



EXECUTIVE SUMMARY OF THE TWO WEEKS TRAINING WORKSHOP ON BASIC AND INTERMEDIATE HIGH-PERFORMANCE COMPUTING

Covenant Applied Informatics and Communication Africa Center of Excellence (CApIC-ACE) in Partnership with Inria (French National Research Institute for Digital Sciences) and ACE-Impact Project Digital Science and Technology Network (DSTN) with support from Agence Française de Développement (AFD) organized a two weeks' workshop on high-performance computing with the theme: Basic and Intermediate high performance computing at the CApIC-ACE, Nigeria, from Monday, May 17th to Friday, May 28th, 2021. It was attended by 27 participants from different African Countries such as Benin, DR Congo, Cameroun, Bukina Faso, Senegal, Tanzania, and Congo Kinshasa with several internal participants from Nigeria.

The workshop aimed at bringing system administrators who were currently managing High-Performance Computing (HPC) infrastructure in their various research/higher education institutions to the state-of-the-art technologies in HPC and to increase their repertoire of skills. Interested faculty members and postgraduate students in the national and regional African Centers of Excellence (ACEs) were also in attendance virtually. Participants at the workshop were those with good knowledge of Linux, networking, cabling, python, ansible, etc.

The objectives were:

1. Acquire skills on the provisioning and allocation of HPC services, consistent with the required technology within a functional service framework.
2. Learn how to set up open-source distributed storage, block storage and file system.
3. Explore innovative methodologies and solutions to improve the efficiency of data storage and the effectiveness of data analytics.
4. Provide secure HPC enterprise services.
5. Provide an avenue that enables the exchange of knowledge among System Administrators from different research institutions in the Sub-Saharan Africa and;
6. Develop integrated enterprise-wide competency to recognize, plan, and evaluate emerging technologies for future acquisitions.

We had brilliant minds in the likes of Prof. Ezekiel F. Adebisi, Prof. Emmanuel Adetiba, Dr. J. A. Badejo, Engr. Akanle M. Boladele, Engr. Olaleye Oladipo, Mr. Olatunde Ajadi, Mr. Dare Falola, and Mr. Olaseni Oluwunmi from the internal context; as well as Mr. Camille T., Mr. Tom Sieg, and Dr. Benoit Leveugle, system experts from ATOS Technologies, France, to properly execute the above listed objectives. Participants were enlightened and informed on Linux, general HPC sysadmin knowledges, setting up of CPU and GPU HPC clusters, LDAP, installation, integration and management, docker and kubernetes (containers) and how to secure HPC and other infrastructures.

The opening session of the workshop was chaired by the Director of the Centre, Prof. Ezekiel F. Adebisi, whom in his remarks thanked God for the possibility of holding the workshop. He



explained that the workshop served as an avenue of interaction and personalized networking between ACE Centers in Africa; which is also the vision of the World Bank ACE-Impact project, for the region specialists and experts to work and connect together to solve regional problems for the greater good of Africa. The Vice-Chancellor of Covenant University, Prof. Abiodun H. Adebayo, who was the special guest of honour, expressed gratitude to God for the successful take off of the workshop. He acknowledged the contributions of the sponsors and partners - the World Bank, Inria (French National Research Institute for Digital Sciences), ACE-Impact Project Digital Science and Technology Network (DSTN) and the Agence Française de Développement (AFD); and further expressed his happiness that Covenant University under the CApIC-ACE initiative was driving and pioneering excellence in terms of computing, communication and applied informatics. Prof. Adebayo admonished the participants to be open-hearted to learn and engage their facilitators in order to build capacity.

On introduction to Docker and Kubernetes, Mr. Dare Falola articulated Docker as a container-based platform for creating, packaging, executing and shipping applications in containers. Participants were informed that containers have become fundamental in information technology because they offer the ability to package an application, its operating environment and its dependencies all in an isolated space. Also, containers offer a good alternative to virtual machines since they are lightweight, easily shared and do not require reserved computing resources. In essence, Docker makes applications portable as containers which can easily be set up on personal computers or on a server on another part of the world.

Fundamental to containers is the issue of managing them. Mr. Falola explained that containers need to be monitored in the case of a crash, scaled up or down in situations of overload or no-load. Kubernetes rise to this situation by providing a complete solution to these challenges. As a portable, extensible, open-source platform, Kubernetes manages containerized workloads and services that facilitates both declarative configuration and automation. Besides managing, Kubernetes coordinates the different containers in an application making its deployment easy and stress-free. It also provides high availability, scalability, monitoring, backup and restoration out of the box. In conclusion, Mr. Falola explained that Kubernetes can be used on own or cloud infrastructure, and only vendor-specific configurations need to be changed.

Each training session was insightful and informative; and at the end of each session, participants engaged in robust discussion sessions on the subject they had learnt. All the participants expressed joy and gratitude for being a part of the workshop. They explained that the knowledge that has been garnered from the workshop will drive efficiency and maximize the effectiveness of HPC technology in the Sub-Saharan African countries. In addition, participants stated that the end of the workshop meant the beginning of partnership for greater achievements in high-performance computing between the ACEs.



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The major actionable steps suggested during the workshop to increase the awareness about HPC Systems and also strengthen the network collaboration in the various sub-Saharan countries include:

1. Increased Capacity Building though
 - User communities' efforts to inform the users about the importance of HPC and train them on how to use the equipment
 - Training Programmers on parallel programming to enable an efficient deployment on HPC Systems.
 - More research in Parallelisation coding among Systems Admins.
2. Need for the interconnection of different HPC Systems.
3. Need for Professionals to be included in the deployment of HPC Systems. More research needs to be carried out on HPC.
4. There should be a platform for comparing of nodes to get optimal results when building a Data Centre and upgrading servers.
5. There is a need to allow the students or other interested persons to visit HPC infrastructures.
6. There is a need to enable people to learn more about HPC through workshops, GitHub, online Master classes, etc.

The workshop was a huge success!