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Interconnection costs

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1. Background

The world is still in the middle of a seismic shift in communication architectures as internet-based networks steadily replace the circuit-switched systems that were designed for voice, while rapid innovation continues to throw new technologies into the mix. We are still in a relatively early stage of this evolution, and as a result, internet interconnection issues are complex, fast changing and not well understood.

The incumbent telecommunication operators were founded on technology where network intelligence was controlled at the centre. Having invested billions of dollars in these older systems, they are resisting the natural evolution of networks toward intelligence and control that lies at the edge, with the end-user. Mobile networks are also included in this dynamic with the emergence of Wifi and WiMax, and other advanced wireless technologies. Other new technologies such as Ultra Wide Band (UWB), smart software radios and adaptive antennae, also threaten to undermine traditional approaches to radio spectrum management, turning a previously scarce resource into a plentiful one.

At the same time the developed world is benefiting from the surplus of fibre laid during the dot-com bubble. This has coupled with advances in fibre transmission technology so that terrabit speeds on fibre networks are now routine, and DSL services that offer upwards of 50Mbps to the home are becoming increasingly common. Using these networks, operators are now providing advanced services such as VoIP, audio streaming and internetTV.

We are also seeing a consolidation and convergence of the telecom and internet markets, with many smaller ISPs losing ground to the telecom and cable operators who own the underlying networks and can benefit from their much greater economies of scale. With the recent emergence of broadband over power-line (BPL), the electricity grids are also in a position to enter these markets with their even more ubiquitous networks.

Increasing North-South inequities: paying both ways

Unfortunately, while users in the North continue to reap the benefits of these developments, users in the South are actually falling further behind. In particular, the privatisation of telecom operations in developed countries, combined with the adoption of new technologies, has greatly reduced net financial flows to developing nations[1]. The largely state-owned telecom operators in the South have seen massive reductions in their primary source of revenue - from incoming international calls - due to the increasingly competitive international environment and the use of bypass technologies such as VoIP and VSAT. While some of these revenues have gone to support over-staffed public bureaucracies, it has also been used to support infrastructure build-out and more equitable local network access.

At the same time, the growth and adoption of the internet in developing countries has been hampered by this environment. Not only due to the high tariffs charged by monopoly operators[2] and the inability of ISPs to service their customers with adequate telecom infrastructure, but also because ISPs must pay for **both** ends of their international telecom links, as well as the transit charges to pass their traffic through to the rest of the internet and to carry the incoming traffic from developed countries. In effect this reverse subsidy to the North has combined with the loss of revenue from incoming calls to exacerbate imbalances between developed and developing regions.

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1 The ITU estimates that between 1993-98 net flows of settlement payments from developed to developing countries was about US$40 billion, or about $8 billion a year.

2 State monopoly operators still hold the bulk of the fixed line and the sole international rights in most developing countries. The International Telecom Users Group (INTUG) observed in January 2005 that “the level of the prices seldom arises from high underlying costs, but instead are imposed by monopoly or dominant operators through the exercise of their market power. Often these operators are shielded from potential competitors by the refusal of their governments to permit any new players to enter the market in international telecommunications”.

The ICAIS debate

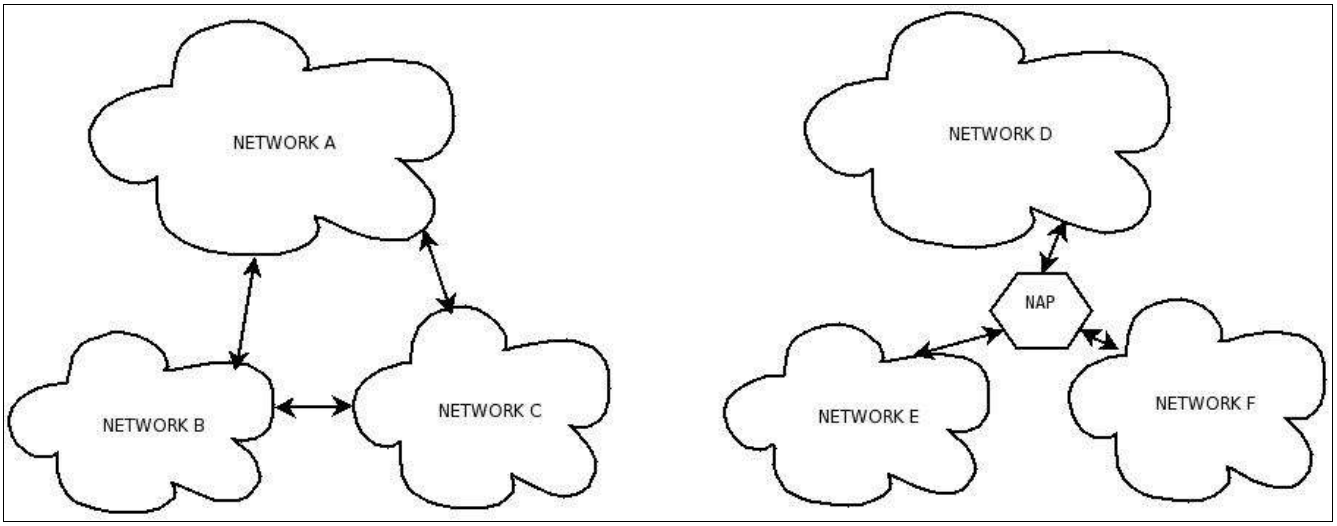
This issue of inequitable access by developing nations to the global internet backbones has been the subject of contention for many years. Known as International Charging Arrangements for Internet Services (ICAIS) debate, the ITU began considering the issue as far back as 1998, and in 2000 adopted Recommendation D.50 that aimed to encourage operators to adopt symmetric peering agreements. The idea had its roots in the earlier ITU conventions for symmetric tariffs on international voice circuits (international accounting rate settlements). These conventions were in effect inter-governmental agreements, as all the operators were state owned. . However this system has been steadily eroding with the privatisation and globalisation of the telecom sector. Prices are increasingly dictated by commercial agreements between the dominant operators and there is little national governments can do to influence this process directly.

As a result few benefits have accrued to developing countries from Recommendation D.50, which in any event admitted that commercial considerations would likely determine pricing, suggesting that operators take into account the possible need for compensation for elements such as traffic flow, number of routes, geographical coverage and the cost of international transmission when negotiating peering arrangements. So five years later, the need to reduce costs for the smaller and more distant developing country operators still remains[3].

[3] ICAIS is covered in the WSIS Plan of Action C2. 9. k: “Internet transit and interconnection costs should be oriented towards objective, transparent and non-discriminatory parameters, taking into account ongoing work on this subject.” .

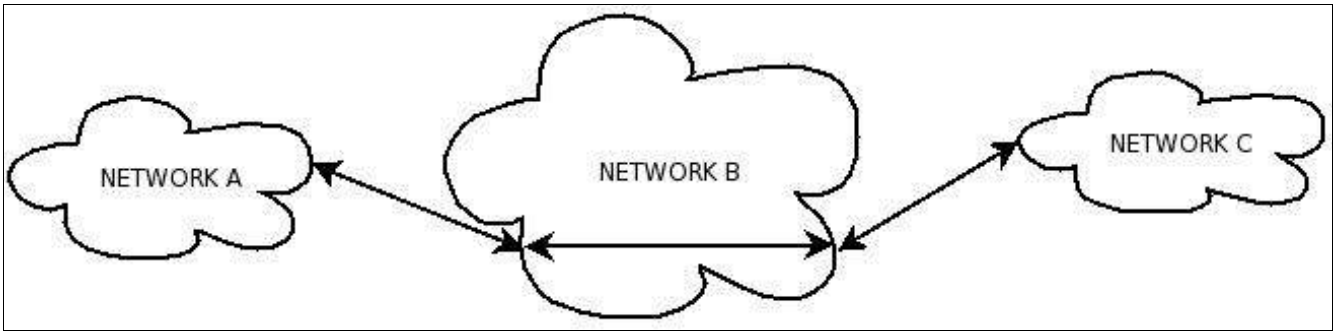
A note on Peering and Transit. Internet backbones interconnect under two different arrangements: peering or transit. In a peering arrangement, backbones agree to exchange traffic with each other at no cost. The backbones only exchange traffic that is destined for each other's end users, not the end users of a third party. In a transit arrangement one backbone pays another backbone for interconnection. In exchange for this payment, the transit supplier provides a connection to all end users on the internet.

Peering:



Each of these three networks peer with each other, either directly, or via an Internet Exchange point (IX) or a Network Access Point (NAP).

Transit:



Network B provides transit for Network A and Network C

2. Proposed Strategies for Minimising the Disparities in Interconnection Rates

Recent reports, including the Draft WGIG issue paper on International Internet Connections (IIC), the Halfway Proposition (see below), and various FCC and OECD studies have so far concluded that support for using legal mechanisms to impose symmetric peering is lacking, and that commercial arrangements are likely to prevail.

Dominant providers could still use their power to exclude smaller players from peering, forcing them into transit arrangements, and this should be revealed in the further studies that are under way. While some have suggested that a WTO process could be engaged to address the issue, there is currently only scattered support for this, partly because many see this as more of a development than a trade issue. In this respect a number of strategies have been suggested, and there is clearly much that can still be done by developing countries and their development partners which could have a much greater impact on the costs of bandwidth. The interlinked strategies that have been proposed[4] can be grouped together as a three-point plan consisting of:

- Accelerating the restructuring of the communications sector
- Supporting the establishment of national and international internet exchange points.
- Building local demand for national and international backbones

2.1 Accelerating the restructuring of the communications sector

In the transition to a competitive environment there are a number of steps to the strategy that are described further below, which can be summarised as follows:

- Eliminate monopolies & duopolies
- Privatise and liberalise at the same time
- Ensure effective competition laws
- Ensure cost-based interconnection regime
- Interconnection licenses should include value added service providers
- Mandate incumbent co-location, unbundling, access to dark fibre and other essential services
- Consider tariff caps on non-competitive services and subsidising non-competitive services for underserviced areas and marginal groups
- Adopt open-access business models for new national and international backbones
- Allow use of Wifi/WiMax etc, VoIP and VSAT for the end-user
- Publish tariff and service level comparisons

Increasing competition in the telecom and internet sectors still remains the most well-accepted initial strategy for minimising the costs of connectivity. While it is true that most developing countries must pay both halves of the circuit, the biggest cost of the circuit is not the IP transit fees or the foreign end of the link, but the local and international charges to the monopoly telecom service provider. Elimination of monopolies or duopolies, and generally increasing national and international competition in communication services[5] will have the biggest impact in reducing the largest cost component of bandwidth charges. This will also fuel investment in the much-needed national and international backbones. This can be the first phase in a staged process – only once competition has reduced infrastructure access charges to cost-related tariffs can peering and transit issues be addressed.

In addition, governments own a considerable number of rights of way, such as roads, electricity

[4] The WSIS Plan of Action C2. 9. j suggests "The creation and development of regional ICT backbones and Internet exchange points, to reduce interconnection costs and broaden network access."

[5] The 2000 Cancun APEC Ministerial Declaration stated that "Governments need not intervene in private business agreements on ICAIS achieved in a competitive environment, but where there are dominant players or de facto monopolies, governments must play a role in promoting fair competition."

and railway networks. Providing ducting for cable along these routes on a non-discriminatory basis will, for example, foster the development of competitive backbone provision. Participation by government in using open access models is seen as a particularly viable approach to building infrastructure.

Sequencing of sector reform

The sequence of sector reform is important, in that simultaneous privatisation and liberalisation has produced dramatically higher growth in teledensity in countries such as Chile as opposed to countries such as South Africa, which privatised first and phased in liberalisation later. Ensuring that public monopolies are not simply replaced with private monopolies is vital[6]. And a competitive local market for bandwidth also helps to guarantee that the benefits of increased competition in the international market are passed on to the end-user.

Effective competition and anti-trust laws will usually be needed for this, not only to generally prevent anti-competitive consolidation among internet backbone providers, but in particular to ensure that incumbent operators (including mobile operators) do not abuse their dominant positions. This is probably the most difficult aspect to address, and also requires the consistent implementation of a series of different regulations for open access, as described below, as well as opening the markets to alternatives, as described in section 2.3 (building demand). So far, these efforts have not been particularly successful because countries have only put some of the necessary regulations in place, and in developing countries they have often not had the autonomy and teeth to ensure compliance. In addition, western models of slow deregulation have often been adopted. These made sense in a market environment where the incumbent served 99.99% of the market and needed protection to ensure that the end-user was not jeopardised, but these models make little sense where the incumbent only serves 1 or 2% of the market.

Regulation for open access

The convergence of voice and data means that internet service providers will need to be able to interconnect with PSTN operators at cost-based charges[7]. This will help drive down the often unrealistic interconnection rates charged by incumbents and mobile operators[8].

Incumbent operators also need to be obliged to provide leased lines to competitors on the same terms as they would for their own operations. This includes local loop unbundling, co-location in ducts and on poles, mandatory provision to other operators of dark fibre and other essential services such as masts and international fibre landing points, and granting permission for self-provisioning. The regular publication of accurate data obtained from operators on delivery times, quality of service/congestion, interconnection and tariffs, will also help to create a more competitive environment[9].

In the interim, while new operators build their networks, national regulators could also look to international benchmarks[10] to establish tariff caps and subsidies for their incumbent telecom operators' leased line services. Temporary subsidisation[11] of high service charges for low-income and remote groups, or for health and education is an option until competitively provided services

6 Experience in Brazil, South Africa, Ghana and Uganda has shown that privatised monopolies, often with added resources from the foreign strategic investor, are even better at maintaining their market dominance.

7 The South African national regulator, ICASA proposed in the May 2005 Parliamentary hearings on the draft Convergence Bill that an amendment to the definition of Interconnection be made to include "categories of licensees beyond just communications network licensees. As a tool to facilitate competition, interconnection provisions should include any person seeking interconnection , subject to the constraints of technical feasibility and the promotion of efficient use of communications networks and services."

8 Strong interconnection agreements are among the most important aspects of regulation to ensure fair competition - if competitors to the incumbent are to be made willing investors, they have to know they can compete on a level playing field.

9 The FCC has recommended that International bandwidth providers should publish their peering policies http://www.nric.org/fg/fg4/FG4StatementOnTransparency5_23_2001.html .

10 Such as Band-X, the Internet bandwidth trading exchange.

11 Universal access funds are one way to finance such mechanisms, using a levy on operators as a first source of income, with additional funds from government and donors if required.

become available. This has also been done by mandating the operators to provide discounted services such as an e-rate[12], and imposing universal service obligations on incumbents.

Ensuring competition on international routes and global backbones is a more difficult and long-term task[13]. Initiatives to build new infrastructure could benefit from the adoption of open access ownership models[14] for international fibre deployment. This still leaves the potential issue of anti-competitive practices among the global backbone operators.

International backbone dynamics

While the matter still needs further study[15], over the last five years there have been significant changes in international backbone dynamics that are already helping to rebalance traffic and charges in some regions. One is that traffic is becoming more symmetric as there is much increased use of the internet for international voice traffic. Perhaps more importantly, regional telecom and internet hubs have already emerged in Asia and Latin America, and some large global telecom networks are now owned by Southern operators.

Regional hubs in Latin America and Asia have partly been the result of the more advanced stage of liberalization of the markets there which enabled exchange points at both national and regional levels to appear quickly. Africa remains the most problematic region, not only because of the more restrictive regulatory environments, but also because of the large number of small and isolated countries. Recent examples of Southern operators moving into global backbone provisioning are: a) the acquisition of Tyco Telecommunications and Teleglobe by VSNL, a leading Indian operator (part of the Tata Group), b) the acquisition of Global Crossing by Singapore Technologies Telemedia, a subsidiary of Temasek Holdings, and c) Mexico's Telmex which now owns Brazil's largest backbone and satellite operator (Embratel).

It should also be noted that these developments, along with the recent deployment of fibre directly connecting Latin America to Africa (Brazil to Senegal), and Africa to Asia (South Africa to Malaysia and India) mean that Southern bloc operators could act to further consolidate their traffic and improve their negotiating position with Northern operators.

2.2 Supporting the establishment of national and international internet exchange points.

The establishment of national internet exchange points is necessary to improve the performance of national networks and reduce the costs of national traffic that must currently travel over international links. Local exchange points will also encourage the build-out of local backbones, as they are more valuable when they are locally interconnected and response times across the nation are minimised. The presence of exchange points will also encourage international backbone providers to establish Points of Presence locally.

National associations of internet providers usually operate exchange points on behalf of their members. In many developing countries without exchange points these national associations are still emerging and support for building their capacity is often needed. There may also be a role for national regulators to mandate the connection of licensed ISPs to the exchange points and to facilitate any regulatory requirements for their operation.

Once restructuring of the communication sector has resulted in cost-based national and

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12 In South Africa the monopoly operator is required to provide bandwidth at a 50% discount for schools.

13 Internet bandwidth provision is by any measurement, a 'concentrated' market with only a few dominant players in each country.

14 A number of recent studies have identified the public-private partnerships and Open Access models as a better solution for fibre deployment. See for example the InfoDev Study: Open Access Models: Options for Improving Backbone Connectivity in Developing Countries. http://www.infodev.org/content/highlights/detail/2568.

15 The World Telecommunications Standardisation Assembly in 2004 (WTSA) voted to continue the work on leased lines in Study Group 3 in the new study period, 2004-8, and the WGIG is also debating this issue extensively.

international terrestrial fibre[16] it will then become economically feasible for ISPs to consolidate cross-continental traffic in regional hubs[17]. Increased competition within the same region will lower the cost of leased lines between countries, enabling more direct intra-regional traffic exchange, and if this is done on sufficient scale, regional providers will be able to negotiate equal peering and transit terms with the global backbone operators. The ITU-T Study Group 3 has recommended that donors and development agencies assist with this process[18]. The Halfway Proposition developed by the African ISP Association (AFRISPA) also articulated these requirements, proposing two specific steps: a) create traffic aggregation through the creation of internet exchange points and supporting emergence of regional carriers facilitating regional peering, and b) create digital arteries to carry the traffic through regional fibre optic infrastructure and international fibre optic infrastructure.

2.3 Building local demand for national and international backbones

Opening the unlicensed or unregulated radio spectrum[19], VSAT and VoIP for last-mile services, and allowing these to interconnect with the national and international network providers will increase access, reduce the cost of local services, and encourage sharing and self-provision in under-serviced areas. This will ultimately increase the demand for national and international backbones and stimulate investment in the sector. Due to the inherently high cost of satellite bandwidth, satellite users will quickly move to competitively provided terrestrial services as soon as they become available.

A related dynamic is that Local Authorities (municipalities) in many countries around the world are now taking the view that Internet access is a public good and are in the process of deploying fibre and wireless networks for their citizens[20]. These efforts will need to be accompanied by legal assurances that communities, municipalities, etc are allowed to build their own connectivity solutions, optimize bandwidth costs and define their own policies regarding usage of their networks[21]. This strategy appears unrelated to inter-country interconnection policies, but if international conventions establish internet connectivity as a telecommunications issue, then legislators could interpret any connectivity initiative as being under national telecommunications legislation, and it is necessary to ensure that this is not the case.

Allowing these backbones to be built will also encourage content and application providers to roll-out national services such as e-banking, distance education and e-government, which will then in turn become a further incentive for infrastructure deployment. Governments in particular have considerable leverage as a major consumer of internet services. By offering to pay for services to be rolled out to public sector operations in rural areas such as schools, hospitals, and customs posts, governments can provide an incentive to private operators to serve local communities.

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16 Satellite connections are unlikely to be attractive for regional hubbing because the cost of transmission is distance independent. In this situation it makes more economic sense for the ISP to simply load the neighbouring country traffic onto its existing upstream Internet link to take advantage of economies of scale.

17 As discussed above, this is already beginning to take place in Asia, and Telegeography recently noted that "in Europe, where telecom liberalisation has been the greatest, and international bandwidth prices have dropped the fastest, two thirds of international Internet connectivity remains in-region," concluding that "the move away from a US-centric architecture depends on well-developed local infrastructure, and a regulatory environment which neither prohibits connectivity nor prices it out of reach."

18 Some countries such as Rwanda have noted that ICT development assistance has tended to put greater emphasis on sector specific aspects and less on the needs for a basic underlying network that can serve all sectors.

19 Usually the 2.4 and 5.8Ghz ISM bands as defined by the ITU

20 See for example Unlicensed Wireless Broadband Community, Municipal & Commercial Success Stories (New America Foundation), and Canarie case studies at http://www.canarie.ca/advnet/fibre.html

21 A good example of a situation that needs to be avoided is the recent case in Pennsylvania, where the incumbent operator, Verizon, asked the governor to ban the building of community networks with participation of local administrations.