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AIPS on an ALPHA AXP Clone

Robert L. Millner, Patrick P. Murphy, and Jeffrey A. Uphoff
National Radio Astronomy Observatory
Charlottesville, Virginia, USA

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Abstract

There has been some interest, both within NRAO and in the general Radio Astronomy Community, in the possibility of running AIPS on one of the many "clone" systems based on the Digital ALPHA AXP 21164 processor. Recently, NRAO/Charlottesville acquired such a system and proceeded to install the Linux operating system thereon. We have also started the process of porting AIPS to this 64-bit system, though the results reported herein are based solely on the use of binaries generated on an OSF/1 (Digital Unix) ALPHA processor and copied to the Linux system. We have successfully run the "DDT" suite of programs on this Linux/Alpha system and have achieved an AIPSMark(93) of 9.0.

1 Introduction — the Porting

The Alpha clone in question is an Aspen Durango with 64 Megabytes of memory, 1 Megabyte of L3 cache, a 433MhZ 21164 Alpha AXP processor, a Quantum Fireball 6 GByte IDE disk, and a CMD646 PCI IDE controller. In addition, a Buslogic BT948 SCSI–II card was borrowed for the tests, as was a Quantum XP34550S Fast SCSI-II disk. This system is running a development kernel (Linux 2.1.57) based on a standard Red Hat installation.

Porting AIPS to such a system is problematic. Under Linux, the approach in the past has been to use the GNU `gcc` compiler and `f2c` Fortran-to-C converter combination, but our initial forays into this realm revealed 64-bit problems with the `f2c` converter (*i.e.*, it was not 64–bit clean). The second approach considered was to use the newer `g77` compiler, but this was deferred on the basis of our experience with a separate porting attempt on an Intel/Linux system: it compiles but fails in the Q routines with a segmentation fault.

However, one of the nicer features of Linux on the ALPHA architecture is that statically linked binaries generated on an OSF/1 "Digital Unix" system can be made to run under Linux/Alpha. After verifying this was the case, we proceeded to build a set of such static binaries for AIPS on one of our DEC Alpha systems, compiling with Digital Unix `f77` and `cc` using optimizations and tuned for the 21164 processor. Such binaries turn out to be quite large, tipping the scales at over 500 Megabytes for the **`LOAD`** area. It may be possible to reduce these via stripping, and we are investigating the possibility of linking in shared mode to the system libraries on the OSF/1 system. There are both technical and licensing issues to be overcome for this to work.

2 Testing and Results

Details of the "DDT" certification and benchmarking package are covered in *AIPS* memo 85 and will not be repeated here. Suffice it to say that the `LARGE` version of the DDT was run on the system in question, using the standard methods as described in aforesaid memo.

The system was first tested with the IDE disks. When these were "un-tuned" the resulting AIPSMark$^{(93)}$ is 4.2. Using the system `hdparm` to tune the disk to `"-m 16 -c 1 -u 0"` increases this value to 4.5 but has the unfortunate side effect of rendering the machine unusable for anything else. Tuning it with `"-m 8 -c 1 -u 0"` gets a 4.5 also, and the CPU actually has some idle time and can be used although sluggish and unresponsive. Un-masking IRQs brings the system back down to un-tuned performance but makes it more usable.

However, when the swap, `/tmp` and *AIPS* areas (source and data) are moved to the SCSI drive, there is a dramatic improvement. On an otherwise unloaded system, the AIPSMark$^{(93)}$ shoots up to 9.0. If there is some background activity (reading e-mail, running a web browser, *etc.*), the result slows down to 8.6. The system "`top`" utility reports consistently less than 5% idle time and under 8% used by the system with the rest going almost exclusively to *AIPS* tasks. The disk needed no tuning.

Finally, for some idea of how well these binaries would perform under OSF/1, they were run on a Digital Alphastation with a 400MHz 21164 processor, which was running Digital Unix version 4.0. These binaries were accessed via NFS, but everything else (the data areas specifically) was local. The AIPSMark$^{(93)}$ for this test on an otherwise unloaded system was 10.0. This would seem to indicate that the emulation code under Linux on the Alpha has relatively little overhead.

3 Conclusions

The viability of a generic Alpha "clone" with Linux as an operating system for AIPS has been demonstrated. The approximate cost of such a system is on the order of US$5k and the dollar-per-AIPSMark$^{(93)}$ value of circa $600 is perhaps the lowest value determined by the authors to date. The use of a good SCSI controller and disk moved the machine out of the desktop PC arena and into the mid- to high-performance workstation arena.

Further investigation will no doubt continue into this system, especially in the areas of native Fortran compilers or emulators. However, NRAO now has the ability to provide the Radio Astronomical community with software that will run at high performance levels on relatively low cost hardware.