Intel Paragon MP3 Node Board

ca. 1994, Intel

Intel Paragon XPS/150 at Oak Ridge National Laboratory

Installed in May 1995, it came in at number three on the June 1995 TOP500 list with a Rpeak rating of 154 Gflops. Standing next to the system are Ken Kliewer and Arthur Bland.

Image credit: Curtis Boles, ORNL (1996)

Artifact loan courtesy of CPUSHACK

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This Intel Paragon MP3 node board has three Intel i860XP-50 processor chips with each one supplying up to 75 Mflops of double-precision computing power. In addition, the board has forty DRAM memory chips offering 32 Mbytes of local ECC memory for these CPUs. When installed in a fully configured system, such as the Paragon XPS/150 at Oak Ridge National Laboratory with 1,024 MP3 node boards (see photo at left), it helped to deliver over 150 Gflops of processing power.

Announced in 1991, the Paragon represented Intel's foray into the MPP, or Massively Parallel Processing, market and would be based on their newly designed CPU, the i860. Interest ran high for MPP systems in the 1990s with many vendors besides Intel offering MPP products, including Ncube, Cray, Thinking Machines, and Maspar. To get the best possible performance from these new systems, researchers needed to come up with innovative techniques to take full advantage of what these new designs offered.

For one group of investigators working on a Paragon system at Sandia National Laboratories, their research resulted in winning the 1994 Gordon Bell Prize for the performance they attained using the boundary element method to solve systems of partial differential equations.

Even though Intel packaged Paragon systems with the OSF/1 operating system, another operating system, SUNMOS, gained its share of users. In a 1994 paper, Subhash Saini and Horst Simon compared application performance under both systems and found that each one demonstrated various advantages and disadvantages, that no one system was always better.

Robust processor performance depended on efficient data I/O performance and various parallel I/O schemes existed to make sure CPU's in MPP systems were not starved for data. In his 1997 paper Caltech researcher Rajesh Bordawekar explored using a 'collective I/O' interface prototype on a Paragon system and found it improved overall performance as long as the inter-process communication (IPC) cost remained low.

In June 1994, a Paragon computer took the top position on the TOP500 list, this system being the 3,680 processor XPS/140 system at Sandia National Laboratories. As an indication of how fast the MPP market would advance, by November 1997 this system's ranking had fallen to #18 with the new #1 held by an Intel-built computer named ASCI Red, also at Sandia, which was the first teraflop machine with a speed 10 times faster than a Paragon.

Given these marketplace dynamics, Intel announced in 1996 that it would discontinue manufacturing Paragon systems having sold about 100 machines. The Intel Paragon had performed well as a valuable testbed for parallel programming, operating system, and I/O development and earned many accolades along the way. Subsequent MPP systems benefited from this research, and they would go on to produce astonishingly high levels of performance.

Gordon Compute Node Board

ca. 2011, APPRO International, Inc.

Allan Snavely & Mike Norman

Mike Norman, right, director of the San Diego Supercomputer Center at UCSD, along with assistant director Allan Snavely look at Gordon, one of the most powerful computers in Southern California on Thursday, December 8, 2011.

Image credit: © San Diego U-T via ZUMA Press Wire

Artifact loan courtesy of the San Diego Supercomputer Center, University of California San Diego

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When a new computer system debuts in the upper 10% of the TOP500 list of the world's fastest supercomputers, this success draws quick interest about the key design elements enabling this newcomer to reside among those fast machines. For the Gordon Supercomputer, which entered production at the San Diego Supercomputer Center in 2012 and was designed to be a "supercomputer system suitable for data-intensive applications" and not simply speedy calculating, its appearance on the TOP500 list generated more than the usual attention.

Gordon's computational power came from 1,024 compute node boards like the one below, each having two Intel XEON E5-2670 CPUs running at 2.6 GHz. Their total computing capacity placed Gordon at the #48 spot on the November 2011 TOP500 list. By providing user programs with abundant CPU horsepower and a memory address space of up to 2TB, Gordon could readily support researchers working on the most demanding "big data" problems.

But where the system's design truly excelled was in its ability to perform I/O, or input/output, operations. Gordon's principal investigator Mike Norman demonstrated this at SC11 in Seattle where Gordon delivered a record-setting 36 million input/output operations per second owing to its pathbreaking design feature: 300TB of Intel SSD 710 series flash drives. According to Gordon's co-principal investigator, Allan Snavely, "Intel SSDs were among the best" and easily helped to fulfill Gordon's 2009 NSF award mandate "to bridge the widening latency gap between main memory and rotating disk storage in modern computing systems."

Predictably, many researchers were eager to take advantage of Gordon's promising performance realized through its design's balanced combination of a flexible compute node architecture and its voluminous flash-based SSD storage.

For example, two users studying forest growth dynamics found Gordon's ability to provide a 300GB shared aggregated memory space helped to reduce the final run time of their application from over a week to under eight hours.

Gordon's low-latency SSD drives proved appealing to many users as either fast temporary storage spaces or as persistent storage for large databases. For instance, several computational chemists looking for new catalysts found that only Gordon offered the large scratch storage able to make their search for larger molecules by the CCSD(T) method practical. When it came to databases, calculations based on 3D molecule structures archived in the Protein Data Bank (PDB) saw a 4X speedup when the database was accessed from Gordon's SSD versus a hard disk.

From 2012 to 2017 Gordon delivered 450 million core hours to these and over 9,000 other users who submitted jobs to support research from an extensive range of scientific disciplines. Some of these users were newcomers to supercomputing thanks to the outreach efforts made by the San Diego Supercomputer Center to promote Gordon and i ts data-intensive computing possibilities. While advanced hardware modules, such as this compute node board, helped to propel Gordon to a high TOP500 ranking, it was Mike Norman, Allan Snavely, and many other individuals who made it possible for these thousands of users to turn their data into knowledge.

CDC 819-21 Disk Pack

ca. 1978, Control Data Corporation

SC04 General Chair Jeffrey Huskamp

Jeffrey Huskamp (front left) looking over the build out of SC04 in Seattle accompanied by SC04 Planning Committee members Janet McCord (right) and Bruce Loftis (back left) in early November, 2004.

All images and artifact loan courtesy of Sandra Huskamp

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Why would anyone want to keep an old disk pack or any other piece of dated computer hardware?

Is it because we are waiting for our kids to find it in the attic or garage and ask...

"What the heck is this?"

Maybe. But deep down we know the things we save help us preserve the memories associated with these special objects. For Jeffrey Huskamp, saving this disk pack meant saving some of his memories of computing and of the people in his life of computing. While this disk pack could hold 600MB of information, (perhaps there is actual data on the disk, sadly we don't know anything about its contents), the memories it preserved for Jeffrey were unlimited.

This CDC 819-21 Disk Pack is just one aspect of Jeffrey's historical register of memories in HPC. Jeffrey saved it to remember us and now we exhibit it and other objects at SC23 to remember Jeffrey.

Jeffrey Huskamp (1949–2010)

A Hard Disk as Metaphor for a Life in HPC

Computer cards and printouts at Purdue.

Among lifelong collegues and friends.

Celebrating with his wife Sandra.

With the other love of his life.

Giving to Maryland

Jeffrey C. and Sandra W. Huskamp
Endowed Computer Science Scholarship

Jeffrey C. and Sandra W. Huskamp
Endowed Bioengineering Scholarship