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Kenya Education Network

KENET COMMUNITY ANNUAL NEWSLETTER 2017

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NOTE FROM THE EXECUTIVE DIRECTOR

This is the first issue of the Annual Newsletter for the KENET academic community that will be released during the 9th Heads of Institutions Forum 2017 on December 7-8, 2017. It highlights the growth of KENET as an organization and as an academic community. It also details the impact of some educational technology initiatives undertaken in 2017 and the advances in research collaboration and the supporting infrastructure and platforms.

The section on the KENET academic community highlights the growth in membership and potential users of KENET, also known as beneficiaries of the KENET Trust services. KENET now serves a community of over 700,000 users that include students, faculty, researchers, and administrative staff. Although the community is still dominated by the universities category of members, other categories of members, particularly the TVETs and tertiary colleges, continue to grow.

In 2017, KENET also expanded its backbone network to 10 Gb/s and connected up 84 campuses on last mile fiber at 1 Gb/s. This increased quality of the network and will also translate to a reduction of the weighted unit prices in January 2017 to under $50 in January 2018.

This newsletter highlights the KENET Direct Engineering Support services that we offered to selected member institutions in 2017. This includes the time of KENET engineers and in some cases, network switches and WiFi access points. In general, DES activities result in improved Internet access for students, faculty and researchers.

The educational technology initiatives and research collaboration sections are aligned to the theme of the 9th HOI Forum – "*Scaling-up Educational Technology Initiatives and Research Collaboration*". The stories show that KENET has undertook *catalytic* educational technology initiatives and research projects in 2017 that need to be scaled up to serve the entire KENET community. I especially would like to draw your attention to the relatively low research productivity of Kenya as compared to other middle-income countries like Egypt, Nigeria, and South Africa. This is a challenge for the universities and research institutes categories of members.

We hope you find this first edition of the Annual Newsletter informative and enjoyable. You can find associated stories on the KENET website (https://www.kenet.or.ke/).

Professor Meoli Kashorda
KENET

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A. KENET Community

In the year 2017, seven (7) new members were admitted by the Board Trustees. The number of *connected* members increased from 88 to 95 in 2017. The International University of Professional Studies (formerly Inoorero University) was removed from the list of members as it was closed, while three other member institutions were suspended due to non-payment of membership fees for two consecutive years (they were also not subscribing to any KENET services).

Table 1 shows the four main categories of members: universities, research institutions, tertiary colleges and Government institutions and affiliate members as at November 2017.

Table 1: KENET Membership categories

Member category	Number of members	Internet bandwidth subscription (Mb/s) – November 2017	Size of Beneficiary community (i.e., students, faculty, researchers, staff)	% members subscribing to KENET Community Cloud services
Universities / University college	67	11,961	651,362	27%
Research Institutions	16	731	3,319	6%
Tertiary colleges (TVETs, medical colleges, TTCs etc)	20	399	83,095	15%
Government Institutions/ Affiliate members	19	574	4,877	42%
Schools (under schools initiative)	32	107	33,832	3%
Total	154	13,772	776,485	-

KENET was serving a total population of 776,485 (693,589 being higher education students). According to the Members Annual Core Data 2016, KENET members were spending an average of 0.8% of their recurrent expenditure on Internet bandwidth. The KENET target is 2% which means that members were consuming less bandwidth than they could afford.

B. KENET Capacity Building Workshops / Forums and Direct Engineering Support services in 2017

In 2017, KENET organized a one-week technical residential workshop on scalable campus networks and an ICT Directors of Universities forum in April 2017. The workshops and forums are considered part of member services and were fully sponsored by KENET at a total cost of Ksh 8 million. The residential workshops serve to build the KENET community. The photos (*Figure 1*) show the technical trainees and a group photo (*Figure 2*) of the 65 ICT directors from 65 member universities / university colleges. More information is available at www.kenet.or.ke/content/scalable-campus-network-training-april-3-7-2017 and www.kenet.or.ke/node/491

In order to scale up technical training of technical staff of member institutions, KENET plans to start offering at least **two** additional *directed online* workshops in 2018. This will ensure that KENET provides timely and cost-effective technical training to many more ICT staff of member institutions in the critical areas of Network Management and Cybersecurity.

C. KENET Network Infrastructure Expansion and Pricing Trends

In order to meet the increasing Internet bandwidth demands of member institutions, KENET expanded its last mile infrastructure, national backbone network, and international circuits connecting it to the global Internet and regional research and education networks. The following is a summary of the expansion:

a. **KENET developed 20 last mile fiber links to 20 campuses.** These links not only increased the capacity, but also reduced the cost of leased lines. They include last mile fiber to Taita Taveta University, Broglio Space Station, SEKU and University of Kabianga, among others. The total number of campuses on KENET last mile fiber currently stands at 83. This includes almost all the main campuses of member universities

b. **Twenty-eight (28) new last mile connections were added using leased lines or Wi-Fi radio**. This added 290 Mb/s of subscription capacity. The total number of campuses connected increased from 198 to **226** .

c. **KENET completed building of a new data centre at the Catholic University of Eastern Africa (CUEA).** The CUEA data center is especially well-placed for KENET members along Thika Road who might need to setup disaster recovery sites at different geographical location.

d. **KENET upgraded the capacity most of the backbone network to 10 Gb/s for using leased government fiber (also called NOFBI)** guarantee low congestion and accommodate the increasing subscriptions of member institutions in those areas.

KENET also successfully negotiated reduction in leased line unit prices with Liquid Telecom and Safaricom. The total leased capacity was 30,858 Mb/s as of November 2017.

The effect of the reduction in leased line costs and network expansion will translate to reduced weighted unit costs of under $50 starting January 2018 through bandwidth allocations as shown in *Figure 3*. (compared to $60 in July 2017). Since Internet is a volume business, KENET will be distributing about 17 Gb/s of bandwidth in January 2018 compared to 13 Gb/s in November 2017.

D. Educational Technology Initiatives

D.1 Remote Teaching Project

KENET launched the remote teaching pilot project in May 2017. The remote teaching project aims to explore the use of KENET web conferencing for remote teaching in order to reduce the cost of teaching multiple classes across different geographical locations. 23

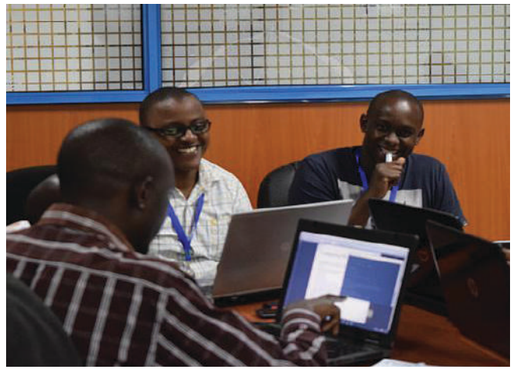


Figure 1: Participants at the Scalable Campus Network Training

Figure 2: Participants of ICT Directors' Forum

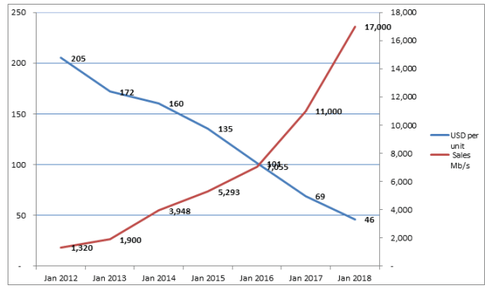


Figure 3: Weighted unit price graph January 2012- January 2018

faculty members from three universities, namely Daystar University, Catholic University of East Africa and the University of Nairobi are participating in the project..

KENET equipped each of the selected 8 classrooms with web conferencing equipment such as microphones, cameras and video display units (TVs and projectors) at an approximate total cost of Ksh. 11 million (approximately Ksh. 1.4 million per classroom).

Using the KENET web conferencing system, lectures in the participating universities are now able to teach more than one class simultaneously. At the end of the project, participating faculty will write a report on the effectiveness of the technology for both teaching and learning. A cost benefit analysis report will also be prepared for senior leadership of the three universities.

The KENET Special Interest Group on Educational Technology (SIG-EdTech) that is overseeing the Remote Teaching Project has developed an evaluation rubric for measuring learning outcomes of the project can be accessed here.

"I have had a chance to interact with the Remote Teaching Program since the beginning of the August semester, 2017, for our Monitoring and Evaluation class. The program has been quite beneficial for us evening class students as most of us have to juggle competing needs such as work and families. The Remote Teaching Program comes in handy for us as it perfectly integrates social media (WhatsApp), online learning platform, and on-site sessions to enable students to continually interact with their colleagues and instructors. I have even been able to attend classes from outside the country and I know of classmates who have been participating from outside Nairobi."

Alain Blaise Ngono, Masters Student in Development Communications- Daystar University

D.2 Cloud-based Virtual labs initiatives for systems administrators and ICT faculty

KENET has been offering residential face to face training at KENET for ICT technical staff of member institutions. The main cost of such training has been travel and accommodation. KENET therefore plans to introduce online hands-on training courses for ICT technical staff. Such online courses will need cloud-based hands-on virtual laboratory setups. Similar virtual labs could also be setup for any STEM-based degree programs. The key advantage of such cloud-based and shared virtual labs is the reduction in the **total cost of ownership** of specialized labs.

Although KENET setup a $100,000 online network engineering lab in 2014 with the support of Network Startup Resource Center (see http://nsrc.org), it has so far not been used to teach networking courses for ICT technical staff or university-based ICT courses. This has mainly been due to the lack of awareness of the existence of the virtual lab by ICT faculty of member universities.

Figure 4: Participants of the KENET Virtual Lab Workshop

KENET therefore decided to hold a 3-day faculty workshop on the KENET virtual lab training between September 18-20, 2017. The training was attended by 27 faculty who teach ICT Networking courses from 13 participating Universities (see Group Photo in *Figure 4*). The workshop gave the ICT faculty an opportunity to interact with the KENET Virtual Lab. See more details www.kenet.or.ke/blog/admin/faculty-workshop-held-use-kenet-virtual-training-lab.

In 2017, KENET setup a cloud-based virtualized lab environment in the KENET data center to support online hands-on lab exercises for training systems administrators. The virtualized lab can also be used to supplement the physical labs at the member institutions especially for lab exercises that require specialized software like MATLAB, pSPICE or Adobe Photoshop.

The current virtualized lab environment can support up to 70 concurrent users and was setup at a non-recurrent cost of **Ksh 1m** and a monthly recurrent cost of **Ksh 160,000**. The lab could easily be scaled up to support a higher number of concurrent users if the demand increases. Similar virtualized labs could also be setup at the main campuses of member institutions that need computing resources for specialized software or teaching of computer science and engineering courses. Students at the campuses would then be able to easily access this virtual lab provided that they have a laptop and access to high-speed WiFi. Faculty in different subject areas could then conduct lab sessions in ordinary classrooms that have WiFi coverage.

D.3 KENET partnership with the Engineering Deans' Council of Kenya

In the year 2016, KENET published the Baseline Survey of Engineering Departments (http://sig.kenet.or.ke/eng_baseline). One of the key findings of the baseline survey was that none of the engineering degree programs in Kenya had attained international accreditation. It was evident from this that was a need for joint curriculum reviews by engineering departments.
The keynote address at the 7th Heads of Institutions Forum in 2014s by Prof. Michael Lightner, DVCAA at the University of Colorado, on the Future of Engineering Education His presentation explained how the top universities in the US, Canada, Europe and Asia had changed the undergraduate engineering education curricula to respond to the changing industry needs.

KENET has therefore partnered with the Engineering Deans Council to drive the agenda of curriculum reform and adoption of new teaching methods using virtualized engineering labs. The Chairman of the Engineering Deans Council Prof Eng. Bernard Ikua of JKUAT and Eng. Martin Nzomo of KU attended the Global Summit of Engineering Deans in Canada with the sponsorship of KENET in October 2017. The engineering curriculum reform and internationalization of engineering degree programs is also being supported by the US-based IEEE (see Photo in *Figure 5* of Meetings of Deans of Engineering with President of IEEE in May 2017).

E. Enterprise services

E.1 Cyber Security awareness campaign materials

Students, lecturers, researchers and other staff are susceptible to cybersecurity attacks while online. KENET has therefore developed Cyber Security Awareness Campaign materials that will be used in the KENET campaign that starts in January 2018. It will highlight a cybersecurity topic each month via an online newsletter. This campaign aims to encourage appropriate online behavior that reduces cyber security risks and vulnerabilities.

Cybersecurity threats and attacks in 2017

KENET operates the Cybersecurity Emergency Response Team (CERT) for the Kenyan academic community since the year 2009. KENET CERT promotes awareness on cyber security incidences, as well as coordinates and assists member institutions in responding effectively to cyber security threats and incidences. It works closely with Kenya's National Cybersecurity Incidents Response Team / Coordination Center (CIRT/CC).

In May 2017, a ransomware attack called WannaCry spread around the world targeting public utilities and large corporations. In Kenya, at least 19 organizations were hit by WannaCry according to the National CIRT/CC. WannaCry ransomware would lock files on infected computers and instruct users to pay a ransom to recover these files.

The KENET CERT helped to resolve a Cyber-attack in one of the member institutions where social media and email accounts had been taken over by strangers and their website defaced.

Figure 5: Group Photo of Members of the Engineering Deans Council at a meeting with the President of IEEE

KENET also participated in the development of National Information Security Guidelines for Kenya in October 2017 representing the academic sector

E.2 Disaster Recovery/ Storage services

Setting up a Disaster Recovery (DR) site is a normal part of the Business Continuity Plan (BCP) of an organization. External auditors, internal auditors, and information systems auditors often want to check that an institution has an operational DR site for risk mitigation such as risks due to cybersecurity attacks on information systems. Other business risks include fire, flooding, rogue employees, and data center equipment failure.

KENET offers member institutions set up and DR hosting services for member institutions. The sites can be located at any of the three data centers. KENET provides high-speed dedicated links between the main campus and the DR site at relatively low costs. This is one of the key benefits of setting up a DR site within the KENET network.

Unfortunately, the uptake of DR services was still relatively low with only 16 member institutions subscribing to DR or backup services. This was probably due to lack of appreciation of the information systems security risks by the leadership of member institutions (see more details at https://www.kenet.or.ke/content/disaster-recovery)

F. Direct Engineering Support Initiatives

Direct Engineering Support (DES) is provided to members to enhance the ability of the institutions' staff to implement transformational changes to ICT resources and infrastructure and is considered part of the membership services. The DES initiatives address campus network infrastructure, cybersecurity, systems design and administration among others are aimed at improving the delivery of ICT services. In alignment with the Strategic Plan 2016-2020, KENET aims to support campus network development or redesign in order to improve Internet access by users.

The DES beneficiary institutions were chosen based on evaluation of requests by member institutions requiring technical support in optimizing or redesigning campus networks to offer better services to the students, faculty and staff. In 2017 KENET conducted several DES activities at various member institutions including: Moi University College of Health Sciences Jomo Kenyatta University of Agriculture & Technology, Adventist University of Africa, University of Nairobi, Muranga' University of Technology, Masinde Muliro University of Science and technology (see photo in *Figure 6*), Kenya Marine and Fisheries Research Institute and United States International University-Africa among others.

DES also often involves network equipment donations such as WiFi access points and network switches.

G. Scaling up Research Collaboration and Research Infrastructures

G.1 Facilitating Research Collaboration

KENET Research Services Group and Special Interest Groups Activities in 2017

One of the mandates of KENET is to promote research collaboration. At KENET, we have been using the Elsevier research analytic tool, Scival, to measure the degree of collaboration among our members. The collaboration is measured in terms of joint publications that are indexed in the Scopus database. We have noticed there is a relatively low level of collaboration between Kenyan researchers/ scientists and other researchers outside Kenya. The table below

Figure 6: KENET Team led by Moses Ojiambo donating access points and network switches to MMUST received by Prof. Joseph K. Rotich (DVC AFP)

shows the level of collaboration in the period 2012-2016. Notice that the top 3 countries are US, UK and South Africa as shown in Table 2 below.

Table 2: Joint Publications and collaborating authors 2012 – 2016 (source Elsevier Scival)

Country	Number of Publications	Number of Kenyan co-authors with collaborating country	Number of collaborating country co-authors with Kenya
United States	3,941	4,275	9,793
UK	2,266	2,499	3,950
South Africa	1,204	1,464	1,602
Belgium	698	480	718
Canada	733	945	1,180
Uganda	664	1,012	893
Tanzania	591	1,067	864
China	498	445	1,393
Ethiopia	341	525	524

In order to increase the level of collaboration among researchers in Kenya, KENET facilitates the activities of the Special Interest Groups in Educational Technology, Engineering Education and in Computational Modelling and Materials Science.

The research services team, including the executive director held half-day research collaboration and infrastructures workshops for researchers and senior leadership at 7 universities and 4 research institutions in 2017. At each workshop, KENET was able to show the research productivity of the institutions and areas of collaboration.

The SIG on **Computational Modeling and Materials Science (**CMMS) held a workshop organized by the MMUST on 6 - 7 July 2017 (see Photo in *Figure 7*). The workshop objectives were to provide platform for networking among researchers and postgraduate students in this area and to identify joint research proposal areas that could be funded by the National Research Fund (NRF) or other funding bodies in East Africa or Europe.

The workshop was very well attended with over 30 researchers from 11 different universities in Kenya with funding of KENET (travel and accommodation only). The participants identified four major research areas that will be the focus of research grant applications.

G.2. Research Infrastructure Initiatives 2017

The Open Access Research Data Repository

In 2017, KENET was invited to participate in the African Open Science Platform (see http://www.codata.org/task-groups/preservation-of-and-access-to-scientific-and-technical-data-in-for-with-developing-countries-pastd) project workshops in Ghana, Madagascar, and Ethiopia. The project is supported by the Academy of Sciences of South Africa and the Research Data Alliance. The objective of the workshops has been to promote Open Access Research Data policies and highlight the need for high speed research and education network infrastructures in African countries.

Figure 7: Group Photo of Workshop participants of the Special Interest Group (SIG) on Computational Modeling and Materials Science (CMMS) workshop

Figure 8 : Group Photo of some of the travel grantees from JKUAT, KU and UoN who attended the IEEE AFRICON 2017

The African Open Science Platform along with the Sci-Gaia Open Science Platform motivated the development of the Open Access Research Data Repository or OARDR at KENET. This is a digital platform that will hold research output and provide free, immediate and permanent access to research results for anyone to use, download and distribute. The initial demand in Kenya is driven by researchers who publish papers in Open Access Journals and who are required to add the supporting research data to an indexed research data repository.

The OARDR has been under test at KENET and will be widely available to the Kenyan research community. It is a fully-federated Open Access Data Repository allowing the research data to be discovered by any researchers in the global research and education network. However, the initial storage capacity is limited and will need to be scaled-up with external research infrastructure funding.

The High Performance Computing (HPC) Initiative

The Special Interest Group on Computational Modelling and Materials Science identified the need for a Kenyan Open High-Performance Computing (HPC) facility in 2016. The HPC shall support ongoing doctoral students research work as well as faculty in the CMMS area.

Kenya is also one of the eight participating countries in the mega-research project called the Square Kilometer Array that will generate huge data sets that will need to analyzed by African researchers. As part of the project, Kenyan researchers in any area who need access to HPC facilities at the Center for High Performance Computing in South Africa can apply to be registered as Principal Investigators through KENET. KENET will also provide the high speed connectivity and research data backup services on the OADR.

KENET will also part in the CHPC National Conference (December 3-7, 2017) in Pretoria, South Africa. The KENET CEO will make a keynote address, while Mr. Hezron Mwangi (KENET engineer) will be attending the conference and the hands-on workshop to help with capacity building in HPC. Prof. George Amolo (Technical University of Kenya) will also be attending the conference to represent KENET and the research community that actively uses HPC facilities in South Africa.

USIU-Africa has also organized a HPC forum to be held on Dec 1-5, 2017 and up to 200 researchers in the KENET community shall be attending the forum. KENET has been involved in promoting the forum within the KENET research community (see http://usiu.ac.ke/hpc)

G.3 KENET Research Travel Grants in 2017

In order to increase the visibility of the research output from the KENET community, KENET Awards up to 15 travel grants per financial year to faculty and graduate students in Science, Technology, Engineering, and Mathematics (STEM) areas. The grants are awarded on a competitive basis and cover travel, accommodation and conference fees for regional or international conferences that are peer-reviewed and indexed in Web of Science and Scopus databases for international visibility.

Since January 2017, KENET has awarded 15 travel grants to graduate students and faculty from 7 universities. The travel grants are in high demand and are much appreciated by the Kenyan researchers as shown below. (See the group of the some of the 11 grantees who presented papers at the prestigious IEEE AFRICON 2017 in Cape Town South Africa in September 2017.) Applications for travel grants are open online throughout the year at http://sig.kenet.or.ke/grant_application.

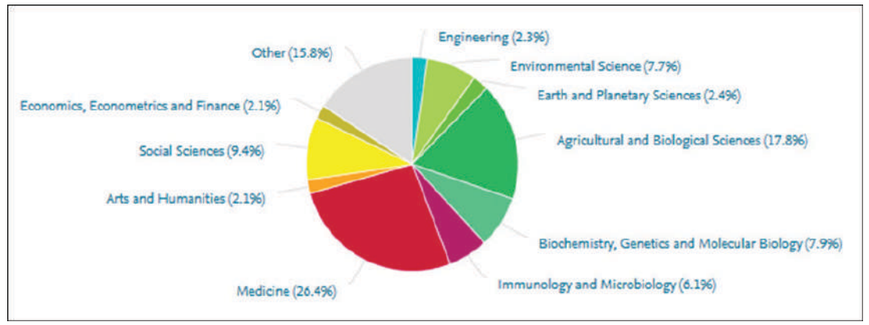
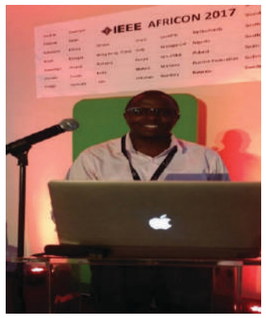


Figure 9: Kenya research productivity 2012 – 2016 (source Elsevier SciVal)



"I am very grateful to Kenya Education Network (KENET) for the travel grant awarded to me to travel to Cape Town, South Africa to present my research paper tilted, "MPPT of a Standalone Wind Energy Conversion System using Magnetostrictive Amorphous Wire Speed Sensor and Fuzzy Logic" at the IEEE AFRICON conference… Presenting my research paper at the conference was very motivating, inspiring and eye opening to me… I was able to benchmark my research against related research work presented at the conference."

Eng. Julius G. Ndirangu, Jomo Kenyatta University of Agriculture and Technology

G.4 Regional Research output in selected research areas in Kenya

The Elsevier Scival tool continues to show that the research output of Kenya is mainly in medicine and biological areas including agricultural sciences as shown in *Figure 9*. Note that only 2.3% of the publications in the 5-year period 2012-2016 were in Engineering.

The total number of papers published by Kenyan authors in the five year period from 2012-2016 was only 11,959 papers. This is low compared to the research output of South Africa or Nigeria as shown in *Table 3* below. There is therefore a need to increase the research output of Kenyan universities and the specialized research institutions in the different areas. Unfortunately, *Table 3* shows that there might be a relationship between research productivity and the GDP per capita.

Table 3: Regional Research Output

Country	Research Productivity (2012 - 2016)	Population in Millions (2016)	GDP per capita (USD) 2016
South Africa	94,779	56	5,273.59
Egypt	78,989	96	3,514.49
Nigeria	30,468	186	2,177.99
Kenya	11,959	48	1,455.36
Ethiopia	8,734	102	706.76
Uganda	6,524	41	615.31
Tanzania	6,227	55	879.19

Source: Elsevier Scival, World Bank

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H. KENET Governance

Current Trustees:	Current Management Board Members
Prof. Timothy Wachira, *Vice Chancellor*, Daystar University- **Chairman** Prof. Peter Mbithi, *Vice Chancellor*, the University of Nairobi- **Treasurer** Prof. Mabel Imbuga, *Vice Chancellor*, Jomo Kenyatta University of Agriculture and Technology Prof. Paul Zeleza, *Vice Chancellor*, United States International University-Africa Prof. Collette Suda, PhD, FKNAS, CBS, *Principal Secretary*, State department for University Education, Ministry of Education Mr. Francis W. Wangusi, *Director General*, Communications Authority of Kenya (CA) Prof. Mary Walingo, *Vice Chancellor*, Maasai Mara University Prof. Joseph Galgalo, *Vice Chancellor*, St. Paul's University Prof. James M. Njiru, *Director,* Kenya Marine and Fisheries Research Institute (KMFRI) Mrs. Sheila G. Muya, *Country Manager Kenya and Head of East Africa*, Pedersen & Partners Prof. Meoli Kashorda, *Executive Director*, Kenya Education Network- **Secretary**	Prof. Edwin O. Ataro, *Professor and Director*, ICT, Moi University- **Chairman** Prof. Timothy Waema, *Professor of Information Systems*, School of Computing and Informatics, the University of Nairobi Dr. Gerald W. Chege, *Assistant Professor* of Information Systems and Technology, USIU Nairobi Mr. Mwirigi Kiula, *ICT Director*, Jomo Kenyatta University of Agriculture and Technology (JKUAT) Mr. Christopher A Moturi, *Director,* ICT Centre, the University of Nairobi Mr. Solomon Mburu, *Head of ICT Department*, Daystar University Prof. Alice Mutungi, *Dean, School of Medicine and Health Sciences (SMHS),* Kenya Methodist University (KeMU) Mr. Ian Moore, *Lead, shared ICT service unit*, CGIAR Centres Mrs. Janegrace Kinyanjui, *University Librarian*, Egerton University Prof. Meoli Kashorda, *Executive Director*, Kenya Education Network- **Secretary**

Figure 10: Annual KENET Retreat for Trustees, MB members and Senior KENET staff in September 2017

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