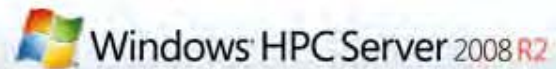harnessing boundless capacity across client, cluster & cloud

WINDOWS HPC SERVER 2008 R2
GOALS AND OVERVIEW

Trends in HPC

Data Proliferation Management

- Data Explosion
- Managing data
- Data Analytics

Accelerate Innovation

- Multi-core platforms
- Cloud computing

Trends Impacting HPC Landscape

To Make HPC Broadly Accessible

- Easier access to more end users in organizations of all sizes
- Use regular IT resources for HPC Systems Administration

Control & Align Costs

- Total cost of ownership
- Enmeshing of Enterprise IT and HPC

What we're hearing

	Developers	**End Users**	**Administrators**
Challenges	Parallel development is too hard	Too much time mired in technology	Deployment, maintenance, and is cumbersome Steep learning curve for niche products
Needs	Easier programming models and tools for multi-core and multi-server.	Better workflow Reduced learning curve Better end-to-end integration	Integrated Solutions Interoperable Solutions Better Admin Tools
Microsoft Approach	Integrated set of parallel and cluster dev tools Reuse existing skills Build robust apps faster	Windows and Office Familiarity Utilize existing Windows skill sets Transparent, integrated solution	Complete, end-to-end pre-integrated offering Reuse existing IT skills

Microsoft's Vision for HPC

"**Provide a complete, integrated, platform, tools and broad ecosystem to reduce the cost and complexity of HPC today. Clear vision for the future** "

Reduced Complexity

Ease deployment for larger scale clusters

Simplify management for clusters of all scale

Integrate with existing infrastructure

Mainstream HPC

Address needs of traditional supercomputing

Address emerging cross-industry computation trends

Enable non-technical users to harness the power of HPC

Broad Ecosystem

Increase number of parallel applications and codes

Offer choice of parallel development tools, languages and libraries

Drive larger universe of end-users, developers, and system administrators

Windows Compute Cluster Server 2003

Microsoft Visual Studio 2005

2006

Personal Super Computing

- ➤ Built on Windows Server 2003
- ➤ Microsoft Entry into HPC
- ➤ Addressing Personal And Workgroup Needs
- ➤ End User Applications available for Windows
- ➤ Parallel and HPC Development Tools
- ➤ Ease of Management and Deployment

Microsoft HPC Server 2008

2006   2008

Broad Reaching HPC

➤ Built on Windows Server 2008
➤ Support Traditional & Emerging HPC
➤ Larger Cluster support & Top500 Range
➤ Better integration for Windows-based Users
➤ Broader Developer support with tools and SOA
➤ Improved Management and Deployment

Windows HPC Today

Highly Scalable, Efficient HPC

- Built on Windows Server 2008 R2
- Scalable HPC Infrastructure for 1000+ nodes
- Customizable management elements for superior control
- Evolved SOA support for scale and programmability
- Ease parallel development with VS 2010 & .NET 4.0
- HPC Services for Excel ® 2010
- Expanded capacity through Clusters of Workstations

Windows HPC Server 2008 R2

- Complete, integrated platform for HPC Clustering
- Built on top Windows Server 2008 R2 64-bit Operating System
- Addresses the needs of traditional and emerging HPC

Windows Server 2008 R2 HPC Edition

- Secure, Reliable, Tested
- Support for high performance hardware (x64, high-speed interconnects)

+

Microsoft HPC Pack 2008 R2 Enterprise

- Job Scheduler
- Resource Manager
- Cluster Management
- Message Passing Interface
- Support for Workstation Nodes

=

Microsoft Windows HPC Server 2008 R2 Suite

- Integrated Solution out-of-the-box
- Leverages investment in Windows administration and tools
- Makes cluster operation easy and secure as a single system

Windows HPC Server 2008 R2 Suite
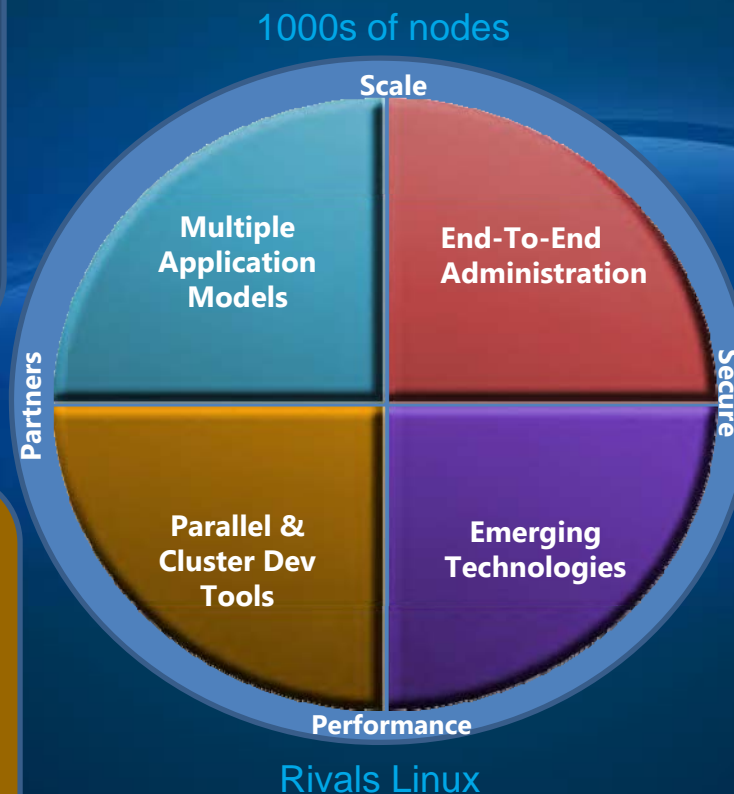
HPC Applications

HPC Middleware Pack

Job Scheduling

Systems Management

Networking & MPI

SOA

Operating Systems

HPC Edition

Windows Server 2008 R2

Web | Virtualization | Management | Better Together with Windows 7
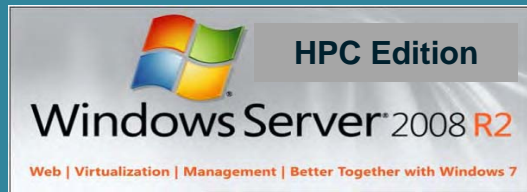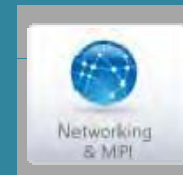
Windows 7

Clusters of Commodity Hardware

intel Xeon 5500

AMD Opteron 64

Performance Accelerated InfiniBand Adapters

nVIDIA TESLA

Microsoft System Center

Windows HPC Server 2008 R2 Suite
Complete. Integrated. Forward Looking.

- MPI
- Long running batch
- Low latency interactive
- Parametric Sweep
- Embarrassingly Parallel
- Business Critical SOA
- Excel and ISV apps
- Job Scheduling Policies

- Deployment
- Configuration
- Monitoring
- Diagnostics
- Trouble Shooting
- Diskless & Dual-boot
- Reporting
- Performance Tuning

1000s of nodes

Scale

Multiple Application Models

End-To-End Administration

Partners

Secure

Parallel & Cluster Dev Tools

Emerging Technologies

Performance

Rivals Linux

- Integrated IDE
- MPI Debugger
- MPI Profiler
- SOA debugger
- Task Parallel Library, PLINQ
- Integrated GPU support

- Private clouds
- Public clouds
- HPC as a service
- Big Data Analytics
- Visualization
- Integrated Workflow

End-to-End Integrated Systems Management
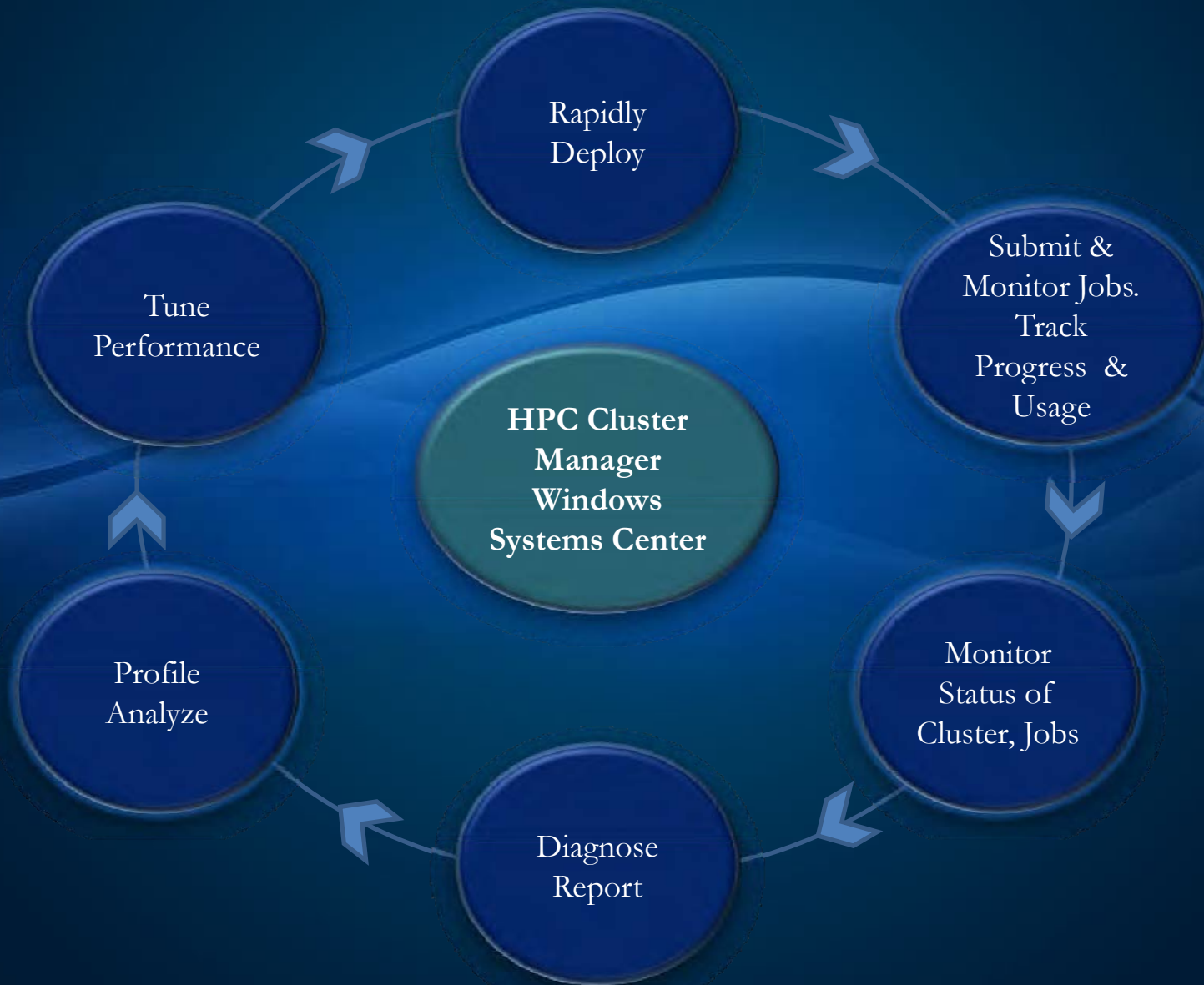
Cluster and Parallel Application Development Overview

- Visual Studio and add-ins offer an integrated set of tools for parallel and cluster development

- Support for developing MPI-based application including **MPI cluster debugger**

- Support for developing SOA-based applications including cluster **SOA debugger and profiler**

- **Parallel LINQ** and **Task Parallel Library** (TPL) included in .NET Framework 4.0

- Support for **GPGPU** programming in partnership with NVIDIA

- Extensive 3rd party library and tool support

"Linux alternatives either had a missing cello, or there was something wrong with percussions or violins. Even if we had managed to combine all the components together, the **coordination between them would stumble**. Microsoft's solution, on the other hand, **was providing everything from the start**.

-**Sami And Kilic, Assistant Professor Doctor, Dept. of Earthquake Engineering,**
- **Kandilli Observatory**

"It's more difficult to resolve issues with Linux because it **involves dealing with five or six software stack components from disparate parties** before even looking at the application layer. The Microsoft approach to HPC includes a well-featured scheduler, file system, security, and other components. The **Linux HPC systems tend to be stitched together with components from multiple sources, which makes deployment and administration more difficult**".

- **Greg Keller, Technical Principal, R Systems**

"As opposed to the Linux cluster, where I have to download packages from all over the place to make it work, I now have an integrated set of management tools for Windows HPC Server—all under a **single pane of glass. It's fantastic**."

- **Vince DiStasi, Vice President and Chief Information Officer, Grove City College**

What's new in R2?
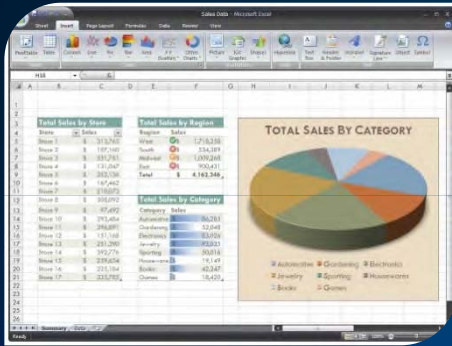
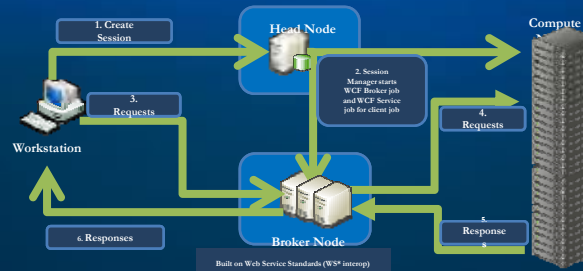More ways to accelerate
Excel on Clusters
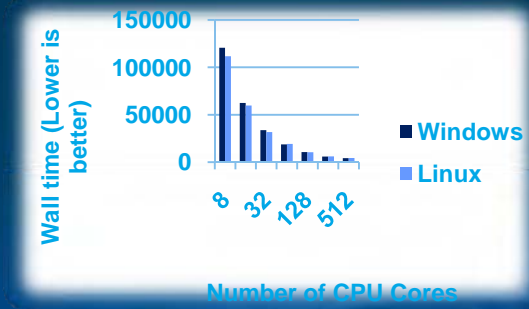
Improved Performance
and Scale

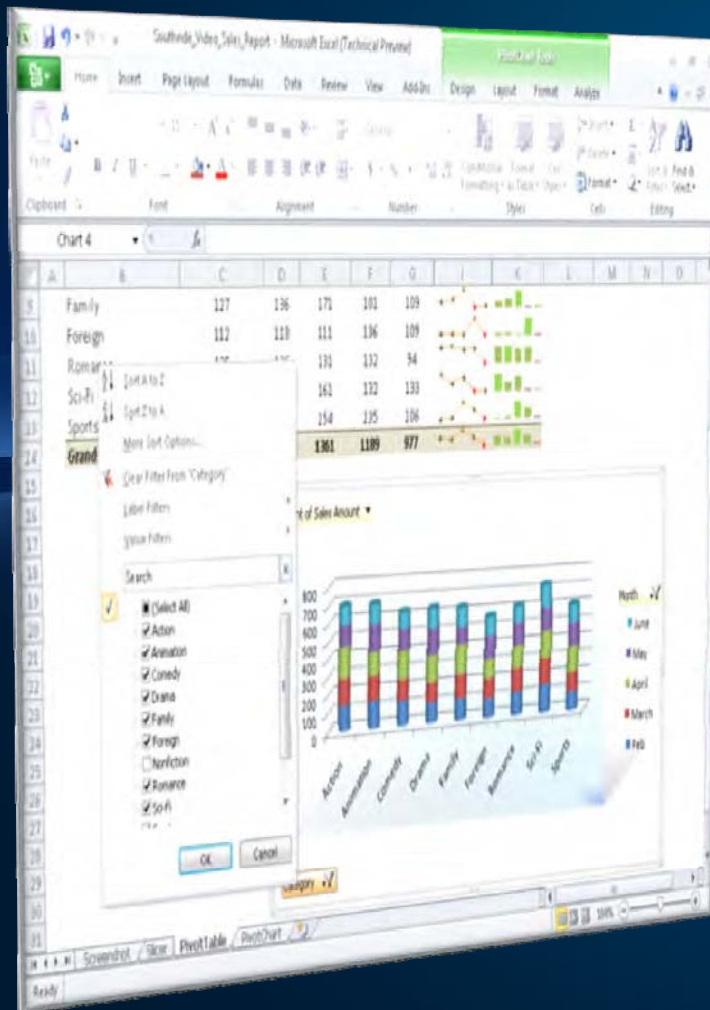Support for
Workstation Nodes

More Job Scheduling
Options

Business Critical
HPC Applications

More options;
faster deployment

Microsoft Excel 2010 On The Cluster

Increase business agility and accelerate time to results by easily transitioning desktop calculations to Windows HPC computations

- Make better business decisions by running larger, more sophisticated models

- Respond to market trends faster and compete more effectively by reducing total time to results

- Manage risk better by increasing accuracy and visibility into the models and datasets

Life Insurance Actuarial workbook examples

- 1700 records that took 14 hours now take 2.5 minutes

- 1 million records that took 7.5 days now take 2 hours

HPC Services for Excel 2010

Windows HPC Server 2008 R2 Provides two new mechanisms to distribute Excel calculations to an Windows HPC Cluster

Excel SOA Client
- ❖ Run Excel as a SOA (Service Oriented Architecture) client
- ❖ VSTO code in workbook calls out to SOA Service
- ❖ Requires brand new development efforts

Excel workbooks on the Cluster
- ❖ Run multiple instances of Excel 2010 on Windows HPC Cluster
- ❖ Transition the business logic from desktop to cluster
- ❖ Requires workbook conversion and Excel on compute nodes

Excel UDF on the Cluster
- ❖ New UI built in Excel 2010 for running UDFs on Windows HPC
- ❖ Easy to develop on a desktop and then deploy to a cluster
- ❖ Requires Excel 2010 or Office 2010 Professional Plus on client

Excel Workbooks on the Cluster
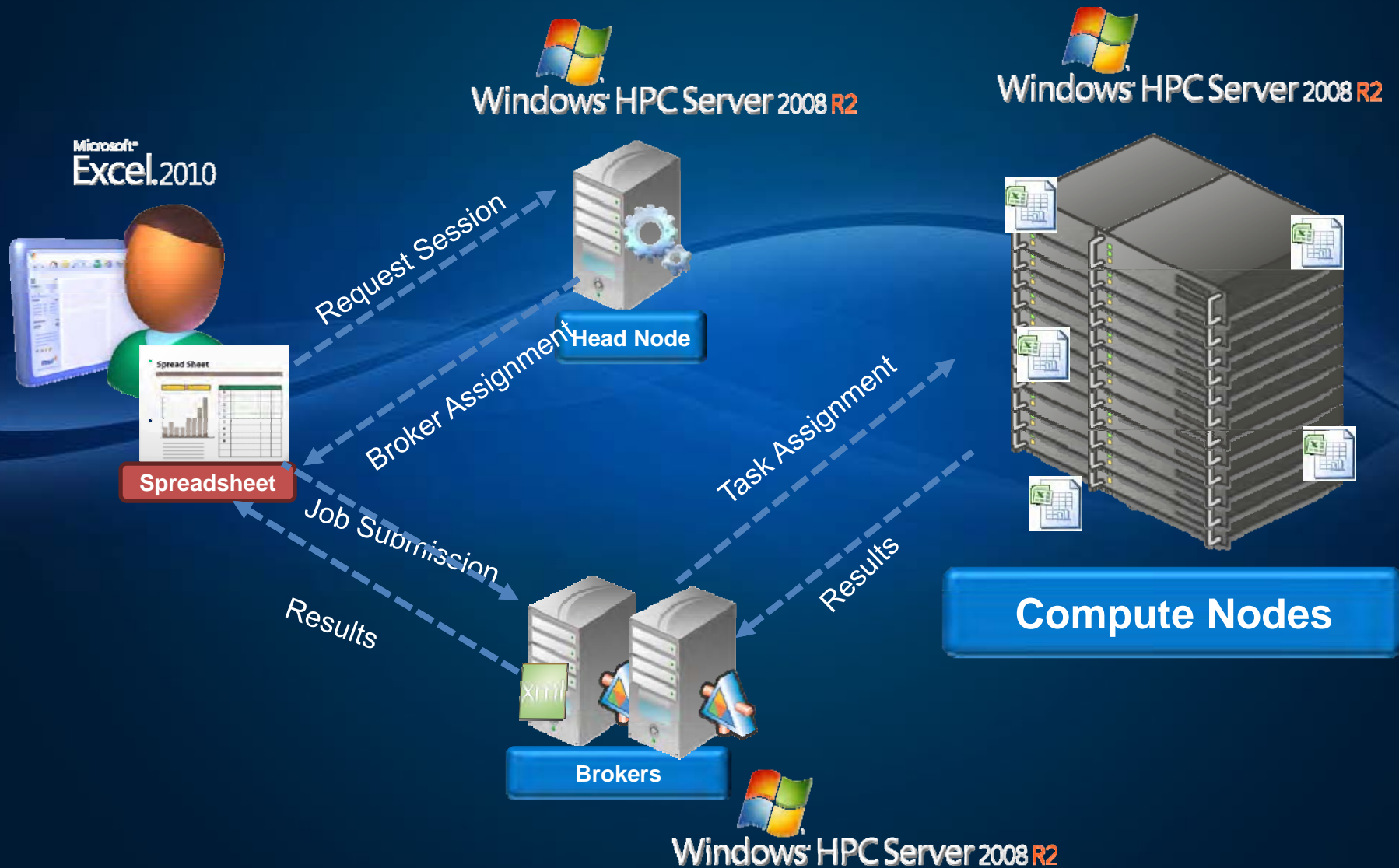
# Support for Workstation Nodes

Expand the capacity of HPC clusters while increasing the return on your existing technology investments by utilizing workstation for running compute Jobs


Feature Summary

- The ability to add Windows 7 workstations as compute nodes
- View and monitor workstations the same as dedicate compute nodes
- Time of day scheduling for Workstation availability
- Draining interval for graceful preemption

Requirements

- Windows 7 Professional or Enterprise, 32 or 64-bit (requires Active Directory support)
- Desktops and cluster in same AD Domain
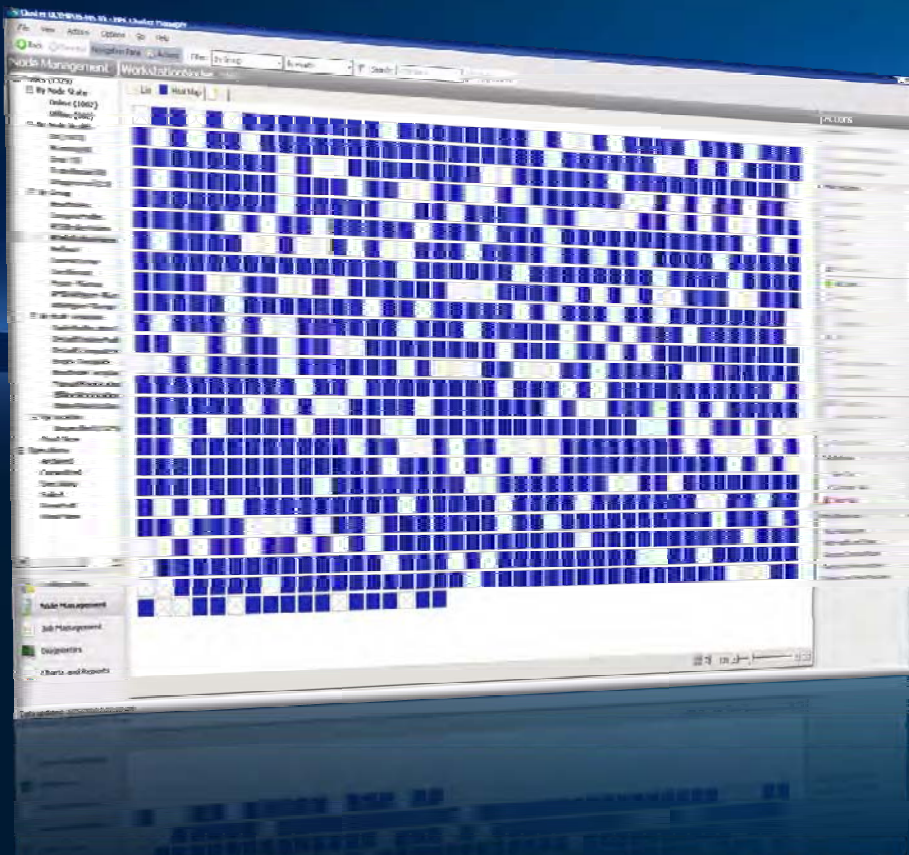
SharePoint Integration
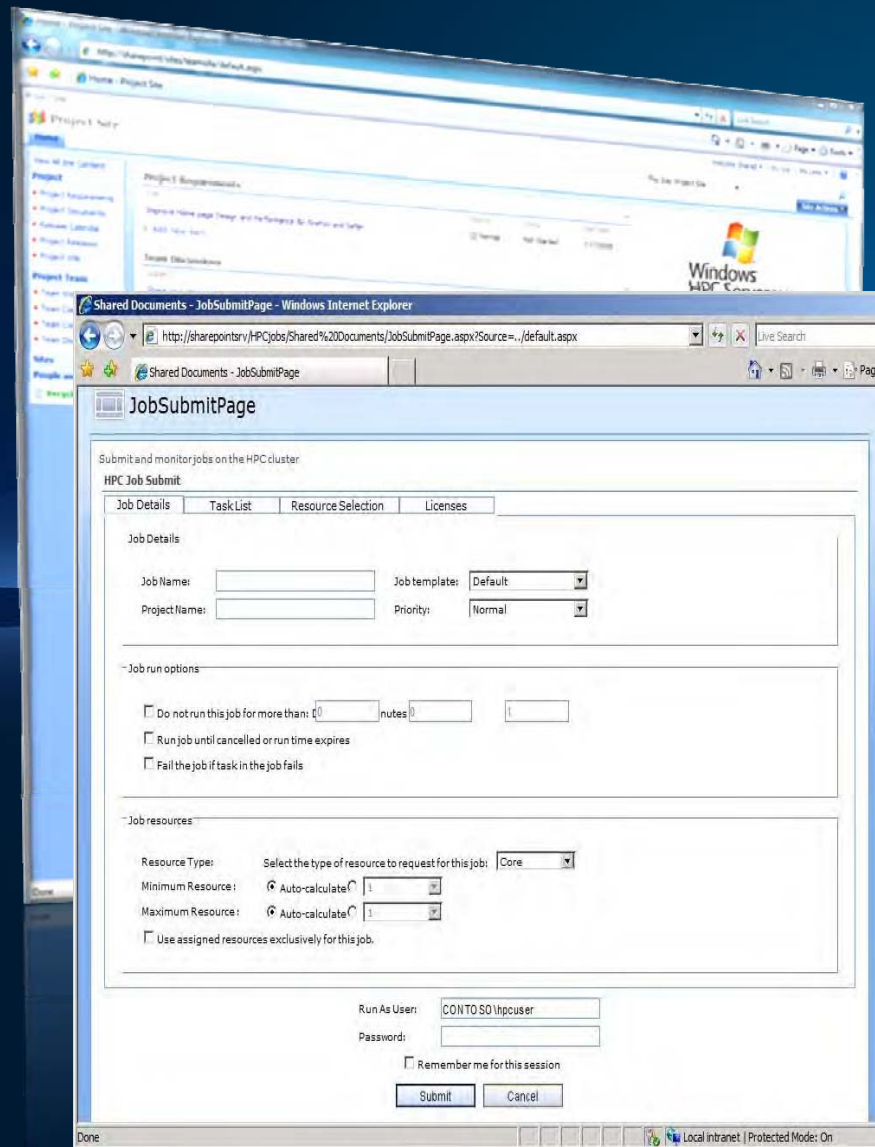
Fuelling productivity and innovation with integration between SharePoint and Windows HPC Server

Windows HPC Pack 2008 - SharePoint Integration Sample provides:

- Easy to use Web based interface to manage Windows HPC Server jobs integrated into a SharePoint based enterprise portal

- Source code of the solution allowing developers to further customize the solution

- Ability to centrally manage, secure, support, and enhance the experience of the Windows HPC Server 2008 users

# Run Windows and Linux Apps on the same cluster

Partners:

- Dynamically switch between Linux and Windows HPC Server based on load
- Scheduling of Jobs on Windows by Windows HPC Server
- Windows System Center can manage both Windows and Linux
- Partnership with Platform Computing and Adaptive Computing

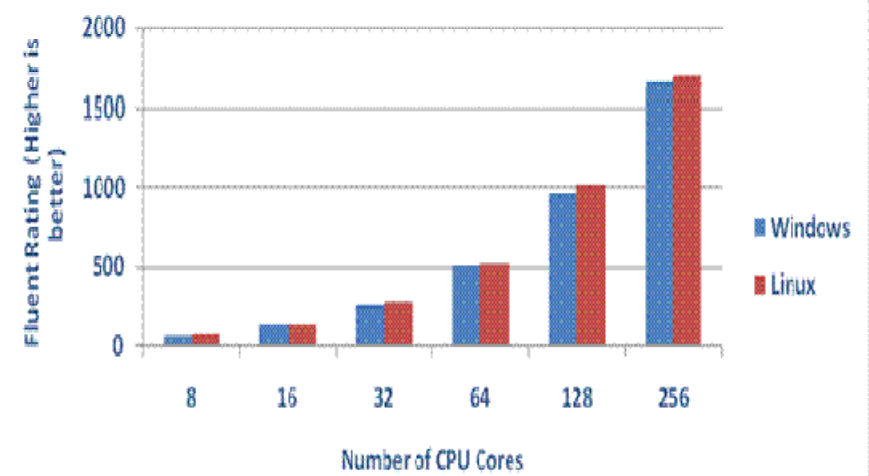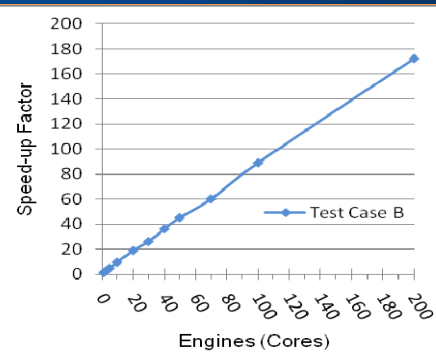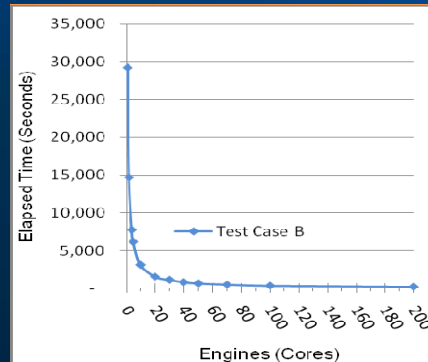# World Class Performance

Real Apps: Windows HPC Server Matches Linux
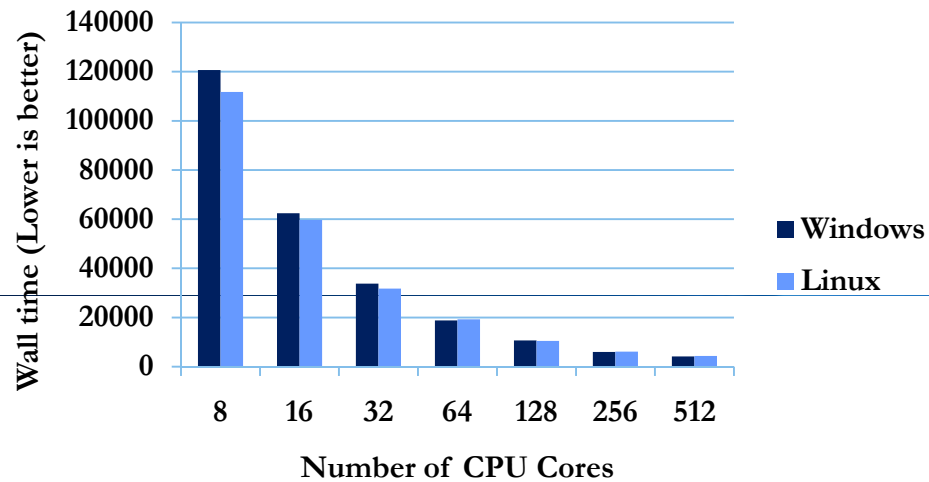
LS-DYNA Benchmark

Ansys Benchmarks

Milliman MG-ALFA Benchmark

"We've done benchmarks with up to 256 cores that showed **performance** that meets, and in some cases **exceeds**, the **Linux** tests done on the **same hardware**.

– Greg Keller,
Technical Principal,
R System

"Our performance tests were so conclusive that we're now converting our Linux server to run on Windows HPC Server 2008. **We're never going back to Linux."**

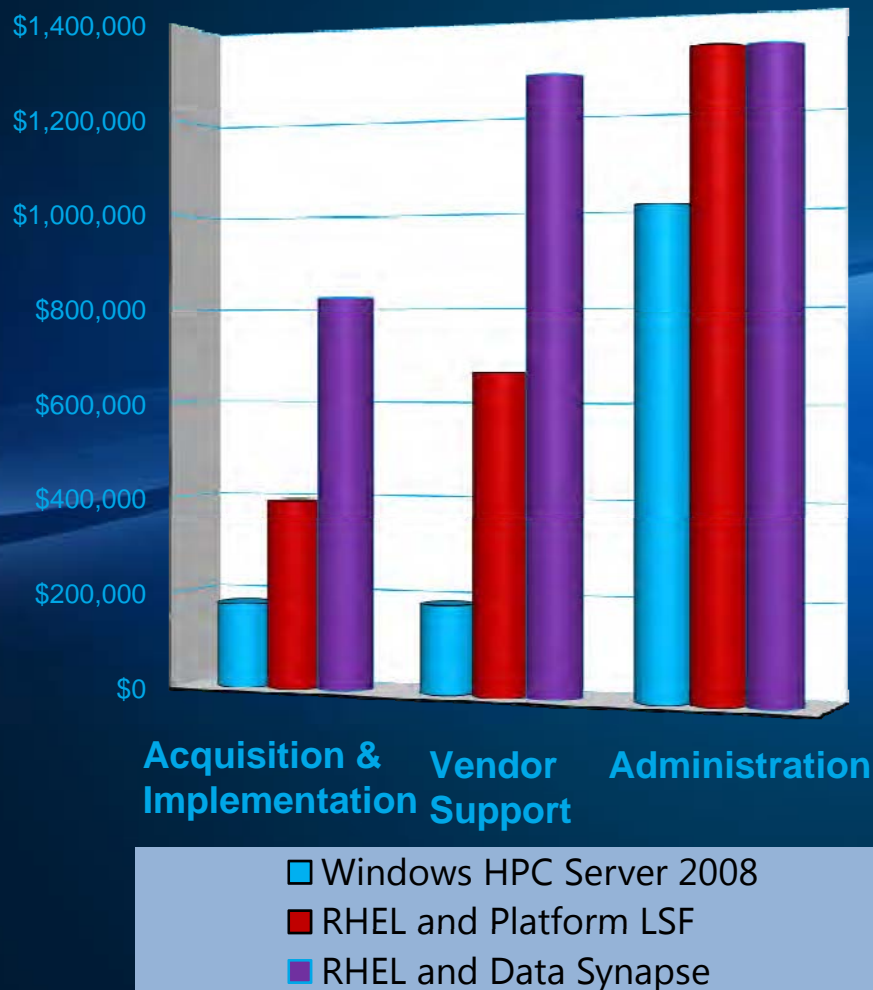**–Dr. Marco Derksen,**
Manager of R&D,
Stork Thermeq

... without any optimizations, the new Windows-based HPC **system outperformed our highly optimized Linux cluster**

-Valerie Daggett,
Professor,
University of Washington

"The performance of Windows HPC Server 2008 has yielded efficiencies that are **among the highest** we've seen for this class of machine".

-Robert Pennington,
-Deputy Director, National Center for
Supercomputing Applications

Window HPC Server 2008 R2:
Lower TCO than Linux-based alternatives

Chart legend:
- ☐ Windows HPC Server 2008
- ☐ RHEL and Platform LSF
- ☐ RHEL and Data Synapse

Chart categories: Acquisition & Implementation, Vendor Support, Administration

Y-axis values: $0, $200,000, $400,000, $600,000, $800,000, $1,000,000, $1,200,000, $1,400,000

- Completed, integrated stack is easier to acquire, deploy and maintain
- Windows Server experience is easier to acquire and cheaper
- Windows HPC Server is licensed per server not per core
- Priced to take HPC mainstream

Download Evaluating the Lifecycle Costs of High Performance Computing Solutions: Windows® HPC Server and Linux-based Solutions »

"We now need fewer people dedicated to system monitoring because we've automated processes, which results in considerable savings for us. We've also experienced a *positive total cost of ownership*. Traditionally, people think that a Windows-based system costs more overall, but we've found that Windows HPC Server is actually the same or *lower than the overall cost of our Linux environment*."

- Xie Hao, IT Manager, Beijing Software Testing & QA Center

"We saved *$100,000 per year in personnel costs* by going with Windows HPC Server over Linux."

- Kurt Dobson, Scientist, Seer Technology

"There was no compelling reason for us to choose Linux for these applications. We saw that a Windows-based HPC solution *would cost less*, perform at least as well, and be easier for us to use and support".

- John Loo, Design Systems Senior Manager, Callaway Golf

"The planetarium has decreased its operating expenses by moving to the new system. We've experienced a **cost savings of up to 10 percent** with our new environment because we've **eliminated a lot of third-party management software."**

- Steven Song, Director of the Digital Studio, Beijing Planetarium

Customer Momentum

HPC Partners

Microsoft®
Your potential. Our passion.™