The Growth of Newton

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The Altix Arrives

At the beginning of 2002, the demand for supercomputing resources from the UK academic community led to an agreement between the CfS board and EPSRC to extend the CSAR contract until June 2006. This extension was combined with an announcement of a second technology refresh, following on from the introduction of the SGI Origin 3800 machine named Green, and it was decided that the new technology to be introduced would be one of the first in SGI's new line of Altix supercomputers, based on Intel chips running the Linux operating system and utilising a high performance NUMAlink interconnect.

On October 1st 2003 a new SGI Altix facility was introduced into service to complement the SGI Origin machines and to act as a more powerful replacement for the Cray T3E 1200 which was due to be retired. The Altix was given the name Newton and consisted of 256 Intel Itanium 2 processors, each clocked at 1.3 GHz, together with 384 Gigabytes of memory. Within a few months Newton was being heavily used and was able to provide a concrete demonstration of the demand for high performance computing facilities in the academic community.

The high utilisation and continued demand for access to the facilities of both CSAR and HPCx, led to the decision being taken to further expand Newton to twice its initial compute capacity and to increase the available memory. This expansion was to take place in three stages in order to introduce extra resources without adversely affecting the continued operation of the service.

A Staged Expansion

In the first stage the original 256 processor Altix had it's memory increased to 512 Gigabytes, and an additional 128 processor Altix machine was added to the service, also with 512 Gigabytes of memory. While the two machines functioned as separate entities, they enabled a higher throughput of work by allowing common job submission to the batch system, with the scheduler able to select the most appropriate resource on which to execute the code.

The expanded 512 processor Newton

The second stage involved the addition of a further 128 processors to the newer machine, further increasing the computational capacity of the Altix service to 512 processors. These additional processors were 1.5 GHz Intel Itanium 2 chips with 6 Megabytes of tertiary cache compared to the original set of chips which were 1.3 GHz processors with 3 Megabytes of tertiary cache. This stage also saw the final configuration of the memory available for jobs being set at 2 Gigabytes per processor.

This is the current configuration of Newton which is already able to provide a high throughput of work for a variety of jobs utilising up to 228 processors in a single run, and with larger per-process memory requirements than have been available on any previous CSAR machine. The memory has increased with each technology refresh from a standard 256 Megabytes per processor on the Cray T3E, to 1 Gigabyte per processor on the

Origin machines and now to 2 Gigabytes per processor on the Altix. The fast processors and high memory are allowing scientific research to be attempted which was not possible on earlier CSAR machines, but the expansion of Newton is not yet complete.

Into the Future

The final stage in the expansion will be the rehousing of the two Altix machines in a new building and the combination of the separate entities which make up the newton cluster to form a single 512 processor system with 1 Terabyte of memory. This final configuration will allow jobs with high processor counts and large memory requirements to run across the entire system, further extending the range of scientific research which will be possible on the CSAR systems.

Further possible improvements to the throughput of research on Newton will not be confined to the advances in hardware, but should also be provided by potential faster program execution for software generated using the next release of the Intel compiler suite, and through the continuing optimisation effort of the CSAR application support team in fine-tuning specific codes to take advantage of the Itanium 2 processor and the NUMAlink interconnect.

The development of Newton will enable the CfS consortium to maintain the commitment of providing an excellent supercomputing facility up to the end of the current service contract, and provides a high quality resource for the UK academic community to continue to lead the way in carrying out world class scientific research.