Thematic report

Rural connectivity in Tanzania: options and challenges

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Rural connectivity in Tanzania: options and Challenges

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Content

A historical perspective

Use of the Internet started in Tanzania as a 'store and forward' system for e-mail in approximately 1989 by the Muhimbili University College of Health Sciences (MUCHS)and FidoNet. Users dialled into the MUCHS servers to send and receive their e-mails. The e-mails resided on the MUCHS server until a Low Earth Orbiting Satellite was overhead. At that point, it picked up all mails waiting to be delivered and dropped mails destined for anyone connected to MUCHS. The same satellite eventually passed over the U.K. where it dumped all collected mails from various locations. In the UK, the e-mails where received by GreeNet and channelled to their respective destinations through the Internet.

In 1995 a company called Star Telecoms Ltd attempted to build a 'Tanzanian Internet'. This was a network of many users and servers within Tanzania but without a link to the global Internet.

The first 'live' internet experience was pioneered in August 1996 by a company called CyberTwiga. Their connection to the Internet was via the SITA network that was used predominantly for 'live' flight booking systems around the world. At the time, SITA and the telecoms incumbent were the only licensed providers of international data connections.

As regulations eased, more data providers were licensed. Initially Afsat and Datel and thereafter many more Internet Service Providers (ISPs) connected to the global Internet. The cost of connectivity however was extremely high with a mere 32kbps link costing about US$16,000. (1 MB = 1,024kbps)

Five years later more licenses were issued and nowadays many operators are active. As a result the bandwidth prices have dropped to about US$3,000 per MB (based on quantity purchase). This is compared to US$512,000 for 1MB at the rates of 1999.

Although the price of international bandwidth has dropped dramatically, it must be compared with cost in the 'developed' world where bandwidth of 1 MB is available for as low as US$300. Prices are expected to decease further as technology gets more efficient and connectivity infrastructure grows. The East African Sub-Marine System (EASSy) - a fibre-optic cable network - will link all countries on the east coast of Africa to the global networks via South Africa and Djibouti. If implemented with a policy of Open Access, this development can mean a further fall in prices of international bandwidth.

All in all, Tanzania has progressed tremendously in terms of Internet access since 1992. Growth in the economy and increase of the users and Internet services fuel the rapid advancements of connectivity in Tanzania as well, also in rural areas.

Rural connectivity: the challenges

Although rural connectivity is feasible in all areas of Tanzania, there are several challenges.

1. The issue of last mile infrastructure:

Rural areas in Tanzania usually lack adequate 'last-mile' infrastructure. This is the final link between a major Point of Presence (POP) of a provider and the user. Because this last mile infrastructure is missing, users wanting access have to deploy expensive and sometimes innovative ways to get access. One way is to get access through a satellite dish. This over-rides any need for infrastructure on the ground. Although this is often very reliable, prices tend to be much higher than if infrastructure existed on the ground.

The other way is where a provider builds his own wireless network that extends from the POP to the user. Although usually cheaper than a satellite link, this option is also relatively expensive. In most areas in Tanzania, this is the medium used by many Internet Service Providers (ISPs).

2. The cost of service:

The cost of service in rural locations is comparatively higher than in urban locations. The reason is the above discussed issue of last-mile connectivity.

The cost of service in Tanzania in general is high for several reasons. Economies of scale play a role here. Most ISPs are based in urban settings and the largest has less than 10,000 subscribers. This creates a costing structure where prices remain relatively high for end users. ISPs remain relatively small for many reasons such as the maturity of the telecom sector to allow mergers and partnerships, the regulatory environment as well as infrastructure considerations discussed above.

3. The 'appropriateness' of the type of services available:

Internet services purchased from one ISP hardly differ from that purchased from another ISP. They all basically sell the same type of service: mere connectivity to the global Internet. There are some uses of connectivity that do not require Internet access per se. Especially a point-to-point voice conversation or a video-conference between a rural location and one that is in Dar es Salaam.

However, most ISPs have a fixed charging system that doesn't take into consideration the different types of access needed. For example, if a videoconferencing session needs 512kbps of bandwidth, they will charge for a 512kbos link to the Internet which is extremely expensive. However, if the ISP were to offer a 512kbps LOCAL link with no access to the Internet, the cost would be substantially lower. Likewise, if a link is used for only Voice over Internet Protocol (VoIP) then it could be charged at a lower rate than full Internet.

This mis-match between services provided and services required is due in part to the end users not yet being aware of what to demand from their providers. If many more customers started demanding a local link at a fraction of an international link, ISPs would soon have their rates specify how much local and international bandwidth is allocated to each service plan.

4. The support and sustainability of the service:

The last major challenge for connectivity in rural areas is the sustainability of the quality of service. Tanzania has a big shortfall of trained information technology (IT) personnel. The few that are available are concentrated in cities. Because supply is short and demand high, the cost of hiring IT personnel is high. Maintaining a centre with connectivity requires high cost input. All these factors act against rural consumers.

Although there is good progress with training of local IT professionals, their skills remain basic at best. The better ones quickly make their way to the cities, unless they secure a well-paid job.

Applications and uses of connectivity

Connectivity can be used for various purposes. Access to the Internet is one important application but it is often misunderstood as the ONLY use of connectivity. Several types of use of connectivity are outlined below:

Surfing the World Wide Web – This is the most common and conventional type of access. 'Surfing' for sites that reside elsewhere in the world is known as Global Internet.

Surfing a Local Website – It is possible to have access and to surf for local content only. This requires a link to the local site where the information is stored, which requires no need for a global link.

Data exchange for software applications – This is in cases where there is a software application, such as a Health Management Information System (HMIS) that can interact with a central server to exchange information and data. Depending on where this server is hosted, a point-to-point link without Global Internet could suffice. Most software applications exchange pure text to and from. This requires very little bandwidth. If this is the only use of connectivity, a simple 16kbps local link would suffice.

Video conference for distance learning or telemedicine – As discussed above, if the two places wishing to have a video-conferencing link are located in the same location (or be connected to) as the location of the satellite hub, then a local link would suffice. If however, the other point is elsewhere on the Internet, then a global link would be needed.

Voice – this is a fast growing application that enables telephone calls to be made at much cheaper rates than through conventional media. If Voice communication is needed within a private network, an exchange could be set up at the same location as the communication hub (such as a satellite hub) that would allow 'internal' voice communications at no cost, above the cost of bandwidth.

If however, telephone calls need to be made to other 'outside' users, then a link to a global provider is needed as well as a VoIP service provider. There will usually be a monthly fixed charge as well as a per-minute charge, but it is still much lower then conventional mediums. This service is one of the most attractive services that promise to bring down the operating costs of a remote location. In other words, it would be a good justification for getting connectivity, if you can prove that the main use would be VoIP that would reduce operating expenses. It is worth mentioning that VoIP is very dependant and relying on the quality of the link, especially with relation to 'latency' which is discussed further below.

E-Mail Communication – This remains the oldest and most critical use of connectivity. If a link is needed for e-mail only, the cost of service can also go drastically lower than a full-service link.

Basic overview of available types of connectivity

When approaching a provider for services, it is useful to know the types of connectivity available and implications for cost, quality of service and reliability.

- Dial-up – This is a simple medium that requires either a stand-alone PC or a network server to call an ISP using regular telephone lines. The cost of the service is cheapest and is in the range of US$30-US$50 per month. However, there are three types of additional factors;
  - The first is the cost of the telephone call. This could easily mount up to be a large expense depending on how often you call, how long you stay online and the location of your ISP. If you are calling from a remote location and your ISP is in Dar-es Salaam, then the call would be billed as a toll-call.
  - The second factor is the 'convenience' aspect. That means that whenever you want to check mail, or to do some surfing, then you first have to log-in to your ISP.
  - The third factor is the connection speed. Although most computer modems are rated at 56kbps, you would be lucky to get 36.6kbps and often less based on the quality of your copper wire connection to the telecoms operator. In some cities in Tanzania, the Tanzania Telecommunications Company Ltd (TTCL) has deployed Wireless Local Loop (WLL) instead of copper wire. These are in essence wireless telephones. It is not advisable to use dial-up connection over a WLL telephone as the transfer speeds will be too slow to be feasible.
- Cable Connection: Ethernet through UTP (unshielded twisted pair) cable. Some ISPs have built up a cable network through a city or town using UTP cable. Traditionally UTP cable is meant for indoor use only. However, due to the lack of infrastructure, ISPs have had to get creative and extended this technology to outdoor use. UTP cable is not supposed to exceed 100 meters. In avertedly this limit is sometimes crossed with a rapid deterioration in service. In addition, due to the limit of distance, the ISP needs to install a switch or hub every 100 meters so as to 'daisy chain' in order to reach further. A daisy chain of more than 4 switches starts to have effect on the quality of service. Additionally, each of these switches needs a power source. Therefore at times, the ISP may have power and the client may have power, but because the intermediary switch may not have power, the link goes down.

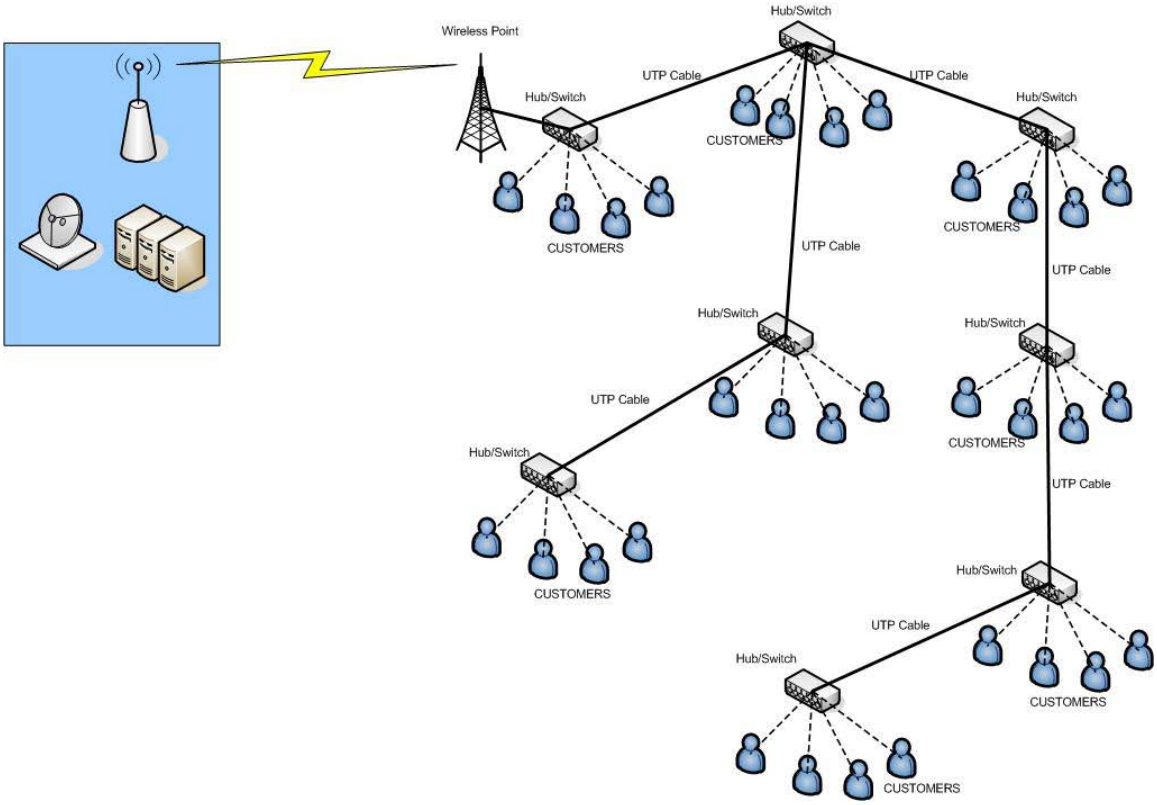

Figure 1: Typical Network Topology of an ISP using UTP & Wireless

In addition, ISPs tend to use a combination of UTP and wireless (discussed below) media to extend their range. For example, if they determine that they will get many customers in a certain concentration 1 km from the ISP head-end, they may deploy a wireless link to that point, then distribute access through UTP, hence sharing the cost of the wireless unit among many subscribers. This is why some users say they have a wireless connection even though it is actually a UTP cable that enters their premises.

- Lease Line Point-to-Point over copper wire. This is a point-to-point connection using 2 or 4 copper wire connections with 'modems' on each side. There are many types of protocols that can run on copper wire and they will have effect on the throughput capacity of the wire as well as on the distance it can run. This type of a link can reach much further than UTP cable. It can reach distances from 200 meters to up to 50 kilometres! This length of copper wire is not recommended but possible. This type of point to point connectivity through copper cable can be deployed via private copper wire pulled by an ISP or through the telecoms operator. The Tanzania Telecommunications Company Ltd (TTCL) has 'Leased Line' available in most, if not all districts in Tanzania. However, their reach is limited to within the city/town limits and is usually dependant on the quality of copper wire between the exchange and the client. The service on this TTCL platform used to be very good but has deteriorated over time. They now have a different type of access, as discussed below.

- Asymmetric Digital Subscriber Line (ADSL) through telecom provider. ADSL is more or less the same concept as discussed above, as it is a point-to-point connection over copper wire. However, ADSL is a much more efficient version of the above. This is because it uses the same copper wire that delivers voice services to your home or office. At the exchange side, they 'input' both voice and data services onto the same copper wire that is routed to the user's premises, but they are inputted at different frequencies. When the copper wire reaches the users premises, it first enters a splitter. This separates the two types of signals and sends the voice service to the telephone and the data to a computer or router. You can therefore use both services simultaneously. Furthermore, using the data service does not constitute a telephone call or any telephone expenses. This is the most common type of service available in most of the 'developed' countries. The only limitation of this is the reach of the copper wire network of TTCL in Tanzania.

- Wireless: Industrial, Scientific and Medical (ISM) Frequency Band - 2.4 GHz, 5.8 GHz etc. This is the most common 'wireless' service used in Tanzania. Because it is license-free, anyone can deploy a wireless network. Service quality varies widely and can be excellent or very poor depending on many variables.

  - The first consideration is how well the wireless network is designed. If an ISP has a huge wireless network but there is no 'routing' then the whole network is one big mesh of traffic. This usually causes congestion and reduces security of users. It is rare that a wireless network is designed to be a routed as this requires additional investment of routers as well as the administration hassles of maintaining a routed network. The second consideration is the interference issue. If many providers in the same city use exactly the same frequency, there is a likelihood of interference. Moreover, when a signal does face deterioration or interference, an ISP usually installs a 'booster' that amplifies the signal. This helps the signal but creates more interference for other providers. Because ISPs rarely discuss and coordinate their activities, this can sometimes be a problem. Third consideration is the power-backup. An extensive wireless network needs 'repeater' stations, which must have a power backup component. When power goes off at the repeater station, many clients and perhaps other repeater stations may be affected.

  Notwithstanding the above, services on the ISM bands are improving drastically. This is due to the fact that the technologies have become more efficient in using less amount of radio frequency and being able to identify interference and migrating to a different channel with no interference. These types of technological advancements carry huge potentials for connectivity in rural areas.

- Licensed Frequency Band – 3.5Ghz, 5.4Ghz etc. Services on these frequencies are more reliable due to the fact that they are regulated. However, services on these frequencies are also usually more expensive. Additionally, just because they are licensed, does not mean that they are necessarily well policed. In other words, if a user decides to start using that frequency, then it is usually hard to identify who it is and take appropriate action. This is a rare occurrence but has proved to be quite a menace to ISPs at times.

- Mobile: 3G (3G refers to the third generation of developments in wireless technology), GPRS (General Packet Radio Service) and CDMA (Code Division Multiple Access). These are different types of connectivity mediums that use the infrastructure of mobile telephone networks. They allow for voice and data communication via small hand-held devices or larger mounted devices both of which can be connected to a computer or a computer network. At present, none of these have 'officially' been launched. However, Celtel is already offering GPRS service on many parts of Tanzania, while TTCL has also started testing with CDMA service in Dar es Salaam. ZANTEL (Zanzibar Telecom Ltd) is also soon to start their CDMA service in Dar es Salaam and Zanzibar, while Vodacom are also in the testing phase of implementing the 3G networks. It is too soon to comment on these technologies. In essence, their quality of service should be quite okay for single users to small and medium size businesses/offices. The charging mechanisms however may not be ideal. It is assumed/implied that they will charge by amount of traffic exchanged. This can easily run up the cost of this connectivity if not used or controlled wisely.

- Satellite (V-SAT): Satellite communication is by far the easiest to deploy and the most reliable, precisely because it does not depend on any terrestrial infrastructure. There are many satellite companies now in Tanzania. Some are local and some international. One major difference between satellite companies is whether their satellite hub is housed in Tanzania or elsewhere in the world, probably in Europe or North America.

This only becomes an issue in the case of using a 'local link'. For example, if one wants to link a rural hospital to the National Hospital in Dar es Salaam for a live video conference for e.g. offering tele-medicine, it is necessary that the shortest link is used. This is necessary to make sure that 'latency' is kept low. Latency is the time it takes for a small amount of data (usually only 32bits) to travel a complete round trip between the 2 points. For example, latency between 2 computers on a perfect network within an office should be less than 1 millisecond, whereas the latency from Dar es Salaam to a point in North America through an international fibre-optic connection would be between 20-80 milliseconds. The latency between the same 2 points but through a single satellite hop would be between 600-800 milliseconds.

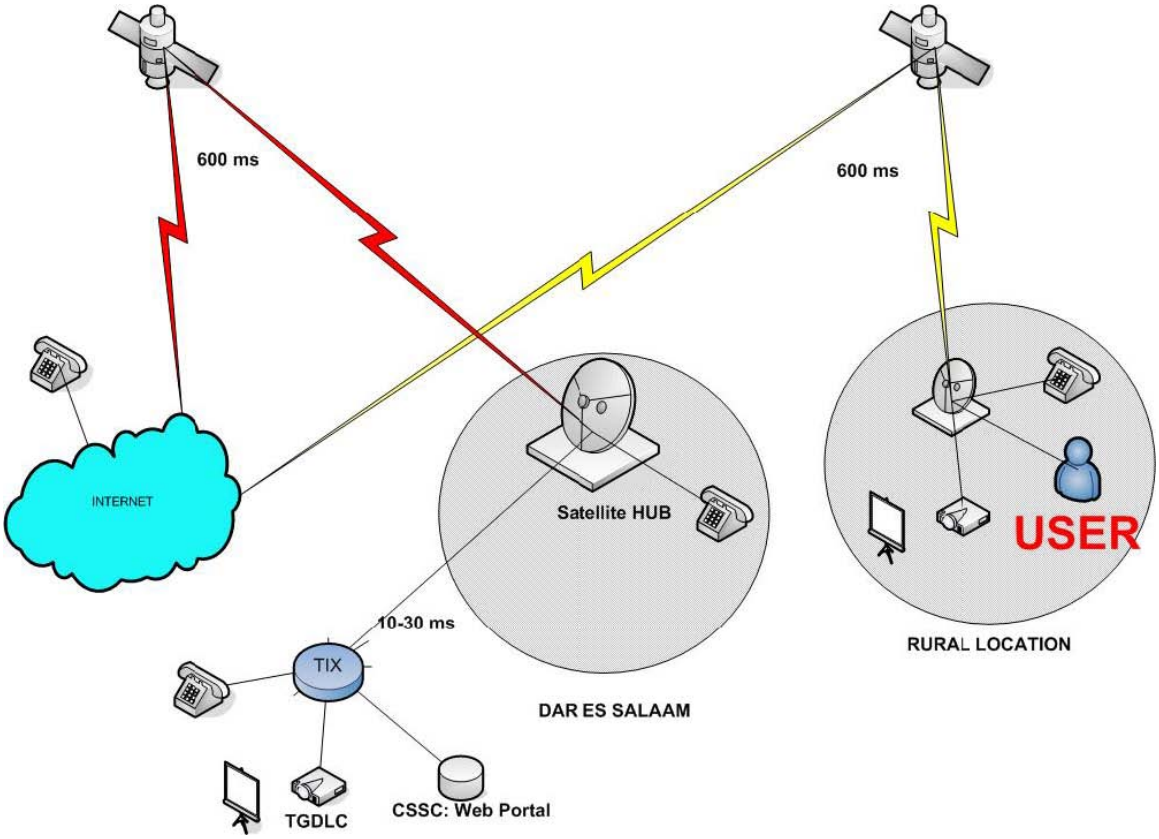

Figure 2: Standard topology of a satellite provider having an INTERNATIONAL satellite hub

This latency of a single satellite hop is still acceptable for most purposes of video conferencing and voice communication. However, if the link has to pass through 2 satellite hops, then latency increases and quality of service deteriorates. This occurs if the two points are connected to the Internet via a satellite link to the global Internet. For example, a Hospital in Dar es Salaam has a satellite link via a provider in Norway and a rural hospital in Mwanza has a satellite link to a provider in Canada, then the two hospitals would link via a satellite hop on each side – therefore making a double jump. Video conferencing would not be practical under normal conditions.

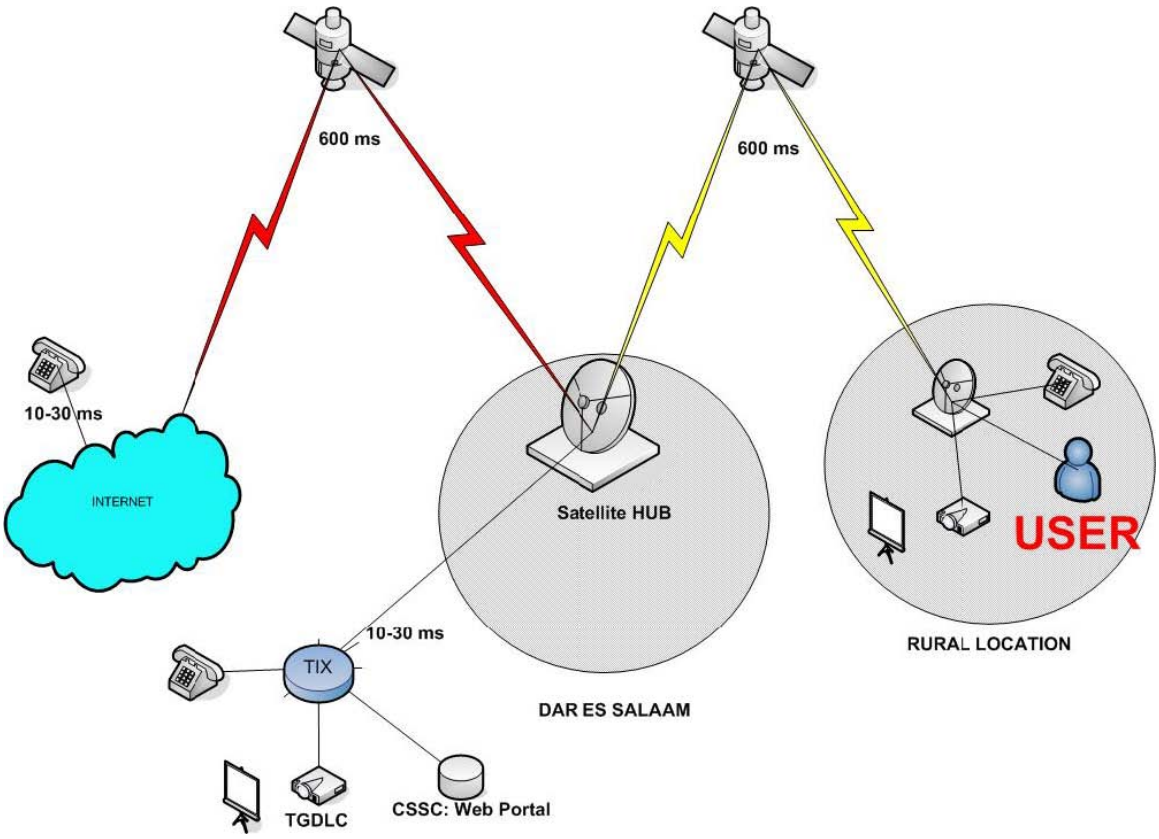

Figure 3: Standard topology of a satellite provider having a LOCAL satellite hub

However, if the hospital in Dar es Salaam was connected to a satellite hub that is located in Dar es Salaam via a wireless connection, and the rural hospital in Mwanza was the customer of the same satellite company, then the link between the 2 would be a single satellite hop – making smooth video-conferencing possible. Furthermore, the rural hospital in Mwanza could negotiate a broadband LOCAL link separately from an international link to the Internet, hence reducing their operating costs.

Types of satellite technology used

There are two main types of satellite technology. One is C-Band (C-Band is the original frequency allocation for communications satellites) and the other is Ku-Band (higher frequencies). C-Band is said to be much more reliable and advisable for 'mission-critical' applications such as banking and real-time transactions. However, technological developments have improved the reliability of Ku-Band devices to a point that it is almost, but not quite comparable to that of C-Band. For most practical purposes, Ku-Band does suffice. The difference is the cost. Traditionally, a C-Band antenna (dish) and modem comes to about US$10,000 – US$12,000 while that of Ku-Band ranges from US$1,800 to US$3,000.

Some general comments

- Bandwidth Allocation – shared vs. dedicated. When an ISP sells a service based on bandwidth they usually give 2 options. The first is shared bandwidth which implies that a customer shares that bandwidth with other users. So a 128kbps shared link, theoretically means that there are several users sharing the same 128kbps link. Some customers then demand to know to what ratio this bandwidth is shared and an ISP can rarely tell definitively, even though they offer many answers. The reason is that in practical terms, it is un-feasible to breakdown a larger pool of bandwidth into little segments that can be shared. For example if an ISP has 10 customers who are buying 128kbps shared, but their 'over-sell' ration is 5:1, then it is not practical for the ISP to have a 512kbps pool broken down to 2 128kbps pools and put 5 customers in each pool. Instead, they put all 10 customers in a pool of 512kbps. They then limit the maximum bandwidth per customer to 128kbps. Therefore in the best case scenario, you will get 128kbps if there are only 2 active users and only 51.2kbps if all 10 customers where pulling as much bandwidth as possible – a situation that is quite rare. To add to the above intricacies of bandwidth sharing, an ISP may have a general over-sell ration but very few have dynamic bandwidth control mechanisms that auto-regulate the size of the overall pool. Most ISPs, if doing any form of bandwidth control, do it manually through rules and policies.

- Dedicated bandwidth on the other hand is as simple as it sounds. A customer is sold a segment that is fixed and will not be used by anyone else, even when not used by the customer. Bandwidth is expensive, so this option has a substantially higher cost for the end user.

- Service monitoring tools. Users usually get involved with arguments and disagreements with the ISP when they are not receiving good service. This is usually that either a customer is genuinely getting bad service but cannot prove it, or that the ISP is actually delivering the right service but the customer is using it in-efficiently or it is being wasted without the customer knowing how. In such circumstances it is useful to ask the ISP for access to an interactive MRTG (Multi Router Traffic Grapher) graph of the user so that this forms a qualitative measurement with which to discuss and resolve any problems. Alternatively there are many tools available to monitor total bandwidth, transfer rate and even determine the type of use of the service that the customer is receiving. This helps to determine the quality of service delivered, the up-time calculation and to help the customer dictate any leakage or abuse of bandwidth such as virus and worms on the network, or excessive downloads like movies and songs during office hours and so forth. Likewise, there are simple devices that can help an organization or company to monitor and actually control the type of uses on the network. For example, a simple bandwidth control hardware (or software) can easily allow certain users to access e-mail only, others to access the web, while blocking other services like P2P (Peer to Peer, often used to download songs and movies) or chatting. It can even regulate these policies according to time of the day – such as chatting allowed only after 5:30pm. These types of control mechanisms are highly advised for users so that the expensive resource can be used and maintained with as high efficiency as possible.

- SLA. This is a Service Level Agreement and it outlines issues of the quality of service to be delivered by the ISP as well as its reliability and other factors. It can also have a clause about a refund formula in the event that the ISP fails to meet the minimum acceptable terms of the SLA. This SLA is also highly advisable for customers. However, many ISPs would only offer this option to customers who are paying for higher levels of service as this is a liability for the ISP. If you are able to get an SLA, there are a few fundamental issues to look for like:

  - Up-time guarantee – This is a percentage of the time that the ISP guarantees you will get the service. For example, an ISP could guarantee an uptime of 99.5%. This means that in a month of 30 days, they guarantee that downtime, if any, would not exceed 3hours and 36minutes.

  - Compensation for downtime – This is a formula with which they will be penalized for not meeting a minimum Quality of Service (QoS). The MINIMUM is for the client to be able to claim compensation for services not received. This is merely taking the monthly rate and deducting the number of hours of downtime, but it is not a ‘penalty’ per say.

  - Latency – This is the time it takes for a small amount of data (usually 32bits) to travel a complete round trip. This has been discussed previously, but a normal satellite connection would give about 600 milliseconds latency at best.

Conclusion and recommendations

From the above, it is clear that mere connectivity is not as simple as 'getting Internet' access. There are many types of connectivity and there are various applications for that connectivity. Moreover, if an organization properly evaluates all these components before deploying a connectivity project, they may find that they can save cost by selecting an appropriate bandwidth option.

Therefore development of an organisational ICT policy may sound 'heavy', but it forces organizations to think critically about their requirements, and helps in finding the solutions to meet those requirements.

More over, there are basic tools to monitor and control use of bandwidth. These can be extremely useful when discussing the quality of services of the provider. More importantly, they can help to use bandwidth better based on pre-set policies. Lastly, if there is a problem on your network, they could help in identifying the origin of the problem and help in troubleshooting.

An important principle is the 'strength from unity' concept. In terms of rural organizations, this could mean collective bargaining power. For example, if 20 telecentres buy their internet access individually they end up paying much more than if they purchased access collectively.

Appendix 1: Available Connectivity Options in Tanzania

This section summarises the various options for connectivity in terms of the types and costs of connectivity in Tanzania as per May 2006.

Type of Connectivity	Equipment Cost	Recurrent Cost	Geographic Reach	Reliability	Quality of Service	Bandwidth	Downtime compensation	Ease of Deployment	Some Providers
Dial-up	<US50	<US$50 / month + toll call	National	Good depending on quality of telephone line	Basic, given bandwidth	Max 36.6kbps	Most ISP do not offer compensation	Very Easy	Almost all ISP
Cable : UTP	Depends on ISP – usually low – approx US$100	Per PC ranging from $40-$70. Bandwidth purchase varies widely depending on ISP	Limited to reach of each ISP	Poor to Good depending on the infrastructure of the ISP	Poor to Good depending on the infrastructure of the ISP	Varies widely from ISP to ISP. Per PC may range from 4kbps to 128kbps. Bandwidth purchase depends on quantity of bandwidth agreed with ISP	Most ISPs do not offer compensation. Larger customers can demand an SLA. In SLA there can be a clause for refunds.	Involves pulling UTP cable and sometimes involves installing hub/switch along the way.	Most ISP in cities and towns would have a UTP network.
Cable: Leased Line through TTCL	Approximately US$ 2,000 - 3,000	Starting at US$ 350/month upwards depending on bandwidth plan selected	Most of the Country but within the city vicinity of each district HQ	Medium to Good	Medium	Plans start at 128kbps shared going upwards	None	Technically straightforward, but could take longer as coordination is done through Dsm office	TTCL
Cable: Private Leased Line	Depends on ISP but much lower than that of TTCL	Depends on the service plan selected	Within 2km of ISP head end	Good	Good	Depends on service plan. Home users would get a shared 64128kbps	Not for home users, bigger clients may demand an SLA	Not easy as involves pulling of copper wire from client to ISP head-end	None in Dsm, Some Local upcountry ISPs like Habari in Arusha

Type of Connectivity	Equipment Cost	Recurrent Cost	Geographic Reach	Reliability	Quality of Service	Bandwidth	Downtime compensation	Ease of Deployment	Some Providers
Cable: ADSL through Telecoms	Between $100 and $200	Starting at $42 for home connection with limited transfer rate of 0.5GB/month going upwards to $100/month for 128kbps shared and unlimited transfer and up to $500 for higher bandwidth with unlimited transfer	So far in Dsm. Starting soon in Arusha and Mwanza	Good	Good	128kbps shared up to 512kbps dedicated	None	Straight forward	TTCL directly as well as raha.com and Africa Online using TTCL infrastructure
Wireless on license free frequencies	Between $500 - $3,500	Starting at $50/month going upwards based on service plan selected	Towns and Cities with a local ISP	Varied widely, has potential to be excellent	Varied widely, has potential to be excellent	Home users usually get a shared 128kbps link, other plans vary based on agreement	Usually none	Quite straight Forward	Mostly ALL Upcountry Local ISP
Wireless on licensed frequencies	Between $500 - $3,500	Usually a corporate solution starting at $250/month	Very few Towns and Cities with a local ISP	Usually Good	Usually Good	Depends solely on service plan selected	Depends on SLA with corporate customer	Quite straight Forward	Very few Upcountry Local ISP
Mobile Service (3G, GPRS, CDMA, etc)	Low – cost of handset $>150	So far based on transfer rate. Approximately $	Currently being deployed in most urban towns	Good	Good	Between 56kbps to 115kbps – maybe more on 3G networks	None – this is a pay-as-you-go service. No service, no payments due	Very easy	TTCL, Zantel, Vodacom, Celtel (None have launched officially yet)

Type of Connectivity	Equipment Cost	Recurrent Cost	Geographic Reach	Reliability	Quality of Service	Bandwidth	Downtime compensation	Ease of Deployment	Some Providers
Satellite: C-Band with INTERNATIONAL hub	$10-12,000	Depends on service plans. Can be as low as $150/month for home, $450 for 128kbps shared and higher according to bandwidth. These are rates of INTERNATIONAL traffic.	National and beyond	Usually Excellent depending on provider	Usually Excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet, SimbaNet, AFSAT, Plus many International providers
Satellite: C-Band with LOCAL hub	$10-12,000	As above PLUS Local traffic can be negotiated as these are not traditional plans offered	National and beyond	Usually Excellent depending on provider	Usually Excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet SimbaNet
Satellite: Ku-Band with INTERNATIONAL hub	$1,8003,000	Same as C-Band with INTERNATIONAL Hub (above)	National and beyond	Usually Excellent depending on provider	Usually Excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet, SimbaNet, AFSAT, Plus many International providers
Satellite: Ku-Band with LOCAL hub	$1,8003,000	Same as C-Band with LOCAL Hub (above)	National and beyond	Usually Excellent depending on provider	Usually Excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet SimbaNet

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IICD Profile

The International Institute for Communication and Development (IICD) assists developing countries to realise sustainable development by harnessing the potential of information and communication technologies (ICTs). The driving force behind IICD activities is that local 'change agents' themselves identify and develop proposals for realistic ICT applications - local ownership forms the essential basis for sustainable socio-economic development.

Acting as a catalyst, IICD's three-pronged strategy is mainly delivered through a series of integrated Country Programmes. First, IICD facilitates ICT Roundtable Processes in selected developing countries, where local stakeholders identify and formulate ICT-supported policies and projects based on local needs.

Second, working with training partners in each country, Capacity Development activities are organised to develop the skills and other capacities identified by the local partners.

Third, IICD draws on its global network to provide information and advice to its local partners, also fostering local information exchange networks on the use of ICTs for development. The best practices and lessons learned are documented and disseminated internationally through a Knowledge Sharing programme.

In support of these activities, IICD invests in the development of concrete partnerships with public, private and non profit organisations, thus mobilising knowledge and resources needed by IICD and its local partners.

Country Programmes are currently being implemented in Bolivia, Burkina Faso, Ghana, Jamaica, Mali, Tanzania, Uganda and Zambia.