

# Beyond Today's Internet: African Participation and Experience of a Smart Future

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## ABSTRACT

The growth of African science and technology has been hampered by a multitude of problems. From the continent's late start in the race to setting up and obtaining universities with research quality fundamentals to equipment acquisition, lack of capacity, limited research and development resources and most importantly the increasing absence of international research partnerships. The lack of a strong international research partnerships for the African university and research community, the fact that most African universities and research communities are new, most of them less than 50 years in business have exerted the expected academic growth of the African university and research. With all these problems, two solutions are fundamental: a development of a strong government backed funding policy for the African university and research community and strong international partnerships and research infrastructure to support a culture of both applied and fundamental research to drive the badly needed indigeneous innovations and development of a knowledge pool of skills for development. Without these, the African university and research will continue to be deligated to the tail end of the world class universities and research communities. This paper focuses on the building of an African international research infrastructure to bring the continent beyond today's internet to a smart future.

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## 1. INTRODUCTION

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In a number of past issues, I have been writing about the crucial need for the African university and the building of African research communities which will lead the continent to be able to derive value in its indigenous research. The reputation of a university and indeed the reputation of a nation's research capacity is built on solid commitment, partnerships and international collegial support. So far, the African university has failed to do that and the small and beginning research communities are finding it extremely difficult to garner that badly needed collaboration, advice and support from their colleagues internationally because of lack of partnership collaborative research infrastructure. In ranking after ranking of world universities, year after year, the African university has failed to attain any position in any ranking that is commensurate to the needs and education aspiration of the African peoples. In fact, according to the 2014 World University Rankings by the British firm Quacquarelli Symonds, University of Cape Town in South Africa is the highest ranked university on the continent, in position 141 [African Development Bank Group]. In the 2014-15 *Times Higher Education* World University Rankings, the only international university performance agency to judge world class universities across all of their core missions - teaching, research, knowledge transfer and international outlook, the University of Witwatersrand with a ranking of 275 was the first African university to appear in the ranking [Times Higher Education,]. In the respected *US News and World Report*, the 2015 rankings of global powerhouses in education, the University of Cape Town comes in at number 251 followed by the University of Witwatersrand at number 270 and the University of Cairo, across the continent at number 443 [US News and World Reports].

## **2. CRITICAL PROBLEMS FACING THE AFRICAN UNIVERSITY AND RESEARCH COMMUNITIES**

There are indeed two major problems currently preventing the advance of the African university to the world stage and these are: the missing critical partner – the African government and the lack of strong international research partnerships and infrastructure to support collaboration and create an enabling research environment.

### **2.1 The Missing Critical Partner – the African Government**

As Mr. Steve Kayizzi-Mugerwa, Acting Chief Economist and Vice-President, AfDB, observed in his presentation, “African universities as agents of innovation and development” [African Development Bank Group] during a panel discussion at the African Economic Conference in Addis Ababa, Ethiopia, an annual gathering organized by African Development Bank (AfDB), United Nations Economic Commission for Africa (ECA) and the United Nations Development Programme (UNDP), the African governments should tap into the increasing interest in higher learning education by investing in international standards for universities.

According to Dr Sarah Ssali of Makerere University School of Women and Gender Studies [SAMUEL KAMUGISHA], government had invested little in research, leaving it in the hands of development partners. It has been the case that university education has traditionally contributed to social and economic development by forming human capital, through workforce development, building knowledge capital pools and bases primarily through innovation and research and dissemination. Based on this, national governments in developed countries supported higher education to develop that human capital as a key factor for economic growth.

In their paper “The contribution of higher education institutions to the South African economy” [Anastassios Pouris and Roula Inglesi-Lotz ], authors Anastassios Pouris and Roula Inglesi-Lotz report that volumes of literature on government investment in higher education indicate that there are strong and positive returns from investing in higher education institutions. KPMG, in its report “Economic modelling of improved funding and reform arrangements for universities. Canberra: Universities Australia; 2009”, [KPMG], observes that ‘increasing university funding from its current level of 1.6% of GDP to 2% of GDP in Australia

and increasing the share of Commonwealth government grants up to 50% from 42%, led to a 5.8% gain in real GDP and a 5.2% gain in living standards in the long term’.

So government support of university education does not only improve the country’s GDP, but human capacity in research, innovation and development is increased. These form the ingredients needed for the African university to match to the world stage.

## 2.2 Lack of strong international research partnerships and infrastructures to support collaboration and create enabling research environments.

The best way to create beneficial research partnerships is to join and participate in public, shared computer network testbeds. The main goal of public, shared computer network testbed for participating users contribute a number of machines, the nodes, which are centrally controlled by the organization’s operating system. Users belonging to a participating site can create slices and choose among the available nodes in order to virtualization and allocation of the node resources to the different slices running concurrently on the same node.

There several of these public, shared computing network infrastructured used by reserachers across the global including as GENI [GENI], Emulab [EMULAB], PlanetLab [PlanetLab], DeterLab [DEterLab] and others. These shared and public research make available a variety of resources experimenters conducting research may not have at their own institutions. As Sarah Edwards et al [SARAH ET EL] puts it, the wide variety and volume of compute and networking resources available in these testbeds would be prohibitively expensive or impossible to have in a privately held university or research laboratory.

Edwards also notes that these (for example PlanetLab, GENI) also provide:

- geographic diversity of their resources,
- support repeatability of experiments.
- provide standardized ways to request resources, operating system images, software, etc.
- make it possible to publish and share experiments so that others can repeat them.

I will now focus on the two most popular of these public and sharable computing networks: **PlanetLab** and **GENI**:

**PlanetLab:** (<https://www.planet-lab.org/>)

PlanetLab is a global research network that supports the development of new network services. Since the beginning of 2003, more than 1,000 researchers at top academic institutions and industrial research labs have used PlanetLab to develop new technologies for distributed storage, network mapping, peer-to-peer systems, distributed hash tables, and query processing. PlanetLab currently consists of 1337 nodes at 694 sites.

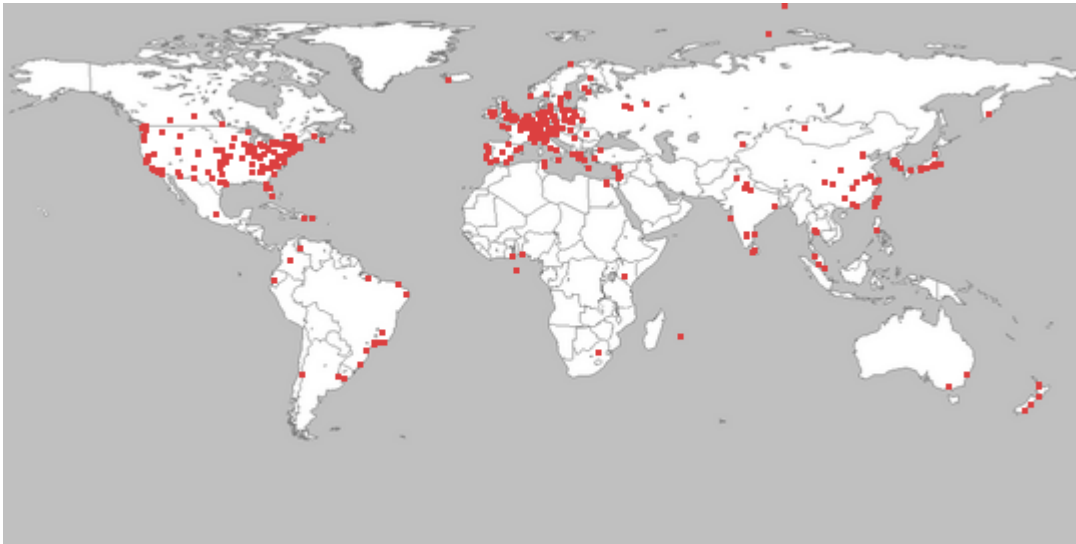


Figure 1: Global Reach of PlanetLab

PlanetLab, is the most popular shared network testbed in which the participating sites contribute a number of machines, the nodes, which are centrally controlled by the PlanetLab's operating system, called PLC.

**GENI:**( [https://www.geni.net/?page\\_id=2](https://www.geni.net/?page_id=2))

GENI for (Global Environment for Network Innovations) is a public and shared virtual laboratory for networking and distributed systems research and education. It is well suited for exploring networks at scale, thereby promoting innovations in network science, security, services and applications. GENI allows experimenters to:

- Obtain compute resources from locations around the United States;
- Connect compute resources using Layer 2 networks in topologies best suited to their experiments;
- Install custom software or even custom operating systems on these compute resources;
- Control how network switches in their experiment handle traffic flows;
- Run their own Layer 3 and above protocols by installing protocol software in their compute resources and by providing flow controllers for their switches.

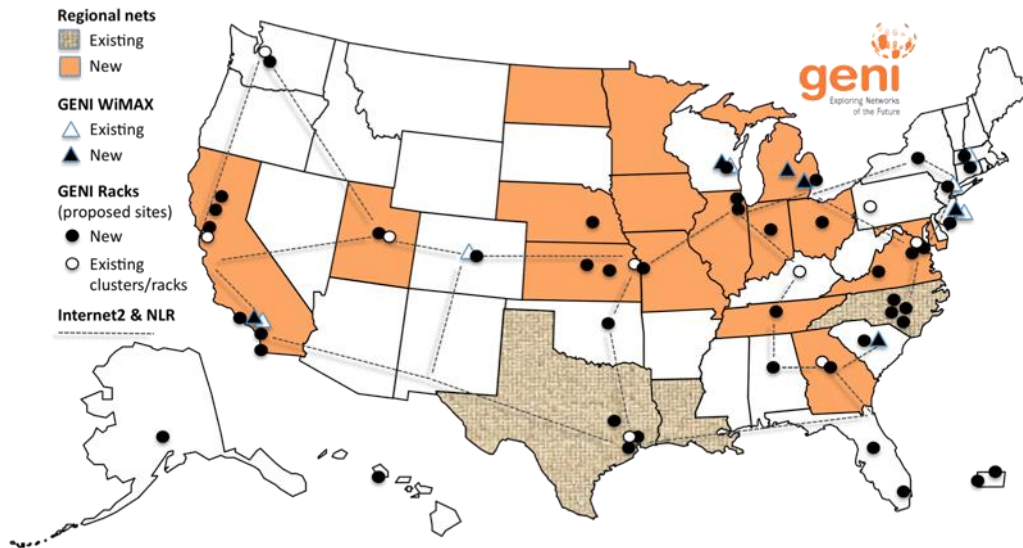


Figure 2: GENI nodes in US

### 3. AFRICAN PARTICIPATION IN THESE GLOABAL PUBLIC and SHARED NETWORKS

As we have pointed out earlier, these networks provide users a wide variety and volume of compute and networking resources that would otherwise not be available at their home institution. Unavailability of such resources in these testbeds, like the current situation on the African continent, the learning and research environment would be prohibitively expensive or impossible to have. The question that remains is how to bring awareness of these resources to African educators and reserachers. In cooperation with the GENI GPO, I will be conducting a GENI Workshop this summer in Kampala Uganda with expected audiences from eastern African higher education and research communities. If and when this is successful, we intend to take this effort continentwide. Watch out for us!

### REFERENCES

- AFRICAN DEVELOPMENT BANK GROUP. African governments must enhance image of their universities – experts say. <http://www.afdb.org/en/news-and-events/article/african-governments-must-enhance-image-of-their-universities-experts-say-13721/>
- ANASTASSIOS POURIS and ROULA INGLESII-LOTZ. “The contribution of higher education institutions to the South African economy” [http://www.sajs.co.za/sites/default/files/publications/pdf/Inglesi-Lotz\\_Commentary\\_0.pdf](http://www.sajs.co.za/sites/default/files/publications/pdf/Inglesi-Lotz_Commentary_0.pdf)
- ALIOUNE CAMARA AND KATHRYN TOURE, —African Universities Strategize and Struggle to Research and Make Research Matterl. [http://www.kathryntoure.net/docs/2010\\_UniversityResearch7.pdf](http://www.kathryntoure.net/docs/2010_UniversityResearch7.pdf)
- DETERLAB (<https://education.deterlab.net/>)
- EMULAB (<https://www.emulab.net/>).
- GENI:( [https://www.geni.net/?page\\_id=2](https://www.geni.net/?page_id=2))

TIMES HIGHER EDUCATION,

<http://www.timeshighereducation.co.uk/world-university-rankings/2014-15/world-ranking/range/201-225>

KPGM. <http://www.voced.edu.au/content/ngv3516> SAMUEL KAMUGISHA *The Observer*. University research takes back seat as consultancy becomes more lucrative, SUNDAY, 19 OCTOBER 2014 16:25 .

<file:///C:/Users/jhd353/Documents/IJCIR/Volume%208%20Issue%202/The%20Observer%20-%20University%20research%20takes%20back%20seat%20as%20consultancy%20becomes%20more%20lucrative.html>

SARAH EDWARDS , XUAN LIU and NIKY RIGA. Creating Repeatable Computer Science and Networking Experiments on Shared, Public Testbeds.

[http://delivery.acm.org/10.1145/2730000/2723884/p90-edwards.pdf?ip=150.182.214.50&id=2723884&acc=ACTIVE%20SERVICE&key=A79D83B43E50B5B8%2EB0474E77875A5C15%2E4D4702B0C3E38B35%2E4D4702B0C3E38B35&CFID=684183544&CFTOKEN=19972140&\\_acm\\_=1434556693\\_6291595f08642ce91dc885cea0da4919](http://delivery.acm.org/10.1145/2730000/2723884/p90-edwards.pdf?ip=150.182.214.50&id=2723884&acc=ACTIVE%20SERVICE&key=A79D83B43E50B5B8%2EB0474E77875A5C15%2E4D4702B0C3E38B35%2E4D4702B0C3E38B35&CFID=684183544&CFTOKEN=19972140&_acm_=1434556693_6291595f08642ce91dc885cea0da4919)

PanetLab: (<https://www.planet-lab.org/>)

US NEWS AND WORLD REPORTS.. Best Global Universities Rankings.

<http://www.usnews.com/education/best-global-universities>