Internet traffic between African countries, (and often within the same country) is still mainly exchanged in Europe and North America. Combined with limited or expensive cross-border terrestrial connections between many neighbouring countries in the region, this substantially reduces performance, consumes valuable international bandwidth, creating a barrier to growth, innovation and limiting operational efficiency.

The objective of this unit is to is to provide an overview of how this issue can be addressed - the interconnection landscape, global best practices and African realities on the ground.

In particular it will aim to:

Highlight the role of the stakeholders in advancing local and regional peering and the bigger picture of regional interconnection which is 80% regional and 20% international traffic by 2020

The course sessions are divided into four groups:

1. Infrastructure overview;
2. Policy and Regulatory Overview
3. Interconnection Challenges
4. Way Forward

Overview

- Background
- Internet Infrastructure Overview
- Policy and Regulation Overview
- Interconnection Challenges
- Way Forward

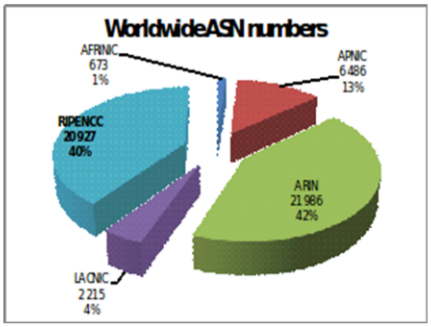
Background

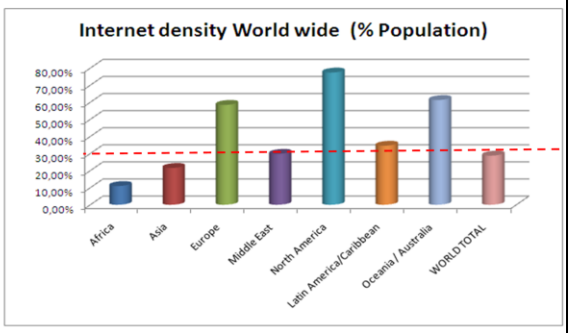
- Independent analysis has shown that Africa pays over US$600 Million to developed countries every year for inter-African traffic exchange that is carried outside the continent.
- The African Internet Exchange System (AXIS) project will address this challenge by facilitating optimization of Internet traffic to support intra-continental traffic flows in Africa.
- To accomplish this goal requires participation of all stakeholders in order to build the right environment for interconnection
- This presentation will provide a high level overview of the ongoing initiatives in Policy, Regulatory and private sectors efforts towards an optimally interconnected Africa

INTERNET INFRASTRUCTURE OVERVIEW

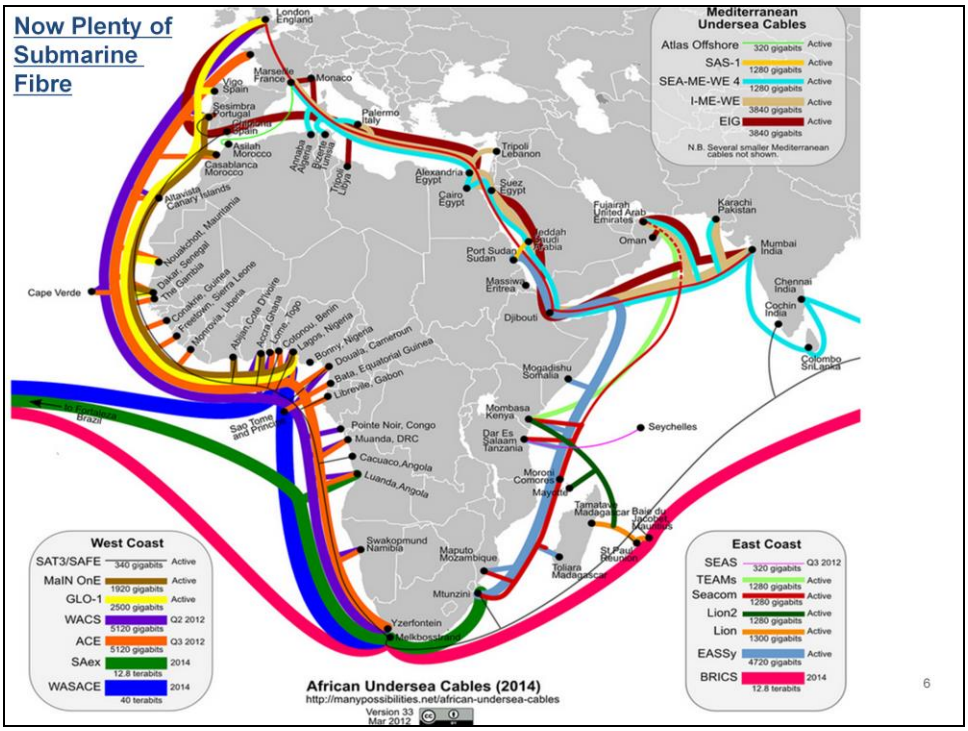
African Internet Status

- In 2011, Africa only had about 6% of the world's Internet users (vs 15% of the world's population).
- Overall, Africa is only one at a third (13%) of the world average (36%) in terms of Internet penetration rates
- In terms of the basic building blocks for Internet interconnection – AS Numbers – Africa is even further behind.





Big variations between countries & regions
COMESA: Egypt - 50% of the region's users
ECOWAS: Nigeria - 90% of the region's users
SADC: South Africa - 45% of the region's users

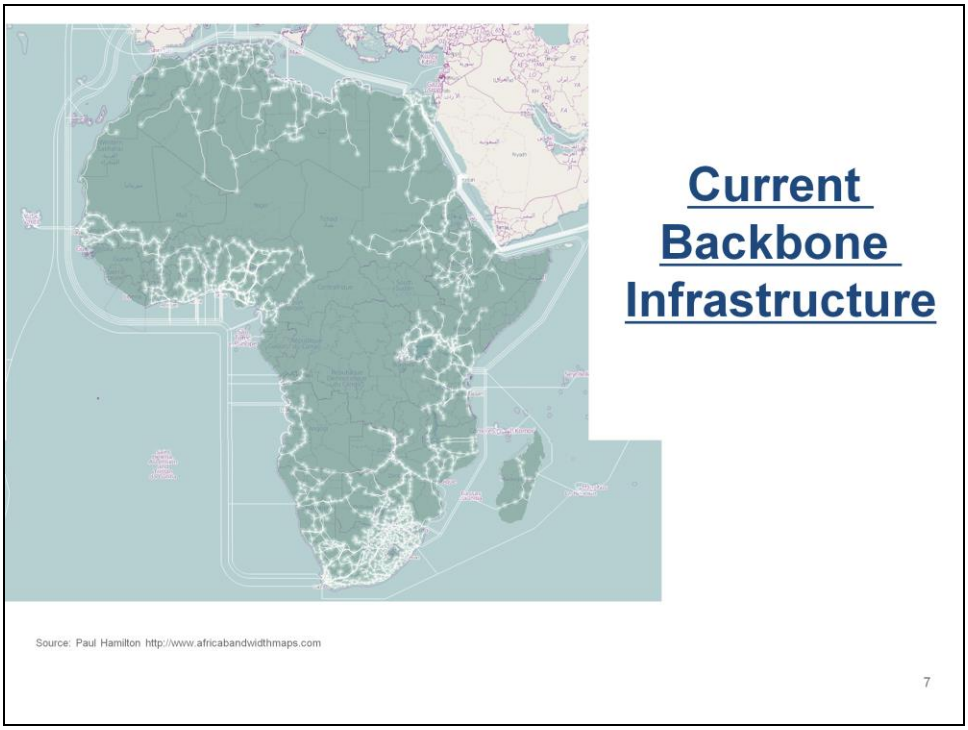


As can be seen from the map, with the WACS and ACE submarine cables now becoming operational this year, there will be at least 60 submarine cable landing stations in the region and all of Africa's coastal countries will have access to at least one submarine cable, and most will have direct access to two.

This is already driving down international capacity costs and providing much increased capacity.

In the more advanced countries with extensive national infrastructure this is now beginning to create the economies of scale that drive the need for international and national interconnection.

For countries at earlier stages of development and limited national infrastructure, they key issue now is bringing this low cost international capacity inland – creating national backbones for the populations at large and ensuring competitive regional routes for the landlocked countries.



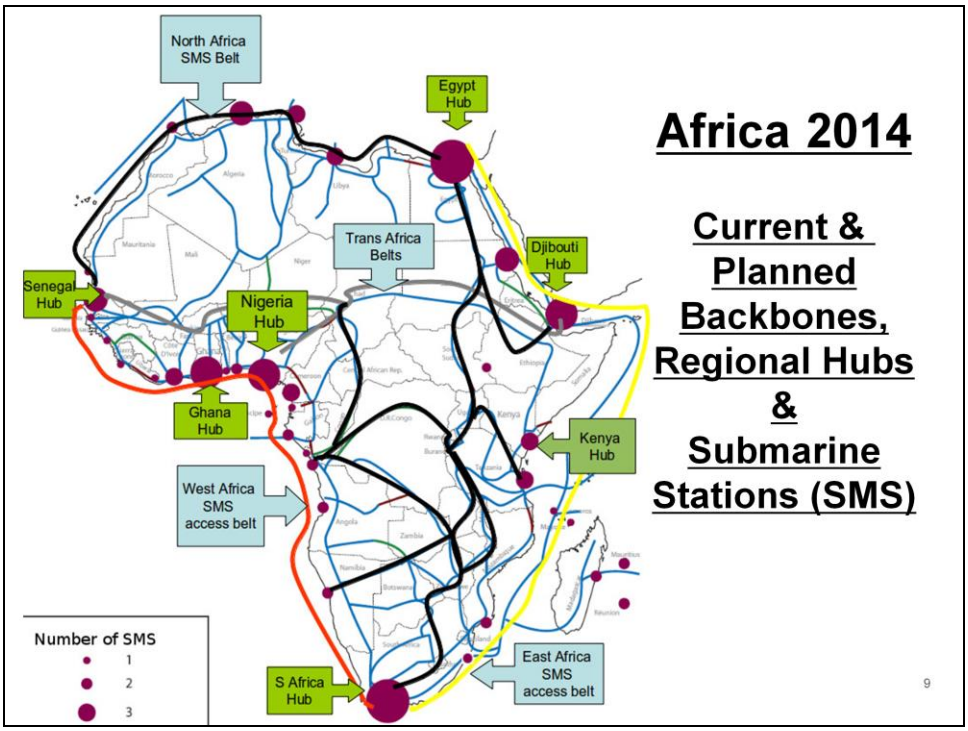
To follow on from the last slide this map shows where high capacity backbone infrastructure is currently present in Africa = mainly concentrated along the coastal countries, with more density in east Africa, southern Africa, north Africa and the southern part of west Africa. Central Africa and the Sahel are the main gaps, which isolate the other main areas of connectivity around the continent.

Ongoing Regional Infrastructure Projects

- **PIDA** - The African Union (AU) has developed the Programme for Infrastructure Development in Africa (PIDA). The ICT component aims to ensure that all African countries are connected to at least two different international links, support for improved policy and regulatory environments and IXPs.
- **ECOWAN** - ECOWAS regional backbone infrastructure and e-Governance platform. ECOWAS project to develop about 8000km of terrestrial fiber, and WIMAX last mile links to government offices.
- **WARCIP** – West Africa Regional Communications Infrastructure Program. 9 candidates: Burkina Faso, Sierra Leone, Liberia, Guinea, Guinea Bissau, Mali, Gambia, Niger, and Togo. Project supports set up carrier neutral landing stations and virtual landing points in landlocked countries
- **SADC RIDMP** – Regional Infrastructure Development Master Plan, being implemented by Southern African countries, including support for IXPs and cross border links were needed.
- **ECCAS** – The REC Implementing the cross border fiber master plan in central Africa.
- **CAB** – Central African Backbone – Fiber links development being supported by the World Bank in Cameroun, Chad, Central African Republic, and Sao Tome Principe.
- **RCIP** - Regional Communications Infrastructure Program open to 25 countries in East and Southern Africa supported by the IFC and World Bank COMESA, SADC and EAC ICT programs working toward coordination as the Tripartite Alliance

Aside from the national government and private national or regional initiatives there are also a number of regional development assistance projects with soft funding.. The largest of these are shown here.

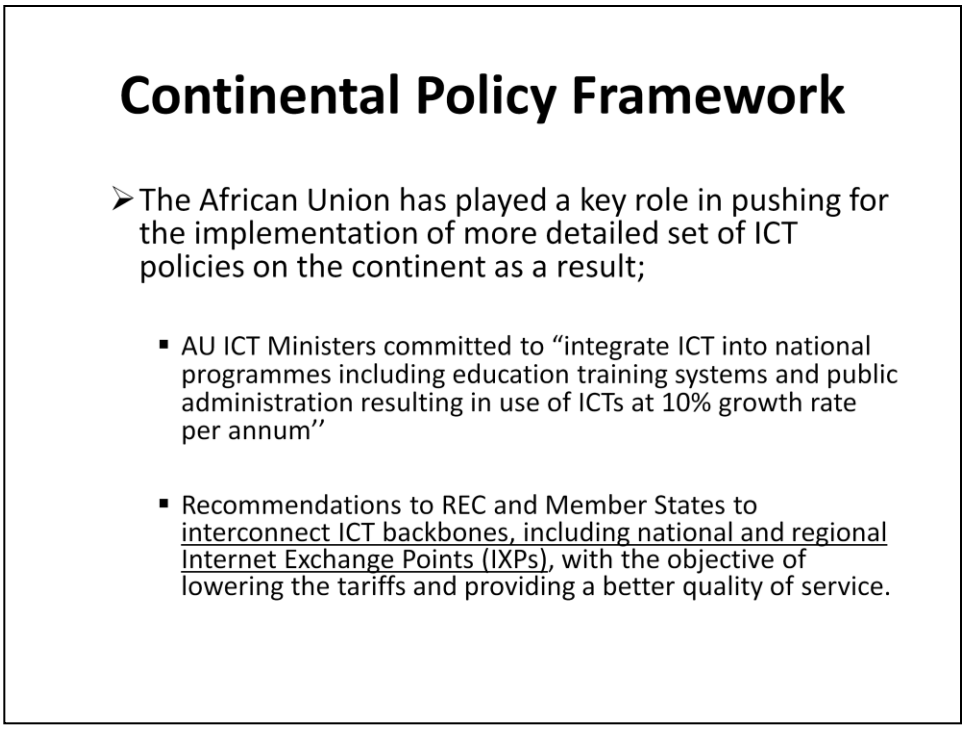
The implementation of PIDA is being led by country governments and supported by the NEPAD Planning and Co-ordinating Agency (NPCA). Implementation is to be monitored by the Regional economic communities (RECs), e.g SADC, ECOWAS, COMESA etc, which have a key responsibility in the PIDA framework to assure the harmonization and implementation of policy and regulatory measures in their Member States.



Once new infrastructure deployed to fill the gaps, ideally over the next couple of years, the picture on the continent should look like this 'merged' fibre network map showing a number of different regional fibre routes that should be in place by 2014. These will create access to redundant rings for each country to ensure reliable access to at least two physically different international fibre routes onto different fibre cables. As has already been observed with the ongoing fibre cuts on the continent, these are relatively frequent and can result in interruptions of service for some weeks.

Aside from ensuring there is no dependency on any one particular link for connection to the Internet, multiple routes also allow the customers to negotiate better rates and higher levels of service from competing providers. As will be noted further below, competition among providers is most easily facilitated at the 'market' provided by an IXP, where customers can switch providers in seconds simply by changing a configuration setting on their router at the IXP. With the terrestrial fibre links between countries now in place, there is the possibility of accessing the submarine cables in neighboring or even more distant countries if access to the local landing station is not competitively priced. The economic sustainability of using a foreign landing station depends on the national backbones to the neighboring countries being affordable, and is of particular importance for the private operators in countries surrounding the hubs where the most submarine landing stations are located and the most competitive prices are likely to be – Morocco, Senegal, Ghana, Nigeria, South Africa, Kenya, Djibouti and Egypt. There is also now the possibility of using one of the new regional operators, which provide competitively priced access to the submarine cables from any of their Points of Presence (POPs) in the region.

POLICY & REGULATORY OVERVIEW



At the continental level Africa has developed a clear set of policy obectives under the African Information Society Initiative (AISI) of 1995. Since then this has now been re-inforced with renewed efforts by the African Union to implement a more detailed set of ICT policies on the continent.

… (Cont'd)

- The African Union's strategic objectives to "Develop Integration Infrastructure" are;
  1. Establish integrated telecommunications infrastructure systems that are reliable, efficient and affordable
  2. Carry out all the necessary actions for the harmonization of policies, strategies and regulation in telecommunications.

- The Revised AU/NEPAD African Action Plan (2010-2015) aims to;
  - Establish harmonized policy, legal and regulatory frameworks
  - Accelerate development of integrated infrastructure
  - Promote e-applications and services
  - Reduce or eliminate transit of intra and inter-regional traffic

The major constraints to affordable and reliable ICT (particularly broadband) services identified by the initial PIDA study were:

a) the lack of backbone infrastructure / fibre connections between countries

b) the lack of appropriate policy and regulatory environments

The AU's goals for ICT policy and regulatory environment are now being implemented through the PIDA programme's soft projects related to improving the enabling environment.

Development of ICT policy and regulatory environment has already been taking place under the programme for Harmonisation of ICT Policies in Sub Saharan Africa (HIPSSA), supported by the ITU and the European Commission

Regional Policy Framework

- The Regional Economic Communities (RECs) – e.g ECOWAS, UMEOA, ECCAS, SADC, COMESA, EAC – are directly responsible for interconnection policy development and policy harmonisation at the regional level

- The RECs are expected to be the driving force for the implementation in collaboration with ECA, ITU, ATU and ADB other partners.

Regional Regulatory Framework

- The RECs in Africa have promoted the establishment or regional associations of national regulators
- The regional regulatory associations play a key role in policy development & harmonisation
- For instance ECOWAS' WATRA has a stronger role in that WATRA decisions and directives are also binding on all national regulators

Not all these have direct impact on interconnection, but may have an indirect effect by building economies of scale making interconnection more viable.

National Policy

- Ministries of ICT are ultimately responsible for interconnection policy adoption and implementation.

- Related policies and regulations can be divided into 5 main areas:
  1. The priority of ICTs in the overall development strategy
  2. ICT sector development through liberalisation and open access, etc
  3. National or regional infrastructure development projects
  4. Policies to promote ICT access and uptake such as import taxes, electrical power, training, etc.
  5. Efforts to harmonize policies with other member countries

National Regulation

- Interconnection regulations are implemented by the National Regulatory Authorities (NRAs) and only a few countries in Africa lack independently established NRAs

- Main areas of focus for national regulation are;
  - Competition & Liberalisation – number of market entrants/licenses
  - Radio Spectrum management and digital migration
  - Rights of Way fee regulation

INTERCONNECTION CHALLENGES

Policy & Regulatory Challenges

- Many regional policies and regulations have not had sufficient time to be transposed to national level
- Lack of political will at national level (decisions made at most RECs are not nationally binding)
- Limited awareness of the importance of policy change
- Resistance to change by vested interests (dominant operators)
- Conflict of interest of governments deriving major revenue source from the incumbent state owned operator
- Limited availability of up-to-date data on progress

Demand for capacity continues to explode, but fortunately fibre technologies continue to evolve and are keeping up with this. A single fibre pair can now transmit more than 1 terrabit of data, ample for short to medium term requirements.

Now that international capacity is available, the challenge is to ensure the investments are made to carry capacity nationally, and then with even more investment required, down to the local level. The ratio of investment needed is probably in the order of 1:10:100 with the international component costing far less than what is required inside the country.

Infrastructure Challenges

- Limited and unreliable access to submarine cable landing stations for landlocked countries
- Limited and expensive national terrestrial backhaul infrastructure and services
- Expensive local loop services
- Lack of operational Internet exchange Points (IXPs)
- Under-developed last mile for broadband service delivery

As mentioned earlier, the lack of competitively priced national capacity is one of the key constraints to increased interconnection and use of IXPs. High local bandwidth costs make it expensive to establish links from the Internet provider to the IXP, and this makes it hard to economically sustain the link when combined with the extra administrative burden for the relatively small amounts of local traffic exchanged, especially if the policy environment restricts services such as VoIP.

The effect of competition on national backbone pricing can also be observed when comparing prices for capacity between, for example South Africa (which has at least 4 competing backbone providers) and Namibia, where Telecom Namibia is the only provider. In South Africa the cost of capacity is currently at least 45% less than the same capacity on the Namibian side

Indirect Challenges

- Low levels of economic integration & demand for x-border traffic
- Limited development of local content and applications/limited demand caused by low levels of basic and computer literacy
- Low economies of scale and low levels of economic development in many countries
- Poor transport & energy infrastructure - high cost of ICT O&M (Operation and Maintenance)
- Delays and high costs for obtaining rights of way and permits for laying new fibre

WAY FORWARD

Public-Private Partnerships (PPPs)

- Investment required is to the ratio of;
  - 1:10:100 International:national:local
- The private sector will invest in interconnection infrastructure if the market is open/transparent
- Cross-border links can provide part of national backbones
  - Utilize public sector funds for national fibre backbones to remote areas & ducts on roads
- PPPs needed for synergising fibre access to public utilities – rail lines, oil pipelines, energy grids, etc
- PPPs can also be used support establishment and development of IXPs
- Joint National ICT data gathering/dissemination to measure progress and adapt strategies

Stakeholder Inputs

- The Africa Peering and Interconnection Forum (AfPIF) is held annually
- Provides a platform for stakeholders to discuss regional interconnection
- There has been 3 AfPIF events held in East Africa, West Africa and Southern Africa regions.
- The conclusions from AfPIF can be summarized in two categories;
  1. Policy Proposals
  2. Operator Strategies

AfPIF Policy Proposals

- Accelerate adoption of policies which increase competition to reduce costs, increase coverage and availability of relevant services such as;
  - Local loop unbundling and other facilities sharing, including access to dark fibre, towers, civil works of other operators and utilities
  - Allowances for self provisioning of infrastructure by Internet Service Providers (ISPs)
  - Reductions in the cost of operator and spectrum licence
  - Reduction of taxes on communication equipment and service
  - License-free regimes for content-providers and IXPs

In helping to ensure better interconnection, the main strategies to improve interconnection that were identified during AfPIF comprised the need to:

Accelerate moves to adopt policies which increase competition in order to drive down prices and improve the level of investment in local, national and regional infrastructure. These include: a) Local loop unbundling and other facilities leasing, b) Provision of access to dark fibre, c) Imposition of limitations on the Significant Market Power of incumbent operators, d) Allowances for self provisioning of infrastructure by ISPs e) Reductions in the cost of operator and spectrum licences, which increase the barriers to entry and ultimately the costs to the end-user, f) Elimination of special revenue raising taxes which increase end-user costs and therefor reduce demand, such as sales taxes on communication and import taxes on communication equipment, g) Eliminating content-provider and IXP licenses where these are in place or being considered., h) Mandatory sharing of essential facilities, telecommunication infrastructure, civil-works and access to alternative infrastructure provided by transport and energy operators, especially for land-locked countries.

Address the outstanding issues which limit the ability of infrastructure developers and Internet service providers to cross borders - in particular the need for harmonisation of regulations between neighbouring countries and addressing the issue of lack of clarity in permitting from governments in digging across no-mans land.

Promote the need for all local carriers, ISPs and content providers to connect to IXPs and carrier neutral data centres so that the development of local content is encouraged and the aggregation of traffic allows Africa to become a region which the international providers wish to connect to, rather than Africa continuing to be the 'client' continent of today where providers need to pay all of the costs of connecting to global backbones.

Recognise the important role of the public sector in financing infrastructure development in remote and less population dense areas, which may not be initially profitable for private operators, and/or to ensure that there is redundant infrastructure in these areas to improve the reliability of service provision.

Work with governments as united groups of operators and other stakeholders to resolve these constraints to improved interconnectivity. This could be achieved through:

a) Increasing the support for information sharing and multi-stakeholder consultation to help take into account the concerns of all affected parties in policy development and to build relationships and trust between the various players.

b) Increasing the level of support for relationship building, btechnical training and skills development to ensure that Internet providers can more effectively use existing IXPs and to quickly implement IXPs in the countries where these are not yet present.

c) Promote awareness at the top levels of leadership within government, in regional governmental agencies, and in the international development assistance community, of the importance of these issues and implementing the necessary policy changes. National regulators also need special focus and specific awareness raising events may be needed for them. These events could be attached to existing fora such as the regional regulatory association meetings.

AfPIF Policy Proposals

- Ensure rapid permitting for cross-border infrastructure deployments.
- Promote interconnection between all local carriers, ISPs and content providers
- Use public funds for infrastructure in remote and low population areas
- Establish multi-stakeholder/muilti-sectoral information sharing and coordinating.

AfPIF Operator Strategies

- AFPIF also identified strategies for network operators to grow their networks by improving their peering & transit relationships. The most important of these were:
  - Holding forums and training workshops to build human capacity.
  - Ensuring there is a designated staff position - 'Peering co-ordinator' to ensure that network traffic is properly managed
  - Aggregating as much traffic as possible at Internet exchange points to build critical mass, leverage economies of scale and attract content providers.

AfPIF Operator Strategies

- As networks move to IP platforms for both voice and data, operators can also use IXPs for voice interconnection between networks.
- Simple policies and fees for IXPs maximise potential membership.
- Local content development can be stimulated by lower-cost local hosting and cost based charges for local vs. international traffic.
- Special peering relationships and transit agreements with academic networks are needed to help encourage human capacity development

PROPOSED GOAL:

80% REGIONAL AND 20% INTERNATIONAL INTERNET TRAFFIC BY 2020

Acknowledgement and Attribution

This presentation contains content and information originally developed and maintained by the following organisation(s)/individual(s) and provided for the African Union AXIS Project

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