few thousand. Narrowband, wideband and broadband cross-connects support channels down to DS0, DS1 and DS3 respectively. Source: www.pcmag.com/encyclopedia_term/0,2542,t=digital+cross-connect&i=41318,00.asp

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79 The formal name of the WTO basic telecom services agreement is the Fourth Protocol to the General Agreement on Trade in Services.

80 See 47 CFR §1.767(g)(5).

81 See: www.satellitetoday.com/via/features/22107.html

82 European Satellite Operators Association, "Market Access Principles and Open Skies Policy", at: www.esoa.net

83 CASBAA and Global VSAT Forum, "Meeting the Satellite Capacity Challenge: 2007 Update on Recommendations", presentation given 19 March 2007, New Delhi.

84 See Malaysian Communications and Multimedia Commission, "FAQs on Determination on Access List (1 of 2005) and Mandatory Standard of Access (2 of 2005)", downloaded from: www.skmm.gov.my/what_we_do/access

85 For example, reported prices for an 8.1 metre diameter antenna are USD 200 000, hub equipment racks and computers can reach up to nearly USD 500 000, and remote terminals (at wholesale rates) can mount up to USD 200 000 (200 VSATs at USD 1000 each). See: www.satsig.net/ivsatcos.htm

86 See: www.mydigitallife.co.za/index.php?option=com_content&task=view&id=7930&Itemid=2 Nov 2007