



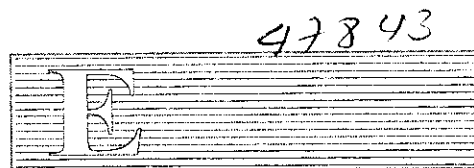
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AFRICA INFORMATION
INFRASTRUCTURE STATUS

The Status of African Information Infrastructure ¹

Introduction

1. Communications and information infrastructure has improved dramatically in Africa over the past 5 years. The Internet, satellite television, cellular phones and itemised billing are now widespread on the continent. But what might have been unthinkable a decade ago is still a dream for the majority of Africans those who do not live in the capital cities and are not part of the elite. Access to telephones is still very scarce on the continent – there are only about 14 million lines installed – fewer than the number of phones in Manhattan or Tokyo, and most of the lines are concentrated in the urban areas, while over 70% of the population is rural. Likewise, cellular phone coverage is generally confined to the capitals and secondary cities. Excluding South Africa, there are fewer than 100,000 dialup Internet accounts for over 700 million people, and as Internet Service Providers are usually concentrated in the capital cities, it is a long distance call to the Internet for most of the (predominantly rural) public. Furthermore, much of the available information on the Internet is oriented toward westernized and urban populations, with few applications relevant to Africa's rural people.

Africa's Information Infrastructure

Broadcasting

2. Radio is still by far the most dominant mass medium in Africa with ownership of radio sets being far higher than for any other electronic device. In 1995 radio ownership was estimated by UNESCO at close to 18 per hundred inhabitants, compared to 3.5 televisions per hundred and 0.31 personal computers per hundred. Over 60 percent of the population of the sub-continent are reached by existing radio transmitter networks while national television coverage is largely confined to major towns. Some countries still do not have their own national television broadcaster, even relatively well developed ones such as Botswana.
3. It should be noted however, that many people listen to the same radio or watch a television at the same time. In fact, large scale sharing of information resources is a dominant feature of the African media landscape. There are usually 3 users per dialup Internet account, as many as 10 people read every copy of a news paper and it is not uncommon to find most of a small village crowded around the only TV set, often powered by a car-battery or small generator.
4. An increasing number of commercial radio stations are being established following liberalisation of the sector in many countries. However the news and information output of these commercial stations is often either a re-broadcast of the national (state-controlled) broadcaster's news, or that of an international broadcaster or news agency. Local news and current affairs, especially that focusing on events outside of the capital, is rarely broadcast and community

¹ Prepared by Michael R. Jensen, consultant, for the Economic Commission for Africa. If quoting or citing, kindly credit Economic Commission for Africa (May, 99).

broadcasting has been slow to take off in the region. Genuine community broadcasters are scarce, nevertheless, Ghana, South Africa and Uganda have seen notable numbers of new community radio licences.

5. Satellite-based broadcasting has seen major activity on the continent in the last few years.
 - In 1995 the South African company M-Net launched the world's first digital direct-to-home (DTH) subscriber satellite service called DSTV. Subscribers have access to over 30 video channels and 40 audio programmes on C-band to the whole of Africa and on lower-cost KU-band to Southern Africa south of Lusaka.
 - Last year South Africa's public broadcaster, SABC, launched Channel Africa, a new satellite-based news and entertainment channel aimed at the continent.
 - In 1998 North Africa started receiving Direct-to-home (DTH) TV broadcasts from Nilesat, the continent's first locally owned geostationary satellite, capable of broadcasting up to 72 digital TV programmes simultaneously. Operated by the Egyptian Radio and Television Union (ERTU), the country's national broadcaster, Nilesat's coverage extends as far south as northern parts of Chad, Sudan, Eritrea and Ethiopia (as well as from Morocco in the west to the Arabian Gulf in the east).
 - A number of private companies and development agencies such as the World Bank have begun broadcasting training courses to downlink centres equipped to receive video casts.
 - Data broadcasting of web pages and email in is now being offered by two companies in Southern Africa.
6. The market for DTH satellite TV broadcasting as well as audio, data and telephone services is also expected to be entered shortly by the highly experienced European operators, Eutelsat, who are offering to focus the steerable antenna on their Hotbird 3 satellite over Africa. The audience for satellite broadcasts are, however, largely confined to the elite who can afford the equipment and subscription fees.
7. The US-based WorldSpace Corporation launched a radio broadcasting satellite called AfriStar in September 1998 and has begun test broadcasts with 12 channels using uplink hubs in South Africa, Ghana and London. Broadcasters in Europe, the United States and in Egypt, Burkina Faso, Kenya, Mali and South Africa have already signed up to provide content. WorldSpace aims to make a suite of over 80 audio channels available to anyone on the continent who can afford \$150-200 for the special digital radio. A range of audio quality streams from 16Kbps for AM mono stations (good for all voice stations) to 128Kbps CD quality music channels will be available, as well as data services, including the transmission of web pages.

Telecommunications

8. There has been an increase in the rate of expansion and modernisation of fixed telecommunication networks overall the past several years, and the number of main lines is now growing at about 10 percent a year across Africa. However, this increase starts from a very low base, much of the growth is in the urban areas

and the overall teledensity is still only about one per 200 inhabitants (versus 0.52 per 100 in 1996, the latest year for which there is data). Between 1990 and 1995, 6 countries actually experienced decreases in their teledensities according to the ITU - Liberia, Ghana, Republic of Congo, Sudan, Sierra Leone and Guinea.

9. Furthermore, 50 percent of the available lines are concentrated in the capital cities, where only 10 percent of the population live. In some countries, notably Eritrea, Guinea-Bissau, Central African Republic, Sierra Leone, Burundi and Chad, the ITU has found that 80-95 percent of the lines are in the main city.
10. On a worldwide basis, sub-Saharan Africa has by far the least developed infrastructure. In 1996 the region contained almost 10 percent of the world's population, but only 0.4 percent of the world's telephone lines (2.9 million lines). This is fewer than the number of lines China installed in 1997 alone. There are currently over 1 million people on waiting lists for a phone. Compared to all of the low-income countries globally, which house 50 percent of the world's population and 10 percent of the telephone lines, the penetration of phone lines on sub-Saharan Africa (SSA) is 5 times lower than the average low income country.
11. The continent (excluding South Africa) has only 2 percent of the world's international telecom circuits (about 16 000). The use of fibre optic cable for international traffic is still in its infancy in Africa, and most international telecom connections are carried via satellite. The exceptions to this are the marine optic fibre link from South Africa to the cross-Atlantic hub in the Canaries, and the SEA-ME-WEA cable running along the Mediterranean and down the Red Sea which provides access for North Africa and Djibouti.
12. There is a high level of variability between countries in the state of their existing telephone networks. Some countries have made telecommunications a priority and are installing digital switches with fibre optic inter-city backbones and the newest cellular and mobile technology. Among the world's most sophisticated national networks are in Botswana and Rwanda where 100 percent of the main lines are digital, compared with only 49.5 percent in the United States.
13. At the other end of the scale, large parts of the network in countries like Madagascar and Uganda are old analogue systems with poor national links between urban centres. Unfortunately these still overshadow the more advanced networks, and overall, the region averaged 116 faults per 100 lines per year, (i.e. every line installed had at least one fault each year), compared to a world average of 22 and a high income country level of 7 per 100 lines. Surprisingly, the proportion of digital lines on the sub-continent in 1996 was 69 percent - close to the world average of 79 percent.
14. On a sub-regional level, the countries of the Sahel and Central Africa, such as Mali, Niger and Democratic Republic of the Congo have fewer than 2 telephone lines for every 1000 people. North Africa and South Africa have a teledensity of around 35 per 1000, while West and East African coastal countries have densities between 2.5 and 10 per 1000. With the exception of North Africa and South Africa, only a few smaller countries have so far been able to increase their teledensity above 1 in 50 - these are Botswana, Cape Verde, Comoros, Gabon, Mauritius, and Swaziland.

15. Even if telecom infrastructure is beginning to spread, a much smaller proportion of the population can actually afford their own telephone. The cost of renting a connection averaged almost 20 percent of the 1995 GDP per capita, vs. a world average of 9 percent and only one percent in high income countries. Despite this, the number of public telephones is still much lower than elsewhere - about 1 for every 17 000 people, compared to a world average of 1 to 600 and a high income average of 1 to 200. However, an increasing number of operators are now passing over the responsibility for maintaining public telephones to the private sector, and there has been a rapid growth of "phone shops" in some countries, with the most well known success in Senegal which now has over 7 000 commercially run public phone points. While most of these are in urban areas, a growing number are being established in more remote locations, especially with the PTO Sonatel's aggressive rollout of backbone infrastructure which is in the process of linking 2000 villages and towns by fibre optic cable.
16. Public Telephone Operators (PTOs) in some countries, such as Botswana and South Africa, provide a 'virtual phone' alternative for those unable to obtain their own phone. Subscribers are issued their own unique phone number and pay a small rental for a voice mailbox, from which they can retrieve their messages from any telephone. Pagers are available to inform the subscriber that a message is waiting.
17. There is a very large variation between countries in the charges for installation, line rental and call tariffs. In 1996 the average business connection in Africa cost US\$112 to install, \$6 a month to rent and \$0.11 per 3 minute local call. However, installation charges were above \$200 in some countries (Benin, Mauritania, Nigeria and Togo), line rentals ranged from \$0.80 to \$20 a month, and call charges varied by a factor of almost 10 - from \$0.60 an hour to over \$5 an hour. Local call tariffs in some countries have increased even further, to over \$8.00 an hour (e.g. in Uganda, Gabon and Chad).
18. While many telecom operators are beginning to reduce their charges for international calls (prompted by the growth of call-back services), the high tariffs and large percentage of international calls mean that African telecom operators enjoy above average profits on their lines. The world average in 1996 was \$1,000 of revenue per main line per year, but in SSA it was \$1,175 and while even in high income countries the revenue was only \$1,051 per line.
19. Mobile cellular telephony has experienced very rapid growth in Africa. From a presence in only 6 countries nine years ago, these are about 78 networks in 42 countries serving over 250 000 customers (excluding the two million in South Africa). Operators provide access mainly in the capital cities, but also in some secondary towns and along major trunk routes.
20. A majority of the systems in use are now based on the digital GSM standard, although international roaming agreements are virtually non-existent, and data communication facilities are often not available except on the older analogue systems that are still in use in many countries.
21. Telex use continues to decline in SSA but not as quickly as elsewhere - the number of subscribers declined by only 5 percent to 28,600 between 1990 and 1996, while the world average decline was over 15 percent, and over 20 percent for high income countries. Fax usage is hard to estimate as not all imports and

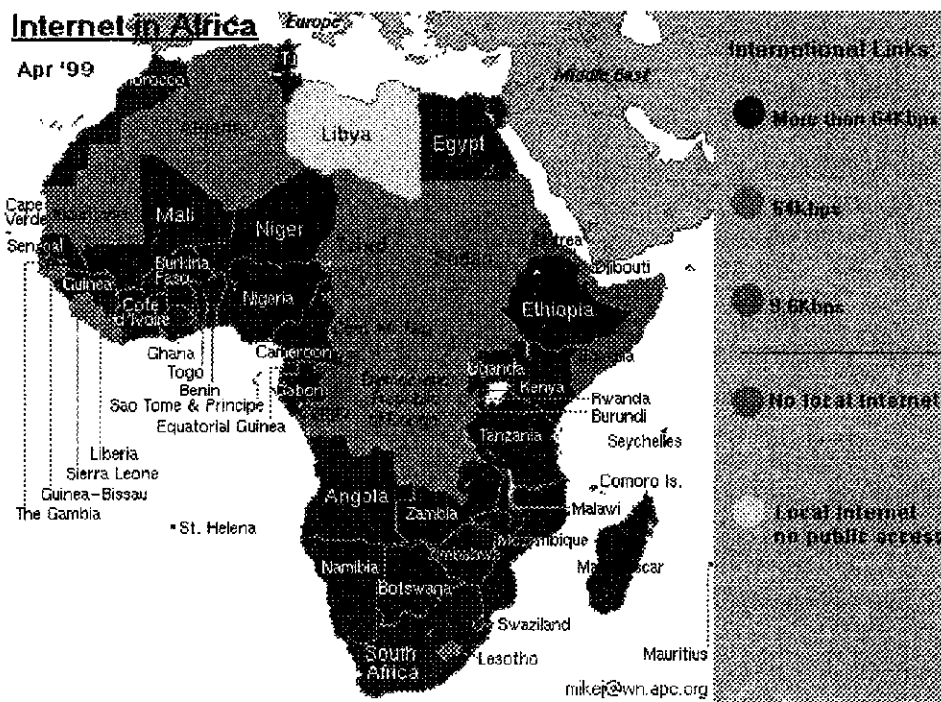
attachments to the network are recorded, but the ITU estimates that these are over 100,000 fax machines in the sub-continent outside of South Africa - 0.2 percent of the world's total.

22. Traditional data communication services based on X.25 are available in half the countries (27), most prevalently in the francophone ones, which adopted the use of the Minitel before the Internet became available. X.25 packet-switched based services were in the past the most popular method of establishing wide-area data networks in Africa, but because of their high-cost, traffic-based tariffs, they are now mainly used by banks and other large corporations requiring secure real-time low-volume data transactions such as credit card verification. Prices for international traffic on the PSDNs in Africa are often \$10-\$15 / 64Kilobytes, although some value added networks such as SprintNet roll average traffic charges into an hourly rate which usually varies between \$24 and \$30 per hour. SITA's charges from Africa vary between \$10 and \$35 / hour or \$75/Mb.

Internet

23. Internet access has grown rapidly on the continent over the last few years. At the end of 1996 only 11 countries had local access, but by April 1999 only the Republic of Congo (Brazzaville), Eritrea and Somalia were still without local Internet services. Thus, 50 of 53 African countries now have direct Internet access.

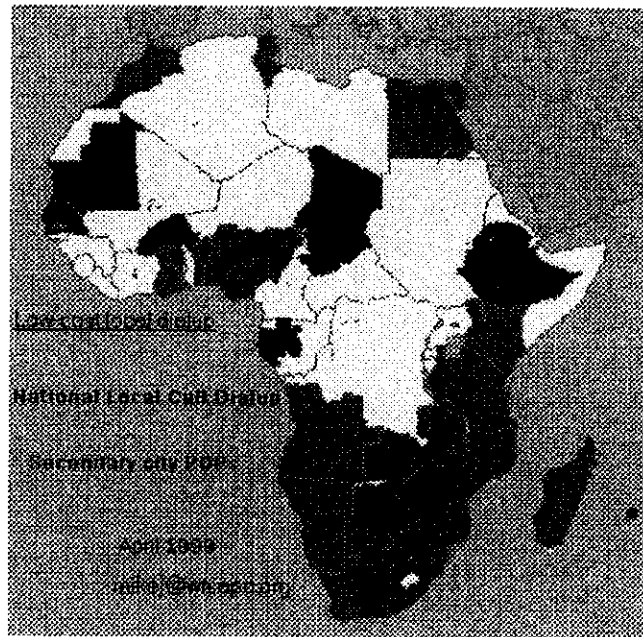
Figure 1



24. Nevertheless Internet access in Africa has been largely confined to the capital cities, although a growing number of countries (currently Angola, Benin,

Botswana, Ghana, Kenya, Mozambique, Namibia, Tanzania and Zimbabwe) do have Points of Presence (POPs) in some of the secondary towns, and South Africa has POPs in about 70 locations.

Figure 2



25. In some countries the PTOs have made a special policy to provide local call Internet access across the whole country. To do this, the local telecom operator establishes a special 'area-code' for Internet access that is charged at local call tariffs, allowing Internet providers to immediately roll out a network with national coverage. With the massively reduced costs for those in remote areas that this provides, it is surprising that so far only 10 countries have adopted this strategy - Burkina Faso, Chad, Gabon, Malawi, Mauritius, Mauritania, Niger, Senegal, Tunisia and Zimbabwe.
26. The total number of computers permanently connected to the Internet in Africa (excluding those in South Africa) broke the 10,000 mark at the beginning of 1999. As measured by Network Wizards, growth is up 36% in six months from July 1998 when there were only about 7,800 hosts, to 10,703 in January 1999. The correct figure may actually be closer to 12,000 or 15,000 due to the measurement technique which cannot count hosts which are not properly reverse referenced in domain name servers. In any case this represents about one host per 75,000 people, or 0.024% of the world's 43 million hosts. Nevertheless, the six-monthly African host growth rate almost doubled the world average (18%), so this a significant increase on the earlier figure of 0.021% in July 1998. Yet all of Africa has about as many Internet sites as Latvia, with a population of 2.5 million.
27. The opening up of the Nigerian Internet market will likely change the picture as the national telecom operator (Nitel) has big plans to provide Internet

countrywide. With a fifth of Sub Sahara's population, Nigeria has been one of the slumbering giants of the African Internet world. Until mid 1998 Nigeria had a few dialup email providers and a full ISPs operating on very low bandwidth links, and few operators were able to afford the \$130,000 a year cost for an international 9.6Kbps leased line. Nitel has now established a POP in Lagos with a 2MB link to Global One in the US and has put POPs in 4 other cities. The Nigerian telecom regulator has recently licensed 38 ISPs to resell the service, and about 12 are currently active.

28. Currently, the average total cost of using a local dialup Internet account for 5 hours a month in Africa is about \$60/month (including usage fees, telephone time, but not telephone line rental). According to the Organisation for Economic Co-operation and Development, 20 hours of Internet access in the U.S. costs \$29, including telephone charges. Although European costs are higher (\$74 in Germany, \$52 in France, \$65 in Britain, and \$53 in Italy) these figures are for 4 times the amount of access, and all of these countries have per capita incomes which are at least 10 times greater than the African average.
29. Nevertheless ISP charges vary greatly - between \$10 and \$100 a month, largely reflecting the different levels of maturity of the markets, the presence or absence of competition, the varying tariff policies of the PTOs and the different national policies on access to international telecommunications bandwidth.
30. Most African capitals now have more than one ISP, and in early 1999 there were over 300 public ISPs across the region. Seven countries had 10 or more ISPs - Egypt, Kenya, Morocco, Nigeria, South Africa, Tanzania and Zimbabwe - while 20 countries had only one ISP. Although Ethiopia and Mauritius are the only countries where a monopoly ISP is national policy (i.e. where private companies are barred from reselling Internet services), there are other countries in which this practice still continues, predominantly in the Sahel sub-region where markets are small. See Table 1 below for further details.

Table 1

African Internet Populations.

Country	Dialup Internet Accounts	Internat. Bandwidth h (Kbps)	Public Access ISPs	ISP Mon opoly	Call Cost (\$/hr)	Est 1998 Populatio n (1000s)	Internet Density (Populatio n/User)	% GDP /Person	Speed (Users/ Internat. Kbps)
Total	428075	114454	319		2.7	778456	1,819		6.6
Excluding SA	178075	34454	249			734160	4,123		6.5
<i>Algeria</i>	750	64	1	Yes		30175	40,233	1531	12
<i>Angola</i>	1,750	192	2	No	6.00	11967	6,838	355	9
<i>Benin</i>	2,000	128	6	No	4.80	5881	2,941	391	16
<i>Botswana</i>	1,000	640	3	No	0.60	1551	1,551	3640	2
<i>Burkina Faso</i>	2,500	256	3	No	1.10	11402	4,561	165	10
<i>Burundi</i>	150	19	1	No	0.75	6589	43,927	205	8
<i>Cameroon</i>	2,000	256	1	No	1.55	14323	7,162	627	8
<i>Cape Verde</i>	50	19	1	Yes		417	8,340	994	3
<i>Cent Afr. Rep</i>	200	64	1	Yes	6.90	3489	17,445	379	3
<i>Comoros</i>	200	64	0	Yes	0.20	672	3,360	367	3
<i>Congo</i>	0	0	0	n/a		2822		1008	
<i>Cote d'Ivoire</i>	4,500	384	5	No	4.80	1135	252	131	12
<i>Djibouti</i>	300	64	1	Yes	1.00	651	2,170	893	5
<i>DRC</i>	500	64	1	No		49208	98,416	117	8
<i>Egypt</i>	40,000	2048	40	No	1.20	65675	1,642	973	20
<i>Eq. Guinea</i>	200	64	1	Yes		430	2,150	388	3
<i>Eritrea</i>	300	29	0	N/A	0.60	3548	11,827	96	10
<i>Ethiopia</i>	2,400	512	1	Yes	2.60	62111	25,880	96	5
<i>Gabon</i>	1,000	512	2	No	13.90	1171	1,171	5007	2
<i>Gambia</i>	150	128	1	No	1.20	1194	7,960	321	1
<i>Ghana</i>	13,000	512	3	No	1.34	18857	1,451	397	25
<i>Guinea</i>	300	128	4	No	2.00	14567	48,557	736	2
<i>Guinea Bissau</i>	150	64	1	Yes		7673	51,153	442	2
<i>Kenya</i>	15,000	4000	10	No	1.36	29020	1,935	330	4
<i>Lesotho</i>	200	10	0	No	1.60	2184	10,920	486	21
<i>Liberia</i>	75	64	0	No		2748	36,640	1124	1
<i>Libya</i>	50	256	1	Yes		5980	119,600	5498	0
<i>Madagascar</i>	700	256	3	No	0.43	16348	23,354	215	3
<i>Malawi</i>	2,000	128	1	Yes	1.56	10377	5,189	142	16
<i>Mali</i>	750	128	4	No	2.80	11831	15,775	223	6
<i>Mauritania</i>	100	128	1	No	6.60	2454	24,540	401	1
<i>Mauritius</i>	12,000	1024	1	Yes	1.00	1154	96	3508	12
<i>Morocco</i>	20,000	8192	70	No	0.85	28012	1,401	1265	2
<i>Mozambique</i>	5,000	572	8	No	0.80	18691	3,738	77	9
<i>Namibia</i>	2,000	1000	5	No	1.00	1653	827	2059	2
<i>Niger</i>	300	192	1	Yes	1.31	10119	33,730	207	2
<i>Nigeria</i>	3,000	1152	12	No	0.40	121773	40,591	587	3
<i>Rwanda</i>	100	128	1	Yes		6527	65,270	238	1

African Internet Populations.

Country	Dialup Internet Accounts	Internat. Bandwidth h (Kbps)	Public Access ISPs	ISP Mon opoly	Call Cost (\$/hr)	Est 1998 Populatio n (1000s)	Internet Density (Populatio n / User)	96 GDP /Person	Speed (Users/ Internat. Kbps)
<i>Sao Tome</i>	50	19	1	Yes		117		49	3
<i>Senegal</i>	3,000	1000	6	No	1.90	9001	3,000	572	28
<i>Seychelles</i>	1,000	128	1	Yes		76	76	7272	8
<i>Sierra Leone</i>	150	128	2	No	1.50	4576	30,507	293	1
<i>Somalia</i>	0	0	0	n/a		10653		119	
<i>South Africa</i>	250,000	30000	70	No	1.60	44296	177	1230	3
<i>Sudan</i>	300	128	1	No		28527	95,090	86	2
<i>Swaziland</i>	900	64	2	No	0.95	932	1,036	1389	14
<i>Tanzania</i>	3,000	4008	10	No	1.04	32189	10,730	139	3
<i>Chad</i>	309	64	1	Yes	10.50	6892	22,973	187	5
<i>Togo</i>	1,700	384	7	No		4434	2,608	322	4
<i>Tunisia</i>	7,000	5120	2	No		9497	1,357	2030	1
<i>Uganda</i>	12,000	512	3	No	8.40	21318	1,777	305	23
<i>Zambia</i>	3,500	256	2	No	1.60	8690	2,483	682	14
<i>Zimbabwe</i>	10,000	2048	13	No	4.00	11924	1,192	786	5

"Users / Int Kbps" is the number of Internet users for every 1 Kilobit per second of the total International bandwidth

"Population / User" is the number of people in the country per Internet User

"Call Cost" is converted to US\$/hour

Source: Michael Jensen, mikej@sn.apc.org

31. In response to the high cost of full Internet based services and the slow speed of access to the World Wide Web, and also because of the overriding importance of electronic mail, many ISPs have launched lower-cost email-only services and are continuing to attract subscribers. Similarly, because of the relatively high cost of local electronic mailbox services from African ISPs, a large proportion of African email users make use of the free Web-based services such as Hotmail, Yahoo or Excite, most of which are in the US. These services can be more costly and cumbersome than using standard email software because extra online time is needed to maintain the connection to the remote site. But they do provide the added advantages of anonymity and perhaps greater perceived stability than a local ISP which may not be in business next year.
32. There is also a rapidly growing interest in kiosks, cybercafes and other forms of public Internet access, such as adding PCs to community phone-shops, schools, libraries, police stations and clinics which can share the cost of equipment and access amongst a larger number of users. Many existing 'phone shops' are now adding Internet access to their services, even in remote towns where it is a long-distance call to the nearest dialup access point. In addition a growing number of hotels and business centres provide a PC with Internet access.
33. The rapidity with which most African public telecom operators have moved into the Internet services market is also noteworthy. In the last three years PTOs have brought Internet services on stream in 31 countries and similar moves are afoot in three others (Liberia, Somalia and Tanzania). This follows trends in the

developed countries where almost all of the PTOs have established Internet services. In many francophone countries the PTO operates the major value added service provider as a joint venture with France Cable and Radio (called Telecom-Plus in many countries and DTS in Madagascar).

34. In all the countries where the PTO has established the international Internet backbone, it is the sole operator except in Côte d'Ivoire, Nigeria, Mozambique, South Africa and Zambia. Usually the PTOs operate the international gateway or access to the national backbone, and leave the resale of end-user Internet access to the private sector. In a few countries the PTO operates a gateway in competition with the private sector, namely Côte d'Ivoire, Nigeria, South Africa, Zambia, Mozambique and Zambia.
35. As far as the multinational ISPs are concerned, AfricaOnline, now a subsidiary of UK based Africa Lakes (<http://www.africaonline.com>), is the largest operation. The group is consolidating a year of growth which saw local branches open in Tanzania, Uganda and Zimbabwe, adding to its stable in Ghana, Kenya, and Côte d'Ivoire. The other three multinational ISPs which operate subsidiaries or franchises in the region are now trailing considerably with UUNET found only in South Africa, Swaziland, Zimbabwe and Namibia, while Swift Global is in Kenya, Tanzania and Uganda.
36. Due to high international tariffs and lack of circuit capacity, obtaining sufficient international bandwidth for delivering web pages over the Internet is still a major problem in most countries. Very few of the countries outside of South Africa had international Internet links larger than 64Kbps until two years ago, but today 17 countries have 512Kps or more, and 10 countries have outgoing links of 1Mbps or more - Egypt, Kenya, Mauritius, Morocco, Namibia, Nigeria, Senegal, South Africa, Tanzania and Tunisia. Excluding South Africa, the total international outgoing Internet bandwidth installed in Africa is about 34Mbps. However this means that on average about 7 dialup users must share each 1Kbps of international bandwidth, making connections to remote sites very slow.
37. As a result, a growing number of African Internet sites are hosted on servers in Europe or the U.S. This is especially necessary for countries where ISPs operate their own independent international links without local interconnections (peering), such as in Kenya and Tanzania, which means that e-mail traffic between the subscribers of two ISPs in the same city must travel to the US or Europe and back. This makes it more efficient to host outside-country, and is also being encouraged because web hosting costs in Africa can be very high, while there are even a number of free hosting sites in the US and Europe.
38. One response to the bandwidth problem is that incoming bandwidth is now starting to outpace outgoing bandwidth, following the increasing use of data broadcasting services which are now being installed by ISPs in Africa. These use a DirecPC-type system providing incoming bandwidth of 64Kbps for about US\$30-\$1000/month (depending on usage). The assymetric service can deliver up to 8Mbps incoming, while the normal terrestrial phone circuit or leased line is used for all outgoing traffic. This arrangement uses a standard digital KU-Band or C-Band satellite television antenna costing \$175-\$500 (depending on size required) and a decoder card for the PC costing US\$450. In Southern Africa the service is provided by two South African companies - Infosat and Siyanda

(<http://www.infosat.co.za> / <http://www.siyanda.co.za>). A similar service covering other parts of Africa via a different satellite is provided by Interpacket (<http://www.interpacket.net>).

39. These systems allow ISPs to limit traffic on their expensive existing links to outgoing data only, and to use a low-cost TV satellite dish for receiving the higher volumes of incoming traffic. This can substantially reduce the operating costs for the ISPs and increases the speed of access to the Web for their users.
40. Two-way satellite-based Internet services using very small aperture terminals (VSATs) to connect directly the US or Europe have also been quickly adopted wherever regulations allow (in Ghana, Mozambique, Tanzania, Uganda and Zambia which all have ISPs that are not dependent on the monopoly telecom operator for their international bandwidth).
41. With the exception of some ISPs in Southern Africa, almost all of the international Internet circuits in Africa connect to the USA, with a few to the United Kingdom and France. However, Internet Service Providers in countries with borders shared with South Africa benefit from the low tariff policies instituted by the South African telecom operator for international links to neighbouring countries. As a result South Africa acts as a hub for some of its neighbouring countries - Lesotho, Namibia, and Swaziland.
42. The major international Internet suppliers are AT&T, BT, Global One/Sprint, UUNET/AlterNet, MCI, NSN, BBN, Teleglobe, Verio and France Telecom/FCR. A number of other links are provided by PanamSat and Intelsat direct to private and PTO groundstations in the US and UK, circumventing local PTO infrastructure.
43. Aside from the South African hub and a link between Mauritius and Madagascar, there are no other regional backbones or links between neighbouring countries. The main reason for this is that the high international tariffs charged by telecom operators discourages Internet Service Providers from establishing multiple international links. As a result ISPs are forced to consolidate all of their traffic over a single high cost international circuit. Roaming dialup Internet access is now a reality for travellers to most African countries courtesy of SITA, the airline co-operative, which has by far the largest network in Africa. SITA's commercial division, SCITOR (recently renamed Equant), which was formed to service the non-airline market, now operates dialup points of presence in 40 African countries. Subscribers to Internet service providers who are members of IPASS (a group of ISPs, including SITA, who share their POPs) can access their home ISPs for about \$0.22c a minute. (See <http://www.ipass.com> for details).
44. The only country in the region with an X.400 service is South Africa. Other advanced services such as ISDN and video conferencing are also generally not available on the continent - the only countries able to provide ISDN services are Egypt, Tunisia, Morocco, the Seychelles, and South Africa, (which had 35,000 subscribers in 1996).
45. Voice over Internet (VOIP) services are not officially available anywhere in the region, and none of the telecom operators have implemented voice over IP technology for their traffic except for Egypt Telecom which is routing some of its voice traffic to the US over IP. Demand for most of these services is expected to

increase once there is a broader penetration of computers and data processing equipment on the sub-continent.

46. The American Registry for Internet Numbers (ARIN) has now taken over administration of Internet IP Address space for Africa (along with North America, South America, and the Caribbean). This means that address space is no longer free and until a local African Registry can be set up, networks will now be required to pay ARIN USD\$2500 per year to obtain a Class-C address. While proposal for an Africa Network Information Centre (NIC) has been discussed for some years, progress is being made only now, partly because of the lack of on-the-ground national networking associations to support it and the political difficulties of identifying the appropriate host country and organisation to operate it.
47. There have been few attempts to establish email-to-fax gateways in Africa despite the apparent need, given the low penetration of the Internet. Currently the co-operative project known as the Experiment in Remote Printing (TPC) only has two African countries among the 27 in its coverage list - South Africa and Botswana. Likewise, none of the commercial Internet fax services have local delivery facilities outside of South Africa.

ICT hardware and software

48. Recent estimates for the number of PCs in Africa put the average at about 3 per 1000 people in 1996, however some studies, such as ACCT's 1995 survey, indicate that this may be an overestimate by between 3 and 6 times, making the average closer to less than one per 1000. Some of the wealthier countries such as Botswana, Mauritius and South Africa have significantly higher levels of penetration, at least 5 per 1000. At the same time, account should also be taken of the number of users sharing a single computer which is much greater than in more developed regions.
49. Given the lack of public sector resources in Africa, the penetration of computers is generally much lower in government, with by far the majority of PC equipment being used by private companies. Computers are still mainly used for accounting and word processing, although spreadsheets are used to some extent for budgets and forecasting or as a simple database application. The limited number of database systems often use Microsoft Access, but many national documentation centres and archives, as well as small university and NGO libraries, use the UNESCO/IDRC developed ISIS/microISIS package for bibliographic data. Geographic Information Systems (GIS) and digitization facilities are beginning to be installed by some universities, ministry planning departments and municipalities.
50. Almost all of the PC equipment uses Intel or Intel-compatible processors except for the publishing industry where there are significant numbers of Apple Macintosh PCs. As a result Microsoft Windows is the dominant operating system, although because many PCs are older machines using 386 and 486-processors, and there are still large numbers of DOS-based systems. Because of poor maintenance and insufficient skills to diagnose system problems and swap

parts, there are many out-of-commission machines which could easily be re-activated.

51. Underutilisation of existing computer resources is also very commonly caused by the preponderance of many standalone PCs in the same office with no use of Local Area Networks (LANs). Often an office may have many machines, but only one with a modem connecting to the Internet. This usually means that there is competition for the machine and a shared email account which is not conducive to effective use of the Internet.
52. Although there are as yet few examples, the use of low cost equipment such as Network Computers (NCs) and set-top boxes are increasingly being seen as a vital means to reduce costs and increase the use of information and communication technologies (ICTs) in Africa, and a number of pilot projects have been established to test these options. Recently a South African cellular phone and subscription TV distributor, Teljoy, has begun marketing a set-top Internet access unit for US\$300 which will use the TV screen as the monitor. In another project, a South African distance education consortium has started using Sun Network Computers for its computer centres.
53. The use of free and open-source software is also gaining popularity. In wide-area networking, where local area networks are connected to the Internet, as well for many ISPs across Africa, Linux the free UNIX-based operating system, is already very widely used. Recent versions of the package have now been tailored for consumer use and are being increasingly supplied with new PCs, by companies such as Dell, Compaq, IBM and others. The Netscape web browser and email package, and the WordPerfect suite have been ported to Linux and are being distributed free use to schools in Africa.
54. Outside of South Africa there are few mini and mainframe computers, and most of these are confined to Ministries of Finance for government payrolls, and a few of the larger parastatals, telecom operators, banks and insurance companies. IBM, NCR, Bull and ICL are the dominant suppliers of mini and micro-computers, although there are also some Fujitsu machines.
55. Few of the international companies operate offices in Africa, but Bull, Compaq, IBM, NCR, Oracle and Microsoft have some form of local representation in most countries. Microsoft now has its own offices in Cote d'Ivoire, Kenya, Morocco and South Africa. PC equipment is often clone equipment imported from Asia but Compaq, Dell, IBM and ICL also have significant shares of the market and Dell South Africa is now selling via the Web.
56. The Millenium Bug or Y2K problem has gained significant attention across the sub-continent, especially because there are large numbers of older machines in use and very limited resources or skills to ensure their compliance. Most large corporations, parastatals and government departments have launched Y2K programmes but it is unclear how many will be able to meet the deadline. The issue is mitigated to some extent by the fact that relatively fewer mission-critical systems have been computerised in Africa, and service interruptions in basic infrastructure such as telecoms and electricity are already common.

Usage of Africa's Information Infrastructure

57. The vast majority of people in Africa rely almost exclusively on radio for information, with far smaller and more elite groups in the cities and towns also making use of television and newspapers. As mentioned earlier, the majority of Africans have not yet made a phone call, but interestingly, the usage of international lines is much higher than the world average, partly reflecting the large size of the African Diaspora and the arbitrary borders within the region. In 1996 the average for international outgoing calls in sub Saharan Africa was 233 minutes per line per year, compared to a world average of 93, and 113 for high income countries.
58. It is notoriously difficult to measure actual numbers of Internet users, but figures for the number of dialup accounts provided by ISPs are more readily available, for which it is estimated that there are now over 400 000 subscribers in Africa. According to a recent ECA study, each computer with an Internet or email connection supports an average of three users. This puts current estimates of the number of African Internet users at somewhere around 1.2 million.
59. Most of these are in South Africa (about 700-800 000) leaving only about 400,000-500,000 amongst the remaining the 734 million people on the continent. This works out at about one Internet user for every 1500 people, compared to a world average of about one user for every 38 people, and a North American and European average of about one in every 4 people. No studies have been made of the number of rural vs urban users, but it is safe to say that users in the cities and towns vastly outnumber rural users.
60. There are now about 26 countries with 1000 or more dialup subscribers, but only about 9 countries with 5000 or more - Egypt, Morocco, Kenya, Ghana, Mozambique, South Africa, Tunisia, Uganda and Zimbabwe. Clearly a number of countries such as those in North Africa and Southern Africa have more highly developed economies and better infrastructures which would naturally result in larger populations of Internet users. Most of these countries were also among the first on the continent to obtain Internet access and so have had the most time to develop the market. There are now local Internet Society chapters throughout Africa and in most of the countries with large Internet user populations.
61. Evidence gathered by ECA suggests the average level of Internet use in Africa is about one incoming and one outgoing email message per day, averaging 3 to 4 pages, in communications which are most often with people outside the continent. Surveys indicated that about 25 percent of the email is replacing faxes, while 10 percent are replacing phone calls and the other 65 percent are communications that would not have been made in the absence of an email system.
62. The highest number of users surveyed belonged to non-government organizations (NGOs), private companies and universities. The ratio of nationals to non-nationals varied between countries: 44 percent of users surveyed in Zambia were nationals as compared to 90 percent in Ghana. Most users were male: 86 percent in Ethiopia, 83 percent in Senegal, and 64 percent in Zambia. The large majority of users were well

educated: 87 percent of users in Zambia and 98 percent in Ethiopia had university degrees.

63. A recent South African survey of the Internet found similar results: the average user was male, 26 to 30, spoke English, was high-school or university-educated, earned between US\$24,000 and US\$45,000 per year and worked in the computer industry. This indicates that the high number of users in the country is largely attributable to the advantaged sector of the population.
64. Email is used for general correspondence and document exchange, technical advice, managing projects, arranging meetings, and exchanging research ideas, although its use is still limited for accessing formal information resources. Across the continent, users report that email has increased efficiency and reduced the cost of communication but as yet it is used almost exclusively for contacting individuals in other regions. The Web is still a relatively under-utilised resource, although 40 percent of Zambian users questioned had conducted literature searches on the web.
65. Universities were initially at the vanguard of Internet developments in Africa, and most of them provide email services; however in early 1999 only about 20 countries had universities with full Internet connectivity. Because of the limited resources and high costs of providing computer facilities and bandwidth, full Internet access at the universities where it exists is usually restricted to staff. Post graduates are often able to obtain access but the general student population usually has no access.
66. In the area of Internet content development, African web-space is expanding rapidly and almost all countries have some form of local or internationally hosted web server, unofficially or officially representing the country with varying degrees of comprehensiveness. However, there are still generally few institutions that are using the Web to deliver significant quantities of information.
67. While increasing numbers of organisations have a Web site with basic descriptive and contact information, many are hosted by international development agency sites, and very few actually use the Web for their own activities. This is partly explained by the limited number of local people that have access to the Internet (and thus the limited importance of a web presence to the institution), the limited skills available for digitising and coding pages, and also by the high costs of local web hosting services.
68. Local African public and academic and research content development for the Internet is still at a very early stage of development. In general only the universities have so far placed any significant quantity of material on the Web. However even among the universities, only a few appear to have made a major effort in this direction. Most of the African academic/research web sites simply detail the departments and activities of the institution concerned, although a few have developed some other applications and areas of content.
69. Across the region there are as yet few locally developed electronic information repositories of national or sub-regional significance, and none of the existing ones are currently available on the Internet. This is partly because national archive and library systems are extremely poorly resourced, and many have had little opportunity to obtain ICT skills or equipment.
70. Although statistics gathering operations are also at a very low level due to insufficient support, many statistical offices are now using common standards

and new tools. With the help of email and fax the collection of statistical information is no longer confined to the largest urban centres. The number of studies aiming at better knowledge of the structure and functioning of the socio-economic sectors is growing, and price indices now cover rural areas in some countries.

71. Surprisingly, it can be observed that the French speaking countries have a far higher profile on the Web and greater institutional connectivity than the non-French speaking countries. This is largely due to the strong assistance provided by the various Francophone support agencies, and the Canadian and French governments, which are concerned about the dominance of English on the Internet. ACCT's BIEF and AUPELF-UREF/REFER's Syfed Centres, which are building Web sites of local information as well as providing access, are the two dominant content developers in this respect.
72. Although there are a few notable official government web sites, such as those of Angola, Egypt, Gabon, Mauritius, Morocco, Mozambique, Senegal, Togo, Tunisia and Zambia, there is as yet no discernible government use of the Internet for existing administrative purposes. Web presence is higher in some sectors, particularly those involved in tourism and foreign investment, and these often have more mature sites, aimed at developing an international market presence. While most ministries and national research centres may have access to electronic mail, very few have a web site. Reflecting the limited resources of the public sector, the ECA survey found that government employees made up only one percent of users in Ethiopia and only six percent in Zambia.
73. As far as regional intergovernmental agencies are concerned, so far ECA, SADC (Botswana) and COMESA (Zambia) have built web sites with fairly extensive information on their activities and member states.
74. There are about 140 electronic mailing lists and UseNet newsgroups on the Internet which discuss issues relating to Africa (although a significant proportion of them are more closely affiliated with US African-American issues). These lists and newsgroups are almost entirely hosted off-continent except for a number in South Africa, North Africa and Kenya. There is a list for almost every nation as well as others on more general topics ranging from African Cinema to Post Colonialism. In the area of ICTs in Africa, AFRIK-IT is the only notable public list, and it is run from Ireland by the University College of Dublin (which happened to be where the person who started the list was studying).
75. There are other announcement and discussion lists with a smaller circulation, many of which focus on some of the programmes the international communities are carrying out in Africa, such as the African Information Society Initiative's AISI-HITD-CL and its associated African Technical Advisory Committee - ATAC-CL, the PICTA-CL and ICT-SCAN-CL mailing lists hosted by Bellanet.
76. There are also some more specialised lists relating to African ICTs in particular sectors, regions or countries, notably:
 - AFAGRICT-L - The use of ICTs in agriculture and natural resource management in Africa, initiated by CTA and hosted by Bellanet
 - AFRINIC-DISCUSS - The list of the Interim Committee and interested parties to establish Africa's NIC, hosted by ISP UUNET/Iafrica in Johannesburg.

- IOZ - The South African Internet Service providers list hosted by ISP Citec in Johannesburg
 - EAIA - The East African Internet Service Providers Association, hosted by UNON in Nairobi.
 - Linux user-group lists hosted in Nairobi, Durban and Johannesburg.
77. The news media are now relatively well represented on the web. The Columbia University African (USA) Studies Department has identified over 120 African newspapers and news magazines that are now available on the Internet, of which over 60 percent are published in the region. (23). Those most well represented in this area are again those with more advanced Internet sectors - Côte d'Ivoire, Egypt, Ghana, Kenya, Senegal, South Africa, Tanzania, Zambia and Zimbabwe. Also of note are the efforts to host daily newspapers by the ISP AfricaOnline which has offices in 5 countries - it is not entirely co-incidental that many of the countries listed above are also those where AfricaOnline is active.
78. There are two major continent-wide African news agencies, both of which extensively use electronic media - Inter Press Service (IPS) and the Pan African News Agency (PANA). Sub-regionally, Southern Africa has the only active regional news agencies using ICTs - the Southern African Broadcasters Association (SABA) and the Media Institute of Southern Africa (MISA). In other regions, use of ICTs amongst the media is much lower, but in West Africa, WANAD (West African News Media and Development Centre) is assisting journalists and media outlets to adopt the use of ICTs.
79. Of course international news correspondents in Africa are heavily dependent on ICTs to deliver material to their operations in the US and Europe. CNN and the other international television news companies regularly rent temporary space segments all over Africa with the local representatives of IntelSat and PanamSat to deliver reports and live coverage. Radio journalists (even freelancers) are now sending edited sound files by email to agencies such as the BBC World Service.
80. Two web search engines specialising on Africa have emerged over the last year - Orientation Africa - <http://af.orientation.com> and Woyaa - <http://www.woyaa.com>. As with other similar services elsewhere, these are run by commercial companies which generate revenue through advertising. Orientation is run by Hong Kong-based BlackBox and Woyaa by a UK company.
81. On a sub-regional basis, Southern and North Africa are the most advanced regions in terms of their use of ICTs, followed by East and West Africa with Central Africa lagging furthest behind.
82. In Southern Africa, South Africa, followed by Angola, Botswana, Mauritius, Mozambique, Namibia, Swaziland, Zambia and Zimbabwe, are at the top end the scale, with some institutions having leased lines and connectivity outside of the capital. These countries are followed further behind by Malawi, which just beginning to expand connectivity, and Lesotho, which has only just established a public access in Maseru. The institutions providing the most leadership in the use of ICTs in Southern Africa are the South African Department of Communications (Ministry of Posts, Telecommunications and Broadcasting), Department of Arts

Culture Science and Technology, CSIR, SangoNet and UniNet (South Africa), ZamNet (Zambia) and CIUEM (Mozambique).

83. In North Africa, Egypt, Tunisia and Morocco are all well advanced in their use of ICTs, followed by Algeria which is lagging behind. The champion agencies in these countries are ONPT and the local Internet Society Chapter (Morocco), IRSIT and ATI (Tunisia) and IDSC/RITSEC (Egypt).
84. In East Africa, Kenya and Uganda are the most advanced countries, followed by Tanzania and Ethiopia, with Burundi, Rwanda, Somalia and Sudan falling far behind. Leading ICT support institutions in the sub-region are the United Nations Department of Humanitarian Affairs, the East African Internet Association (EAIA) and HealthNet (Kenya), the East Africa Help Desk (Uganda), ECA (Ethiopia) and COSTECH (Tanzania).
85. In West Africa, Senegal and Ghana are the leaders, followed by Benin, Burkina Faso, Côte d'Ivoire, Mali and Niger. Further down are Guinea and Guinea-Bissau, with Liberia and Sierra Leone last. The leading ICT support agencies in West Africa are UCAD, ENDA and ORSTOM (Senegal) and NCS (Ghana).
86. Central Africa is still at a very low level of development in ICT use, with Cameroon and Gabon being the most advanced countries, followed by Nigeria, Chad, Central African Republic, Equatorial Guinea and then the Democratic Republic of the Congo and Congo Republic. The leading ICT support institutions are NACETEM (Nigeria) and ENSPY/UniYaoundeI (Cameroon).
87. Aside from Mauritius and the Seychelles, the island countries are all at relatively low levels in the development of ICT use, with Madagascar being the most advanced of the remainder. The leading agency in this area is the Mauritius National Computer Board.

Current and Planned initiatives to improve Africa's Information Infrastructure

88. Due to the restrictions on size of documentation this paper is unable to cover this topic. However, an annex with this information is available upon request from ECA. It has also been posted at: <http://www.bellanet.org/partners/aisi>.