INTERNET AND GLOBAL INFORMATION INFRASTRUCTURE IN AFRICA

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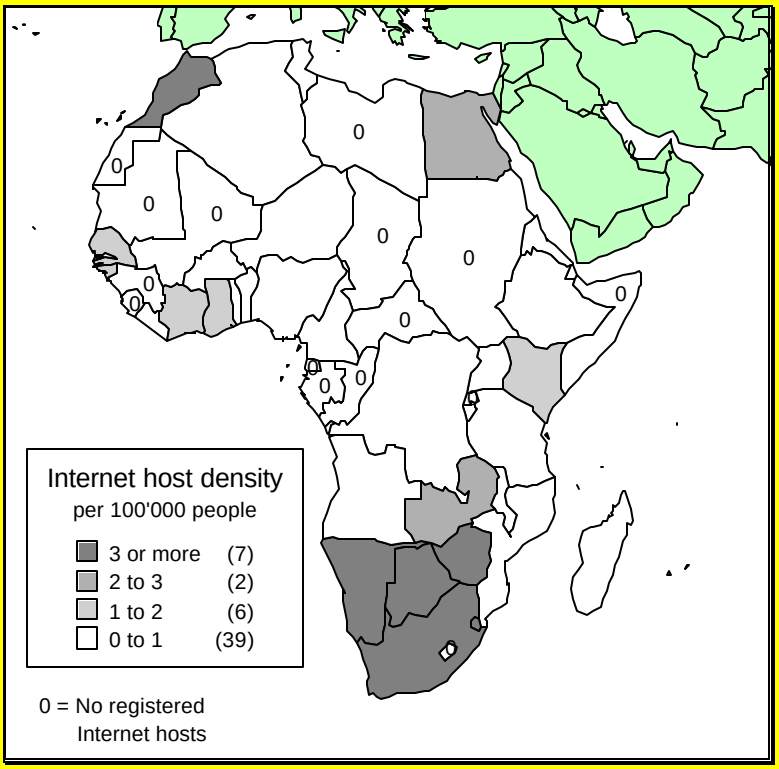
1. Internet status in Africa

The Internet has seen a phenomenal growth in the past few years, but the spread of Internet has not been even in all the parts of the world. The African continent (excluding South Africa) still has fewer Internet hosts than the Slovak Republic, Estonia or Iceland.

Nevertheless, Internet is today one of the most dynamic telecommunication markets in Africa. While the Internet was first introduced to Africa thanks to a range of initiatives by national, international and non-governmental organizations, now Internet is clearly becoming a commercial undertaking with increasing private investment. Most of the countries (47 of the 54 nations) have developed some form of Internet access in capital cities - either through a local dialup, store and forward e-mail with a gateway to the Internet, or through a full leased-line service. Some 44 countries and territories have achieved full Internet public access services at least in capital cities. It is expected that many of the remaining countries will soon move to offer Internet access.[1] But even though many countries are offering services, the scope of coverage is still very limited.

[*] The views expressed in this paper are those of the authors, and do not necessarily reflect the opinions of the ITU membership. The text draws upon on ITU report entitled "Challenges to the Network: Telecoms and the Internet" published in September 1997. It is available for purchase for the ITU website at http://www.itu.int/ti/publications/inet_97/inet_97.htm.

Figure 1: Internet hosts per 100'000 people in Africa, January 1998



Note: The figures in parenthesis refer to the number of countries within each range. Countries marked with zeros have no hosts registered in that country domain name, though they may have indirect access from servers elsewhere.

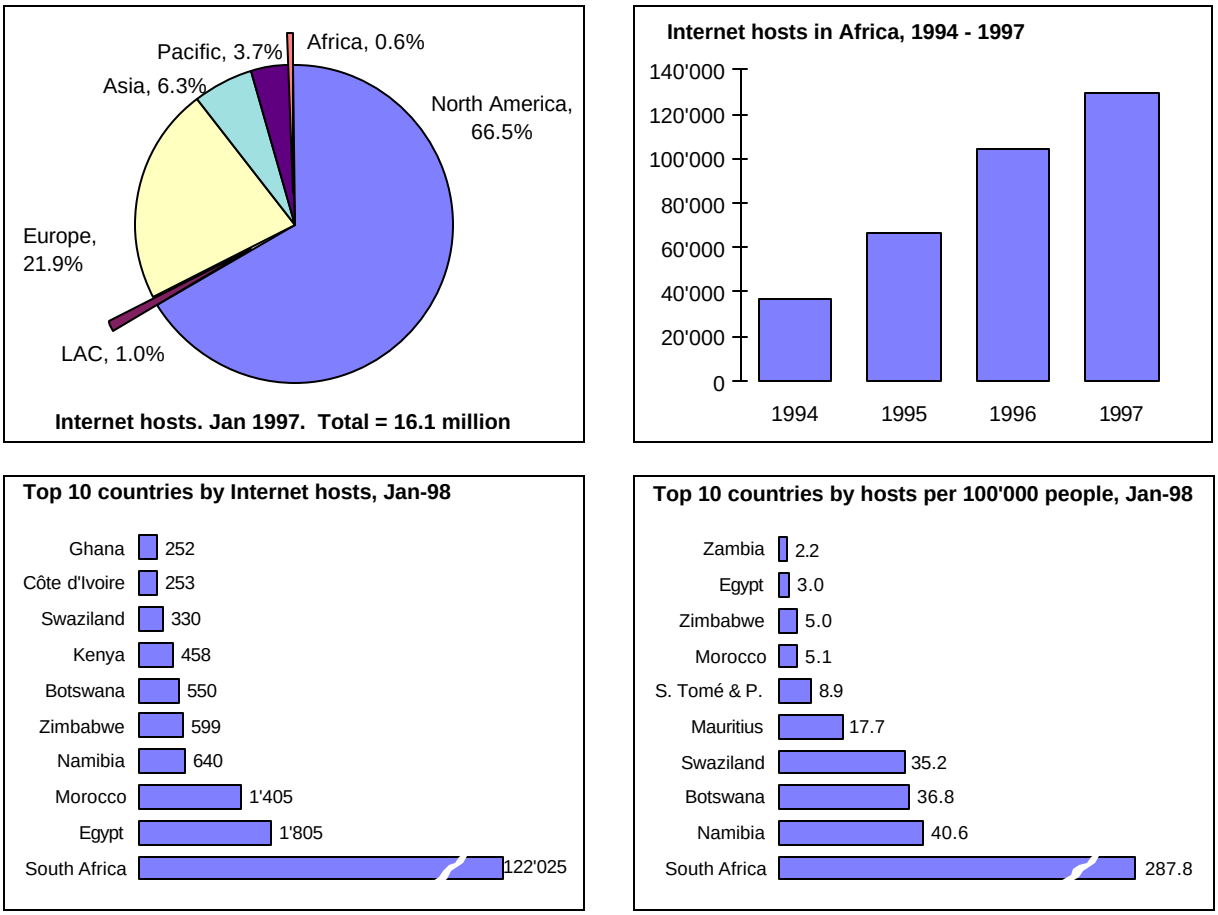
Source: ITU World Telecommunication Indicators Database, Network Wizards (www.nw.com), the Réseaux IP Européens (RIPE) (www.ripe.net).

One key indicator of Internet development is the number of Internet host computers. At the start of 1998 there were about 129'300 host computers in Africa, of which 122'000 were in South Africa, 3'300 in North Africa and 4'000 in Sub-Saharan Africa. The density of Internet hosts was some 287.8 hosts per 100'000 people in South Africa, 2.5 in North Africa and 0.7 in Sub-Saharan Africa.

Another key indicator of the Internet development is the number of competing Internet Service Providers (ISPs). More than half of the African countries allow competition and have more than one ISP. Of the 300 or so ISPs in Africa, around 200 offer full Internet services. The highest concentration of ISPs is in South Africa with over 70 service providers.[1]

A reliable number of Internet users is difficult to determine. Latest figures estimate about 82'000 users on the continent of Africa, plus 700'000 to one million in South Africa. This is equivalent to around six users for each host computer. The number of users averages at about one user per 5'000 people (excluding South Africa with a rate of one to 65 people), compared to a global figure of one Internet user per 45 people; or one per 6 people in Europe or North America.[2]

Figure 2: Internet host computer distribution regionally; host growth and top Internet countries in Africa



Note: SSA stands for Sub-Saharan Africa

Source: ITU World Telecommunication Indicators Database, Network Wizards (www.nw.com), the Réseaux IP Européens (RIPE) (www.ripe.net).

Box 1: How big is the Internet?

One of the most commonly-asked questions, and also one of the most difficult to answer, is "how big is the Internet?" The simplest answer is to use the definition of the Internet as a "network of computer networks". With that definition, as of January 1997, there were some 828'000 Internet "domains" or networks, a number which has increased from just 21'000 in January 1993. But an Internet domain is an ambiguous term that can cover anything from a single computer to a proprietary service provider with many millions of users. Indeed, a domain might only be a "virtual" domain which merely points to another address.

Thus it is preferable to count the number of "Internet hosts" that populate the Internet. An Internet host is normally a single computer. The great majority of hosts are individual Internet users. However, it is possible for a single Internet host to serve multiple users in the same way that a company's private branch exchange (PBX) serves many telephone users.

The estimation of the number of Internet hosts is a process which is reasonably automated.[3] The Network Wizards survey, which is carried out twice each year, uses a computer programme to attempt to contact and verify all known hosts accessible via the public network. It produces an assessment of the *minimum* size of the public Internet on a specific date. In January 1998, Network Wizards ran a new Internet Domain Survey which queries the domain system for the name assigned to every possible IP address, starting with a list of all network numbers that have been delegated within the IN-ADDR.ARPA domain. While it is likely to be more reliable, the new survey shares many of the same potential problems as the old one. For example, the figures might be distorted if the link to a particular country, say a leased line, is out of service at the time of the survey. Equally, there are problems regarding the geographical location of a host. The survey reports the number of hosts by country based on the presence of the two letter ISO country code in the host name. However this may not correspond to the actual physical location of the host. For instance, a host name ending in ".eg", the country code for the Egypt, might physically be located in the United States. Equally, a generic Top Level Domain (gTLD), such as .com or .edu, might be located almost anywhere in the world, although the majority are in the United States. In this paper, we assume that all second-level hosts are located in the geographical territory specified and that all gTLDs are located in the United States. A further limitation of the survey is that it does not locate non-registered host computers which may be frequent in Africa. This limitation is also detectable in Table 1. About 10 African countries have one or more ISPs but no registered hosts.

But to really address the question of "how big is the Internet?" one would ideally like to go to a further level of detail to calculate the number of users. This is usually estimated by assuming an average number of users for each Internet host. This is likely to be lower in more mature markets, such as Finland, which has one Internet host for every four PCs, but higher in developing countries, such as China which has one Internet host for every thousand PCs. Using numbers derived from Internet Service Providers, it is possible to estimate a range of between 2.5 and 4 Internet users for every host (though somewhat higher in newly emerging economies, such as those of Africa). This would imply a worldwide user base, at the start of 1998, of between 75 and 120 million users.

Source: Adapted from "Challenges to the Network: Telecommunications and the Internet", ITU, September 1997.

Table 1: Internet connectivity and telephone penetration, 1998

Country	*Number of Internet hosts Jan-98*	*Number of ISPs Jan-98*	*Internet hosts per 100'000 people*	*Estimated Internet users 1997*	*Telephone lines (k) 1996*	*Teledensity (main lines per 100 people)*	*Hosts per 1'000 telephone lines*
Angola	4	5	0.04	1'500	52'440	0.47	0.08
Benin	13	6	0.24	1'750	32'679	0.59	0.40
Botswana	550	6	36.76	*1'375*	72'189	4.83	7.62
Burkina Faso	45	3	0.42	700	34'055	0.32	1.32
Burundi	0	1	0.00	75	15'181	0.25	0.00
Cameroon	2	4	0.01	2'000	70'558	0.52	0.03
Cape Verde	0	n.a.	0.00	n.a.	25'232	6.37	0.00
Central Af. Rep.	0	1	0.00	200	8'950	0.27	0.00
Chad	0	*3*	0.00	50	6'004	0.09	0.00
Comoros	0	0	0.00	0	4'980	0.79	0.00
Congo	0	0	0.00	0	*21'410*	*0.81*	0.00
Côte d'Ivoire	253	3	1.71	1'000	129'808	0.88	1.95
DR Congo	4	1	0.01	100	*36'000*	*0.08*	0.11
Djibouti	0	1	0.00	400	8'151	1.32	0.00
Equatorial Guinea	0	1	0.00	200	3'668	0.89	0.00
Eritrea	0	4	0.00	300	18'919	0.51	0.00
Ethiopia	78	4	0.13	3'000	148'739	0.25	0.52
Gabon	n.a.	2	0.00	400	35'000	3.16	n.a.
Gambia	n.a.	4	0.00	150	21'319	1.87	n.a.
Ghana	252	9	1.41	4'500	77'886	0.44	3.24
Guinea	0	5	0.00	300	16'206	0.22	0.00
Guinea-Bissau	11	1	1.01	200	7'926	0.73	1.39
Kenya	458	16	1.44	5'000	261'406	0.82	1.75
Lesotho	0	1	0.00	100	*17'792*	*0.90*	0.00
Liberia	1	0	0.04	0	4'500	0.16	0.22
Madagascar	17	5	0.11	700	39'406	0.26	0.43
Malawi	0	3	0.00	400	35'471	0.35	0.00
Mali	0	5	0.00	400	21'294	0.19	0.00
Mauritania	0	2	0.00	100	10'204	0.43	0.00
Mauritius	201	6	17.72	1'000	183'861	16.21	1.09
Mayotte	n.a.	n.a.	0.00	n.a.	6'618	6.56	n.a.
Mozambique	69	6	0.39	3'500	61'175	0.34	1.13
Namibia	640	6	40.63	2'000	85'549	5.43	7.48
Niger	2	2	0.02	200	15'353	0.16	0.13
Nigeria	49	6	0.04	1'000	*405'073*	*0.36*	0.12
Réunion	1	n.a.	0.15	n.a.	225'851	34.01	0.00
Rwanda	0	1	0.00	100	15'000	0.28	0.00
S. Tomé & Principe	12	n.a.	8.89	n.a.	*2'503*	*1.97*	4.79
Senegal	117	9	1.36	2'500	95'070	1.11	1.23
Seychelles	1	n.a.	1.32	n.a.	14'864	19.56	0.07
Sierra Leone	0	1	0.00	50	17'189	0.40	0.00
Somalia	0	0	0.00	0	15'000	0.15	0.00
Sudan	0	1	0.00	300	99'000	0.36	0.00
Swaziland	330	3	35.18	900	20'509	2.19	16.09
Tanzania	25	14	0.08	2'500	92'760	0.30	0.27
Togo	37	2	0.88	300	24'050	0.57	1.54
Uganda	30	4	0.15	2'000	47'927	0.24	0.63
Zambia	181	3	2.19	2'000	77'935	0.94	2.32
Zimbabwe	599	12	5.03	10'000	174'985	1.47	3.42
SSA	**3'982**	**172**	**0.70**	**52'375**	**2'917'645**	**0.48**	**1.36**
South Africa	**122'025**	**75**	**287.84**	**800'000**	**4'258'639**	**10.05**	**28.65**
Algeria	49	3	0.17	500	1'278'142	4.38	0.04
Egypt	1'805	28	2.98	20'000	3'024'947	4.99	0.60
Libya	n.a.	0	0.00	n.a.	*318'000*	5.88	n.a.
Morocco	1'405	17	5.09	6'000	1'251'000	4.53	1.12
Tunisia	51	4	0.56	3'500	585'238	6.43	0.09
North	**3'310**	**52**	**2.51**	**30'000**	**6'457'327**	**4.90**	**0.51**
AFRICA	**129'317**	**299**	**17.39**	**882'375**	**13'633'611**	**1.74**	**9.49**

Note: Number of Internet hosts includes registered hosts only, thus a country may have ISPs or Internet users even though no hosts are registered.
Number of ISPs includes all ISPs: the ones offering full services and those providing email store and forward services.
SSA stands for Sub-Saharan Africa, n.a. for not available.
For telephone lines and teledensity, numbers in italics refer to 1995 data.

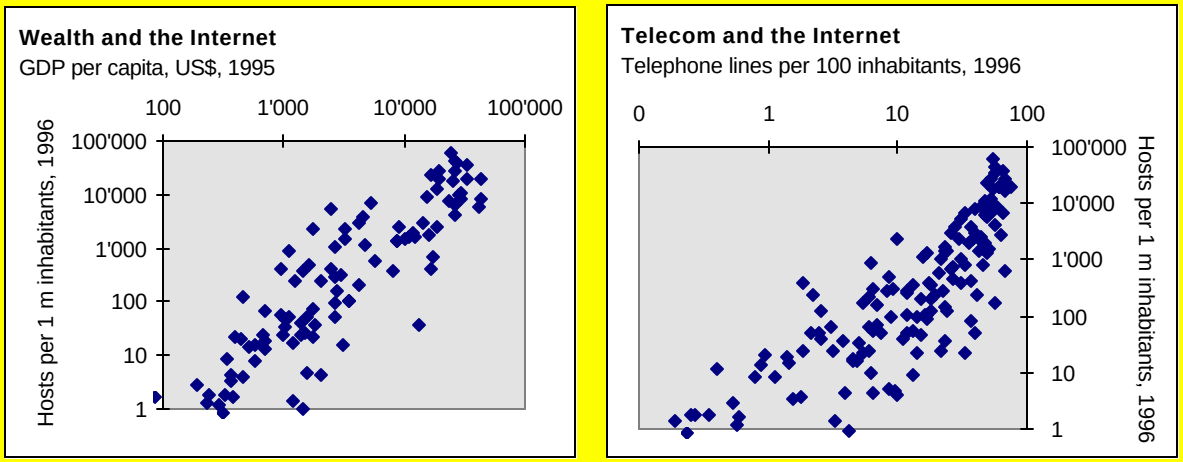
Source: Network Wizards (www.nw.com), the Réseaux IP Européens (RIPE) (www.ripe.net), ITU World Telecommunication Indicators Database, Mike Jensen, http://demiurge.wn.apc.org:80/africa/.

2. Differing stages of Internet development

As figures for Internet connectivity (in the previous section and in Table 1) show, the Internet has reached widely differing levels of development across the African continent.

Why does Internet development vary so much between countries? One answer is that Internet access, like so many other things, depends on wealth. As income is the main factor affecting telecommunication access, so it is impacting Internet access. A relationship is indeed observable between Internet hosts and the economic output of a country as measured by Gross Domestic Product (or Gross National Product). In general, the wealthier a country, the higher its level of Internet access.[4] However, the level of income in a country is not the only determinant of Internet development. If wealth were considered as the sole determinant, it could not explain why some countries have a much higher or lower levels of Internet access than their level of GDP would predict. It does not explain, for example, why Swaziland or Namibia have higher Internet host densities than for example Gabon which has higher GDP per capita. Other factors impacting Internet development include sector infrastructure and policies, Information and Communication Technologies (ICT) development, service pricing and social factors, such as age, language and education.

Figure 3: Mapping the info-communications gap
GDP per capita compared to Internet hosts and telephone lines compared to Internet hosts



Note: Scales are logarithmic. Each dot on the chart represents one economy.
Source: "Challenges to the Network: Telecommunications and the Internet", ITU, September 1997.

3. Info-communication infrastructure and technologies

3.1 Info-communication infrastructure

The Internet is not a brand new network but rather the coming together of existing public and private networks operating under a common protocol. For the most part, Internet services run over conventional telecommunication networks. Therefore, if a country has poor telecommunication facilities, it is quite likely that Internet penetration will also be limited. This means that the gap that one finds between South Africa, North Africa and Sub-Saharan Africa in terms of telecommunication service availability is also present in relation to Internet access.

The basic obstacle in the path of rapid Internet growth is thus the lack of telecommunication infrastructure. Although many countries have taken major steps to improve their infrastructure, great variation still remains between regions and countries. In Africa, over 30 countries still have less than one telephone line per 100 people (teledensity) compared to the average global penetration of 13 telephone lines per 100 inhabitants. For the whole of Africa teledensity was 1.74 main telephone lines per 100 people in 1996, while it was 10 in South Africa, 4.9 in North Africa and 0.48 in Sub-Saharan Africa.[5] Demand for telephone service in Africa is high,

and the waiting time for service averages 4.5 years. The period to attain high level of teledensity is still relatively long. Until a country has passed the threshold of 1 telephone line per 100 people, it is difficult to estimate how long a time is needed to reach higher levels.[6] In many African countries, telecommunication networks are being extended and modernized, but rural areas, where 70-80 per cent of the population still lives, are largely uncovered by telephone service.

On the brighter side, the lack of an extensive communication infrastructure might, in the long run, become an advantage for some African nations in the adoption of Internet services. The low level of existing network facilities implies that when new telecommunication infrastructure is installed, it will be digital right from the start. Given that Internet services rely heavily on the degree of network digitisation, developing nations that deploy infrastructure from scratch might be able to quickly reach the network conditions required for the provision of Internet services. For example, Botswana today has one of the world's most sophisticated national networks, and in countries such as Djibouti, Gambia, Mayotte, Mauritius and Rwanda, 100 per cent of the main lines are digital.

Access to international bandwidth is still a major limitation in Africa. Internet bandwidth is lacking because international leased lines are costly which has resulted in ISPs crowding too many users into limited bandwidth channels. The lack of peering[7] between ISPs also worsens the situation. There are several proposals to improve international connectivity, such as the Africa One and SAFE-2 cables, or the RASCOM satellite, but these remain projects for the future. However, the recently laid SEA-ME-WE fibre cable already provides high bandwidth connections to some African countries, such as Djibouti or Egypt.[1]

3.2 New technologies

Recent developments in wireless communication may provide possibilities for African countries to overcome wireline infrastructure constraints. A number of Internet Service Providers (ISPs) in African countries have started to experiment with wireless networks—mostly through very small aperture terminal (VSAT) satellite systems, and conventional HF radio systems—to deliver Internet services to both urban and rural areas. VSAT enables fairly high bandwidth (64K-8Mbps) and many provide lower costs than most PTO supplied international leased circuits. Regulatory barriers, however, have been limiting the use of this technology, except in a handful of countries, such as Ghana, Tanzania and Uganda.[1] In mid-1997, a pilot project was launched in Arua, a small town in Northwest Uganda, to provide Internet services through a HF radio system. The system, operated by Uganda Connect and the World Food Programme, is designed to serve the communication needs of neighbouring hospitals, agricultural projects, non-governmental organisations (NGOs) and mission stations. Wireless systems like the one in Uganda and others being deployed around the globe offer reasonably high bandwidth at relatively low prices.[8]

Box 2: The Leland Initiative

The Leland Initiative by the US Government seeks to extend full Internet connectivity to about twenty African countries in order to promote sustainable development. The three strategic objectives of the five-year US$15 million USAID project are (1) to create an enabling policy environment, (2) to create a sustainable supply of Internet services and (3) to enhance Internet use for sustainable development. This project promises to make a difference in getting Africa connected, though there are strings attached for those countries that take up the offers.[9]

Mozambique, for example, was the fourth country to be connected to the Internet under the Leland Initiative, and towards the end of 1997, five Internet service providers (ISPs) were connected. Affordable full Internet access is presently available only in the capital city Maputo, and in most cities and towns throughout the country it is possible to get e-mail service through long-distance calls to ISPs in Maputo.[10] USAID donated an inexpensive high-speed gateway to Telecomunicações de Moçambique (TDM) which is composed of a satellite dish, network equipment and a link to a server in the United States. TDM leases 64kbps lines to local, private Internet service providers (ISPs) at prices reflecting costs. Equipment and a portion of operating costs are funded by the Initiative for three years, which should allow prices to ISPs will be low enough to encourage a rapid expansion of use in Mozambique. The program has also offered assistance to ISPs in developing reasonable cost structures and business plans, where necessary.[11]
For more information, see the Leland Initiative website at: http://www.info.usaid.gov/leland/

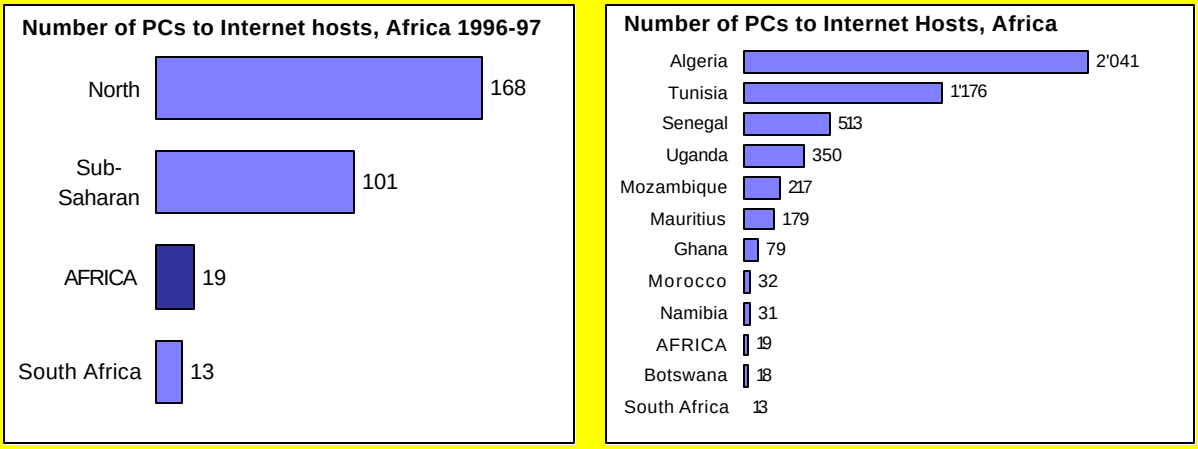
Other satellite-based communication systems, such as those being planned by Global Mobile Personal Communications by Satellite (GMPCS) consortia including Globalstar, I-CO, Iridium, SkyBridge or Teledesic; or new projects, such as Sky Station, based on stratospheric Helium-supported balloons, could substantially improve access for people living in the most remote areas.

These technological innovations, that potentially provide an important leverage to boost Internet development in Africa, are probably less important when placed in the wider technological context required to run Internet services. Here, the availability of personal computers (PCs), and the ability of the local population to use them effectively, is a factor that cannot be overlooked.

3.3 Availability of hardware and software

In most cases, access to the Internet is dependent on the availability of PCs. Indeed, there is typically a close correlation between PC penetration and Internet host computer penetration. Among developing countries, the correlation is also observable, albeit at a much lower level. In Sub-Saharan Africa, on average, there is one Internet host for every 100 PCs. In northern Africa there are as many as 160 PCs per Internet host computer (Figure 4).

Figure 4: Estimated spread of Personal Computers in relation to Internet hosts
By region, and for selected African countries, 1996/97



Note: The data on PC penetration relates to year-end 1996 while that for Internet is for year-end 1997.
Source: ITU World Telecommunication Indicators Database, Network Wizards (www.nw.com), the Réseaux IP Européens (RIPE) (www.ripe.net).

The lower level of correlation between PCs and Internet hosts in Africa is to be expected given the relatively high costs of purchasing and connecting a PC to a network in a developing country, which is high in relation to GDP per capita. If an Internet-capable computer in Africa is assumed to cost about the same as in developed countries, around US$1’500, then the cost of PCs would represent over 15 times the GDP per capita in countries as Ethiopia or Mozambique, or over 8 times the GDP per capita in Tanzania, Chad or Rwanda. Even in countries with slightly higher GDP such as Algeria, Egypt, or Morocco, the cost of a PC roughly equals the yearly per capita income. In reality, a basic PC actually costs up to 50 per cent more in Africa than in the United States, after government duties and taxes have been added.

The high price of hardware and software relative to income is a major inhibiting factor for wider use of computers and networks in Africa. Therefore, cost effective solutions are often welcome. For example, the free version of UNIX called Linux is the choice of operating system for many of African ISPs. Linux enables a low cost server which is also flexible and high performing. [1]

Considering the lower incomes of most African countries, it is unrealistic to expect widespread ownership of PCs. A more feasible approach is to disperse PCs with Internet access in public places such as schools, libraries and payphone centres (See Box 4). A number of African countries have recently liberalised their

payphone market which has greatly expanded the number of public telecommunication outlets. There is a trend for these centres to move beyond conventional services—i.e., telephone and fax—and add Internet access.

4. Sector structure and pricing

4.1 Sector structure policies

In at least a dozen African countries, Internet services are still provided under the monopoly control of the national carrier. PTOs have assumed a monopoly position especially in countries where the Public Telecommunication Operator (PTO) established the international Internet backbone, with some exceptions such as South Africa, Mozambique and Zambia. An increasing number of countries are allowing Internet Service Provider (ISP) competition and over ten countries have active markets. In the last two years, for example, over 100 new ISPs have been established in Sub-Saharan Africa. Apart from South Africa, that has over 70 ISPs, Egypt, Kenya, Morocco, Tanzania, and Zimbabwe have particularly active ISP markets. In Kenya, for example, full Internet service was introduced in 1995, and by the end of 1997 there were some 16 ISPs. Foreign Internet service providers are increasingly entering into Africa and are expected to gain market share from the local companies. In some countries, however, regulations are limiting the possibilities for these new entrants. Africa Online—partly owned by Prodigy, the world's third largest ISP—is a major player offering service in Cote d'Ivoire, Ghana, Kenya, Tanzania, Zimbabwe, and shortly in Mali and South Africa. Other multinational Internet providers include CompuServe, EUnet, UUnet and Global One. [1] Open entry for ISPs is not enough to ensure rapid Internet growth. An appropriate, "Internet-friendly" regulatory framework is also important to achieve effective entry, survival and growth of ISPs. High licence fees, for example, can limit the entry of ISPs.[12]

Table 2: Selected Major ISPs in Africa

Country	ISP	URL	Country	ISP	URL
Algeria	CERIST	www.cerist.dz	Mali	SOTELMA	www.sotelma.ml
Angola	EBONET	www.ebonet.net	Mauritanie	OPT	www.opt.mr
Angola	NetAngola	www.netangola.com	Morocco	MTDS	www.mtds.net.ma
Angola	Univ. Agostinho Neto	www.uan.ao	Mozambique	CIUEM	www.uem.mz
Benin	OPT	www.opt.bj	Namibia	UUNET	www.uunet.com.na
Benin	REFER/AUPELF/UREF	www.refer.org/benin_ct	Niger	STIN	www.intnet.ne
Botswana	Info Botswana	www.info.bw	Reunion	REnet Guetali	www.guetali.fr
Botswana	Mega	www.mega.bw	Rwanda	Rwandatel	www.rwanda1.com
Burkina Faso	Onatel	www.onatel.bf	Senegal	Metissacana	www.metissacana.sn
Burundi	CBINET	cni.cbinf.com	Senegal	SONATEL	www.sonatel.senet.net
Cameroun	ICCNET	www.iccnet.cm	Seychelles	Atlas	www.seychelles.net
Cameroun	CamNet	www.camnet.cm	South Africa	Global-One	www.global.co.za
Cameroun	Ditof	www.ditof.cm	South Africa	Internet Solution	www.is.co.za
Cent. Afr. Rep.	Socatel	www.socatel.intnet.cf	South Africa	UUNET	www.iafrica.com
Congo D.R.	Inter-Connect	www.ic.cd	Sudan	SudanNet	www.sudanet.net
Congo D.R.	NIC Congo	www.nic.cd	Tanzania	Africa On-line	www.africaonline.co.tz
Côte d'Ivoire	Africa On-line	www.africaonline.co.ci	Tanzania	Twiga	home.twiga.com
Djibouti	STID	www.intnet.dj	Tchad	OPT	www.tit.td
Egypt	RITSEC	www.ritsec.com.eg	Togo	Icafe	www.cafe.tg
Ethiopia	ETA	www.telecom.net.et	Tunisia	ATI	www.ati.tn
Ghana	Africa On-line Ghana	www.africaonline.com.gh	Tunisia	IRSIT, Tunis	www.irsit.rnrt.tn
Ghana	NCS	www.ghana.com	Uganda	Imul, Kampala	www.imul.com
Guinea	Sotelgui	kassa.leland-gn.org	Uganda	Swift Uganda	www.swiftuganda.com
Guinea-Bissau	Guinea-Bissau Telecom	sol.gtelecom.gw	Zambia	ZAMNET	www.zamnet.zm
Kenya	Africa On-line	www.africaonline.co.ke	Zambia	Zamtel	www.zamtel.zm
Kenya	ARCC	www.arcc.or.ke	Zimbabwe	Africa On-line	www.africaonline.co.zw
Kenya	Interconnect	www.iconnect.co.ke	Zimbabwe	Interdata	www.id.co.zw
Lesotho	Nat. Univ. of Lesotho	www.nul.ls	Zimbabwe	Samara	www.samara.co.zw
Madagascar	DTS	www.dts.mg	Zimbabwe	UUNet IAFRICA	www.harare.iafrica.com
Malawi	MalawiNet	www.malawi.net			

Source: Mike Jensen, http://demiurge.wn.apc.org:80/africa.

4.2 Pricing

Access prices are an important factor influencing Internet take-up. Many of the countries that have a high level of Internet penetration also have low access charges for using the service. Prices are of even greater significance in African countries since incomes are considerably lower. Internet access charges are composed of two elements: (1) usage charges for the telephone network and (2) the ISP's access charge. In developed countries ISP charges typically form less than half the total cost of accessing the Internet. Thus low or no telephone usage charges can significantly boost Internet take-up. This is not necessarily the case in Africa where local usage tariffs are sometimes high, and in several countries no service is available nationally. Users often need to call abroad in order to be connected, paying high international tariffs. The majority of population is effectively cut off, especially the rural population, as often the only service available is offered in capital cities.[1] Even urban telephony is nearly non-existent in some countries. The average cost of a low volume Internet account in Africa is about US$65 per month[13] for the lowest priced services (e.g. e-mail), compared with below US$20 per month for full services in North America. Since the average local call charge in Africa for 20 hours usage is about US$35, the average Internet usage cost including monthly subscription charges is probably over $100 per month. ISP dialup charges in Africa vary greatly reflecting the different stages of market development and different policies on access to international telecommunications bandwidth (See Table 3).

Table 3: Cost of Dial-up Internet Access (in US$)

Charge	**Metissacana** Dakar Senegal	**Online Welcome** Johannesburg South Africa	**MTDS** Rabat, Morocco (40 hours)	**NCS** Accra Ghana	**ONATEL-Fasonet** Ougadougou Burkina Faso
Monthly charge	$14	$18	$40	$45	$150
Annual charge	$168	$180	$480	$100	$1'800
Setup charge	$40	$0	$50	$0	$65
Local call per 3 min	$0.10	$0.07	$0.09	$0.08	$0.12
URL	www.metissacana.sn	www.onwe.co.za	www.mtds.com	www.ghana.com	www.onatel.bf

Note; Unless otherwise noted, ISP charges are for unlimited access.
Source: Company websites, ITU World Telecommunication Indicators Database.

There is evidence to suggest that competition in the ISP market has sharply affected the level of prices and degree of Internet penetration. In South Africa, for example, widespread competition in the Internet market led to low prices and rapid diffusion of Internet services. One problem was that in order to avoid bankruptcy, most ISPs oversold their bandwidth, leading to slow connections due to swamped international links. Since 1994, the prices—and the quality of service—have gone up but they remain significantly low by international standards.

5. Social factors

Ultimately, people are the most important part of a network. The skills, habits, culture, history and goals of a population greatly affect Internet development. For example, language and the availability of content, as well as age, literacy and computer knowledge, contribute substantially.

5.1 Language and content

One point to consider is that the growth of the Internet occurred in a way that favoured the usage of English, due to the origination of the network in the United States. As many people in Africa do not speak English, it

has been suggested that value to the content would need to be added in some form in order for it to be useful. Value can be added either through translation, or even better, through creation of local content.

The ease with which content can be distributed over the Internet, and the difficulties associated with its control, has raised the concerns of governments worried about social and political instability. For some of them, the overwhelming amount of foreign content also constitutes a threat to national customs and beliefs. On the other hand, the Internet has the potential to create communities and support local culture. Some commentators have even suggested that Internet may have potential in nation-building, after periods of instability.

5.2 Age and education

Age also plays a role in Internet diffusion. The ability of people to use and benefit from an interactive technology such as the Internet is closely related to age.[14] In theory, this factor should tend to favour developing countries which have relatively youthful populations.

But, in the case of developing countries, the "age factor" is attenuated by the "knowledge factor". That is, despite a youthful population, the expansion of new technologies and services such as the Internet will remain limited unless current levels of education and Information Technology (IT) knowledge and skills are dramatically improved. In 1997, more than 42 per cent of the African population was under the age of 15.[15] Considering that the use of the Internet is often associated with youth, this is an encouraging indicator. However this youth advantage needs to be placed in the context of education level. In 1995, less than 30 percent of the population in Africa participated in secondary education.[16] In high income economies, by contrast, more than 97 per cent of the population had access to secondary education in 1993.[17]

The adult literacy rate in Africa is about 55 per cent.[18] Where the population is indeed literate, limited typing and computer skills can inhibit the wider use of Internet services. In those African nations where Internet services have been made available as a free service for the general public, inexperienced users can take a very long time looking for keys while typing. Lacking skills can thus become costly for service providers and it may be more cost effective to employ staff for the typing function. The message being sent—be it a funeral, wedding or other family announcement—can be explained to whoever is using the equipment and keying in the message. On one side, skilled network technicians are needed to establish electronic network services; and on the other side, users need to be trained to use the new technologies.[19]

Box 3: Puzzling South Africa

Many networking developments taking place in Africa began as grass roots initiatives, spearheaded by the international community and serving the academic and scientific community. In 1993 there were only 43 Internet hosts in all of Africa. By 1994 the number had skyrocketed to 27'000 hosts. Towards the end of the following year 16 African countries had direct Internet connectivity and the number of hosts had reached 50'000. Yet, a closer look to the Africa landscape showed that almost all of these hosts (more precisely 48'277) were in just one country: South Africa. The number of hosts in the country had more than doubled again by the end of 1997 to about 122'000, placing South Africa among the global leaders in Internet development. What explains the high level of penetration of Internet in the country?

Some have argued that language is the main factor driving the rapid growth of Internet in South Africa. Yet English is the first language of only 9 per cent of the population, lower than isiZulu, isiXhosa and Afrikaans. A more persuasive reason is that, after years of Apartheid, South Africa became two separate nations: an affluent white minority and a poor black majority. In communication terms, this led to a distorted situation, with the majority of infrastructure concentrated in small pockets of wealthy population. One example of the disparity in access to communication media is television sets. According to national statistics, 96 per cent of white South African households had a television in 1995 compared to 44 per cent of Africans/Black households. This same white affluent population has, in their great majority, access to PCs and the Internet and the skills required to run them.

One of the most influential factors in the Internet phenomenon in South Africa has been the largely unregulated and highly competitive environment in which Internet Service Providers (ISPs) have operated until recently. Commercial Internet services in South Africa were provided since 1992 solely by ISPs. By the end of 1997, there were some 75 ISPs in the country—many of which had expanded operations to neighbouring countries such as Botswana, Namibia, Lesotho and Swaziland.

It is also worth noting that even in the cyberspace era, geographical remoteness might play an important role in the take up of Internet services. Countries with high levels of Internet penetration are, in general, those with a low population density and which are geographically distanced from the main world population centres: Canada, Scandinavia and Australia and New Zealand; or isolated by political tension, such as Israel. South Africa historically fell into this category.
Source: Adapted from "Challenges to the Network: Telecommunications and the Internet", ITU, September 1997.

Aside from possessing the knowledge required to run and use the Internet in an effective manner, educational institutions have played an important role in sewing the seeds for Internet development. There is evidence to suggest that the development of the Internet in some countries is closely related to the degree of involvement by the academic community. In many countries a strong development of the Internet among academic institutions has served as a basis for further development of the network among private, governmental and non-governmental institutions. For instance, during the Apartheid period in South Africa, the local academic community maintained electronic links to the world mostly through well developed national and international Internet connections. This set the foundation for the later take-up of commercial Internet services. Tunisia has a well-established academic Internet community initiated by the national research organization, L'Institut Régional des Sciences Informatiques et des Télécommunications (IRSIT). In operation since 1986, the institute has active connections within Tunisia and overseas. In Mozambique the first full Internet service was provided by an academic institution, the Informatics Centre of the Eduardo Mondlane University Centre (CIUEM). The centre is dedicated to teaching and research, and promotes the use of information and communication technologies to help meet the needs University and of the country. Most African universities have e-mail connectivity, and about ten universities have full Internet connectivity. [1]

Box 4: "Sharing the Internet"

Individual Internet access in Africa will remain limited for a while to most of the region's inhabitants, due to a shortage of telephone lines, and the expense of computer hardware and Internet connection. Instead, the quickest way to spread Internet access is through provision in public places, such as schools and libraries and other shared areas, such as telecentres or "Internet cafés".

- **Telecentres** are shared by a community (e.g. village, neighbourhood), and are equipped to provide a range of services from basic telephony to multimedia and Internet. The idea of telecentres is to bring information technologies to the unserved and stimulate community participation and awareness of not only basic telephony but also new technologies, such as the Internet. Given the low literacy levels in Africa, the Internet can be useful in transmitting pictures and voice to a population which is used to processing information in non-written form. Multipurpose community telecentre (MCT) initiative, in cooperation between the ITU, UNESCO and IDRC, will establish pilot telecentres initially in five countries: Uganda, Mali, Benin, Tanzania and Mozambique. The Uganda telecentre will be located in the community centre of Nakaseke and will be equipped with telephones, fax, e-mail and WWW access along with other video, audio and documentation production facilities. The target groups include medical and support staff, teachers and other user groups. The overall objective of the project is to *"develop and test a MCT model to facilitate a process of development which is affordable and accessible for rural communities"*.[20]
- Another type of shared access points are "**Internet cafés**" that typically provide lower costs and training facilities. For example, the Metissacana Cyber Café in Dakar, Senegal, operational since mid-1996, provides 14 computers 24 hours a day with Internet access (see at http://www.metissacana.sn/metissacana/present/presentationhp.html).

5. Conclusions

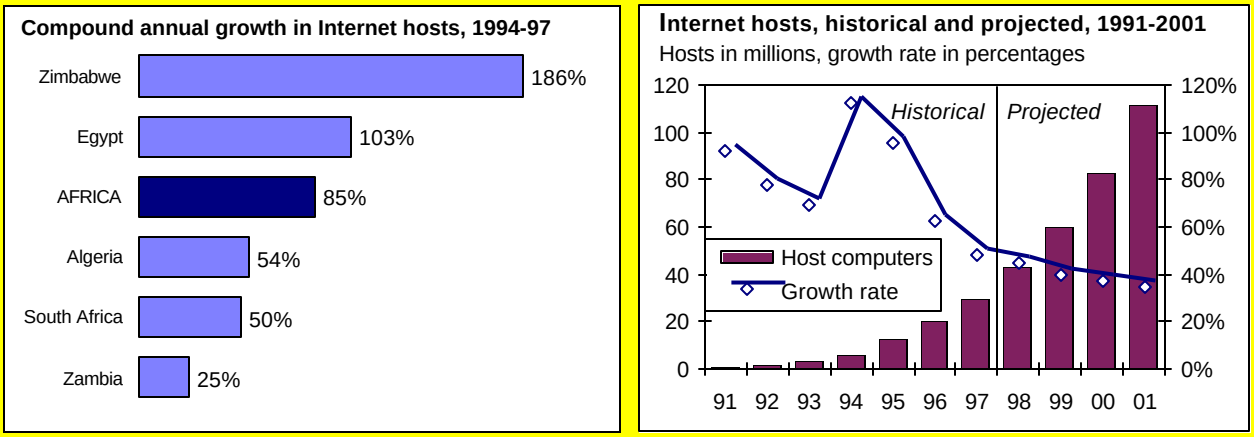
The Internet has been developing at a stunning pace throughout the world. Its growth, however, has been uneven not only between developed and developing nations, but also among nations with similar socio-economic development as well as within individual nations (Figure 4). Until recently, this has meant that the relevance of the Internet for development has not been as great as it could have been. This paper has explored the role of various factors affecting Internet development in Africa. The availability and quality of the existing telecommunication infrastructure has proven to be an essential pre-condition to achieve rapid

expansion of Internet services. Other factors—not directly related to telecommunication infrastructure availability—such as age, language, content, technical knowledge, and access to computers are also of key importance in the development of Internet. Furthermore, economic issues, mostly related to market structure and pricing, have shown to be crucial to the growth pace of Internet.

As Internet market in Africa becomes increasingly liberalized, and market forces take shape, private efforts are likely to ensure the continued growth for Internet in Africa. Prices will be driven lower, making access more affordable and creating new and innovative services for Africans. The significance of the Internet for economic, social and cultural development, as well as for opening new business opportunities, can only grow.

Figure 5: Past, present and future

Internet growth rates ,in selected African countries 1994-97, and projected future growth to 2001



Source: Network Wizards (www.nw.com), ITU World Telecommunication Indicators Database

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[1] *Internet Connectivity in Africa - A status report* by Mike Jensen, January 1998, available at http://demiurge.wn.apc.org/africa/afstat.htm.

[2] *Use of the Internet is Growing in Africa,* NUA Internet Surveys, 18 February 1998, available at http://www.nua.ie/surveys/index.cgi?service=view_survey&survey_number=610&rel=yes.

[3] The most well known Internet host surveys are the Network Wizards Internet Domain Survey carried out twice a year (see http://www.nw.com) and the Réseaux IP Européens (RIPE) host count statistics for the European region carried out monthly (see http://www.ripe.net).

[4] See *Challenges to the Network: Telecommunications and the Internet*, ITU, September 1997, available for purchase at http://www.itu.int/ti/publications/inet_97/inet_97.htm.

[5] These numbers are derived from a forthcoming ITU report *African Telecommunication Indicators, 1998.*

[6] See *ITU World Telecommunication Development Report 1998: Universal Access*, available for purchase at http://www.itu.int/ti/publications/.

[7] *Peering* refers to an agreement devised between two network service providers for the purpose of private and direct data exchange between their respective networks. Peering agreements usually result in faster and more efficient data exchange. ISPs have various possible settlement methods. They can settle as equal peers, unequal peers or in groups. See *Challenges to the Network: Telecommunications and the Internet*, ITU, September 1997, available at http://www.itu.int/ti/publications/inet_97/inet_97.htm.

[8] One example are the communication services provided by Volunteers in Technical Assistance (VITA), a non-governmental organisation whose goal is to support economic growth in developing countries. VITASAT—VITA's data satellite system—is a low-earth orbiting satellite system designed specifically for developing countries that permits Internet and other data to be sent worldwide. The satellite collects data over South America and Africa, and as it flies over gateways in various places around the world,

it transmits the contents to ground stations. This system permits data to be delivered anywhere in the world in 90 minutes. See http://www.vita.org.

[9] See the USAID Leland Initiative at http://www.info.usaid.gov/leland/.

[10] See News and Events section at http://www.info.usaid.gov/mz/News&Events/news.html.

[11] See USAID at http://www.info.usaid.gov/mz/Enabling/leland.htm.

[12] It has been suggested that a regional Network Information Centre (NIC), comparable to InterNIC, RIPE or AsiaNIC, would need to be established in Africa. This organ would provide Internet space and guidance for emerging ISPs. Currently, the absence of this type of an organ may limit the entry of new service providers.

[13] Jeff Cochrane's data at AfricaLink, June 1996.

[14] One survey found the average age of Web users to be 33 years old. See Georgia Institute of Technology. *GVU's 5th WWW User Survey*. Available at http://www.cc.gatech.edu/gvu.

[15] *Indicators on youth and elderly population*, Statistics Division and Population Division of the United Nations Secretariat, at http://www.un.org/Depts/unsd/social/youth.htm.

[16] The figure is derived from statistics provided by UNESCO on *Participation in education, Gross enrolment ratio*, Africa, 1995, available at http://unescostat.unesco.org.

[17] World Development Report 1993, World Bank.

[18] The source used for this figure is *Literacy, Estimate adult literacy rate* by UNESCO, available at http://unescostat.unesco.org.

[19] *Policy constraints to electronic information sharing in developing countries*, Mike Jensen, 8 September 1997, at http://www.connected.org/develop/constraints.html

[20] African ICT - Activity Information Management System, at http://resources.bellanet.org/aiaims/program_show_record.cfm?record_identifier_001=6.