

Ford Motor Company: Building an Efficient HPC Infrastructure



Key Highlights

Industry

Automotive

Challenge

To make all machines appear as simple tools to their users.

Altair Solution

PBS Professional to marry its complex hardware and software with job attributes.

Benefits

- Provides freedom to move in a technology market where processors are rising in performance and dropping in cost

Customer Profile

The cars, trucks, vans and SUVs that roll off Ford Motor Company assembly lines are safer, quieter, and more comfortable than ever. Many of the intangibles that contribute to Ford quality flow from the innovative use of high-performance computing (HPC) techniques. At Ford's Numerically Intensive Computing Department (NIC) in Dearborn, Michigan, engineers run simulations in codes such as NASTRAN and LS-DYNA for predictive analysis of cylinder cooling, wind noise, vibration, ride quality, crashworthiness, durability, and other characteristics that contribute to industry-leading automotive design.

The Challenge: Decomplexify

Over the years, NIC has built a sizeable heterogeneous HPC environment that combines both capacity and capability. The Center runs Beowulf clusters based on Xeon, Itanium, and Alpha processors. It has SGI Origin and Altix servers, IBMP650 capacity, and large SMP Cray systems. Building up this compute power has enabled NIC to process the compute-intensive jobs of its users in a timely way, but it has also produced a complex infrastructure of platforms and applications.

"The challenge for NIC was to make all these machines appear as simple tools to their users," says Robert Walsh, account manager

Ford Motor Company Success Story

NIC can bring in the latest technologies to ensure that Ford is getting maximum value for its hardware dollar. PBS Professional enables NIC to plug them in and present them to users as part of a single resource.

at Altair. “In the old days – 10 or 15 years ago – NIC used a single Cray machine to process the majority of its CAE workload. It was a simple environment, but it got the job done. With the wide variety of technology available in today’s marketplace, NIC now runs everything from Xeon-based Linux clusters to Cray SMP machines.”

NIC also faced complexity on the solver side. It runs many application versions, and none of them run on all architectures. Which environments run the version the user needs for a CFD or finite element analysis run? Which offers the best turnaround for this job? NIC is using PBS Professional® to marry its complex hardware and software with the attributes of jobs.

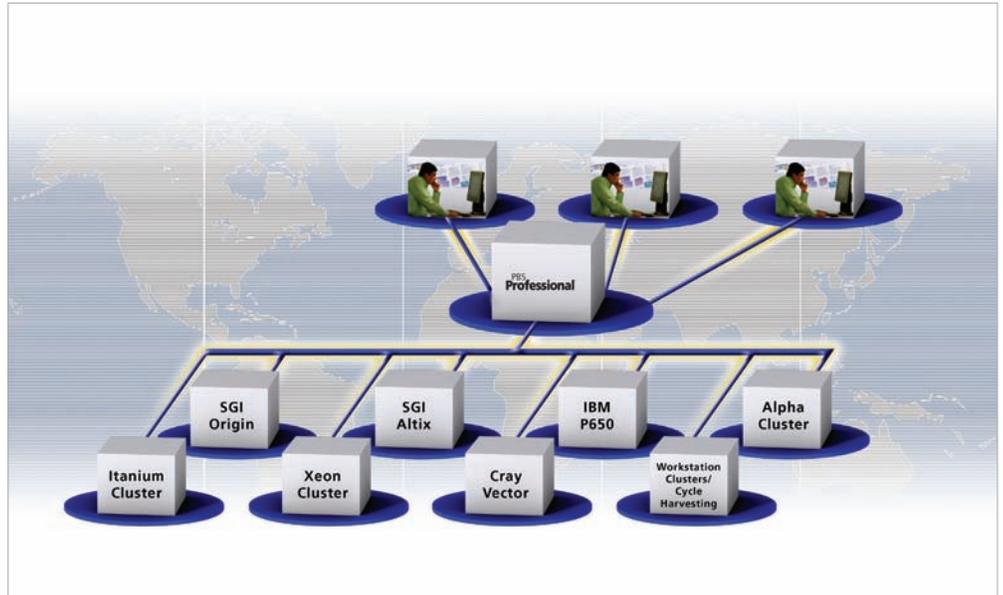
PBS Professional: Maximizing Hardware Investment

It became obvious that NIC’s previous workload manager had reached the limits of its scalability and could not efficiently handle NIC’s soaring processor count. NIC was looking for an alternative, and evaluated commercially available workload management software, working closely with two vendors. The emphasis of the evaluation was on cost, flexibility, and availability of the source code. At the end of the day, NIC went with PBS Professional. One factor in this decision was that the availability of PBS Professional source code enabled NIC to run the PBS Professional server infrastructure and develop a custom scheduling package that runs on top of it.

The PBS Professional infrastructure gives NIC freedom to move in a technology market where processors are rising in performance and dropping in cost. NIC can bring in the latest technologies to ensure that Ford is getting maximum value for its hardware dollar, and PBS Professional will enable NIC to plug them in and present them to users as part of a single resource. This is a key value proposition for PBS Professional.

“NIC runs several Beowulf cluster systems with a relatively high processor count,” says Walsh. “This was not possible five years ago, because there was no way to scale to it. The key is the infrastructure, and the key to the infrastructure at NIC is the flexibility a robust workload management system provides.”

NIC was one of the first companies to use PBS Professional to harvest compute cycles from workstation clusters.



NIC was one of the first companies to use PBS Professional to harvest compute cycles from workstation clusters. Altair provides consulting services to Ford on a year-to-year basis to take care of the administration of the system and update the PBS Professional environment to adjust for the changing computational environment. Their services have allowed Ford to maximize the use of available processor time on the clusters.

Letting Engineers Engineer

One of NIC's objectives, then, is the obvious one of getting the biggest bang for Ford's buck – raw processing performance at the best price/performance the market can offer. The other prime objective is letting engineers engineer.

“PBS Professional does all the heavy lifting behind the scenes and hides all the complexity,” says Walsh. “Engineers should be able to say, ‘I want to run this job. I don't know how much memory it needs. I don't know how many CPUs I should give it. And I don't care. What I care about is getting the right answer as quickly as possible.’”

NIC hasn't fully achieved this vision yet. NIC users still have to select a platform, and those that aren't using Ford's homegrown job-submission GUI (known as SIMMAN) need to access resources manually to submit or track their jobs. But with the help of PBS Professional, NIC is getting closer to a virtualized approach.

Engineers at Ford's Numerically Intensive Computing Department (NIC) run simulations in codes for predictive analysis of cylinder cooling, wind noise, vibration, crashworthiness, and other characteristics that contribute to industry-leading automotive design.

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About Altair

Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 1,800 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 27-year-plus track record for high-end software and consulting services for engineering, computing and enterprise analytics, Altair consistently delivers a competitive advantage to customers in a broad range of industries. Altair has more than 3,000 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the electronics, architecture engineering and construction, and energy markets.

About PBS Works

PBS Works™, Altair's suite of on-demand cloud computing technologies, allows enterprises to maximize ROI on existing infrastructure assets. PBS Works is the most widely implemented software environment for managing grid, cloud, and cluster computing resources worldwide. The suite's flagship product, PBS Professional®, allows enterprises to easily share distributed computing resources across geographic boundaries. With additional tools for portal-based submission, analytics, and data management, the PBS Works suite is a comprehensive solution for optimizing HPC environments. Leveraging a revolutionary "pay-for-use" unit-based business model, PBS Works delivers increased value and flexibility over conventional software-licensing models.

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