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Book of Abstracts

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Session 2 - Libraries, Access to Information and Research and Collaboration / 1

NRENs, library consortia and government: Nexus for democratic access to scholarship

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The propagation of NRENs in Africa is transforming the knowledge infospheres through providing internet connectivity to enhance research collaboration and shareability of research output among researchers irrespective of chronemic and spatial limitations. NRENs serve as special vehicles for facilitating access to scientific research and collaboration for socio-economic development. This article will seek to scrutinize how NRENs, library consortia and government can collaborate to support research and education. It will examine how the helical collaboration between NRENs, library consortia and government supports education and research. It will examine how the collaboration between NRENS and library consortia are contributing to the virtualisation of learning teaching and research with regards to collaboration and unlimited access to information. It will seek to highlight how users are benefitting from cooperation between libraries, library consortia and NRENs. The article will explore the challenges and opportunities of NRENs and library consortia collaboration. It will examine the patterns of collaboration at different organisational and inter-organisational levels. The article will also seek to explore the opportunities for collaboration beyond national boundaries. It will study how cooperation amongst academic libraries has helped to provide for the epistemic landscape in Zimbabwe. The researchers will also examine how collaboration with other institutions outside the country is contributing towards widening access to scholarship. It will also make recommendations on how Zimbabwe can benefit from intra African collaboration with regards to research and education. The article will also examine how collaboration between NRENs, library consortia and government are working together to overcome connectivity challenges.

Summary:

The papers uses a praxis oriented approach to explore the collaborative initiatives between NRENs, library consortia and government with regards to widening access to scholarship to support research and education in Zimbabwe

Key words: collaborations; education and research; library consortia; internet connectivity

Session 4a - Tools and e-Infrastructure required for Intra-African Collaboration / 3

Utilizing Virtual Learning and a Virtual GIS Computer Laboratory in Spatial Sciences Learning for the Expanded Open Distance Education at Mzuzu University

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This article describes the application of an emerging virtual learning environment for the teaching of GIS and spatial sciences to open and distance learning (ODL) graduate as well as undergraduate students of Mzuzu University. Focusing mainly on the innovative hybrid architecture of the

virtual GIS computer laboratory, benefits and constraints of this mixed architecture are discussed. To develop this virtual learning environment, consideration was made to use a combination of synchronous and asynchronous communication tools so as to enable interaction between student and facilitator, student and computer, and student and student; to develop a liberated online learning environment where students will access a group of passive and active multi-media tools; and to allow students access a mixed Web-facilitated and hybrid architecture that arouses their cognitive geographic skills and affords hands-on experience in GIS use. This innovative architecture is simple, affordable, and versatile; and provides a flexible and collaborative virtual learning environment for distance education instruction.

Session 4b - Tracking and Contributing to Intra-African Collaboration in Research and Education / 6

Cross-continent collaboration for advanced research

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We present a case study and lessons learnt in cross-continent collaboration (Europe, Africa, Asia) which covers the whole lifecycle of scientific research: from conception of ideas through collaborative work on large-scale scientific experiments in different scientific fields, through the use of data processing, manipulation and storage services, to joint authorship and publication of research results and scholarly papers, data and software.
The use case - H2020 VI-SEEM project - is a collaboration between researchers from 14 countries including North Africa (Egypt), Middle East (Jordan, Lebanon, Israel), and Europe, connected via their NRENs and GEANT/ASREN which provide the basic connectivity platform. VI-SEEM is a Virtual Research Environment (VRE) which unifies the value-added services on top of the network: the existing regional High-Performance Computing, Cloud and Grid Computing resources, data management services, software and tools, as well as application specific on line software services, and delivers to cross-border communities an integrated platform for high-quality research.
This VRE aims to support the scientists and researchers by enabling full lifecycle of research: accessing and sharing relevant research data, using it with codes and tools to carry out new experiments and simulations on large-scale e-Infrastructures, and producing new knowledge and data. VI-SEEM focuses on 3 high-impact regional communities to enable the launch of new collaborations and support ongoing collaborative activities which require the use of shared e-Infrastructure resources. Digital Cultural Heritage community deals with tools and techniques for new understanding of the past and more accurate interpretations of historical interactions between human actors, agency and the rich heritage of regional cultures. Life Sciences community deals with services for understanding disease mechanisms in the populations of the region. Climate Science community predicts global and regional climate change, weather extremes, and related impacts.
The Service Catalogue offers a set of services in the areas of compute resource provisioning, data services provisioning, datasets provisioning, software and scientific workflow provisioning as well as domain-specific applications provisioning, available at https://services.vi-seem.eu/ . Services include Login (eudagain-enabled), HPC Access Service, Cloud Access Service, Grid Access Service, Data Discovery Service, Archival Service, Simple Storage, Repository, Regional Community Datasets, Scientific Application Environment, Workflow and Software Tools Repository, and a set of Application-Specific Services. Services are geographically distributed across 14 countries and are shared, and technical aspects are commonly managed.
End-user access to services and resources is provided via VRE portal: https://vre.vi-seem.eu . Data services are provided to all users via unrestricted free access, if data sets have creative commons or similar license. Access to application-specific services, and read access to the code and tools repository is provided for free, subject to fair usage policy. Access to large amounts of computation and storage resources for performing scientific simulations and storing large amounts of data is provided to excellent research projects from the region via the open calls. Calls are open once a year, addressed to scientists and researchers that work institutions in the region.
We hope that African community can benefit from this example of common technical and scientific cross-border endeavor, and are supportive of collaborations with African scientists from the target scientific fields.

Summary:

We present a case study and lessons learnt in cross-continent collaboration (Europe, Africa, Asia) which covers the whole lifecycle of scientific research: from conception of ideas through collaborative work on large-scale scientific experiments in different scientific fields, through the use of data processing, manipulation and storage services, to joint authorship and publication of research results and scholarly papers, data and software.
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This VRE aims to support the scientists and researchers by enabling full lifecycle of research: accessing and sharing relevant research data, using it with codes and tools to carry out new experiments and simulations on large-scale e-Infrastructures, and producing new knowledge and data. VI-SEEM focuses on 3 high-impact regional communities to enable the launch of new collaborations and support ongoing collaborative activities which require the use of shared e-Infrastructure resources. Digital Cultural Heritage community deals with tools and techniques for new understanding of the past and more accurate interpretations of historical interactions between human actors, agency and the rich heritage of regional cultures. Life Sciences community deals with services for understanding disease mechanisms in the populations of the region. Climate Science community predicts global and regional climate change, weather extremes, and related impacts.
The Service Catalogue offers a set of services in the areas of compute resource provisioning, data services provisioning, datasets provisioning, software and scientific workflow provisioning as well as domain-specific applications provisioning, available at https://services.vi-seem.eu/ . Services include Login (eudagain-enabled), HPC Access Service, Cloud Access Service, Grid Access Service, Data Discovery Service, Archival Service, Simple Storage, Repository, Regional Community Datasets, Scientific Application Environment, Workflow and Software Tools Repository, and a set of Application-Specific Services. Services are geographically distributed across 14 countries and are shared, and technical aspects are commonly managed.
End-user access to services and resources is provided via VRE portal: https://vre.vi-seem.eu . Data services are provided to all users via unrestricted free access, if data sets have creative commons or similar license. Access to application-specific services, and read access to the code and tools repository is provided for free, subject to fair usage policy. Access to large amounts of computation and storage resources for performing scientific simulations and storing large amounts of data is provided to excellent research projects from the region via the open calls. Calls are open once a year, addressed to scientists and researchers that work institutions in the region.
We hope that African community can benefit from this example of common technical and scientific cross-border endeavor, and are supportive of collaborations with African scientists from the target scientific fields.

Session 4b - Tracking and Contributing to Intra-African Collaboration in Research and Education / 7

Promoting Collaborative Research among State Universities in Zimbabwe through Identity Federation and Researcher Information Management

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Normally, the process of applying to universities in Zimbabwe is a generally redundant activity which involves filling in application forms to the multiple local universities using the exact same information on all forms. This paper proposes a platform that not only does away with this redundancy but also reaps great benefits as by-products of its implementation.
The solution will streamline the university-application procedure and also help further collaborative and nationally-relevant research for the benefit of Zimbabwe as a nation. Effectively, it will help in bridging the gap between the raw ideas and concepts undergraduates may have and the well-honed and experienced research skills older researchers are equipped with. This will be by creating a platform where the research potential of each and every person interested in academia in Zimbabwe can potentially be harnessed.
The goal of this paper is to propose a design of a Federated Identity and Access Management (FIAM) platform integrated with a National Researchers Database Management System (NRDMS) to be used by potential university students during their application process to universities in Zimbabwe. This will involve the use of a single set of login credentials to be used by the students when applying to any local university and will also allow them to apply to any of those universities without having to re-enter the same application data for each university. It will also enable them access all their biodata and academic history data which will then be added to the NRDMS. This data management system will also comprise of all university-based researchers in Zimbabwe including all the current and past students and academic staff at state universities. In the process, the students will then automatically be registered to a national database of researchers (upon enrolling with any particular university) which would also then give them access to selected resources availed by that university from anywhere in the world due to the use of Identity Federation.
In the case of academicians working in the same research area but from different universities, this platform will also help them greatly as well. They will gain access to resources availed through the various funded research areas and programmes relevant to the Zimbabwe National Agenda as well as data from other local researchers working in the same area. As an added benefit, this platform will also be able to help postgraduate applicants select supervisors for their PhD or Masters' Degree basing on the set of current researches being undertaken across the country within their own particular area of interest.
Ultimately, the adoption of this model and platform will not only reduce redundancies and the other related costs currently being faced with the current system and thereby simplify the whole university-application process, but it will also help streamline, coordinate, synchronize and better organize researches being undertaken across the nation. In the event that this model is successful, it could have more services added to it and possibly even be applied at a regional or global scale.

Summary:

We are proposing the design of a platform that registers all current and potential university students in Zimbabwe as researchers and aims to harness their knowledge by availing various research tools to them which they can access securely through the federated identity management platform. This can ultimately help streamline and better coordinate researches being undertaken across the country in universities and also rope in the raw young undergraduate minds into these research areas as well for the betterment of Zimbabwe as a whole.

Session 4b - Tracking and Contributing to Intra-African Collaboration in Research and Education / 8

Research Metrics: Does it matter in the African scholarship and collaboration?

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Review of literature reveals that Africa's contribution to global knowledge and innovations is still rated at low. Scholarly communication in the region is bedeviled by among others, poor discovery and access to local scientific information, low publishing levels, and low funding and collaboration in research enterprise. Scientists in the region are at pains on to remedy situation. One development that is steadily gaining popularity globally is use research metrics to evaluate research productivity, visibility, collaboration and impact at individual, institutional, national and regional levels.

The overall objective of this paper is to examine the role of metrics in promoting collaboration and quality in research, publications and innovation in the African region. More Specifically the paper will evaluate first, the concept of metrics in research and publication and the rationale behind the existing research metric key tools and services. Secondly, it will examine the potential application of metrics in both higher education and research institutions as a strategy of promoting and evaluating productivity and promoting intra-Africa collaboration among scholars and institutions in the region. Thirdly, it will review areas of collaboration in the improvement of research in the African region. Fourthly it will examine the key obstacles to the use of metrics and measures required to create conducive organizational ecosystem for fruitful use of research metrics. Finally the paper will propose a unique tool that be used to identify research publications across Africa and apply conventional metrics to them

Summary:

The overall objective of this paper is to examine the role of metrics in promoting collaboration and improvement in research, publications and innovation in the African region. More Specifically the paper, will examine the concept of metrics in research and publication and the rationale behind the existing research metric key tools and services, the potential application of metrics in both higher education and research institutions as a strategy of promoting and evaluating productivity and promoting intra-Africa collaboration among scholars and institutions in the region, areas of collaboration in the improvement of research in the African region and key obstacles to the use of metrics and measures required to create conducive organizational ecosystem for fruitful use of research metrics.

Session 3 - Projects for Intra-African Collaboration / 11

AFriNIC Updates for improved Engagement with the REN Community

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AFRINIC LTD is one of the 5 Regional Internet Registry(RIR) and it's service region covers the entire AFRICA continent and part of the Indian Ocean Islands, and it's headquartered in Mauritius.
AFRINIC's core business include the distribution and management of Internet Protocol number resources (IPv4, IPv6 and ASN). AFRINIC also provides various services and trainings related to these IP number resources.

Globally, IPv4 addresses are exhausted and its only AFRINIC which has the remaining pool of IPv4 addresses to issue. Currently AFRINIC is already in the softlanding phase (maximum /13 can be issued to a member at one go) and now approaching.

UbuntuNet-Connect 2017 with the theme "Enabling Intra-African Collaboration in Research and Education"presents a great opportunity to AFRINIC for an increased level of engagement with the Research and Education Networking community, with the objectives of improving our collaboration and increase awareness on IP resources and related services; in turn ensuring that the Intra-African Collaboration is achieved with greater degree of scalability.

AFRINIC presentations shall cover across the following:
a. Policies –How policies are developed and implemented, how the polices impact members of the community.
b. AFRINIC Services –IP Number resource management, DNS related services, Internet Routing Registry, RPKI and Trainings.
c. How AFRINIC fit into the REN community and Initiatives by AFRINIC to increase IP address uptake by the academic institutions.
d. IPv4 exhaustion and depletion updates.
e. IPv6 uptake updates

Underlying principles that are crucial to consider when designing networks being covered:

a. Scalability –Advantages of network scalability with global IP addresses and limitations of RFC1918 space.
b. Global reachability –Some services performs better in end-to-end network models and has proven to be challenging on many instances running IP NAT.
c. Redundancy - E-services are becoming critical in many aspects our daily lives, uptime and resilience of these services is critical.
d. Autonomy - Institutions can easily manage traffic and routing polices as an autonomous system rather than being enveloped by the service providers network.
e. Content localisation - AFRINIC takes note of this aspect as one of major objectives of UbuntuNet Alliance and other similar regional REN's.

Summary:

As the members of the research and education networking community of Eastern and Southern Africa plus others sharing common and special interests come together to brainstorm on research and education networking activities; AFRINIC as part of its outreach activities will be on site to learn and understand the progress made so far, the plans moving ahead and challenges faced and also take an extra mile through this presentation to provide awareness in our role as regional Internet registry, the services we provide and importance of adopting some of the best common practices with regards to information technology networks, in order to improve on the network infrastructure performance and facilitate service growth and easier adoption of new technologies.

Session 4a - Tools and e-Infrastructure required for Intra-African Collaboration / 13

The NEAAR Collaboration: Supporting low-cost PerfSONAR deployments for end-to-end perfomance monitoring

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The Networks for European, American, and African Research (NEAAR) collaboration, led by Indiana University and GEANT in partnership with the UbuntuNet Alliance, WACREN, ASREN, SANReN, and TENET, is building a dynamic platform for connecting researchers in the US
with their counterparts in Europe and Africa. By providing bandwidth, targeted education and training, and pro-active end-user engagement, NEAAR, funded by the US National Science Foundation, is significantly improving connectivity for existing science collaborations while also enabling new collaborations to take advantage of the growing global research and education networking infrastructure.

Since launching in late 2016, the NEAAR project partners have made significant progress towards achieving the project's year 1 goals. A 100 GB circuit between New York City and London has been installed, adding 100GB of transatlantic connectivity and increased resiliency to the Advanced North Atlantic (ANA) collaboration. The NEAAR partners have also started working to deploy an Open Exchange Point in West Africa that will enable additional peering and resilience for African RENs. Finally, the NEAAR partners have begun working on a human capacity building program that is supporting regional perfSONAR workshops, one-on-one consultations, and other targeted training opportunities for African NRENs and campus staff. This talk will provide updates on these and other NEAAR year 1 developments, an overview of lessons learned to date, and a brief look into what to expect in year 2.

Session 1 - NREN as Facilitators of Intra-African Collaboration / 14

Reorganizing for Efficiency: Framework for National Education and Research Stakeholders Collaboration

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National Research and Education Networks (NRENs) are involved with diverse activities ranging from core connectivity to simply brokerage. Some of the services are so indispensable to research and education institutions that they must be available in the institutions before NRENs are capable of providing them. While TERNET is restructuring itself for relevance and for efficient service delivery to its members, we have been observing various organizations with overlapping services offers to members, the situation which has resulted in inefficiency and wastage of precious resources in the country as well as confusion and sometimes frustration to consumers.

In order to ensure systematic and resource efficient service provision to our consumers, we believe that a framework for collaboration among all stakeholders and service providers is necessary. In this paper, we propose the framework by first reviewing services offered by the stakeholders and other service providers to identify the underlying overlapping areas. The framework will allow these stakeholders to harmonize their efforts towards a common goal of providing well-thought-of services to research and education institutions in Tanzania.

Session 1 - NREN as Facilitators of Intra-African Collaboration / 16

Technical Capacity Building and the Growth of an NREN - Case Study: RENU since 2014

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An NREN network is an aggregation of member institution networks. Sadly, the state of the member institution networks, and the technical competence of member institution network and systems administrators are, many a time, not considered vital contributors to the growth of an NREN. The member institution technical staff are faced with various hardships in their day to day tasks. Aside from the limited budgets allocated to ICT departments, there are two other major reasons for these hardships; the limited network and systems support skills, and the very poor state of the networks of member institutions - many of which are inherited from several generations of neglect. In this paper, we present the technical capacity building drive that was undertaken in RENU and also seek to bring out the impact it has had on the growth of RENU as an NREN. The background and the problems facing campus networks are brought out in the first chapter of this paper. The second chapter details the activities and structure of the RENU capacity building program. In the third chapter, we discuss the benefits and results (both direct and indirect) that have come out of the capacity building program. A trajectory of RENU's growth from 2014 as a network and an NREN community is discussed, highlighting the invisible contribution of technical capacity building. The challenges faced are discussed in the chapter before the conclusion. We conclude by arguing that an NREN suffers in various ways when member institution networks function sub optimally.

Keywords/phrases: throughput, bandwidth, latency, bottleneck, capacity building, campus networks, direct engineering assistance.

Session 1 - NREN as Facilitators of Intra-African Collaboration / 17

Forging Meaningful Synergies between NRENs and CSPs - The Case of Uganda's NREN (RENU)

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In the first five years of its existence, when RENU was not able to operate its own network, an effort was made to establish a symbiotic relationship with a then leading commercial service pro-vider (CSP). A consortium of willing Ugandan R&E institutions engaged this CSP under the aus-pices of RENU in a first attempt at collective bargaining to get the maximum possible discount on bandwidth unit price. The Uganda R&E institutions'bandwidth purchase consortium that emerged was in operation for about four years before ending acrimoniously in December 2013. This was after RENU succeeded to complete the process specified by UbuntuNet Alliance for its member NRENs becoming eligible for admission to the EU-supported AfricaConnect project in September 2013, thus becoming eligible to benefit from AfricaConnect.

RENU's receipt of a private network operator's (PNO) license from the national regulator com-bined with its eligibility for AfricaConnect, created a unique opportunity for Uganda's research and education (R&E) institutions to initiate their cooperatively-owned private network. This net-work would be dedicated to serving their connectivity, access and collaboration needs, to empow-er their communities of practice, and thus trigger the development of a more effective national research and education network (NREN) in Uganda.

This paper presents RENU's experience on this journey from inception, through various growth stages. It focuses on the meaningful synergies that have emerged between the NREN and a still growing number of CSPs by intentionally cultivating mutually beneficial business opportunities. The pursuit of competitiveness, the methodology for enhancing it competitiveness and the resulting impact are also reported and illustrated, from a community-driven perspective for Uganda's R&E institutions, both public and private. The paper assesses the failure of the initial attempt to develop a symbiotic working relationship with a CSP. The process of adopting a model for shared infrastructure access is explained. Exploitation of a zoned public/private partnership environment supplemented by international connectivity, provided through development partner assistance, is highlighted as a combination that triggered a more viable academia/industry partnership regime.

The paper also outlines the experience of initiating a dedicated R&E network that was (pre-determined) to operate as a community-owned and community-driven network, and highlights the effect of the providential rapid-growth phase that resulted into viability and maturity faster than would have ordinarily been possible. The goals and objectives that guided the new approach for nurturing the NREN initiative, the business and ownership models adopted are presented and ex-plained along with opportunities that were explored, what worked and what did not work, the chal-lenges experienced and how they were mitigated are also presented.

Finally, this paper reports RENU's experience in its effort to mainstream the use of meaningful synergies with CSPs and documents the lessons learnt so far. It provides performance evaluation over the first 30 months of stand-alone network operation through a tabular outcome to purpose review (OPR) report plus the trending of unit-price and aggregate bandwidth over the same period.

Keywords/phrases: Community-owned, Community-driven; Competitiveness; Synergy, aggregate-bandwidth unit-price trending, long-term sustainability.

Session 4b - Tracking and Contributing to Intra-African Collaboration in Research and Education / 18

Collaboration in Academia: Motives, Forms and Impacts on scientific Productivity

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Abstract:
With the Internet becoming readily available and cheaper, even in the most remote corners of the world, opportunities for exchanges of all kinds are more and more wide spread. This is true for the exchange of ideas, results and research methods. Many scientists are taking advantage of these new opportunities by working collaboratively with peers, industry and governments both locally or in further places. The review of the literature on such activities clearly shows that industry-university collaboration in applied engineering receives the bulk of the attention. As well, these previous studies mainly focus on mechanisms and the financial costs and benefits of collaborative research. They thus leave out the impact of collaboration on academic productivity. Some of these studies also claim that collaborative research is just a pretext for generating additional research funds with minimum coordination. Others further contend that increased collaboration by scientists and educators will ultimately bastardize the traditional mission of universities, i.e. producing graduates and generating new knowledge and ideas.

While these previous studies shed useful lights on scientists' collaborative activities, by mainly focusing on applied engineering, they are limited in scope. They also overlook many of the motives behind collaborative activities in academia. These omissions are in addition to the limited attention they pay to the impacts of collaboration on scientists' productivity.

Using information from a survey of 1,566 scientists from all scientific disciplines in Québec, Canada, our study tries to overcome some of these limitations by i) looking at collaboration by scientists from all scientific disciplines; ii) by accounting and comparing collaborative activities among 1) researchers; 2) with industry; and 3) with other institutions, namely, governments and organized interest groups and finally iii) by assessing the impacts of these collaborative activities on scientific production.

The results show that collaboration is prevalent in all scientific disciplines even though scientists in humanities have fewer collaborative output than others. As well, motives for collaboration are of three types: strategic, organisational and operational. Furthermore, even though academic collaboration intended to produce patented or unpatented products, scientific instruments, softwares and artistic products has few output, collaboration ultimately increases productivity, regardless of the discipline or the partners. Thus, university administrators aided by NRENs, government decision-makers and other donors should work at creating and enabling a collaborative friendly environment for academic researchers.

Session 4b - Tracking and Contributing to Intra-African Collaboration in Research and Education / 20

Developing Effective Public Awareness Communication Strategy to Stimulate the Role of NRENs in Intra- African Collaboration Strategies

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We explain developing effective public awareness communication strategy will help to stimulate the role of NRENs s well as the regional RENs to spur the current and projected intra- African collaboration strategies for enhanced research and education outputs. The main objectives are to: review the role or benefits of public awareness communication strategy in promoting intra-regional networking for enhanced research, education, and public outreach services; discuss the social responsibility of the media (press) to crate or raise public awareness of the need to enhance the national and regional integration of research and education networks for improved performance outputs on the African continent. In this review, we examined the roles of national and regional regulators of research and education institutions and networks, NRENs, regional RENs, and institutions themselves in developing collaborative programmes or strategies. More data were sourced from policy documents on the strategies, methods, status, and outputs of collaboration goals. Additional information was obtained from internet searches on the role of governments, status of shared infrastructure services, resource access or use; cost effectiveness, as well as the roles of NRENs; the roles of the regional RENs in stimulating their optimal effectiveness, efficiency, and investment expansion.
Key words: Africa, regional RENs, NRENs, collaboration, networking, strategic plan, Uganda

Session 2 - Libraries, Access to Information and Research and Collaboration / 28

Research driven Innovation: A collaborative approach for developing countries' research Uptake

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This paper aimed at assessing the impact of the pre-incubation approach to students' ideas uptake at the University of Dar es Salaam and establishes a framework with which the research uptake can follow suit. The first part of the paper describes the pre-incubation process, achievements and lesson learned. The second part establishes a link between research uptake and the UDICTI pre-incubation processes and proposes a framework that will tap from the research works in the sub-Saharan Africa region to provide products and solutions through a research driven innovation.

The study reviewed the rationale and approach to the pre-incubation process at the University of Dar Es Salaam ICT incubator (UDICTI) and established the success stories and challenges which emerged from the process. Data was collected through interview, questionnaires and bench review of the UDICTI's processes, tools and achievements repository. Questionnaires were distributed online to a sample of 50 students who had gone through the programme during the 2011-2016 period. A number of 10 UDICTI coaches who had participated in the programme during that period were also interviewed in order to supplement and corroborate the survey and repository review results.

The study found that, during 2011-2016 period, UDICTI approached over 1000 University students to participate in the pre-incubation programme whereby over 200 students were trained, coached and mentored. It was also established that, over 20 minimum viable products have been developed with five (5) companies and/or solutions either in existence or in their final stages of development. The study also found that through the process, UDICTI has created relationships with local stakeholders in the innovation ecosystem including governmental units, local incubators and innovation hubs, and national projects working on ICT and innovation. Through collaboration with KTH, UDICTI also conducted Phase II of the World Bank Negawatt challenge which included an acceleration program for two local teams whereby Team STIC went on to participate in the finale in Barcelona, Spain in 2015 and became the overall global winner. The study also found that one of the major challenges

that UDICTI faces, is lack of fund and equipment for incubatees to prototype their initial businesses. The study proposes a framework that builds on what UDICTI has achieved, and brings together the industry, research institutions, non-governmental and public agencies to solve the existing challenges and generate ideas on solving the societal and industrial issues. The framework involves an ICT platform that virtually connects the stakeholders to contribute to the idea bank and face-to-face forums where stakeholders meet and strategize on different regulatory and technical issues. The ripe ideas coming out of the framework are used by the incubation programmes to develop solutions and also feed into government policies. It is expected that the framework will be able to stimulate the development of the innovation ecosystem within the country by empowering institutions that are key contributors to the innovation ecosystem structure in the country.

Summary:

This research paper aims at establishing a research uptake framework that will enable research driven innovation in Tanzania and provide a baseline for the same for other developing countries–especially sub-Saharan African countries. Based on a work done in grooming the university students'ideas to ICT products and services, the paper proposes a framework that ensures a countrywide/regionwide catchment as well as enabling collaboration between different stakeholders through the ICT platform. The expected outputs include dissemination and use of research results, and development of solutions/services ideas based on the research knowledge shared. The expected impacts include businesses establishment and government policies improvement/establishment.

Session 3 - Projects for Intra-African Collaboration / 29

The Sci-GaIA project: final results, lessons learnt and opportunities for the African Communities of Practice

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Sci-GaIA (www.sci-gaia.eu) is an EU funded project that ran from May 2015 to April 2017. Initially set out to create sustainable training to support scientific endeavour through Science Gateways and e-Infrastructures in Africa. To better motivate and to establish a clearer route to impact, the project shifted focus to embrace Open Science to better open up scientific achievements in Africa across the world. Overall, the Sci-GaIA project has made thousands of people made aware of Science Gateways, e-Infrastructures and Open Science and has created a sustainable ecosystem of Open Science compliant, Open Innovation capable and Open Education based collaboration across Africa. It has also addressed a number of UN Sustainable Development Goals effectively addressed: (3) Good Health and Well-being, (4) Quality Education, (9) Industry, Innovation and Infrastructure, (11) Sustainable Cities and Communities, (13) Climate Action and (17) Partnerships for the Goals. Overall the project has made effective impacts on African health and public health and, consequently, on the quality and duration of life.

The major results of the project were:

- The creation of the Open Science Platform, a DevOps-compliant public research e-Infrastructure (both Grid and Cloud based) for projects and applications, and supporting training and educational materials.
- The creation of e-Research Hackfests that uses effective challenge-driven education to train, innovate and create new services, applications and developers.
- The creation of 35 Champions who have has supported 24 Communities of Practice, created 7 new Science Gateways, multiple new services and 5 new Open Data Repositories.

- A thriving developer community that interacts through the African e-Infrastructures Discussion Forum, a web forum where people (users, stakeholders, decision makers) can freely discuss e-Infrastructure and Open Science related topics.
- A catalogue of services for different types of "customers"that includes 19 new federated services and 30 new applications.
- A survey analysing trends in Science Gateway and e-Infrastructure development in Africa.
- An approach to ensuring interoperability and interoperation between African, EU and global e-Infrastructures of our Open Science Platform via an e-Infrastructure Sentinel.
- The successful creation of 100 dissemination and communication media, publications, many different Sci-GaIA events and the exciting Sci-GaIA Festival of Open Science that combined a Champions conference (the User Forum Conference) and a Final Project day that celebrated the project' s achievements.

In this contribution we plan to present Sci-GaIA results, share the lessons learnt and discuss the opportunities for the African Communities of Practice to leverage and exploit project results.

Session 2 - Libraries, Access to Information and Research and Collaboration / 30

Without data, science is merely an opinion: the African Open Science Platform project

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The Science International Accord on Open Data in a Big Data World presents an inclusive vision of the need for and the benefits of Open Data for science internationally, and in particular for Lower and Middle Income Countries. In addition to benefiting from Data from the international community, African countries have much to contribute for all to benefit in making progress towards implementing the United Nations Development Programme (UNDP) Sustainable Development Goals (SDGs), provided that Data curation activities are aligned with international standards. Providing a comprehensive view of what is happening on national and continental level, will not only assist fellow researchers and potential funders in identifying gaps –it will also assist African countries to identify opportunities for capacity building, inter-regional links to strengthen collaboration, towards international alignment with science activities on international level. The African Open Science Platform initiative is an important outcome of the Accord on Open Data in a Big Data World, and great progress has been made towards a better understanding of the following four focus areas:

1) buy-in and support from countries and institutions through data policies;
2) capacity building and developing skills;
3) how sharing of data by researchers is awarded (incentives); and
4) current infrastructures that exist to support the sharing of data.

This presentation will be focusing on the alignment of the project with the SDGs, as well as sharing outcomes of the project regarding the mentioned focus areas. Phase 1 of this project focused on creating awareness and doing a landscape survey of what is done in terms of Open Data. Phase 2 –starting on 1 November 2017 –will be focusing on building capacity and presenting training workshops. Initiatives indicated above are captured in a database, which will inform future recommendations. This platform is expected to enhance accessibility to and increase the impact of African science, and specifically the data sets underlying the science.

Session 1 - NREN as Facilitators of Intra-African Collaboration / 38

Building and Strengthen National Research and Education Networks (NRENs) in Africa through Intra-African Collaborations

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Abstract

A National Research and Education Network (NREN) is both; 1) a high performance communications network owned and operated for and by the education and research community of a country and; 2) the organization that operates that network, constituted as a consortium of members, a dedicated agency, a company, NGO, or other type of body. In World Bank partner countries an NREN may simply be a consortium of universities that organize themselves as a "buying club"in order to get a better price from Internet Service providers (ISPs), or it may be more sophisticated and be offering connectivity services to its members. (Case for NRENs 2009). Several countries around the world have adopted the NREN as the centerpiece of an advanced network for collaboration and communication between the Tertiary and Research Institutions within their country and to other parts of the world. (Ravinder 2008; C@ribNET 2010).

Around the time of the mid 1990's, the United States Congress took critical steps toward what was called then the National Public Network. The United States Senate and the House of Representatives moved toward enacting legislation to authorize their NREN (Kahn 1992). Yet in the context of most Africa Countries, the lacking of similar political strong intervention is what could have led to slow deployment of NRENs on the Continent.

The African NREN

Poor Internet connectivity is one of the pertinent issues in the digital divide between developing and industrialized countries, hampering the transition to the global information society. Africa is currently the most under-served continent in terms of the information and communication technologies. Hence the collaboration amongst tertiary education institutes in Africa is imperative to make them key players in the enhancement of information and communication technologies for society (Ravinder 2008).

To date there are only about four successful and sustainable NRENs on the African continent that enable a number of educational and research institutions in their respective countries to now enjoy improved internet services, are able to collaborate globally and also access useful e-resources for teaching and research. West and Central Africa is the only region in the world that current is not connected to the global Research and Education Networks and as such, their researchers are not able to collaborate within the region and other global researchers.

Most African NRENs have gone through several iterations of starting and stopping, various Boards and memberships, and various models of operations, which did not make any significant process in providing a sustainable NREN. Current attempts to have a sustainable NREN have been directed towards providing technical and services oriented solutions by focusing on the business model and financial plan (casefornren.org). Beyond merely the technical aspects of scalability, our concerns lie in how to reproduce and translate the necessary learning processes alongside the spreading of artifacts, funding, and people. (Braa, Monteiro et al 2004).

Interventions Required

A conscious effort has to be made using the theory of Information infrastructures to look at the collection of governance, policy, structures, people, procedures and technologies that make up an NREN and its infrastructure in order to make it sustainable (Star and Ruhleder 1996). Without a conscious effort to achieve sustainable systems, initiatives from aid organisations, governments and NGOs are likely to replicate past outcomes of lengthy technology deployment and fast technology abandonment (Beardon et al. 2004).

In order to leapfrog NRENs into becoming a vibrant and sustainable, the practices that have worked elsewhere on the continent should be reinforced. There is no need to rebuild the same problems in

the new networks we are building. Instead there is a need to make the NREN stronger by building an organization with and active and vibrant community.

In order to achieve this, interventions and collaborations existing and functional NRENs would have to be taken in the areas of governance, policies, procedures as well as the products and services that the NRENs would be providing to its community of users and practitioners like Universities ICT Directors, Researchers, Academicians, Librarians and other stakeholders. Hence the focus on Intra-African collaborations should not only be with products and services but all the areas from Governance to best practices.

Conclusion

The establishment and strengthen of NRENs on the African continent is still very relevant as they are increasingly viewed as the centerpiece of an advanced network for collaboration and communication between the Tertiary and Research Institutions within the country and to over parts of the world. Thus the concerted effort lead by the AAU and working together with the Regional RENs needs to revitalize and renew its mandate to ensure that its Members can effectively play a vital role in the African higher education arena.

Summary:

A National Research and Education Network (NREN) is both; 1) a high performance communications network owned and operated for and by the education and research community of a country and; 2) the organization that operates that network, constituted as a consortium of members, a dedicated agency, a company, NGO, or other type of body. In World Bank partner countries an NREN may simply be a consortium of universities that organize themselves as a "buying club"in order to get a better price from Internet Service providers (ISPs), or it may be more sophisticated and be offering connectivity services to its members. (Case for NRENs 2009). Several countries around the world have adopted the NREN as the centerpiece of an advanced network for collaboration and communication between the Tertiary and Research Institutions within their country and to other parts of the world. (Ravinder 2008; C@ribNET 2010).

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Session 4a - Tools and e-Infrastructure required for Intra-African Collaboration / 39

Developing A Virtual Computing Lab for REN Community

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National Research and Education Networks (NRENs) build and maintain advanced broadband networks that interconnect universities and research institutes. The NRENs not only provide basic Internet and shared services but are also considered part of innovation and capacity development ecosystem of the countries. KENET has embraced the idea of providing online training boot camps including the Internet Society (ISOC) introduction to Unix course that is moderated by KENET technical staff. This paper will describe the innovative methodology, automation, architecture and tools used by KENET to develop the Virtual computing Lab, usage by KENET for internal and external capacity building and the usage by the University and research community. KENET has adopted the Ganeti virtual machine cluster management tool with synnefo open source cloud management tool to deploy a massively scalable cloud-based virtual computing lab solution integrated with several automated services to enhance its usability. The virtual computing lab has optimal computing resources that will enhance the training methods and improve efficiency by providing virtual machines during training boot camps for KENET members.

The Virtual Computing Lab developed by KENET allows staff, faculty and students within KENET members to register to the cloud environment and upon approval they can utilize the computing resources by self-provisioning a virtual machine within a few seconds. This lab is also used internally by KENET technical staff to simulate practical environments for pilot services before production deployments. Security is also enhanced on the lab by ensuring that rules and traffic shaping is implemented for all the virtual machines as a way of curbing possible abuse by users. The architecture and design of the lab ensures scalability by having a cluster model where resources are increased by adding physical machines to the cluster. The key advantage is that KENET training boot camps are now no longer limited by the computing resources available on end user machines. The virtual lab is currently available to users only within the KENET network and will be tested with large numbers of ICT students in the next 12 months.

Keywords—KENET, ISOC, Ganeti, Synnefo, Iaas, Capacity Building, Training, Virtual lab

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Planning and Management of ICT Shared Infrastructure and Services - MoRENet Case Study

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The Government of Mozambique, through the Ministry of Science and Technology, Higher and Technical Education, is promoting the establishing of the Mozambique Research and Education Network (MoRENet), to be a technical platform for shared IT infrastructure and data communication services for the research and academic community in Mozambique. MoRENet cover today 91 institutions including higher education, research, and technic professional education institutions as well as other institutions, that by the virtue of their mandates and roles are considered significant players of Mozambique´s research and education ecosystem like the libraries, meteorological, statistics and other scientific data producing institutions.
One of the challenges facing institutions or initiatives like MoRENet is the adoption of business models or approaches that can address the sustainability of their operations. The other is the clarification of the roles of all the players, specifically of the government and of the beneficiary institutions, in the investment and in supporting the operational costs of an NREN. Of particular importance is the role played by the government, usually represented by the related ministries and regulating agencies, by having the power and potential to hinder of support the growth of an NREN, and of the telecommunications service providers by the impact of the telecommunications costs on the successful operation of an NREN.

This paper will focus on the approaches adopted by MoRENet for addressing the challenges of planning MoRENet´s ICT shared resources, including data communication services provided by national and international telecommunications operators as part of the operationalization of its business model and its strategic plan for the period 2017-2019. It will also provide data demonstration the significant savings for the beneficiary institutions well as for the Government of Mozambique, the main promoter of MoRENet, by the options designed and implemented for contracting shared national and international data communications services. Another dimension of this paper will be the presentation of elements illustrating not only the receptivity by the beneficiary institutions of the approaches adopting by MoRENet for addressing the sustainability challenges, mainly those related to the definition and approval of MoRENet´s tariffs, but also of the government intervention from the policy, financial, and other kind of incentives points of views.
One of the main and ultimate objectives of the MoRENet is to be a platform that facilitate and support the launch of new collaborative initiatives between the members of the research community within Mozambique but also with their peers in other African countries taking advantage of the overwhelming options and opportunities offered by the digital ecosystem of applications and services providers, including mobile applications. This paper will share some example of how some of the actors of the education and research ecosystem are already using or planning to use in the new future MoRENet shared services for setting up data bases and information systems using group related collaborative work, in areas like management of education institutions, publication of information, assessing the quality of tertiary education, broadcasting research results in areas so diverse like health, agriculture, education, tourism, energy, and others.

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Governance model for Educational Roaming (eduroam) in African research institutions

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Abstract

Educational Roaming, "eduroam"is a globally accessible, secure wireless service for members of participating universities and research institutions. eduroam is a widely used example of a technology that uses trust and identity federations to share essential tools for collaboration and research by enabling visiting partners to use the Internet at trusting institutions. Identity is a key service provided by eduroam service, and use of the service is limited to active users from collaborating institutions and potentially collaborating institutions. As the popularity of eduroam increases, this freedom is in jeopardy as ransomware worms and network saturation potentially impinge upon providing consistent service levels at African member institutions. In addition, the high cost of an adequate Internet gateway in Africa, creates a supply side constraint, leading to de facto restrictions that other continental partners may not have to consider. The effects of this tension can cause degradation in services for the roaming user and could also spill over into the existing pool of network resources offered by the service provider. Some member institutions may address these problems by implementing overly restrictive policies, creating a very inconsistent experience when using eduroam between member institutions. These challenges may lead member institutions to discontinue support for eduroam or for prospective members to chose not to adopt eduroam. We used quantitative and qualitative methods to establish a baseline of Internet priorities. We performed deep packet inspection to reveal common categories of Internet resources, applications, and specific Internet hosts that are used at research institutions under our administration. We assigned a bandwidth cost of applications and used surveys to gauge relative importance of Internet resources, applications and hosts.

After one year of service at NIAID African research institutions, this body of work produces a proposed convention for eduroam member institutions that introduces a behavioral policy for eduroam users and a scalable, platform independent configuration policy for member institutions.

Summary:

I. Notes

Configuration policy

1. Bandwidth Caps
2. Filtering internet content on what users can access
3. Network behavioral guidelines
4. Incident response policies for administrators when responding to behavioral incidents
5. How do we make eduroam a single SSID on our network. That is, getting rid of other network broadcast SSIDs.

Monitoring

1. How do we automate monitoring eduroam to ensure it's working at the local institution?
2. How do we automate monitoring eduroam to ensure its working for RHSP users roaming at other visited institutions worldwide?
3. How do we know if the service at the home national radius proxy server is up or down?

Security concerns

1. Packet and disassociation spoofing because 802.1x doesn't use a keyed MIC
2. Need to physically segregate the eduroam wireless Aps from the institution Local area network.
3. The eduroam wireless network is on a separate Virtual local area network

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Peoples-uni: public health capacity building through online education

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The mission of Peoples-uni (http://peoples-uni.org) is to build Public Health capacity to meet the enormous needs for improving the health of populations in Low- to Middle-Income Countries (LMICs). Open content and open access both facilitate the development of the programme we describe, and will further contribute to education for health professionals. Education is provided fully online, and a unified global education programme enhances collaboration among health experts.

Peoples-uni, outside but benchmarked to the traditional higher education system, has been offering very low cost online Masters level courses since 2008. 19 modules are available covering the foundation sciences of Public Health and health problems facing LMICs populations. Seventy percent of the students are from Africa and 12% from Southern Asia. Enabling factors include volunteer tutors (from 50 countries) and use of Open Educational Resources. A previous collaboration with a traditional university in the UK was a success, but a hinderance to further development is failure so far to identify an alternative university partner, either in a high-income country or an LMIC.

1474 students have enrolled on 5449 modules where 35% of the students have passed at least one module at the Masters level. In a partnership with a UK University, 128 students, who had already passed two modules, enrolled on the MPH programme: 73% graduated with an MPH and a further 14% gained a graduate Diploma or graduate Certificate. Many graduates collaborate by joining as tutors themselves or as Student Support Officers. Alumni perform collaborative research as a group, with so far one paper on the use of IT for guidelines in the peer reviewed literature and a further study on HIV management in the analysis stage.

A sister site for Open Online Courses (http://ooc.peoples-uni.org) allows self-paced learning in a number of areas not usually found in university courses. Most of these have been developed collaboratively with, or for, other organisations. An upcoming course for Continuing Professional Development is developed in partnership with a large healthcare organisation in Uganda.

Collaboration in Ethiopia, led by the Education Strategy Center, was to create and offer an online course in trauma. Included were the Ethiopian Civil Service University, ICE-Addis, Jimma University, Gonda University, the Ethiopian Research and Education Network (EthERNet). An EU grant application was unsuccessful, but we are exploring alternative ways of developing the course.

Programme development would not have been possible without collaboration from an IT group who understands the requirements of online education in LMICs, and has the skills to support students and tutors through an educational programme including for those with low bandwidth. MoUs have been signed with the Africa Training Institute, to provide content in the field of Public Health to the IT infrastructure offered by the ATI, and the Ivoirian Research and Education Network (RITER) and the Virtual University of Cote D'Ivoire to collaborate on modules for French speaking populations.

Challenges remain in how to further collaborate with African universities and to accredit our awards.

Summary:

The mission of Peoples-uni is to build Public Health capacity to meet the enormous needs for improving the health of populations in Low- to Middle-Income Countries (LMICs), and has been offering very low cost online Masters level courses since 2008. The programme is the result of, and leads to many opportunities for, collaboration. Outcomes, enablers and hinderance to further collaboration are described.

Session 1 - NREN as Facilitators of Intra-African Collaboration / 46

Mapping the research collaboration networks in computer science: The case of central, eastern and southern African Countries. .

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Mapping the research collaboration networks in computer science: The case of central, eastern and southern African Countries.
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Abstract
Purpose: We conducted a scientometric analysis to determine the research collaboration networks in the field of computer science in central, eastern and South African countries. The study covered publications published from 1980 to 2016. The study analyzed publication growth trends and impact, global share and rank, collaboration levels within and outside of selected countries, top-ranking countries, institutions and individuals in the region, most preferred journals in the region, and a text-based research topic trend.

Methods: We used SCOPUS to retrieve data on publications of all computer scientists from 16 countries covering the UbuntuNet alliance by using a pre-determined search strategy. We used Gephi software program to show co-authorship networks, because of its great analytical power to construct and visualize large networks.
Results: A total of 22,083 publications were recorded from 1990 to 2016. The study shows that there has been an increase of publication from 78 in 1990 to 2395 publications published in 2016. Most scholars had published journal articles (n= 13734, 62.2%), followed by conference papers (n= 7106, 32.2%) and review articles (n= 1243, 5.6%). The top five countries with high number of publications across these UbuntuNet alliance countries were South Africa (n=16936, 77.64%), followed by Kenya (n= 1525, 6.9%), Ethiopia (n= 848, 3.8%), Tanzania (n= 733, 3.32%) and Uganda (n= 695, 3.14%). Scholars mainly published in the field of computer science (n= 5822, 26.4 %), which was followed by engineering (n=5579, 25.6 %), and medicine (n=4334, 19.6 %).Network analysis revealed strong ties between ubuntuNet researchers with hubs of computer sciences in the USA, China and European Institutions such as CERN. Intra-collaboration between institutions in the selected countries was low. The results are correlated with other demographic and economic indicators of the selected countries. . The most top five authors and contributors come from the following universities; university of Cape Town (n= 100, 0.45%), universiteite Pretoria (n=88, 0.4%), universiteite Stellenbosch (n=85, 0.4%), university of KwaZulu-Natal (n=83, 0.38%) and university of Witwatersrand (n=79, 0.36%).
Originality: This is a comprehensive empirical study that visualizes research productivity and collaborative networks among institutions and countries in the east, central and South Africa region. The study findings provide useful findings for determining funding patterns and policy formulation for scientific research in the computer science domain.
Policy and practical implications: The study findings suggest the following: a need for African journals to adopt open access publishing approaches to enhance their online visibility, since they were ranked low in this study; institutions to consider various metrics when evaluating the research productivity of individuals; institutions and ministries dealing with science and technology to develop and publish scientometric national/institutional reports in order to promote research productivity and collaborative research. The emphasis should be made to encourage ubuntuNet alliances to promote collaborative research network since collaboration between ubuntuNet countries is low.

Summary:

This is a comprehensive empirical study that visualizes research productivity and collaborative networks among institutions and countries in the east, central and South Africa region. The study findings provide useful findings for determining funding patterns and policy formulation for scientific research in the computer science domain.

Session 4a - Tools and e-Infrastructure required for Intra-African Collaboration / 50

Digital Tools for Collaborative Research

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Collaboration in research facilitate connecting researchers, exploration of literature, collaborative writing, publishing, evaluation, finding and sharing of data and code amongst a lot many research activities. A collection of digital tools are needed to support collaborative research efforts from research tasks ranging from search to article visualization so as to enhance reading, writing and navigation experience for researchers. Researchers stationed in different institutions and regions of the world are increasingly reaching out to connect with experts as well as other researchers to solve different problems facing governments of the world. This calls for tools that support collaboration such as in the creation of electronic lab notebooks, mind mapping, generation and analysis of data sets, which serve as the nervous system that provision services that support meaningful collaborative activities. Digital tools supporting outsourcing of experiments and connecting instruments and sharing of development platforms through virtual environments have come in hand in strengthening collaborative research. In this era of collaborative research writing, research writing tools have become a requirement especially those able to adapt to the needs of researchers to enable storage and management of references facilitating writing of manuscripts while keeping a close track in the modifications by others to the text. Evaluating research enables scientific value of articles and overall achievements of researchers to be known through peer reviews. Digital Tools that analyse impact of one's research to check impact factor and citation counts help researchers visualize the impact of their research. In this research work, we will analyse the various digital tools supporting collaborative research and how they assist the various collaborative research activities. Furthermore, we will establish tools that researchers are still yearning for, that need to be developed to help them in undertaking their research activities which are currently not covered by existing digital research tools.

Keywords: - digital research tools, digital tools for research collaboration, collaborative research tools

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Developments in regional SADC Cyberinfrastructure to support Collaboration,Open Data and Open Science

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\begin{abstract}
There is a convergence of data and compute intensive paradigms and a proliferation of research, and projects in these areas and applications. There also is a global trend in developing distributed and federated high performance data cyberinfrastructure and e-infrastructures to support to research,

encourage collaborations and to facilitate data sharing for open science. These cyberinfrastructures can also be used to share expensive instruments and resources including high performance computing (HPC) resources through connected research networks. These efforts are typically aimed at accelerating research and discovery across domains and countries often reinforcing National, Regional or Continental objectives or geopolitical objectives such as integration.

Regionally, the Southern African Development Community (SADC) countries have engaged and developed a regional collaborative Cyberinfrastructure Framework. The vision around the regional cyberinfrastructure is that of -

"An education, research and innovation environment that provides for human capital development and shared access to unique or distributed facilities to impact socio-economic development in the SADC region and promote knowledge based economy"

The Cyberinfrastructure proposed in the Framework will cover;

1. National Research Networks - Specialized broadband infrastructure networks and service providers for education, research and innovation ,
2. Computational Resources - Ranging from HPC to other computing capabilities ,
3. Data - tools and facilities (including repositories) to enable sharing and efficient data driven discoveries, technologies and innovations,
4. Policies - To enable optimal establishment and utilization of cyber-infrastructure, generation, analysis, transport as well as stewardship of information, and
5. Human Capital - To make effective use of the Cyberinfrastructure.

The Framework will seed and form a basis for a SADC Cyberinfrastructure Strategic Plan with the goal to promote high level quality education, research and innovation; accelerate technology transfer, commercialization and industrialization in SADC, and to promote shared cyberinfrastructure commons (i.e. infrastructure and capabilities).

It is also envisaged that once developed - the cyberinfrastructure will add value to scientific programmes, foster partnerships and collaborations
and develop regional Cyberinfrastructure networks through interconnecting HPC centers, scientists and research on regional priority challenges. For example, once fully developed, the infrastructure will also enable the region to address regional priority challenges in the areas of Energy, Water, Climate, Agriculture, Health and provide capability to support the global projects such as the Square Kilometer Array (SKA), continental project like the H3Africa Human Heredity and Health in Africa, promote citizen science and will help facilitate science research and education in the continent.

The Framework proposes an implementation plan to cover the key focus areas of;

1. Policy or Strategy Development - institutionalization, implementation support,
2. Education, Research & Development and Innovation,
3. Human Capital Development,
4. Infrastructure Development,
5. Resource Mobilization, Communication, Awareness & Advocacy and
6. Strategic Partnerships.

Finally the framework proposes governance structure for the Cyberinfrastructure strategic plan comprising of the key stakeholders of relevant SADC Ministerial Committees, thematic Groups, international advisory experts Group; regional expert working groups and centers of excellence.

\end{abstract}

\keywords{Cyberinfrastructure, High Performance Computing, Open Data, Open Science, NRENs, Policy.}

\end{document}

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Open Access, Open Science, Open Data: Who will benefit? A user profile

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The scientific community aspires about unlimited and open access to knowledge and information. Just a click and researchers enter the Nirvana of databases, libraries and communication platforms around the globe. Thanks to governments'efforts in developing as well as in developed countries National Research and Education Networks (NREN) have been established and provide the technological infrastructure. Government and research sponsors around the world have agreed that research data bases and their deriving results should be –in most cases - open and accessible for everyone. In a digitized research environment, research budgets turned back as side topics.

A dream came through - in form of a Tsunami. Many researchers around the globe might be overwhelmed and surprised about the fact and the timing and are not prepared to plunge into the digital world of libraries, laboratories and research collaborations. This research will explore the prerequisites a researcher has to have in order to participate in and benefit from Open Access, Open Science, Open Data (OASD). The focus is on the digital competences of researchers to tackle the challenges they face in the digital research world. This is exactly the position most researchers from developed and developing countries are taking on. This research poses the question: What kind of digital competences the users of OASD have to have, in order to take advantage of the possibilities offered?

The EU puts high priority in bringing digital competences to citizens, consumers, educators, students etc in order to succeed with its efforts to create the Digital Single Market and bringing the European Open Science Cloud alive. Therefore, this research sees the European efforts as benchmark, to give orientation what developing countries could do to become active participants in the OASD. This paper is structured in a brief introduction to the OASD and will explore the definitions of digital literacy, information literacy and media literacy before presenting the European digital competence framework with its competence areas. In a next step, it will analyse the criteria of a potential OASD user to satisfy the curiosity as a "data archaeologist". Data mining and digging are the key activities to find facts for further investigations. EU digital literacy understanding is built on a hierarchy of competences and sub-competences (digital competence framework), starting from the basic level (foundation) of digital literacy up to an intermediate, advanced or highly professional level. Subsequently, the discussion is led to the Computer Driving License (CDL) and how far it lays the foundation for digital literacy necessary for researchers. The final section will deliver recommendations, how specifically Ethiopian researchers –as representatives of researchers from a developing country could get prepared to take most out of the free access to world class data bases, literature and research communities.

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Blockchain technology: Facilitating collaborative research via Intellectual Property sharing

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Blockchain is the underlying technology on which CryptoCurrencies such as Bitcoin and Etherium are based. Blockchain is implemented via the use of a distributed ledger. Blockchain ensures permanence of information and addition or modification is subject to everyone and the owner of information contained in the ledger agreeing as well thus making it temper proof. Transactions are grouped into blocks and time stamped and the whole mechanism is decentralised in nature and open to anyone and everyone. Many African countries currently do not have the requisite information sharing infrastructure in place. The use of blockchain technology will enable African and other developing countries to jump the technology gap. The current ledger systems where Intellectual property is adjudicated and stored (such as ARIPO) is centralised in nature. The storage and sharing of Intellectual property such as Patents could harness such technology as blockchain. Various academic, corporate and research institutions across the African continent and other developing countries can be able to share and access Intellectual Property inexpensively and thus effectively facilitating collaborative research.

Summary:

Use of blochain technology in the facilitation of collaborative research across the African continent.

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Facilitating content distribution in Sub-Saharan Africa through Software-Defined Exchange Points

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Sub-Saharan Africa is the fastest growing region of international Internet capacity in the world. Content in Sub-Saharan Africa is increasing: Microsoft is bringing two new data centers to South Africa, and Google and Akamai have been installing caches. The demand for content distribution within Sub-Saharan Africa is growing as the number of data centers and caches increase. Strategic placement of local compute, storage and networking is increasingly important in response to demands in local content distribution growth.

Internet eXchange Points (IXPs) are resources that play a central role in interconnecting many networks. In addition, their role has been expanding in importance for bringing content closer to end users. For example, as content traffic continues to rise, IXPs are in the foreground of the peering issues between content providers and access networks. IXPs are considered a natural resource to evolve into a SDX, because they offer a physical location where multiple networks meet to exchange traffic and to peer (exchange routes).

This paper presents a Software-Defined Exchange as a novel internetworking paradigm to facilitate content distribution. A SDX facilitates sharing of compute, storage and networking resources among multiple independent administrative domains, such as ISPs, CDNs, or NRENs. A survey of the most relevant SDX studies and use cases for a SDX, including content distribution, will be presented. Finally, deployment considerations and projects implementing SDXs will be discussed.

Session 1 - NREN as Facilitators of Intra-African Collaboration / 58

MoRENet as a Platform for Intra-country Collaboration in Research and Education: Evidence Based on Analyses of Usage Patterns and Network Data Flows

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MoRENet (Mozambique Research and Education Network) has been defined as a technological platform to support the collaboration between national research and education actors within the country, and between these and their peers in Africa and other parts of the world. Focused on this aim and on the government's policy of facilitating the mobility of researchers, lecturers, and students, the Government of Mozambique, has been promoting and supporting the establishment of MoRENet, a network that interconnects today more than 91 research and education institutions distributed by all the provinces of Mozambique. This number includes all tertiary education institutions, research institutions and a small number of technic professional educations. This number covers institutions in areas like agriculture, education, health, energy, tourism, food processing and food sciences, architecture and engineering, social sciences and humanities opening a wide spectrum for intra and interdisciplinary research and education collaboration initiatives.

This paper will explore the measurement and analyses of usage patterns and network data flows to investigate the usage of MoRENet as a platform to promote and support the collaboration between actors of the scientific and academic community within Mozambique as well as between then and their peers in Africa and other parts of the world. It will also provide evidence, based on the analyses of MoRENet data traffic, protocols, topology and architecture as well as the on the applications and services accessed by users, the potential role of MoRENet's policies, strategies, architecture, and controls in promoting or hindering the growth of the network.

The Government of Mozambique MoRENet's investment was instrumental in the growth of the network capacity in its national and international links as well as in its storage capacity in both NOCs (Network Operations Centers) enabling significant capacity to host research and education related applications and content. MoRENet has grown from 1 STM-1 international link to 12 STM-1s, from 50 Mbps national backbone links to 500 Mbps, and from 20 Mbps access links to 100 Mbps in less than four years. This paper will explore, through specific measurements tools, techniques, and parameters, the utility of MoRENet's data communications, storage and processing capacities as incentives for national research and education institutions to localize their content in MoRENet's infrastructure as well as for other content providers to elect MoRENet as a partner for peering agreements.

As part of this work and through appropriate tools and techniques, the MoRENet technical team will measure and analyze, with the purpose of generation policy recommendations, about the usage of applications, their localization and the possible peering agreements. Based on the results of the assessment of usage patterns of MoRENet, including the analyses of access to applications and services determinant for the performance of the network, both at international and national backbone links, the MoRENet technical team will propose measures for improving the management and performance of the network as well as for easing the identification and establishment of links between institutions, between researchers, and between students of different institutions within Mozambique with the aim of building communities.

Session 4b - Tracking and Contributing to Intra-African Collaboration in Research and Education / 59

Growing a Data-Ready Continent: Every Contribution Counts

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The current acute shortage of computational, data management and analysis skills amongst researchers and practitioners has been described in numerous publications. Programmes have been developed to address this shortage at institutions globally. Interventions aim to provide training in multiple ways, including: short courses, bootcamps, and Massive Open Online Courses. Some "data science"initiatives target people with formal education in computationally fields while other programmes try to upskill applied researchers with limited formal computational and data training.

Despite the availability of all these resources, the growth of data scientific skills and competencies are not keeping pace with the demand for these skills. It is time to think creatively about more rapidly building "data-ready"communities in industries as well as in academia.

Over the past few years, exciting new international initiatives, have emerged. Software, Data, and Library Carpentry are non-profit, volunteer organisations that develop training material, train instructors, organise workshops to teach computing and data skills, and support the development of communities of practice. They have found that mobilising and empowering people at all career stages to share their knowledge with peers offer a simple solution to building skills capacity, thus not depending on large amounts of money or highly ranked government officials or acclaimed professors and experts.

Carpentry workshops teach open-source tools like R, Python, Shell, SQL, OpenRefine, and git to people with little or no prior programming experience. The workshops are typically run over two to three days. Workshop assessment data shows many participants leave workshops with a sense that they too can learn to code and work better with data.

Since 2013 almost 30 Software, Data, and Library Carpentry workshops have run in seven African countries, with many more in the pipeline. These workshops attracted participants from disciplines including life sciences, engineering, health sciences, social sciences and humanities, mathematics and statistics, computer science, as well as support environments like the libraries and IT.

In 2015 the first South African Carpentry instructors participated in online instructor training and four instructors qualified during that year. Two in-person instructor training events were also held in South Africa with a third planned for October 2017. To date, more than 60 African researchers and students have gone through instructor training. These trainees have represented countries including South Africa, Namibia, Zimbabwe, Kenya, Benin, Democratic Republic of Congo, Cameroon, Nigeria, Ethiopia, and Malawi.

The potential to run workshops at a variety of institutions across the continent, is increasing daily through the help of numerous funders, supporters, volunteers, students, researchers, and champions. The entire vision of building computing and data science capacity and communities of practice in Africa, relies entirely on the collaboration across continents, institutions, disciplines, and career stages with reliable internet access playing a crucial role in all of this.

Summary:

Since 2013 Software, Data and Library Carpentry workshops have been run in numerous places on the African continent. These workshops teach open-source tools such as R, Python, Shell, git, SQL, and OpenRefine to researchers and students across all disciplines and from all career stages. Through the Carpentry initiatives, more than 60 African instructors have gone through instructor training and hundreds of researchers and students have learned about tools for data manipulation, analysis and visualisation. This paper will give an overview of the tremendous collaboration across continents, institutions, disciplines, and career stages to build data and computing capacity through the Carpentries in Africa.

Session 2 - Libraries, Access to Information and Research and Collaboration / 60

A Pilot Survey on Institutional Enablers and Barriers Affecting the Evolving Role of Librarians in African Higher Educational Institutions

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Background and Motivation

African higher education institutions (HEIs), like many in this sector worldwide, are experiencing a confluence of forces that are set to influence the direction taken by these institutions in the foreseeable future. Among these influences are digitalisation, globalisation, platformisation and continuing digital innovations, all affecting the content, delivery, resourcing and packaging of academic knowledge.

As with other contemporary industries, information and its related processes are key drivers of these influences. In most institutions, including HEIs, information processing is generally associated with information technology (IT) professionals and linked to the appropriation of mostly technical skills sets. While technical knowledge is important for understanding digital innovations, more important is the expertise in promoting an institutional information culture where there is an appreciation for how information is collected, disseminated, stored, processed etc., in other words, information resource management.

This is an area which is more the province of information professionals such as librarians. The profession of the HEI librarian, however, is itself being disrupted by technological innovations and digitalisation. This means that new roles are evolving, which are intrinsic to the ongoing influences affecting the sector.

In developing country contexts, lack of, or insufficient access to, key technological infrastructure has consistently been identified as a barrier to the performance of information-related functions in the HEI sector. Access to high capacity Internet connectivity is key to providing the infrastructural platforms to support these initiatives and Research and Education Network (RENs), whose development has been supported by network connectivity projects such as AfricaConnect, are seen as key underlying enablers. At the national level (NRENs), they can offer HEIs a range of services underpinned by digital infrastructure. The existence of this digital infrastructure is meant to support innovation, collaboration and knowledge sharing between HEIs that are connected and to boost a region's education/research capability and support initiatives such as Open Science, Open Innovation and Open Data, i.e. information-rich platforms that help build information resource capability institutionally.

Clearly then, a focus on the direction and development of the evolving role of African HEI librarians, identifying the institutional factors that either constrain or enable this evolving role and an understanding of how the capabilities of NREN services could be leveraged in these efforts becomes a key research agenda. To progress such an agenda a pilot survey involving the West and Central African Research and Education Network (WACREN) and the University of Sheffield Information School was launched.

Pilot Survey Aims and Objectives

The aim of the pilot survey was to identify key institutional enablers and hindrances in the current support for the evolving role of librarians in the West and Central African higher education community and to understand their underlying NREN service needs.

The objectives of the survey were to:

1. Understand the evolving role of the librarian in contemporary higher education settings, especially vis-à-vis digital resources.
2. Understand how institutions within the higher education sector support or constrain the roles of librarians, especially where these are concerned with management of digital resources.
3. Elicit the NREN service requirements that librarians need to support their roles
4. Gather demographic information that would be useful in categorizing the librarian communities of practice so as to understand theevolving field better.

Survey Development and Deployment

Preliminary work on initial drafts of the survey were accomplished through the following initiatives: (a) distribution of a draft "Skeleton Survey"on the "Discussion About Libraries in WACREN"mailing list in February (b)incorporation of initial feedback and further comments taken at the Association of University Librarians of Nigerian Universities (AUNLU) workshop on 5-8th March 2017 in Abuja, Nigeria (c) launch of a draft version of the survey at the WACREN Librarian's Workshop on 27-28th March 2017 in Abidjan, Côte d'Ivoire and (d) finalisation of the resulting changes with the help of WACREN, the Ivorian Research and Education Network (RITER) and AULNU and a literature survey on the topic area undertaken at the University of Sheffield Information School.

The final pilot survey questionnaire contains 66 questions split into 6 sections. Sections A to D relate respectively to questions about the management, operational, specialist subject and technical library functions of an HEI. Section E asks questions about the sufficiency of the librarian's digital skills sets and the evolving roles of the library and librarian while section F captures sample demographics. The pilot survey was launched using the existing mailing list (the WACREN librarian community discussion list) that serves a subsection of the higher education librarian communities in the West and Central African higher education community and is hosted by WACREN serving a region of 22 West and Central African countries. There are about 95 registered users of this list, to which a link to an online version of the survey, also hosted by WACREN, was made available. Any other potential

respondents were canvassed by WACREN and its collaborating NREN organisations through their mailing lists.

The data were captured automatically by the online survey and stored on WACREN's servers. 100 responses were received, from which complete responses totalled 64. Analysis of the data was done using Microsoft Excel.

Findings and Discussion

The completed version of this paper will provide an in-depth analysis and discussion of the pilot survey findings. Since it was a pilot study, two aspects will be analysed: (1) what the findings reveal about the underlying research objectives/aim and (2) what the findings reveal about the way in which the sample respondents reacted to questions, e.g., what they chose to disclose or not disclose. All questions were based on categorical variables, and therefore all analyses are either descriptive or based on simple bivariate correlations. All free text questions were analysed using simple thematic analyses.

Some interesting findings that will be explored in the final paper include:

1. The gender and age composition of the sample and its relationship to the prevailing views held about the role of the library (most claimed it was a service provider and not an innovator)
2. The tendency of the sample to frame the "evolving role of the library"in terms of technology-enabled traditional activities and not see the potential for innovation/novelty
3. The sometimes conflicting responses concerning infrastructural support and technological capability (claims of adequate technological support against claims of resource-poverty)
4. An apparent difference between the responses between Francophone-based participants vs. Anglophone-based participants
5. The extent to which the library function can control information architectural issues related to information resource management
6. A broad appreciation of how HEI resources such as budgets and training are apportioned
7. A broad appreciation of how digital techniques are supported and catered for in HEI libraries
8. A broad understanding of how librarians identify their roles in the evolving HEI landscape

These findings will be discussed in the light of the literature researched around these topics. Finally, recommendations for the launch of a wider-ranging survey addressing the full WACREN HEI librarian community and beyond will be proposed and links made as to how this can progress HEI policy in these regions.

Session 4b - Tracking and Contributing to Intra-African Collaboration in Research and Education / 61

The case for IoT applications in Africa

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The Internet of things (IoT) refers to the networked interconnection of objects in addition to traditional networked devices. This is starting to happen, as the incessant decrease in size, cost and energy consumption of wireless devices is boosting the number of deployed wireless devices dramatically. The number of mobile objects composing the IoT will be huge: in 2020 between 12 to 50 billion devices are expected to be connected with each other, a 12- to 50-fold growth from 2012. Several different technologies will converge into IoT, such as RFID systems, wireless sensor and actuator networks, personal and body area networks, etc., each using its own access solution.

One key issue with the Internet of Things is the ability to rapidly create IoT applications. Fields of applications include for example sustainable development, environment and infrastructure monitoring, emergency response and disaster mitigation, waste management, continuous health care, smart product management, smart meters, home automation and smart events. Applications of Internet of Things can greatly benefit populations in Developing Countries: food safety can be checked, water quality can be monitored, air quality can be measured, landslides can be detected and mosquitoes can be counted in cities in real time.

In the paper we focus on research activities necessary to find solutions to the issues faced by IoT applications in Developing Countries, such as intermittent energy availability, limited bandwidth, low data storage capacity, harsh environmental conditions, privacy issues for underrepresented communities, user interface for illiterate operators. These peculiar issues require research to be solved and solutions will drive IoT architectures. To realize the benefits offered by IoT, a broad portfolio of successful deployments in Developing Countries will be needed as a proof of concept and the future community of African IoT researchers will have to be trained.

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Sustainable and effective pathways for International Research Collaboration: Evidence from Mekelle University, Ethiopia

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ICANN: Securing the DNS and the KSK rollover

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Securing the DNS and the KSK rollover