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High Performance Computing in Yangon University

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Abstract

Yangon University (YU) has, with support from the Ministry of Education and the Asia Research Centre – YU, embarked on a project to deploy the Microsoft® Windows Compute Cluster Server (CCS) system at YU. This initiative is part of the High Performance Computing (HPC) project's ongoing strategy to make the central HPC resources a more mainstream option for researchers at YU. This paper will report our progress to date with the deployment and our future plans for the use of the CCS system within YU.

Key words: Parallel processing, grid computing, cluster computing.

Introduction

Yangon University (YU), Myanmar, is a research-driven university with dynamic research activities and education portfolio and strong international cooperation. YU has a strong desire for the use of high-performance computing (HPC) to develop research solutions. His Excellency Dr Chan Nyein, Minister for Education, has mentioned, "Researchers should have capabilities in supercomputing and YU should have such an HPC facility as the model in Myanmar. The resource of HPC can, then, be made available to all Higher Education Institutions in Myanmar". Support from the Ministry of Education and the Asia Research Centre (ARC-YU) has enabled the University to test and install Windows Compute Cluster Server (CCS) 2003 and related computer equipments for the project, which will comprise two facilities. The first will focus primarily on applications for the key partners from Physics, Chemistry, Mathematics and Computer Studies, while the second will provide a Windows-based, high-performance computing and data (HPC & D) platform for the broader academic community.

Windows Compute Cluster in Need

Given that experimental approaches provide only limited amounts of information, a researcher uses computer simulations that require massive amounts of computation. Therefore, the HPC resources are needed. In the past, an answer to that need was a hodgepodge of hardware running Linux

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or UNIX. One of the reasons why a researcher hesitates to use the HPC resources was that people working in the humanities and other nonscientific disciplines found the UNIX and the Linux too time-consuming to learn and use effectively. These researchers preferred to work in the more familiar Microsoft® Windows operating system environment, where third-party software was more widely available to meet their needs. In contrast, researchers who used the UNIX were more accustomed to working in a command-line environment.

The lack of universally accessible HPC reduced the efficiency of many researchers. For example, many of the users use the MATLAB on their workstations, and running very large data models took up all of the computers' resources. That often took days. One researcher's computer was unavailable to him for an entire week. The release of a distributed version of the MATLAB software that could be run on a computer cluster spurred the university's efforts to find an HPC solution that everyone could use (Pepper 2006, Ciapala 2006).

Windows Compute Cluster Indeed

Universities' Research Centre (URC) has installed Windows CCS 2003 in September 2008, on a 16-node cluster of Dell® PowerEdge 2900 server computers, each of which is configured with two 2.33 gigahertz (GHz) Intel® E5410 Xeon quad-core processors, 8 gigabytes (GB) of memory and 10 gigabit (G) Myrinet® network interface cards (NICs). 3Com® Switch 5500G offers 10G connectivity to the cluster's network. The cluster is accessed by a user's workstation in the university's local area network.

Figure 1 illustrates a CCS-based HPC cluster configuration. This configuration uses both head node NICs, with Myrinet® NIC1 connecting to the compute nodes and Ethernet NIC2 connecting to the university's local area network; the compute nodes use only Myrinet® NIC1. If the compute nodes require the public network access, the administrators can enable the Internet Connection Sharing (ICS) on the head node or use the secondary network connection (NIC2) on the compute nodes.

A matrix multiplication programme was test-run on the cluster for two matrices each having a rank of 5000. The programme was written in the Microsoft® Visual Studio 2008 development system to adapt the software to run on the Windows CCS 2003. It ran 50 percent faster than it does on a

typical workstation. Windows CCS 2003 enables us to double-task the cluster, using it for both simulation and analysis. The university immediately saw that the powerful computing capabilities combined with the familiar Windows environment would provide an HPC solution that would meet the needs of both highly technical and less technical users.

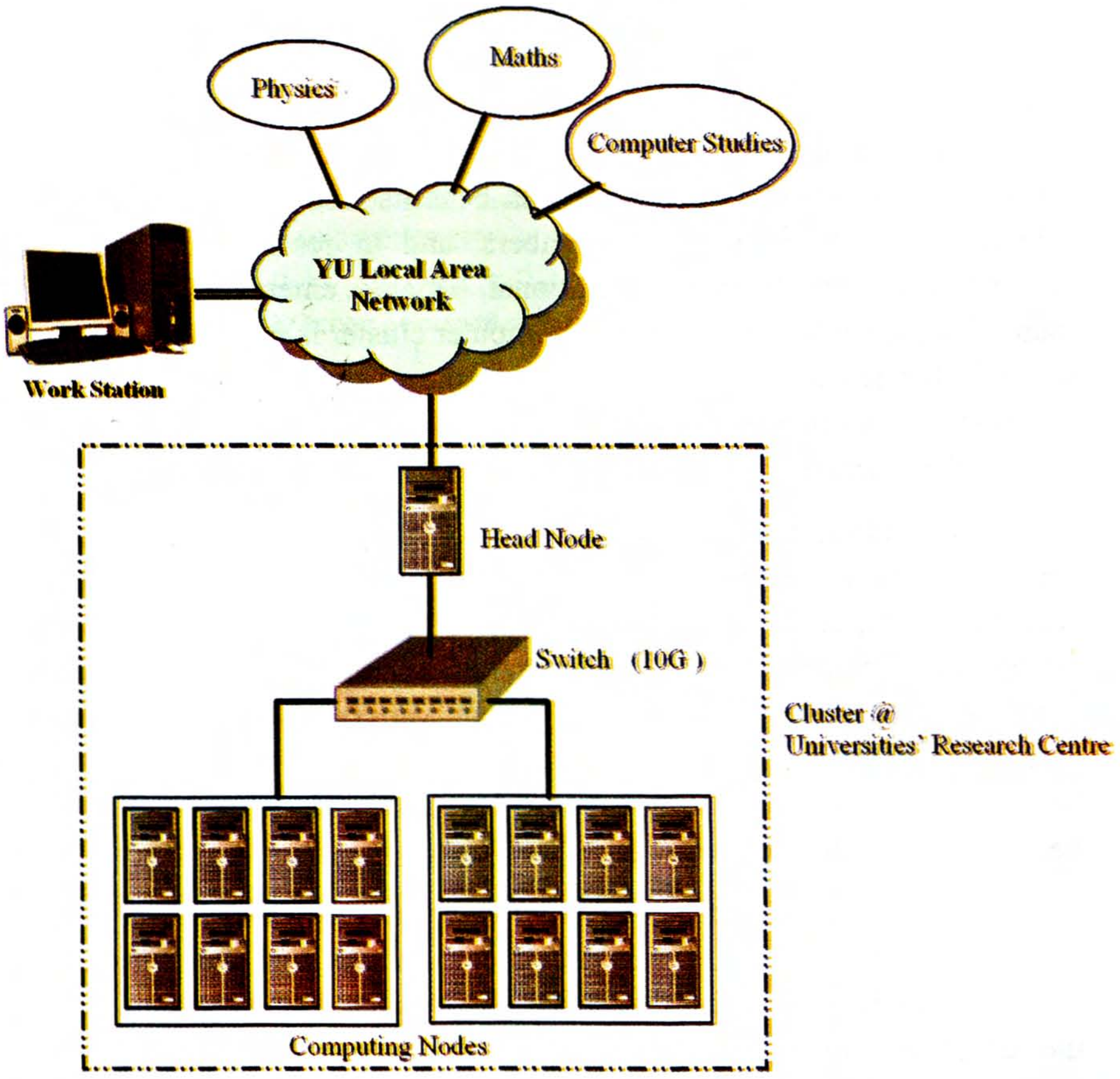

Figure 1.The cluster at Universities' Research Centre of Yangon University

YU has begun gradually making the system available to users. The project group is meeting with various departments throughout the university about using the computer cluster to meet their needs. A new HPC cluster at URC-YU has the potential to revolutionize the creation of computer code for technological design. The YU Computer Cluster, which is based on Microsoft® Windows CCS 2003, will enable scientists and academic researchers to more effectively perform complex computations.

Conclusion

YU has made the new Windows CCS 2003 deployment available to researchers, who will enjoy numerous benefits from the system. As YU extends access to more staff members, and to researchers outside the university, it expects to see additional benefits emerge. The university found that computation on the new computer cluster is much faster than it is when performed on workstations. The virtue of the Windows CCS is that one is reaching out to a broader community with a centralized service that ensures that users get their appropriate share of the resources.

The introduction of Windows CCS 2003 will help YU address a persistent challenge in academic computing: cost control. In the past, academic computing was very compartmentalized, with various groups buying and maintaining their own computers. Having a centrally managed computer cluster that's available to a wide variety of users makes groups more inclined to buy into a shared system. This helps reduce overall costs because one is not duplicating support. Moreover, adding computing nodes become less expensive day by day.

Few researchers at YU have the computing power necessary in their workstations to easily run very large calculations and data models. By deploying an HPC solution that offers the familiar Windows environment, the university gives that power to more users in a controlled way. Researchers who are unfamiliar with UNIX or Linux can easily access the computing resources that they need, using an operating system they're comfortable and skilled with.

With the new computer cluster, researchers can solve complex computational problems by running modeling, data analysis and visualization, and many standard UNIX / Linux imaging and engineering applications in a more familiar environment. More research groups are beginning to use the HPC applications, and researchers are now running large data models on the cluster rather than tying up their workstations with such tasks for days at a time.

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