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**UNIVERSAL DATAFLOW AND TELECOMMUNICATIONS  
CORE PROGRAMME**

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**7**

**AFRICAN TELECOMMUNICATION  
INFRASTRUCTURES  
FOR INFORMATION ACCESS**

**Muriuki Mureithi**  
Summit Strategies



July, 1997

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# AFRICAN TELECOMMUNICATION INFRASTRUCTURES FOR INFORMATION ACCESS

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## CONTEXT

Telecommunication networks provide the pipelines through which information flows. The success of such flow is dependent upon many factors. Chief among them is availability, quality, affordability, and capacity of the telephone network. In Eastern and Southern Africa, all of these factors are major problems. In particular, telephone services are either not available, or where available, the quality of the service is poor. The absence of basic telephone service, while denying the citizens basic voice and fax services, also restricts the availability of value added services such as the Internet. The Internet and basic e-mail services are only as good as the available telephone network.

It is clear that future economies will be dependent upon information, and that this information will be exchanged through telephone networks. In the next millennium, the Africa region will be even more marginalised if the information infrastructure is not in place. In globalized economies, consumption of such information will increasingly rely on telecommunication networks.

It has been demonstrated that the telecommunication business is profitable and, with new technologies, all parts of a country can obtain adequate telephone services. It would benefit our governments to create an enabling climate for the private sector to build sustainable networks. It is the belief of the author that sustainable information infrastructures can be constructed based on market forces. African governments have a duty to ensure that the

disadvantaged and rural communities are not excluded because of restrictive telecommunication policies.

This paper reviews the telecommunication networks in the Africa region and proposes a way forward to the new millennium. For the purposes of this paper, the Africa region is defined as 25 countries bounded by Sudan in the North, the Democratic Republic of Congo in the west, South Africa in the South, and the Island nations in the East. All these countries are considered to be eligible to be members of the Common Market of Eastern and Southern Africa.

## THE AFRICAN REGION

The Africa region has great disparity in size (Sudan is the largest country in the region); demographics (Ethiopia has a population estimated at over 55 Million); wealth of the nations; and, most importantly, the exploitation of such wealth as expressed through Gross Domestic Product per capita (ranging from a high of over US\$3000 in South Africa and Mauritius to US\$80 in neighbouring Mozambique). Sources of wealth in the region also exhibit a high degree of disparity. Mauritius, for example, has more reliance on human resources (to the tune of 85%), compared with the high regional reliance on natural capital, averaging 52%.

There is also a great disparity in basic telecommunication services in the region. They vary according to levels of sophistication, availability, quality, and national spread. In addition to basic telephony, the region exhibits a wide range of other enhanced services with the capability of offering data

services. These services are described in the next few pages.

## **TELECOMMUNICATIONS INFRASTRUCTURE**

### **Basic public switched telephone networks (PSTN)**

There is great disparity to be seen in the PSTN (commonly referred to as "fixed telephony") in volume, availability, and quality. South Africa has the largest telephone network (accounting for 72% of 5.3M lines in the region) and certainly the best teledensity (ratio of telephones per 100 people) for countries with large populations in 1995. The island nations of Mauritius and Seychelles have a far higher teledensity, followed by Namibia, Botswana and Swaziland. In all the other countries, teledensity is below two. The fact that close to 80% of the population live in the rural areas where only 20% of the phones are installed illustrates just how seriously the telecommunication services are lacking for the rural majority of people in the region. Despite a concerted effort to wire rural Kenya, for example, teledensity is still only 0.16, compared to 4 in the urban centres. In South Africa, teledensity in rural areas is 1.4. Many other countries are worse off. By comparison, in Europe, North America, and Japan the teledensity is over 50 and this does not take into account the various enhanced services and broadband networks available to the citizens of these regions.

Unfortunately, teledensity in the Africa region has not improved over the last decade. Twenty countries barely managed to provide telephones to cover population increase and maintain a constant teledensity over the period 1991-1995. In fact, teledensity for Angola and Madagascar fell, meaning decreased telephone availability for its citizens. Along with this trend, the number of applicants waiting for telephones (called "waiters") increased from 692,000 in 1991 to 955,000 by 1995. Ethiopia accounted for 19% of all waiters in the region. Fortunately, it was not all gloom in the region. Botswana, Mauritius and Seychelles grew their networks rapidly to almost double the teledensity. Figure 1 summarizes teledensity in the Africa region by country.

In 1985, in Arusha (Tanzania), world governments met and committed themselves to providing basic telephone services within walking distance to all the inhabitants of the African region by the early part of

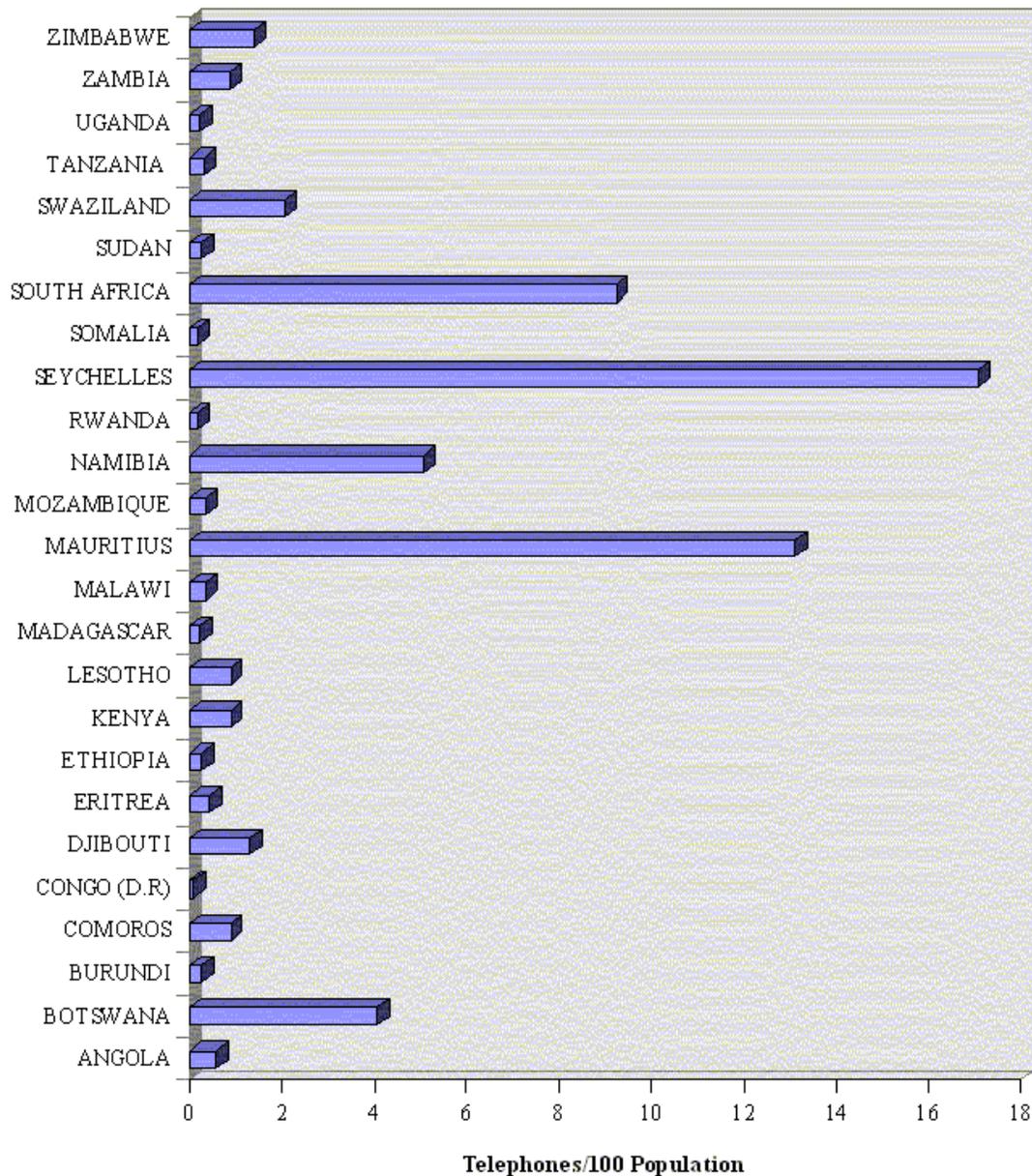
the next century. The next two years will put us into the next millennium with a largely unfulfilled dream. Last year, in Addis Ababa (Ethiopia), African governments made commitments to involve themselves in the African Information Society Initiative (AISII). The Initiative's goal is to realise a sustainable information society by the year 2010 where "every man and woman, school child, village, government office, business can access information and knowledge resources through computers and telecommunications."

AISII does not quantify the volume of telephones needed, but Kenya, for example, which is looking to increase teledensity from the present 1 to 5 by the year 2015, will be investing US\$5.4 billion--an amount equal to three years of its government annual budget. In the process, rural teledensity will rise to one from the present 0.16, while urban teledensity will rise from four to 20. Considering the daunting problems facing the country, the government has admitted that it does not, and will not, provide such investment capital. Yet it is imperative that the telecommunications network be expanded. Other sources of such capital must be sought and quickly. All African countries are facing similar problems.

There are, however, some bright lights within the region that provides role models. Botswana, Mauritius and Seychelles have seen a steady rise in teledensity and, consequently, the spread of services to its citizens. It is worth noting that the sterling performance of telecommunication network expansion is more prominent in countries that maintained and encouraged business principles in the management of telecommunication companies after establishing a clear mandate. Such is the case with star performers Mauritius and Seychelles. Others in this category include Swaziland, Botswana, and South Africa.

The success of the telecommunications expansion in these countries provides a practical lesson for other countries. Yet, the similar positions endorsed by all countries from the Africa region in 1990 (Africa Regional Telecommunication Conference - Harare), 1994 (World Telecommunication Development Conference--Buenos Aires) and 1996 (African Green Paper - Telecommunication Policies for Africa - Abidjan) have hardly been implemented. Sector reform is a prerequisite.

## 1995 Teledensity



Uganda intends to use competition to drive development. Within the year, the Uganda government will award a licence for a second network operator and sell off a majority shareholding of the successor to the national operator in a bid to raise teledensity tenfold to 2 by the year 2002. Other countries are taking different routes: strategic investing (South Africa, Mauritius), Initial Public Offering (Kenya, Zambia and Mozambique), or a combination of both licences for rural areas (Tanzania).

## REGIONAL INFRASTRUCTURES

### Terrestrial

In the late 70s and early 80s, a continental, analogue, microwave network--called PANAFTEL-- began to connect all countries in Africa in hopes of reducing the need to transit intra-continental telephone calls outside the continent--a situation now estimated to

cost African countries over US\$900 Million annually. Despite the admirable vision, a number of countries have not connected their portion. For the countries that have fulfilled national commitments, the network is in use. Yet, old technology, inadequate capacity, and coordination among countries are a major challenge.

New, technologically advanced, regional networks are now under serious consideration along with various levels of development for the Southern Africa Development Community (SADC), Common Market for Eastern and Southern Africa (COMESA), East African Cooperation (EAC), and Inter-governmental Authority on Development. These future networks will be digital and offer higher capacity.

### **Satellite**

RASCOM, a continent wide satellite project, intends to consolidate African intra-continental traffic from the present six satellites to one satellite, to reduce hopping outside Africa and, as noted earlier, reduce transit fees. The rationalised traffic would form a basis for the acquisition of a dedicated satellite for Africa. Presently, most of the traffic is carried by Intelsat satellites, although the Panamsat system is playing an increasing role as liberalisation gathers momentum. With large parts of the region far from getting simple telephony, Very Small Aperture Terminals (VSAT) will play an increasing role in providing telephony and data services to the remotest parts of the region. The Inmarsat system offers data connectivity from remote sites to head offices.

In May 5th of this year, the first of the big Low Earth Orbiting (LEOs) satellite systems, Iridium, began preparations for the launch of its 66 satellites. When commercial service commences late next year, all parts of the earth, even the remotest parts of the Africa region, will have the potential of obtaining telephone service. Data services requiring broadband infrastructure will have to wait until 2002 for Teledesic to provide "Internet in the sky".

### **Submarine cable**

A submarine cable, known as Africa ONE, is planned to link all coastal countries and inland countries, providing immense capacity. Financing and support may delay the project. Already, some coastal countries in the region, including Tanzania, Somalia and Madagascar, have been omitted as cable landing points. South Africa is operating a high capacity cable, SAT 2, to Europe and is planning another, SAFE, to the Far East.

### **Mobile Cellular**

In the mid 80s, no cellular network existed in the region. This position slowly changed with introduction of cellular in South Africa (1986), Zaire (1988), and Mauritius (1989), which closed the decade as analogue systems. Presently, only six countries have no cellular networks. These countries have plans, however, to be operational within the next two years. The current trend is to license additional cellular networks, as is planned in Angola, Botswana, Kenya, South Africa, Uganda and Zimbabwe. The majority of networks constructed since 1994 are digital systems based on the GSM standard--forming a GSM zone that will lessen roaming across the region. Only Zambia has licenced a competing technology--Code Division Multiple Access (CDMA)--to a private operator, Telecel. Still, ZamTel, which is an analogue system, is planning to build a GSM system soon in Zambia. South Africa, with a million customers (accounting for 93% of all cellular connections), dwarfs the other countries. Figure 2 summarizes the state of cellular telephony in Africa.

With the relative ease of deploying cellular networks, countries in Asia (particularly Thailand), are seeing a faster growth of cellular customers than fixed line customers. Consequently, cellular telephony is increasingly seen as an alternative to fixed line telephony (particularly in rural areas where no telephones exist). New technology introduced in the region is bringing smaller, compact cellular systems to cater to hitherto 'unprofitable' rural areas. This is an opportunity to deliver connectivity much faster and fulfill the dream of telephone service within walking distance by the early part of the next century.

Another growing trend is that all of the alternative networks, apart from Mauritius, are licensed to the private sector, bringing new marketing skills and unleashing competition. Such market forces have forced down prices (e.g., in South Africa, Tanzania and Mauritius), improved quality of service, and forced companies to venture into the rural areas in search of customers.

Country	Operator	Technology Standard
ANGOLA	Angola Telecom	AMPS
BOTSWANA	-	-
BURUNDI	Telecel Burundi	AMPS
COMOROS	-	-
CONGO (DR)	Comcel	TACS
CONGO (DR)	Telecel	AMPS
DJIBOUTI	-	-
ERITREA	-	-
ETHIOPIA	-	-
KENYA	KPTC	ETACS
KENYA	KPTC	GSM
LESOTHO	Vodacom Lesotho	GSM
MADAGASCAR	Telecel Madascar	AMPS
MALAWI	Telecom Networks	GSM
MAURITIUS		GSM
MAURITIUS	Emtel	ETACS
MOZAMBIQUE	TMN	GSM
NAMIBIA	Mobile Telecom	GSM
RWANDA		
SEYCHELLES	Cable & Wireless (Seychelles)	GSM
SOMALIA	-	-
SOUTH AFRICA	MTN	GSM
SOUTH AFRICA	Vodacom	GSM
SUDAN	Sudatel	GSM
SWAZILAND	DVI	GSM
TANZANIA	MIC Tanzania Ltd.	TACS
TANZANIA	Tritel	GSM
UGANDA	Clovergem Celtel	GSM
ZAMBIA	Telecel	CDMA
ZAMBIA	ZamTel	AMPS
ZIMBABWE	PTC	GSM

**Figure 2: Cellular telephony in Africa**

Source: Summit Strategies database

The initial fear of marginalisation through of lack of telephony appears to be mitigated by the growth of market-driven network expansion. For example, a monopoly cellular service in South Africa gained only 15,000 customers in eight years. In three subsequent years, market forces have brought cellular service to 1,000,000 South Africans. These are the forces that need to be unleashed in other countries. Kenya has a pent-up demand that cannot be satisfied by the present telco and once a private operator comes on stream next year, similar explosive growth is expected, though not in same volumes.

## Data networks

The region has invested poorly in dedicated data networks. Figure 3 summarizes the status of data networks in Africa. While basic data transmission can be accomplished through leased lines on the public switched telephone network, advanced services need dedicated high-speed networks. Outside South Africa, which has a wide range of services for data transmission and database access, only six countries (Malawi soon to be added) have invested in dedicated data networks--all with X.25 packet switched networks, accessed at various speeds ranging from 2, 400 to 6 400 bps. Kenya has built a 64/128 Kbps infrastructure distributed to key towns and linked to major international destinations. Regarding ISDN, few countries have it as a priority or have the resources to build such a network. Only two countries have Integrated Services Digital Network (ISDN).

It should be noted that with the use of ISDN, both voice and data can be in the same network. Yet, while telecommunication regulators in Africa are liberal on data transmission, voice is highly regulated.

	Public Switched Data		Broadband	
	Frame Relay	Packet Switched X25	Digital Lines	Switched
Bostwana	-	Botspac	-	-
Djibouti	-	Minitel	-	-
Kenya	-	Kenpac	Kenstream	-
Mauritius	-	Mauridata	-	ISDN
Mozambique	-	Teledata LDA	-	-
Namibia	-	Telepac	Telenet	-
South Africa	yes	Saponet	Diginet	ISDN
Tanzania	-	-	Datel SITA Wilken	-
Zimbabwe	-	Zimnet	-	-

**Figure 3: Summary of the status of data networks in Africa.**

Source: Summit Strategies database

South Africa has pioneered low-speed data over the GSM and, with the GSM zone slowly building in the region and as the service spreads to the rural areas, another option for data transfer is soon to be established.

Unlike cellular, where the private sector has played a major role in its development, data networks have yet to catch the eye of the private sector, with exception

of Tanzania where three companies are providing data infrastructures. With shrinking opportunities for investment and increasing policy reform, the private sector will soon be eyeing this area and similar fast growth will be seen as in cellular.

### **Datacasting**

Datacasting provides fast and efficient wireless broadcasting of large amount of data to an unlimited number of users in the designated area of coverage. The data are distributed over available transmission infrastructures, which could be radio, television or satellite. With television, 'virtual blank lines' are used for data transmission, while in radio, the whole bandwidth is used for data transmission outside broadcasting hours. The choice of media depends on the coverage area and volume of data to be transmitted. Within a city, data may be transmitted over FM radio or television; for wide area coverage, satellite is most appropriate. Data are received by computers, equipped with appropriate antenna for radio, TV, or satellite. Advances in datacasting are providing the capability for distinct addressability of data.

Datacasting is a cost-effective technology that can be used to facilitate the fast delivery of information to rural areas (particularly where a telephone infrastructure is unavailable). Therefore, it would be most appropriate for the Africa region where telephony is largely insufficient. Orbicom is using this technology for commercial applications in South Africa. With the mushrooming broadcasting companies arising from liberalisation, datacasting can be an extra source of revenue if aggressively marketed.

The greatest drawback to datacasting is the lack of interactivity due to its one-way distribution mode of information delivery. This limitation can be overcome by requesting specific information using other means of communication, which may include fax, telephone or mail.

### **Internet**

Four years ago, the Internet was virtually unknown in Africa, but today all capitals in the region, apart from Comoros and Somalia (which, incidentally, do not have plans for deployment in the near future) have Internet services. Telecommunication companies of South Africa, Zimbabwe and Ethiopia are the major providers of Internet services in their respective countries. In the remaining countries, private companies run Internet services independently. In

Kenya, for example, full Internet service was introduced towards the end of 1995 and, within the last two years, 7 private Internet services providers have become operational. Despite lack of support by the Kenyan government, private Internet service providers (ISPs) are now connecting key towns outside the capital, Nairobi. This trend is also evident in Uganda and Tanzania. GSM networks will extend the Internet into the bush as network coverage expands. Once again, market forces are driving the price down, enhancing quality and encouraging the spread of services throughout the country.

The Internet provides the easiest way to achieve the dreams of the AISI, but critical challenges facing the region in its quest to get on the information superhighway must be fully addressed.

## **CHALLENGES AND OPPORTUNITIES TO THE INFOBAHN**

### **Democratising information**

In our developing political institutions, the political leadership has withheld information from the citizenry and, therefore, maintains a strong hold over an ignorant society. This can no longer be sustained. A fresh perspective on leadership and governance, based on participation by informed citizenry, is imperative for our economies to develop. Consequently, government should actively support the development of telecommunications and broadcasting as major conduits for such information access and delivery.

### **Creation of awareness of information resources**

**World's wealth for selected regions**

<b>Region</b>	<b>Human Resources</b>	<b>Produced Assets</b>	<b>Natural Capital</b>
East/Southern Africa	33	14	52
Sub-Saharan Africa	31	17	52
East Asia	75	13	12
Industrial countries	67	16	17
World	64	16	20

*Source: World Bank, 1995*

With low incomes, countries in the region face daunting problems in developing the economy, providing good governance, and promoting social development. The availability of timely and relevant information is crucial to empower all stakeholders to play a meaningful role. Such information is available from major repositories, including those libraries that

are members of the International Federation of Library Associations and Institutions (IFLA). Most citizenry are not aware of these repositories, however, and few governments have proactive policies to disseminate information widely to their citizens. The World Bank estimates that, in 1995, the wealth of Eastern and Southern Africa is largely dependent on the exchange of natural capital for produced assets to the tune of 55%. In industrialized and East Asian countries, by contrast, natural capital accounts for only 17% of economic assets. Continual depletion of natural capital in Africa may explain falling incomes. Clearly, the need for increased use of our human resources for wealth creation cannot be over emphasised. That resource, properly harnessed by industrial countries, requires more information input.

Increased awareness of the importance of information will create the requisite demand and justify the massive investment needed to build information highways from the major centres to the villages. This is also an opportunity to create a local content industry for local, as well as international, consumption.

#### **Policy reform**

As the need for information increases, the need to ensure that fair dissemination is achieved cannot be over-emphasised. The main handicaps to equitable access to information include the disparities surrounding urban/rural locales, income, gender, disadvantaged and disabled, availability and affordability of telephone and/or terminal devices, modems, and computers. This is the role of government who must foster policies designed to alleviate these disparities. There should be specific goals set out within such policies that provide for connectivity as well as access to information sources within a country.

As the largest corporate entity in a country, governments must be a model user to affect change. Recent actions in Zimbabwe, denying licences to

private entrepreneurs to provide cellular services, does not inspire the private sector to participate in the construction of the information infrastructures. Figure 4 summarizes the countries that are undergoing telecommunications regulatory reform.

#### **CONCLUSION: Increased investment**

Billions of dollars are required to build an high-quality networks and to extend those networks into rural areas. Such funding is simply not available in the majority of African governments. The least they can do, then, is to provide a level playing field for private sector investment. What is needed is to build sustainable networks is regulatory liberalisation and competition, supported by pro-active regulators that take their cue more from market forces than the rulebook. African governments have much to gain from regulatory and competitive liberalization. Given that each telephone yields an annual revenue of US\$1000 - US\$1700, and considering that there are 955,000 waiters in the Africa region, there is an untapped US\$1Billion in potential annual revenues. Tapping this flow of capital will help African countries bootstrap themselves into the Twenty-first century and to benefit, with the rest of the world, from the emerging global information economy.

#### **REFERENCES**

World Telecommunication Development Report 1996/97 – ITU Exploiting Information Technology to Accelerate Socio-economic development in Africa: An action plan.- ECA

**Figure 4: African countries undergoing telecommunications sector reform.**

*(based on Resolution No. 1 African Telecommunication Development Conference -Harare 1990)*

	<p><i>Telecommunication Dept - Somalia</i>  <i>Swaziland Posts and Telecommunication</i>  <i>Office National des Telecommunications -Burundi 1</i>  <i>Office National des Posts et des Telecommunication du Zaire</i>  <i>Posts and Telecommunication Corporation of Zimbabwe</i>  <i>Societe National des Postes and Telecommunication - Comoros</i>  <i>Office des Postes et Telecommunication - Djibouti 2</i></p>
	<p>Uganda Telecom Ltd.                  Second National Operator  <b>Uganda Communications Commission</b>                  Telkom Kenya Ltd.  <b>Communications Commission of Kenya</b>                  Botswana Telecommunication Corporation</p>
	<p><b>Ethiopia Telecommunication Authority</b>                  Ethiopia Telecommunication Corporation                  Telkom SA  <b>South Africa Telecommunication Regulatory Authority</b></p>
	<p><i>Malawi Posts and telecommunications Corporation</i></p>
	<p>Tanzania Telecommunications Ltd.  <b>Tanzania Communication Commission</b>                  ZamTel Ltd.  <b>Zambia Telecommunications Authority</b>                  Telecommunication Service of Eritrea  <b>Eritrea Posts and telecommunication Authority</b>                  Angola Telecom  <b>Direccao Nacional de Correios e telecomunicacoes DNCT</b></p>
	<p>Telecomunicacoes de Mocambique (TDM) 1981  <b>Instituto Nacional des Commncaoes de Mocambique (INCM)</b>                  Sudan Telecommunication Company Ltd. (SudaTel)  <b>National Telecommunication Council</b>                  Sudan Public Telecommunication Corporation (STPC)                  RwandaTel  <b>Direction des Communication - Ministere des transports et des communications</b></p>
	<p>Telecom Namibia  <b>Namibia Communications Commission</b></p>
	<p>Telkom SA Ltd.  <b>Dept. of Posts and Telecommunications</b></p>
	<p>Cable and Wireless (Seychelles) Ltd  <b>Ministry of Finance and Telecommunication</b>                  Mauritius Telecom  <b>Mauritius Telecom Authority</b>  <i>Lesotho Telecommunication Ltd</i></p>

1 Frequency management not handled by ONATEL

2 A 1994 study recommended separation of postal and telecommunication operations

## BIOGRAPHY

Muriuki Mureithi has been in the telecommunication industry for the last 15 years, for 12 years as senior manager in International Relations of Kenya Posts and Telecommunication Corporation and later as Deputy Managing Director of Telecommunication Foundation of Africa. Presently Mr. Mureithi is the Director of Summit Strategies based in Nairobi - Kenya.

The mission of Summit Strategies is to provide support to the investor community in the telecommunication markets in Eastern and Southern Africa through 'strategic information for decision support in telecommunication business'. Over time, Summit Strategies has built the largest and most up-to-date database of telecommunication infrastructures in the region based around:

- Public Switched Telephone Network,
- Mobile cellular,
- Radio paging,
- Public mobile radio
- Internet.

Data collection is based on primary research in respective markets through a network of associates. Consumption of this data is largely by industrial organisations and investors through subscription and/or consultancy intending to invest in the region. Summit Strategies also publishes a monthly newsletter - Summit View - focusing on telecommunication developments in the region for its clients.