

KENET Schools Connectivity Initiative - Concept Note

1 Introduction

The mission of KENET is to be a catalyst in the transformation of education using ICT. Since it KENET Trust was constituted in 1999, it has focused on promotion of ICT usage in higher education institution. As of September 30, 2014, KENET had connected 152 campuses of universities and higher education institutions in different parts of the countries (see KENET coverage map at <http://www.kenet.or.ke>). However, the original vision of KENET was to use higher education institutions nodes to connect neighbouring schools. This vision could not be achieved in the past because of lack affordable broadband Internet that the institutions could use to connect the schools. This situation has changed and KENET and higher education institutions now have International bandwidth capacity to connect neighbouring schools. The challenge is to provide last mile connectivity from KENET nodes to the schools.

The KENET Schools Connectivity Initiative therefore aims to coordinate the different commercial, educational and government organizations that are interested and willing to promote the use of ICT in Kenyan schools for teaching, learning and administration. The different categories partners could provide one or more of the following services or infrastructure:

1. Affordable last mile connectivity services to schools. Partners in this category include commercial fiber and mobile network operators.
2. Setup of backbone schools networks and WiFi hotspots
3. Setup networked computer labs and provide the computers and tablets for use by students and teachers for teaching and learning
4. Cloud-based school management software or ERP services for use in school administration. This would enhance the efficiency of schools
5. Cloud-based e-learning systems and content to transform teaching and learning in schools.
6. Capacity building services for teachers in the areas of teaching with technology and e-learning content development.

The National ICT Master Plan that was launched in April 2014 envisages a National School Network that would provide connectivity to all schools in Kenya. The KENET initiative would be a catalyst in the creation of such a National School Network. Wananchi Group already supports the KENET initiative through a partnership to connect Nairobi schools using its expansive home fiber infrastructure to the KENET node at the University of

Nairobi. About 200 schools in Nairobi will be connected in the first year of operation. KENET will provide the broadband Internet and content. Other partners could provide last mile connectivity to other schools with the aim of connecting up to 300 schools in the first one year in different parts of the country.

In the following we provide a brief of KENET organization and its backbone network established using government funding in collaboration with commercial operators.

2 KENET Background

The Kenya Education Network Trust (KENET) (<http://www.kenet.or.ke>) is a not-for-profit membership organization that is licensed by the Communications Commission of Kenya as an Alternative Network Facility Provider. KENET is the National Research and Education Network (NREN) of Kenya and provides broadband Internet services to the higher education and research community in partnership with other licensed telecommunications operators. It also conducts research ICT in education and pilots innovative learning technologies in collaboration with faculty and students in member institutions.

KENET has been upgrading and expanding its national broadband network for the past five years using a \$22.5 million grant from the Government of Kenya through the Kenya ICT Board. It currently operates the network and the associated network operations center (NOC) and data center as a not-for-profit telecommunications operator. The focus of KENET in the strategic plan period 2011-2015 is to use the broadband Internet and shared services infrastructure to support member institutions that aim to transform teaching learning, research and promote innovations in education and content development. As of September 2014, it had connected 152 higher education institutions campuses and was generating over 5 Gb/s of Internet traffic.

KENET had connected 152 campuses of higher education member institutions in 32 counties as of September 2014 (see Figure 1 - KENET network coverage map). The campuses have a combined student enrolment of over 500,000 students, the majority being university students. KENET

network had a national distribution capacity of over 25 Gb/s and was generating about 5.0 Gb/s of international Internet traffic as of September 2014. It is therefore one of the largest IP networks in Kenya with direct peering with other NRENs in Africa and the rest of the world (e.g., TENET in South Africa, GEANT in Europe and Internet2 in the US).

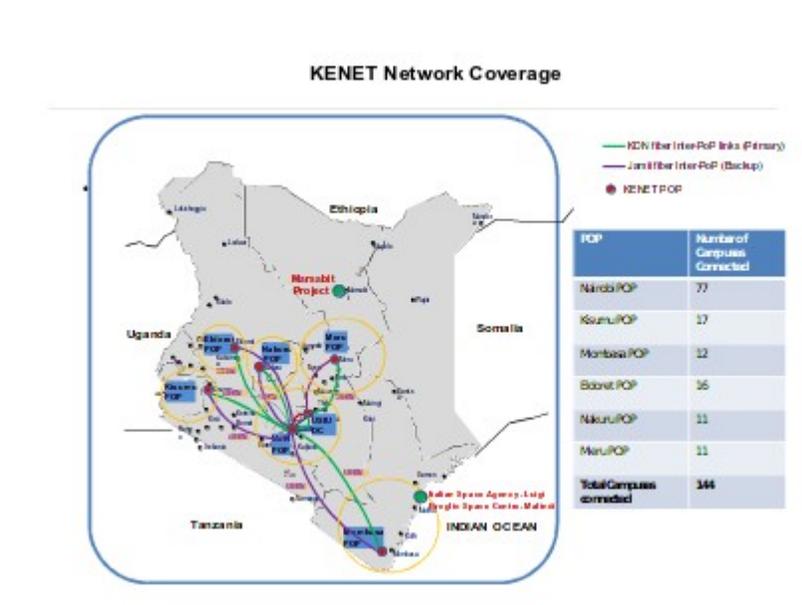


Figure 1 - KENET backbone network coverage

3.0 The Nairobi Schools Fiber Connectivity Pilot Project

On March 4, 2014, at Moi Girls High School, Nairobi, the Nairobi County Government launched the Nairobi Schools Fiber Connectivity Pilot project that aims to connect 245 schools in West of Nairobi area to the Internet. This was a very big event attended by principals, teachers and students from about eight Nairobi schools. The Nairobi County Governor was represented by Mr. Christopher Khaemba, the Nairobi County Executive in charge of Education and Youth Affairs and Teachers Service Commission.

The project is a Corporate Social Responsibility (CSR) initiative of the Wananchi Group that aims to connect Nairobi schools to the Kenya Education Network (KENET) backbone network using their existing expansive home fiber network in Nairobi, starting with about 200 schools in the pilot phase. KENET will in turn provide the local and international

Internet and content distribution services to the schools in the same way it does for the higher education institutions in Kenya (see <http://www.kenet.or.ke>). The main contribution of the Wananchi Group CSR is to provide last mile connectivity from the schools to the KENET node at the University of Nairobi.

The pilot project is expected to run for a period of 15 months to allow the partners to develop a sustainability framework and to assess the e-readiness of the schools. The author is not aware of any other large-scale schools connectivity project in Kenya. The project will therefore provide the schools, the Nairobi County government and commercial operators and partners with invaluable knowledge of the challenges of operating a schools network in Kenya. It will also be the basis for scaling up to a fully-fledged National Schools Network as envisaged in the National ICT Master plan that was launched in April 2014 (see <http://www.ict.go.ke>) The first 69 schools in Nairobi will be connected to the Internet by November 1, 2014.

3 The KENET Schools Connectivity Initiative

3.1 Problem description

About 76% of the campuses are connected to the KENET backbone using commercial leased lines. Most of the inter-PoP links also use commercial leased lines. *Thus, it is the expansive Mobile and fiber network developed by commercial operators in Kenya that has made it possible for KENET to build a national broadband network in the past five years.* This initiative proposes that the pilot National School Network should leverage on the existing national KENET broadband network infrastructure.

The high non-recurrent and recurrent costs of connecting of campuses, particularly those outside Nairobi, limits the growth of the KENET broadband network and is the main reason why broadband Internet prices remain higher than those in developed countries. For example, the average non-recurrent cost of connecting a campus outside Nairobi is about \$5,000 without counting the cost of network and power equipment required. The recurrent costs of the leased lines can be as high as \$250 per Mb/s outside Nairobi. Figure 2 shows a typical setup for connecting a campus to the KENET backbone. Connecting one such campus takes on average 3 months from the time the engineering surveys are conducted to commissioning of the sites.

Building a National School Network using the commercial leased lines would therefore be slow and it could a very long time to connect all of the 30,000 public schools in Kenya. However, the approach adopted by the pilot project with Wananchi Group has the potential to connect large number of schools in a relatively short time by using the available local access fiber networks or links from interested partners rather than leased lines.

3.2 Project objectives

The general objective of the project is improving the quality of education by transforming teaching, learning and administration of schools in Kenya. For example, the network could be a platform for continuous capacity building of teachers or efficient distribution of educational digital content, including e-books to all schools in Kenya. It could also help to support and empower teachers by directing them to supplemental material and open educational resources to support their teaching, and in the process, enhance their pedagogical skills. Coupled with KENET's educational portal, the project will help in providing secure and safe content for the teachers and the students. By bring together several partners who might be willing to donate their last mile connectivity for educational purposes, it might be possible to eventually bring down the cost of traffic through a free local loop, thus making the resource affordable to most of the schools. The project can also provide a platform testing cloud-based ERP platforms for managing the schools.

1. To provide a common schools network for all educational institutions
2. To guarantee safety of content delivered to students and teachers.
3. To provide teachers with supplemental content for use in teaching

3.3 Project setup

Wananchi Group and other willing partners would connect schools to the nearest KENET node - a university campus, a data center or a Point of Presence. All the schools will therefore be part of the KENET network and will use KENET IP addresses. KENET will aggregate all the Internet traffic from the schools and provide access to the Internet and educational content available in Kenya and in the global Internet.

KENET will operate Internet services and connect schools to appropriate educational and research content. All the schools will be required to

register a school domain name (e.g., *moigirls.sc.ke*) through KENET and will be provided with some limited web-hosting storage space through the umbrella schools heads associations (e.g., Kenya Secondary School Heads Association).

Unfortunately, the development of school campus networks and capacity building for teachers is capital intensive and very costly. It is unlikely many schools, particularly public schools, could establish the required schools ICT infrastructure without government or donor support. But even if only 20% of schools have adequate levels of e-readiness, they will provide valuable experience on what it takes to operate a schools network successfully.

Since the majority of public schools in Kenya are not in urban areas with well-developed home fiber or metro-fiber coverage, the model of the Wananchi Group Schools connectivity project cannot be scaled up to a national network. The schools in dispersed areas of Kenya would still be connected using commercial leased lines or over 4G mobile networks to the nearest KENET node at a PoP or University campus as shown in Figure 2. As a minimum each university campus node would have an aggregation router as well as an authentication server similar to the one installed at the KENET data center in Nairobi. Assuming that each University node connects up to 300 schools in a particular geographical area, then 100 University nodes could connect up to 30,000 schools. Connecting more schools would simply require upgrading the aggregation routers as well as the capacity of the last mile links from the University nodes to the KENET backbone.

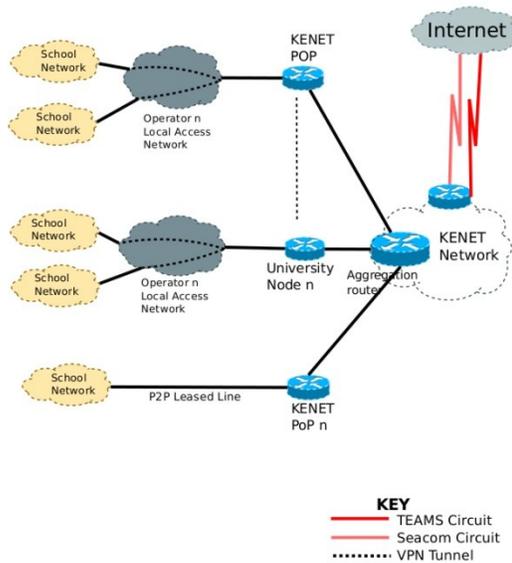


Figure 2 - National Schools Network with Multiple Operators

3.4 Partnership model

The partnership will involve approaching several partners, some of whom have already expressed interest, such as Wananchi, Liquid Telcom, Jamii Telecommunications, Google, government agencies such as KICD and non-governmental agencies dealing with education, technology and development. The partners would provide one of the following infrastructure or services to support the schools:

1. Affordable last mile connectivity services to schools. Partners in this category include commercial fiber and mobile network operators.
2. Setup of backbone schools networks and WiFi hotspots
3. Setup networked computer labs and provide the computers and tablets for use by students and teachers for teaching and learning
4. Cloud-based school management software or ERP services for use in school administration. This would enhance the efficiency of schools
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6. Capacity building services for teachers in the areas of teaching with technology and e-learning content development.

3.5 E-Readiness Assessment

In the light of the ongoing project, the anticipated opportunities and challenges it is recommended that a thorough study be done to:

1. Provide a basis for developing appropriate institutional framework for the schools network - the National School Network - as envisaged in the ICT Master Plan perhaps as a separate unit within KENET. This unit would be governed separately (another MB for the unit) and a Director of the Schools Network who reports to the KENET Executive Director;
2. Identify the nature of the Management Board of the unit which would perhaps have teachers and heads of teacher training organizations as well as deans of schools of education and some technical and finance people from the industry;
3. Identify the means for sustainability of the project beyond the partnership agreement; and
4. Unravel the underlying risks and risk mitigation.

The Schools Connectivity Initiative has already developed the following Terms of Reference for the e-readiness of schools survey project team:

1. **Carry out an E-readiness Survey of a sample of schools in Nairobi County** drawn from schools covered by the Wananchi Project. The survey covers, among others, the existence of computer labs; the availability support infrastructure (electricity, backup power); the presence of a computing teacher and his/her expertise; whether the school runs the KNEC computing syllabus and examinations; other uses the computing facilities; presence of an ICT budget and existence of any partners and sponsors in the field of computing;
2. **Conduct Stakeholder analysis.** This includes educational, para-educational and technology stakeholders and their impact on the schools network, provision of educational continent, bandwidth services, influence on decision-making, provision of educational technologies, ICT integration education and financing. It will also include an analysis of the nature of engagement with the respective stakeholder (s) in the schools network;

3. **Develop a training and capacity building plan** for the schools network; and
4. **Develop a sustainability** and risk management plan.

4 Conclusions

The schools connectivity initiative will require the corporation of the schools, principals, and teachers in order to be successful. The schools will be engaged through the through umbrella associations of public and private schools where available, and individually in some cases. It will also engage the University Schools of Education and faculty as well as middle-level teacher training colleges. The idea is to involve the teachers directly in a large-scale experiment on the transformation of teaching and learning with ICT and broadband Internet.

The key challenge in school connectivity is sustainability. The last mile connectivity attracts very high recurrent costs without a CSR contribution similar to the one of Wananchi Group. International bandwidth also attracts significant recurrent costs. Public schools would therefore need government support to sustain the connectivity. Commercial operators would have to develop new business models based on connecting large number of schools at low recurrent costs.

KENET hopes to develop strategy and policy briefs at the end of one year for use by stakeholders interested in the use of UCT to transform education in primary and secondary schools and developing ICT skills for the future workforce.