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RESEARCH INTERESTS : Networked Systems, Network Architecture & Protocols, Unmanned Aerial Systems Communications, Software Defined Networks, Quantum Networking

TEACHING INTERESTS: Computer networks, Network Security, Network Programming/Softwarization

EDUCATION BACKGROUND

1. **North Carolina State University (NCSU)** North Carolina, USA
   Ph.D. in Computer Science –Networking July 2016
   Advisor: Dr. Rudra Dutta

2. **University of Dar es Salaam (UDSM)** Dar es Salaam, Tanzania
   Msc. Computer Science –Applications Security Jan 2008
   Advisor: Dr. Jabiri Bakari

3. **University of Dar es Salaam (UDSM)** Dar es Salaam, Tanzania
   Bsc Computer Science Jun 2005

WORK EXPERIENCE

Research Associate – North Carolina State University (NCSU)
September 2021 – present

1. Conduct research in networking of Unmanned Aerial Vehicle (UAVs) under the AERPAW project.
2. Architect and design secure backplane in support of dynamic software-defined fixed and mobile experiment resource allocation for customizable remote access.

Chief Executive Officer – Tanzania Education and Research Network (TERNET)
April 2017 – August 2021
1. Oversee implementation and evaluation of TERNET Rolling Strategic Plan
2. Oversee Network Operational Center (NOC) activities and connection to member universities and research institutions

3. Research and develop strategies to extend network connectivity to rural education and research community.
4. Initiate business partnerships with stakeholders
5. Drive the culture of the organization
6. Identify organization risks and ensures appropriate strategies are in place
7. Oversee employment and ensures appropriate level of staffing with adequate skills.
8. Generates new opportunities and gives approval of new projects
9. Responsible for day-to-day decision-making regarding TERNET welfare.

Researcher and Lecturer – Open University of Tanzania (OUT)
July 2017 – August 2021
1. Principal Investigator (PI) for the computer networking lab at OUT conducting research in network reliability and security.
2. Supervising Master's and Ph.D. students in Computer Networking and Security.
3. Teaching Computer Security and Networking to Bsc. and Msc. Computer science students.
4. Conduct consultancy activities in the department of ICT and Institute of Education and Management Technology (IEMT).

Assistant Lecturer – Open University of Tanzania
November 2016 – June 2017

1. Teaching 5 courses in Computer Security, and Networking to Bsc computer science students.
2. Assist in conducting research and consultancy activities in the department of ICT and Institute of Education and Management Technology (IEMT).

IT Advisor and Grant Proposals Writer – GetMAGIC Corporation
June 2016 – November 2016
1. Write and submit proposals for grants to support GetMAGIC work of mentoring and providing resources for girls aspiring STEM fields.

2. Review and advise on different IT applications within the Corporation.

Tutorial Assistant (Cloud Computing) - North Carolina State University
January 2016 – June 2016, North Carolina, USA

1. Assisted students to understand lecture materials and homework
2. Designed, tested, and supervised class projects
3. Supervised and marked examinations

Information Technology Intern – 4 the World
May 2014 – August 2014 – North Carolina, USA

1. Redesigned and implemented the organization's information system.

Tutorial Assistant – Open University of Tanzania
July 2005 – June 2012

1. Assist in teaching courses, setting labs, and marking in Computer Security, and Networking to Bsc. computer science students.
2. Assist in conducting research and consultancy activities in the department of ICT and Institute of Education and Management Technology (IEMT).

Associate Director - Information Resources and e-Learning - Open University of Tanzania
January 2007 – June 2012 - Dar es Salaam-Tanzania

1. With the team of 54 staff we managed and maintained all university software and hardware IT resources.
2. Motivated my team to customize and maintain in-house information systems such as the Learning Management System which dramatically reduced the cost incurred by printing and mailing study materials to students. We developed and maintained other systems such as helpdesk management, exams management, university website, mailing system etc.
3. Managed installation and maintenance of computer centers in 12 regions in Tanzania to provide free Internet access to students and staff in the rural areas of Tanzania. This enhanced enrollment while reducing the dropout rate from 25% in 2008 to 10% in 2011.
4. Conducted research on how teaching and learning can be improved using ICTs. As a result of this research the university increased the ICT budget.

Deputy Executive Officer – Tanzania Education and Research Network (TERNET)
April 2008 – June 2012 - Dar es Salaam – Tanzania

1. Established the organization and the Network Operation Center (NOC) connecting 43 university network infrastructure. This was an important change that marked the establishment of a common body to oversee networking infrastructure of higher education and research institutions.
2. Negotiated with the government to fund the first STM-1 and support last mile connectivity for higher education and research institutions. 27 universities were connected to the NOC under phase I of government budget.
3. Led a team of 5 engineers to perform operational and technical duties to connect the universities to the NOC, and the NOC to SEACOM Broadband Network, which in turn enabled universities and research institutions team up and share computing resources.

PROFESSIONAL SERVICES AND ACTIVITIES

1. *Conferences Organizing:*

   2021: Chair of the Organizing Committee, TERNET 1st International Conference on Digital Transformation

   2018: Chair of Local Organizing Committee, 38th UbuntuNet-Connect Conference

2. *Technical Program Committee:*

   2022: Member, European research and education networking conference (TNC22)

   2021: Member, TERNET 1st International Conference on Digital Transformation

3. ***Conference Reviewer:***

2018-2020: UbuntuNet-Connect Conference Series

2022: European research and education networking conference (TNC22)

4. ***Conference Session Chair:***

2018: Internet2 Global Summit, Africa Special Interest Group

2022: INFOCOM Computer and Networking Experimental Research using Testbeds (CNERT 2022), Tools for Experimentation Session

5. ***Board and Committee Membership:***

2019 – 2022: Member, UbuntuNet Alliance for Research and Education, Malawi – Professional Organization

2017-Present: Member, More Active Girls in Computing (GetMAGIC), California - NGO

2019 – Present: Member, Kampala International University in Tanzania (KIUT) Council, Tanzania - University

2017 – 2019: Chairperson, UbuntuNet Alliance Commercial and Technical Committee, Malawi – Professional Organization

6. ***Professional Membership:***

2015 – Present, Professional Member, Institute of Electrical and Electronics Engineers (IEEE)

7. ***Invited Talks/Panels:***

2022: Midscale Experimental Research Infrastructure Forum (MERIF) Testbed Data Management and Outreach

2022: RFDataFactory At-scale data collection through Platforms for Advanced Wireless Research (PAWR) platforms

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HONORS & AWARDS

1. Network Startup Research Center (NSRC)-Internet2 Fellow — March 2018
2. Schlumberger Foundation Faculty for the Future PhD Fellow — Mar 2015 – Jun 2016
3. Google Anita Borg Scholar — Jul 2014 – Jun 2015
4. Fulbright PhD Fellow — Jul 2012 – Jun 2016
5. Best Paper Award (author and presenter) at the 2nd International Conference of Engineering and Meta-Engineering (ICEME) — Mar 2011
6. National Social Security Fund (NSSF) prize for being the best female student in Mathematics — Sept 2003

RESEARCH/PROJECTS FUNDING

1. **[Sida HERI Repository Fund](#)** **(2019-2021)– Awarded**. I was PI in developing a proposal for researching the needs and connect higher education and research institutions data repositories to the central national repository hosted at the National Commission for Science and Technology (COSTECH). The grant was awarded by the Swedish International Development Agency (Sida) through COSTECH.

2. **[ACTEA](#)** **(2018-2021)- Awarded.** I was one of the 12 partners in writing proposal for the Applied Curriculum In Technology East Africa (ACTEA) project under Erasmus+ Key Action 2, Capacity-building in the Field of Higher Education 2015, which is a logical continuation of the Trans-European Mobility Programme for University Studies (Tempus) Program that was started by the European Union to facilitate the modernization of higher Education in countries surrounding the EU. I was the PI in Tanzania overseeing implementation at the NREN level.

3. **[AFRICACONNECT](#)** **(2011-2023)– Awarded**. I was one of the 16 members team in Eastern and Southern Africa (under [UbuntuNet Alliance](#)) in developing proposals for this multi-phase project to connect Africa Higher Education and Research Institutions (HERI) together and to the rest of the HERIs in Europe. I was the PI for Tanzania overseeing project implementation during AfricaConnect2 (2015-2019) and AfricaConnect3 (2019-2023) phases.

Other proposals (not ultimately funded) were submitted to various agencies, such as USAID (US Federal Government), IEA2020 (African Union), WorldBank Tanzania, EOL2019 (Global Partnership for Education), INNO-TRIBE (European Union).

PUBLICATIONS

Journals Publications

1. M. Mushi and R. Dutta, "Designing for Proactive Network Configuration Analysis." Journal of Systemics, Cybernetics and Informatics, 17, 1, pp. 221-239, 2019

2. M. Mushi and R. Dutta, "Human Factors in Network Reliability Engineering." Springer Journal of Network and Systems Management, 26, 3, pp. 686–722, July, 2018. doi: https://doi.org/10.1007/s10922-017-9440-1

3. M. Mushi and J. Bakari, "Security in In-House Developed Information Systems The Case of Tanzania." Journal of Systemics, Cybernetics and Informatics, 10,2, pp. 1-5, 2012

4. M. Mushi and Z. Ruhwanya, "The Potential of Open Educational Resources (OERS) in Higher Education Curriculum and Course Materials Development." Huria Journal of the Open University of Tanzania, 13, 2, pp 15-23, 2012

5. Z. Ruhwanya, G. Mbwete, and M. Mushi, "The Role of Mobile Phone Learning in Escalating Access to Open Educational Resources (OER) in Developing Countries." Huria Journal of the Open University of Tanzania, 13, 2, pp. 87-93, 2012

Conference Publications

1. M. Mushi, H.P. Joshi, R. Dutta, I Güvenç, M. Sichitiu, T. Zajkowski, Yufeng Xin, Michael J. Stealey, and Erik L. Scott, "The AERPAW Control Framework – Considerations for Resource Control and Orchestration for a Computing-supported Physical Research Platform." International Federation for Information Processing (IFIP) Networking 2022 Conference (NETWORKING 2022) SLICES Workshop, Catania, Italy, June, 2022

2. S. J. Maeng, I. Güvenç, M. L. Sichitiu, B. Floyd, R. Dutta, T. Zajkowski, O. Ozdemir, and M. Mushi, "National Radio Dynamic Zone Concept with Autonomous Aerial and Ground Spectrum Sensors." Proceeding of the IEEE ICC 2022 Workshop on Spectrum Sharing Technology for Next Generation Communications, Seoul, South Korea, May, 2022. doi: https://doi.org/10.48550/arXiv.2203.09014

3. M. Mushi, H.P. Joshi, R. Dutta, I Güvenç, M. Sichitiu, B.A. Floyd, and T. Zajkowski, "The AERPAW Experiment Workflow - Considerations for Designing Usage Models for a Computing-supported Physical-Equipment Research Platform." Proceedings of the INFOCOM Computer and Networking Experimental Research using Testbeds (CNERT) Workshop, Virtual, May, 2022

4. M. Mushi, E. Murphy-Hill, and R. Dutta, "The human factor: A challenge for network reliability design." Proceedings of the 11th International Conference on Design of Reliable Communication Networks, Kansas City, MO, March, 2015

5. M. Mushi, J. Bakari, K. Enaya, and S. Yazdani, "The Realities of Operating an Open University in Sub-Saharan Africa." Proceedings of the Learning International Networks Consortium (LINC 2013), Cambridge, MA, 2013.

Theses

1. M.Mushi, "Factoring Human Workflow in Network Reliability Engineering," Ph.D. dissertation, CS, NCSU, Raleigh, North Carolina, 2016.
https://repository.lib.ncsu.edu/handle/1840.16/11221

2. M.J. Mushi, "Development of In-house Applications Security Analyzer (IASA)," Master's Thesis, CS, UDSM, Dar es Salaam, Tanzania, 2008.

Others

1. S. Shah and M. Mushi, "Verifying timing-based algorithm for TOR traffic detection," North Carolina State University, 2015
2. M.J.Mushi, "Human-Aware Network Reliability Design," North Carolina State University, 2015
1. M. Mushi, "CSC 893 Report: Science of Security," North Carolina State University, 2015

2. M. Mushi and R. Dutta, "Data-driven Study of Network Administration in the Evolving Landscape of Software Defined Networking." Proceedings of the Workshop on Human Centered Big Data Research, Raleigh, NC, 2014

SERVICE AND CONSULTANCY

1. Worked with 67 universities in Tanzania to transform digitally by developing digital transformation strategies and overseen their implementations.

2. Work closely with universities to assess e-readiness level in the areas of Internet Access, Digital Learning, Digital Community, and ICT Policies and Strategies

3. Led Tanzania e-Government Authority to develop framework and implementation guidelines for establishment of government Research, Innovation, and Development Center (GovRIDC) in 2019

4. Developed strategies for integrating ICT in organization governance for Board of Directors and Executive Management. These strategies are now used by Tanzania Institute of Directors to train organizations board members and executive management in ICT governance from 2018.

TEACHING AND SUPERVISION

1. **PhD and Master's Students**

   Kelvin Mwiga - PhD (2018-Present) – SDN Framework for Cyberattacks Resilience

   Musa Kasela Amos- Masters (2018-2020) - Challenges Of Computer Network Infrastructure In Acessing Electronic Information Resources In Academic Libraries

   Said Ramadhan Said-Masters (2017-2018) - Solutions For Ict Accessibility To Persons With Visual Impairment at The Open University Of Tanzania

2. **Special Projects Mentorship**

   Huawei Sub-Sahara ICT Competition – In 2020 I mentored a team of three undergraduate students (Mpoki Abel Mwaisela, Hongo Kelvin, and Henry Kihanga) from UDSM through Huawei innovation challenge. The team [won the first prize](). The project was focused on designing future resilient network infrastructure.

3. **Teaching**

   OIT 117 – Data Communications and Networking I

   I taught this course every year from 2007 to 2012 and then again in 2017 and 2018. This was an introductory course aimed at providing the students with an overview of the concepts and fundamentals of data communication and computer networks. I covered topics such as Internet standards and organizations, key terms in computer networks, introduction to data communication concepts and techniques, network topologies, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN) and their protocols, introduction to wireless networking concepts, and network applications.

   OIT 215 –Data Communications and Networking II

   I taught this course every year from 2007 to 2012 and then again in 2017 and 2018. This was level 2 course on data communication and networking where I taught details of three key layers in the OSI model (i.e Data link, Network, and Transport) including design issues, error detection and correction, protocols, Ethernet, wireless LAN, routing algorithms, congestion control, network addressing and subnetting, Interior gateway routing protocols, TCP, UDP, and performance issues. I also introduced students to network security and network virtualization.

   OIT 313 –Network Design and Administration

   I taught this course every year from 2007 to 2012 and then again in 2017 and 2018. The course covered the Top-Down Network Design methodology which provided practical and comprehensive guide to designing enterprise networks that are reliable, secure, and manageable. It involved campus LANs, remote-access networks, WAN links, and large-scale internetworks.

   CS 348 –Network Switching and Routing

I taught this course in 2020. It is a comprehensive 1-year course covering basic to advanced topic in network switching and routing. It covered bridging and switching, ethernet, network architecture, protocols, algorithms and routing technologies.

OUTREACH AND COMMUNITY ENGAGEMENT

1. Board Member – More Active Girls in Computing (MAGIC), USA, Jul 2013 - Present
2. Founder – Big Sister in STEM (BigSiS), Tanzania Aug 2017 – June 2021
3. Vice president – IEEE Women in Engineering Eastern North Carolina Section, USA, Jan 2015 - Jun 2016
4. Secretary – IEEE Women in Engineering Eastern North Carolina Section, USA, Jul - Dec 2014
5. Mentor – More Active Girls in Computing (MAGIC), USA, Jul 2013 - Present
6. Member – NCSU Women in Computer Science (WiCS), USA, Aug 2012 – Jun 2016
7. Founder – Network of Professional Women Empowering other Women (NEPROWEW), Tanzania, Oct 2010 – June 2021
8. PeakPerformance International lead trainer – Team training and personal coaching, Sept 2007- Jun 2012

TECHNICAL CERTIFICATIONS
1. Cisco Certified Network Associate (CCNA) - August 2013 – July 2016 (License CSCO12429820)

LANGUAGE PROFICIENCY

Language	Spoken	Written	Read
English	Very Good	Very Good	Very Good
Swahili	Very Good	Very Good	Very Good
Spanish	Beginner	Beginner	Intermediate

REFERENCES

Dr. Rudra Dutta (Role: Former Academic Advisor)
Department of Computer Science
North Carolina State University
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Mtumba Government City
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