CRS4 Technical Report

Arcosu Cluster

Status Report, January 2001

Introduction

The performance of the processors used in personal computers (PCs) has steadily increased. Present-day PC clock speeds exceed the clock speeds of classical supercomputers such as the Cray. It is widely recognized that the overall computational speed of a typical high-end PC is two or three times inferior to high-end processors such as the DEC/Compaq Alpha processor because of memory bandwidth limitations of PC support chips, moreover, processors such as the Alpha have superior double-precision floating-point architecture. Nevertheless, the high-volume, commodity pricing of PC components (processors, main boards, network interface cards, etc.) results in a cost-effective computer. In addition, a cluster of PC computers provides a very cost-effective parallel computer for programs that use the Single Program Multiple Data (SPMD) paradigm implemented with message passing.

A further consideration is that the performance of PCs is projected to increase by a factor of two in less than two years. One can add PCs to a cluster incrementally and the cost of each addition is quite low. In contrast, the high cost of a commercial parallel computer must be amortized over many years.

The PC cluster at CRS4, named the Arcosu cluster, uses the Linux operating system. For software packages that use a Unix-like operating system, support for Linux has become commonplace. A few years ago, such commercial software packages were first ported to Hewlett-Packard HP-UX, IBM AIX, Silicon Graphics IRIX, etc. before the Linux operating system was considered. In contrast, recently the use of Linux has become widespread and the Unix-like operating systems of HP, IBM and SGI have become almost niche markets. In addition, an extensive range of public domain software is available for Linux and is included in the freely available distributions of Linux such as Red Hat and Debian.

The Arcosu cluster at CRS4 was initiated near the end of 1999. The first configuration consisted of three HP Kayaks (later 4 Kayaks) and a file server assembled locally. Two other PCs are also loosely associated with the cluster for historical reasons.

Recent News

Towards the end of the year 2000, four additional PCs were added to the cluster. These PCs use the Server Works LE chipset and fast SCSI disks. The first PCs of the cluster (Hewlett-Packard Kayak) use 500 MHz processors, 100 MHz memory, 100 MHz Front-Side Bus (FSB), and 60 MHz SCSI hard disks. The most recent PCs added to the cluster use 800 MHz processors, 133 MHz memory and FSB, and 160 MHz SCSI hard disks. The four Kayak PCs and the four PCs with the Server Works chipset each have a GigaByte of memory.

In addition, a 24-port Fast Ethernet switch was added to the cluster. A much faster interconnection, Myrinet, has been ordered and is expected to arrive near of the end of January.

Commercial compilers for the parallel languages OpenMP and High Performance Fortran (and the Fortran 90 language) had been purchased from the Portland Group (PGI) when the cluster began. Recently, a new version of PGI software has been installed. In addition, the optimizing C++ compiler of Kuck Associates has been installed on the cluster, though a problem with the license server needs to be resolved.

In anticipation of the arrival of Myrinet, it should be mentioned that PGI software can be configured to use Myrinet and Myrinet has implemented a version of Message Passing Interface

(MPI) with very low communication latency.

Installed Software

Documentation can be found on a cluster computer in subdirectories under /Archive/docs. Under the directory hierarchy /Archive/docs are symbolic links to documentation inside various software packages. In addition, on the computer cixerri4 an http server has been installed (Apache) that has access to the hierarchy /Archive/docs so users can browse documentation without logging into a cluster computer.
The installed software includes:

PGI Portland Group software for clusters, which includes Fortran 90, High Performance Fortran (HPF) and OpenMP.

FFTW
The "Fastest Fourier Transform in the West" (FFTW), a parallel FFT.

MPI Message Passing Interface (MPI) for parallel programs. The distribution MPICH has been installed.

KAI C++
The optimising compiler for C++ developed by Kuck Associates has been installed. This software includes KAI's debugger.

ORBacus
A high-quality CORBA implementation for C++ and Java has been installed, called ORBacus, it is being developed by Object Oriented Concepts, Inc.

Java
The Java compiler, virtual machine, and related classes such as Swing Set, have been installed on the cluster.

DX IBM Data Explore has been installed, a product that recently was released to the public domain.

Perl
The a recent version of Perl has been installed: version 5.6.0. Moreover, a large number of modules have been downloaded from CPAN.

Geomview
The geometry viewer Geomview has been installed on the cluster.

Cascade
Though not directly installed on the cluster, the three-dimensional geometry library Cascade compiled for Linux has been installed in a subdirectory of the Advanced Laboratory project (LapS).