A growing number of Sub-Saharan African (SSA) countries, governments, regional organizations, and private sector operators have identified the development of affordable cross-border backbone infrastructure as a top priority for improving connectivity in the region. Sub-Saharan Africa has the lowest levels of connectivity in the world and the region relies mostly on satellite systems, which are more expensive and of lower quality than terrestrial alternatives such as fiber, thus hindering the region’s potential for economic development. Wholesale bandwidth prices are 20 to 40 times higher than in the United States. The East Africa region is in particularly bad shape, being the only part of coastal Africa that does not have direct connections to global fiber optic networks. Africans made information infrastructure development and access a priority at the World Summit on the Information Society in Geneva in 2003 and again at the meeting of NEPAD Head of States in Algiers in November 2004.

It is important to emphasize the need to combine new infrastructure projects with policy and regulatory reform to foster regional backbone infrastructure development. Infrastructure built without a suitable enabling environment will have little impact on prices and access. West Africa is currently connected by fiber to the global fiber optic networks through SAT-3, but prices remain nearly as high as they do in East Africa where there is no fiber backbone connectivity. The prices of dial-up Internet access in countries connected to SAT3 remain twice as high as in other developing countries, as shown in Figure One. Significant regulatory and policy bottlenecks remain that will need to be addressed to ensure competitive access to existing infrastructure in West Africa, and as part of an effort to develop new regional infrastructure in East Africa.

The private sector can provide the bulk of the financing for the deployment of regional communications, but the public sector retains a key role to play in creating enabling environment for open access regional backbone infrastructure, then. This note focuses on some key policy and regulatory safeguards to remove constraints and bottlenecks and ensure cheaper access to infrastructure. In particular it focuses on: (1) liberalization and licensing; (2) appropriate terms of interconnection and pricing; (3) physical access to facilities and infrastructure, and (4) regional harmonization. Beyond this, the note discusses (5) ownership models and the role of the public sector and; (6) the role of donors, including the World Bank.

**Liberalization and licensing**

**Open Access, Competition and Licensing**

The monopoly control of access to national and regional fiber infrastructure – either by an incumbent at the national level or through exclusivity arrangements at the regional level - limits the developmental impact of national and regional infrastructure. Under a monopoly or limited competition regime for international fiber traffic, incumbents have traditionally operated a high-margin, low-volume business, with inflated prices charged to domestic consumers as a result. The experience of South Africa is an example: as a member of SAT-3/WASC/SAFE cable, Telkom SA has exclusive rights to wholesale cable access in the country.
This has meant that competitors can only obtain access to the cable at very high retail prices — and many are forced to revert to costly US and European satellite circuits to carry international traffic. A comparison of prices of international bandwidth shows that operators in South Africa get charged 8 to 10 times more than operators in India for access to the international gateway (Figure Two).6

Open, non-discriminatory and pro-competitive access to infrastructure helps to secure lower prices and the highest level of voice and data traffic. In addition, allowing more players into the market can bring additional private investment to new regional infrastructure projects — not least, through mobile operators not yet licensed to provide international services. As will be discussed later, choosing an ownership and regulatory model that guarantees open access and entry may secure funding to build first-line back-bone infrastructure or even competing networks.8

**Interconnection and cost of access at the national level: access for operators who do not have access to cable capacity**

Unfavorable interconnection or access pricing conditions, including delays in providing access to bandwidth, may be used by incumbents to protect their businesses. This is particularly true where incumbents having exclusive rights to access to the cable are active in both the wholesale and retail segments, as has been the case with SAT-3 (Box One).11 Adopting transparent terms, conditions and costs for interconnection should lead to reasonable and fair access to cable infrastructure by non-owners. The explosive growth of Nigeria’s telecommunications sector, for example, is in part due to the combined efforts of the Ministry of Communications (MOC) and the Communications Commission (NCC) to ensure all licensed operators can gain fair and equal access to the SAT-3 submarine cable which is controlled by NITEL, a state-owned company. The NCC, strengthened by a new Telecommunications Act adopted in 2003, carried out an open, transparent and participatory consultation process to develop and enforce effective interconnection regulations that created incentives for NITEL and operators to reach agreement on SAT-3 access. Provisions have also been included in telecommunications licenses to allow the operator to intervene in cases where access is not achieved on agreeable terms. If multiple operators in Nigeria (and elsewhere) are eventually granted fair and direct access to the cable, requirements on interconnection agreements and guidelines might be relaxed.12
Interconnection at the international level: cross-border interconnection and access to backbone

Establishing backhaul links from regional cable systems to countries which are not on the main routing of the cable has the obvious advantage of connecting these countries, and may also potentially facilitate the financial viability of the whole project – by increasing demand for system. Cross-border interconnection therefore becomes an essential element of successful cable projects along with interconnect to the regional cable itself.

In the case of submarine cables, operators in countries without direct physical access to the backbone cable have no alternative but to use a ‘gatekeeper’ carrier in order to access the landing station and/or cable system. For example, in Uganda, two of the country’s telecommunications providers are signatories to the Memorandum of Understanding for a cable project on the East Coast of Africa (EASSy). However, in order to access the proposed submarine cable landing points at either Mombassa or Dar es Salaam, they must lease capacity or interconnect with an intermediary carrier in Kenya or Tanzania to physically deliver traffic from Uganda to the submarine cable. This requires cross-border interconnection and/or backhaul to the landing point.

The competitiveness (and so likely cost) of cross-border backhaul carriers depends upon at least two factors:

1. **the competitive environment in the domestic long distance segment of the intermediary country**: if there is no competition, incumbent monopoly operators will be in a position to charge excessive rates to operators in neighboring landlocked countries. If competition does exist, the landlocked operator can choose between backhaul carriers, exercising choice over the tariffs charged and quality of service.

2. **diversity of routes to connect landlocked countries to the cable**: having two or more different geographic routes for accessing the cable (through different intermediary countries) creates a market, so that gatekeeper carriers do not entirely control supply - and consequently prices.

Redundant routes for access to the cable – i.e. diversity - is not only commercially desirable but also technically, politically and strategically important. If cables are damaged or countries are unable or unwilling to access upstream fiber infrastructure - for example in case of conflict - the existence of alternatives and the ability to switch to another routing and/or supplier mitigates the risk that access be controlled by an intermediary country or operator. Nonetheless, many landlocked operators will face limited choices in terms of routing, at least in the short term.

Subregional interconnect frameworks that establish mechanisms for setting cross-border interconnect/backhaul charges at reasonable rates will be important to ensure the maximum development impact of cable projects. The lack

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**Box 1: Access to SAT-3/WASC bandwidth capacity for non-owners**

In the SAT-3/WASC cable, each of the consortium carriers owns capacity on the cable, based on a pro rata scale depending on their respective level of investment. In addition, there is a pool of unused capacity which these operators do not require in the immediate future. Capacity in this pool can be used by one of the owners, or by other operators. Non-owners can access capacity in one of two ways:

- They can buy capacity from the national carrier in countries that are owners of the cable. A prerequisite for direct access is that such operators are licensed to carry international traffic.

- Alternatively, operators can buy directly from the pool and therefore bypass that carrier, through an Indefeasible Right of Use (IRU) from the cable’s network administrator – which is Telkom South Africa. However, the national carrier has right of first refusal and owners have been granted exclusivity for the first five years (which will expire in April 2007). Non-consortium operators could be forced to buy capacity from the incumbent carrier even after exclusivity ends, then. Furthermore, pool prices are set by the consortium at very high levels, considerably above any national carrier access price, so that even those non-consortium operators able to purchase from the pool will garner little savings in switching from satellite connectivity.
of such agreement covering Malian and Senegalese operators has delayed Mali’s access to SAT-3 capacity, for example.16 For the EASSy cable, some landlocked countries (e.g. Uganda) will be able to connect by transiting through a single country, whilst others (e.g. Rwanda) could have to transit through two. The number of countries transited can potentially multiply obstacles, and unless provisions are made in advance for landlocked operators to obtain backhaul capacity at wholesale or at-cost basis, costs could approach or top those of satellite services.

Physical access to facilities and infrastructure

Some aspects linked to physical access to infrastructure impact the availability and competitiveness of backbone networks at the national and international level:

- **Collocation facilities**: Significant cost advantages can be gained by collocating facilities. Encouraging or facilitating collocation can be a safeguard to ensure fair competition. ISPs in South Africa, for example, have in the past argued that, unlike Telkom SA’s ISP which is collocated with the authentication service, they need to pay for expensive links between the central ADSL authentication servers and their own networks. In Kenya, conversely, two public data networks (KDN and UUNet Kenya) are establishing collocation facilities from which operators can have direct access to Telecom Kenya’s network.

- **Rights of way and alternate infrastructures at the national level**: national backbones based on the existing networks and rights of way of mobile operators, electricity distribution grids, oil and gas pipelines and railway lines offer special potential to lower start-up costs and provide more immediate service. In addition, national governments can facilitate the build-out of backbones and backhauls by creating efficient, fair and uniform right of way guidelines for fees and regulations, including vis-à-vis local or municipal authorities. Beyond rights of way, many non-telecommunications infrastructure companies need fiber optic systems to control their own networks. This fiber capacity could easily be augmented and be made available to backbone operators to stimulate competition.

- **Rights of way at the international level**: Landlocked countries are at a disadvantage with respect to coastal ones for terrestrial access to submarine cables. This right of way issue touches on sovereignty issues. The United Nations Convention on the Law of the Sea (1982) establishes the legal framework relating to, amongst other things, the extent to which a coastal country may claim sovereignty over the sea, the right to lay submarine cables and pipelines, and the right of access of landlocked states to and from the sea.17 In order to ensure equitable access, provisions can be made in advance for landlocked operators to guarantee their access to the submarine cable landing point on equivalent terms as other owners of the system. At least two main options exist: 1) a special provision for single and double-land locked operators guaranteeing the ability and terms of access to submarine cable landing points by incorporating the principles of the UNCLOS treaty; 2) inclusion of the backhaul as part of the project cable system. This would level the playing field by effectively bringing the access point to the system to the border of all countries. Failing such approaches that ‘lock in’ fair access as part of project creation, landlocked countries will have to rely on cross-border interconnection regulation.

Harmonization of regional rules

Appropriate regulatory frameworks and governance models need to be in place not only at the national level but also at supra-national and regional levels in order to regulate certain aspects of backbone projects. Areas where additional regional pressure is needed include establishing open access frameworks and guidelines for international termination and interconnection and provisions for access for landlocked countries. Regional frameworks could also be helpful for dispute resolution, for example in mediating cross-border interconnect pricing disputes.

In Europe, the European Commission has issued detailed regulations on cross-border interconnection in open and competitive markets. An equivalent body is absent in Africa. A limited set of issues are covered by ITU regulations, and others by the World Trade Organization. While African regional organizations or regulatory forums can discuss these issues, they do not do not necessarily have the capacity (or sometimes mandate) to enforce solutions.
Over the last five years, regional or sub-regional satellite-based IP operators have emerged in Africa, allowing them to achieve greater economies of scale. In Western and Central Africa, several planned regional backbone projects based on a carrier’s carrier model are under consideration. One option for policy makers is to consider the issuance of multi-country international carrier’s carrier licenses (comprising both the domestic long distance and international long distance segments). These could be wholesale transmission carriers, not licensed or permitted to retail telecom services to end-users, but selling long haul transmission capacity to licensed national or regional operators. They would therefore not compete directly against existing incumbents. Currently some licensing regimes prohibit cooperation between operators within a region, stifling such potential initiatives for regional connectivity. The issuance of such ‘regional carrier’ licenses could be discussed, and eventually implemented, by appropriate regional bodies.

Beyond regulatory constraints: Effective partnerships for developing backbone infrastructure

As reviewed above, efforts to date to accelerate progress in national and regional African broadband networks have been hampered by restrictive policy and regulatory environments. Additionally, there is also a lack of awareness of appropriate models for financing communications infrastructure. The ownership structure of regional backbone projects is pivotal to whether or not they allow open and competitive or closed and monopolistic access. Four types of ownership models are reviewed in Table One: i) consortium (like Sat-3/WASC and SAFE), ii) a private model (like FLAG), iii) a co-build or iv) a hybrid.

The experience of SAT-3/WASC suggests that a consortium can lead to a closed system in which gatekeeper PTOs control supply and direct access to the cable and therefore are able to dictate their own prices of that access. In order for non-members to obtain access on the same terms as incumbents in a liberalized international segment, national regulators must be able to impose and enforce strong equal access requirements, or non-members who meet certain minimal criteria must be given the option to become de-jure or de-facto members of the consortium. Unless one of these options is put in place, new entrants, mobile operators and ISPs will be locked out of the opportunity to participate directly in the cable system.

In general, the hybrid model based on open access holds the greatest potential for maximizing social, economic and commercial benefits as they have built-in incentives to

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**Figure 3: Ownership Structure of Submarine Cable Systems**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Examples</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consortium</td>
<td>Built by a consortium operating through a management committee.</td>
<td>Sat-3/WASC; SAFE; TAT-14</td>
<td>Owners get capacity at cost; financial stability.</td>
<td>Conflict between large and small owners; owners pay fixed operations &amp; maintenance charges regardless of actual capacity used. Access to cable by non-consortium members can be limited and/or expensive. Some owners may have an incentive to limit access.</td>
</tr>
<tr>
<td>Private</td>
<td>Built, owned and managed by a single company. In some cases the company sets up national subsidiaries that own the national portion of the cable while portions of cable that are in international waters can be owned by another subsidiary. These companies usually operate as a carrier’s carrier. Company sells or leases (on an IRU or other basis) capacity on dark or lit cables to third parties.</td>
<td>FLAG, Tyco, Transatlantic, Hibernia, Atlantic, Global Crossing</td>
<td>Rapid deployment, simpler management, owner has incentive to maximize use of cable. Greater flexibility in terms of pricing, terms and conditions.</td>
<td>Responsibility for entire construction and maintenance costs is borne by one company. Financial risks are not spread and are borne by a single company. Monopoly pricing of cable services may result.</td>
</tr>
<tr>
<td>Co-build</td>
<td>Built by two or more carrier’s carriers: owners manage and market capacity individually.</td>
<td>Yellow/AC2, FLAG/REACH, North Asia Loop</td>
<td>Financial risk is spread; owners get capacity at cost.</td>
<td>Owners compete against each other; may introduce too much capacity into the market.</td>
</tr>
<tr>
<td>Hybrid</td>
<td>Built by one or more carriers but operated and managed by a separate private company.</td>
<td>C2C Cable Network, Australia-Japan cable</td>
<td>Financial risk is spread; simpler management than traditional consortia.</td>
<td>Owners are charged capacity above cost.</td>
</tr>
</tbody>
</table>
foster greater use of backbones and increase the number of eligible operators who have ownership rights to cables. Under this ownership structure, the developer hosts, manages and sells dark or lit fiber or bandwidth to other carriers and service providers, typically on an impartial basis, often using what is called the open access or “carrier’s carrier” model, which is the unimpeded ability of service providers to use or interconnect with a physical network. This developer thus maximizes the volume of usage via open access.

Preliminary studies on the proposed East African cable (EASSy) show that the increased volumes generated in an open access regional system would compensate operators for lower prices charged while still ensuring overall commercial viability of the regional backbone. In this model, participation by incumbents (and/or other investors) in the operating company does not confer ownership of capacity, which can be sold direct to any eligible operators as and when they are licensed.

In some instances, governments also contribute to the financing of infrastructure to ensure project viability and help create an ownership model fostering competitive delivery of services. Further work is needed to study best practices, understand the obstacles and solutions to successful backbone deployment and explore business models for successful public-private partnerships. Nonetheless, Andhra Pradesh (India) suggests one potential model where the state government took a small equity stake in a backbone project in addition to guaranteeing significant capacity purchase (Box 2). Another model, used in support of local telecommunications and Internet access schemes in a number of countries including Uganda, involves awarding a subsidy to a private provider or consortium which offers to build and operate capacity at a given price for the lowest subsidy amount – the so-called output-based subsidy approach.

**The Role of Development Partners and the World Bank**

The New Partnership for African Development (NEPAD) Secretariat and several governments have requested that the World Bank Group play a pivotal role in regional backbone infrastructure initiatives by examining the policy, legal and regulatory barriers in the SSA region and by helping facilitate consensus-building activities between SSA governments and regional organizations on prioritizing and rationalizing competing initiatives. In East and Southern Africa, the World Bank Group has been assisting NEPAD with assessments of the market for cross-border connectivity and appropriate strategies for advancing a program of regional harmonization. The World Bank Group, together with other development partners, has sponsored a number of technical studies to assess the viability of open access models and evaluate various options for structuring the deployment of regional connectivity. The World Bank is also supporting regional harmonization of telecommunications policy and regulation in Western and Central Africa. In addition the World Bank Group, with other partners, is exploring various options to contribute to the financing of cross-border infrastructure and national backbones for coastal and landlocked countries.

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**Box 2: Government as Financier – Lessons from Andhra Pradesh, India**

The public and the private sector can cooperate to optimize the deployment of backbone infrastructure. For example, in the state of Andhra Pradesh in India, the public sector acted as rule maker, market maker and financier to build a backbone network. As a rule maker, it set issued a tender for the development of a broadband network meeting public access objective, including end tariffs for customers. As a market maker, it aggregated demand for broadband so that the predominantly private consortium that won the tender was guaranteed revenues, including for carrying an extended range of government-to-citizen e-services. As a financier, the State of Andhra Pradesh provided an equity investment to the winning bidder worth approximately 6% of total investment costs (estimated at approximately $90 million). The consortium selected to develop and operate the backbone network has provided the remaining equity and includes private operators (a fiber optic manufacturer, a telecom operator, an equipment supplier, a cable television provider and an ISP), other private equity investors as well as the government railway entity. The network is expected to connect 22,000 villages including 40,000 government offices by December 2006.
Conclusion

Governments and regulators have different instruments to catalyze the rollout of regional infrastructure projects while ensuring maximum development impact through the competitive provision of services to consumers. The ownership model of an infrastructure project can itself be a significant determinant of the extent to which new infrastructure can lead to lower prices. Especially where the ownership model does not itself favor competitive provision, regulatory and policy interventions are needed at both the national and regional levels to ensure competitive prices for telecommunications services across the region. While the private sector has the credible managerial and operational capacity to provide services for a broadband system and financing of broadband networks there remains, then, a significant role that governments can play as regulators, consumers and even minority financiers of regional projects.

Footnotes

1 This note draws on the content of reports prepared for GICT by Paul Hamilton, Telegeography, Helen Ng and Mike Jensen. The authors worked under the direction of Pierre Guislain, and would like to thank Laurent Besançon, Boutheina Guermazi, Robert Stephens, Jerome Bezzina and Charles Kenny for helpful comments and suggestions.

2 The term backbone, as it is used in this note, refers to the use of communications infrastructure to connect major switching centers, as opposed to last mile connectivity.

3 In response to these gaps, several regional backbone infrastructure initiatives are currently under discussion across the region notably the East Africa Submarine Cable System (EASSy), COMTEL, COM-7 and SADC’s Regional Information Infrastructure (SRII), etc. The cost of each project ranges from $60 million to over $300 million.

4 Source: WDI Central, 2003

5 In consortium club closed deals return on investment is guaranteed mostly through the exclusivity period, via the ability to control supply and determine prices.

6 A similar case exists in Ghana, where SAT-3/WASC access prices are currently determined exclusively by Ghana Telecom and remain outside the scope of the national regulatory agency.

7 Prices represent E-1 half circuit monthly lease prices excluding installation fees. Source: World Bank Analysis based on TRAI and Telegeography research, September 2005

8 After construction of the initial international backbone facilities de facto competition may require, in addition to licensing, a model of cable ownership that allows for rights to new entrants. With the introduction of international competition, more international gateway license holders will be eligible for direct access to the cable, but the cable ownership structure will have to be such that these new members can join. This issue is discussed in Section Five.

9 In this context backhaul refers to transporting voice or data traffic to a point where it can connect to the submarine cable network.

10 Publication of pricing as well as terms and conditions of interconnection between operators by the regulator can be one factor behind transparency and enhancing competitive pressures, especially on routes were one or more parties have significant market power.

11 Conversely, it would be in the commercial interest of a carriers’ carrier operating in the wholesale business to lease as much capacity as possible and there would be no preferential access towards retail arms.

12 Furthermore, as users (e.g. ISPs) switch from satellite to fiber, with increased usage of the cable and growing utilization of its capacity, operators can partner to negotiate bulk discounts on capacity, thus securing more accessible prices.

13 Using satellite to backhaul traffic from the landlocked operator’s international earth station to the submarine landing point is an option, but the latency issues associated with satellite and the additional charges would negate the benefits of direct fibre access.

14 In Europe, operators in landlocked Austria or Switzerland must transit traffic through neighbors to send traffic overseas. In this case the markets are open and competitive, landlocked operators have choice over which intermediary carriers to use, and may also be permitted to build, operate and even sell capacity in neighboring countries.

15 For example, during the war between Ethiopia and Eritrea, all international links were severed between the two countries and Ethiopia installed a high capacity link to Sudan.

16 The Malian operator, Sotelma, has been unable to agree with Senegalese operator Sonatel on access to Sat-3/WASC.

17 Five maritime African countries have not signed the UNCLOS: Congo, Eritrea, Liberia, Libya and Morocco. Of the landlocked African countries, Burundi, Lesotho, Malawi, Rwanda, and Swaziland are not signatories to UNCLOS.

18 These operators have obtained international VSAT data gateway, ISP and other licenses in various countries.

19 As this category of license is only wholesale, it is less commercially attractive for entirely new entrants given upfront capital expenditures required, but considerably more attractive for alternative operators (e.g. electricity, rail, pipeline and other alternative infrastructure operators) which may already have physical infrastructure in place.