

# 微软高性能计算解决方案 助力用户提升工程仿真能力

徐辉

微软高性能计算方案经理

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中国制造业产品创新数字化峰会

苏州 2010

Get the full proof at [www.microsoft.com/hpc](http://www.microsoft.com/hpc)

“高生产率”的HPC方案

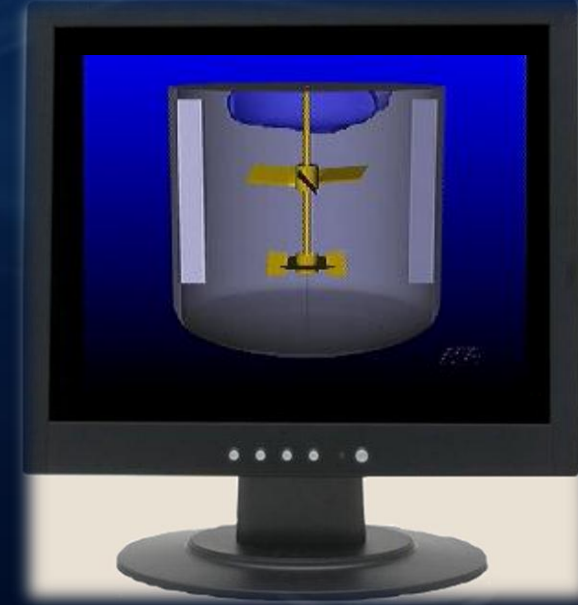
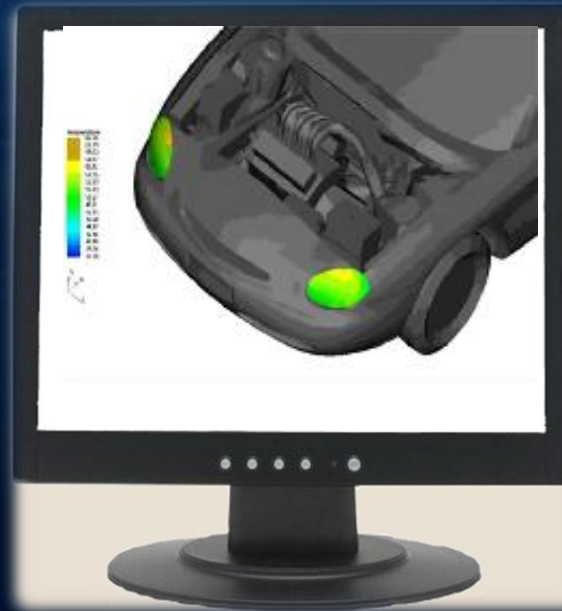
微软HPC和CAE

案例分享

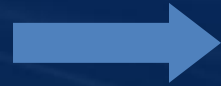
讨论

HPC++

- 开发创新和更高质量的产品；
- 显著缩短产品上市时间；
- 节约产品研发和售后维护(warranty & liability)费用；
- 提高企业研发实力



- 更大规模的仿真计算
  - 更多细节
  - 更复杂的条件
- 更多样性的仿真计算
  - 时效要求
  - 多个设计选项
  - 自动优化



内存(lots)  
计算能力 (more)  
速度 (more)  
数据管理(lots)



HPC



HPC++

# 现实：仿真工作的挑战

现状	解析
单机能力有限	仿真工作模式：单机→集群→.....
集群管理困难	用户管理独立，仿真平台割裂，产生信息孤岛 交互命令繁琐，文件辗转腾挪，用户体验糟糕 软件部署复杂，无法解析管理License
知识管理迟滞	面向硬件调度，排队策略呆板，无视应用特色 偏重结果存档，忽视过程监控，经验教训流失
仿真成本失控	时间成本偏高，人力成本闲置，软件成本失控
研发能力迷失	管理平台缺失，仿真沦为鸡肋，无奈人才流失



“Provide the platform, tools and broad ecosystem to reduce the complexity of HPC by making parallelism more accessible to address future computational needs.”

## 降低复杂性

方便部署大规模群集系统

简化群集管理

整合现有基础架构

## 主流HPC

满足传统HPC的需求

满足跨行业计算趋势的需要

让非技术用户驾驭HPC

## 宽广的生态系统

增加并行应用数量

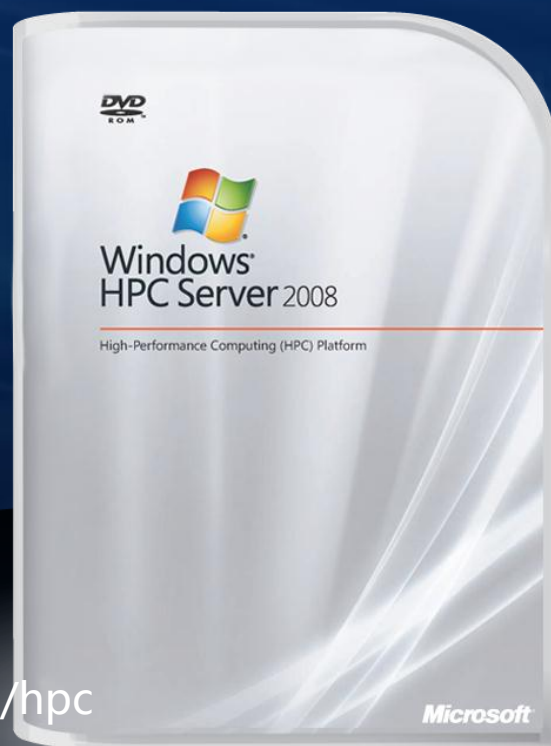
可选择多种开发工具，语言和程序库

扩展终端用户，开发人员和系统管理员的空间

# “高生产率” 的HPC系统

 Windows HPC Server 2008

## Windows HPC Server 2008 R2



[www.microsoft.com/hpc](http://www.microsoft.com/hpc)

中文网址：

[www.microsoft.com/china/hpc](http://www.microsoft.com/china/hpc)

- 高性能群集的**完整集成平台**
- 基于Windows Server 2008 **64位操作系统**
- 满足高性能计算的**常规需求和潜在需求**



Windows Server 2008  
HPC Edition

- 安全，可靠，经过测试
- 高性能硬件支持(x64, 高速互联)

Microsoft HPC Pack  
2008

- 作业调度!!!
- 资源管理
- 群集管理
- MPI网络并行环境支持!

Microsoft Windows HPC  
Server 2008

- 集成解决方案  
“立即上手(out-of-the-box)”
- 利用在Windows上的管理经验和工具
- 使群集操作象单一系统一样容易和安全



# 微软HPC：“全能选手”

Hardware

OS

Scheduler

Deployment

Authentication

Management

Network validation

Operational cost

Application software

## Windows HPC



Windows HPC Server 2008



# Low Cost!

Configuration

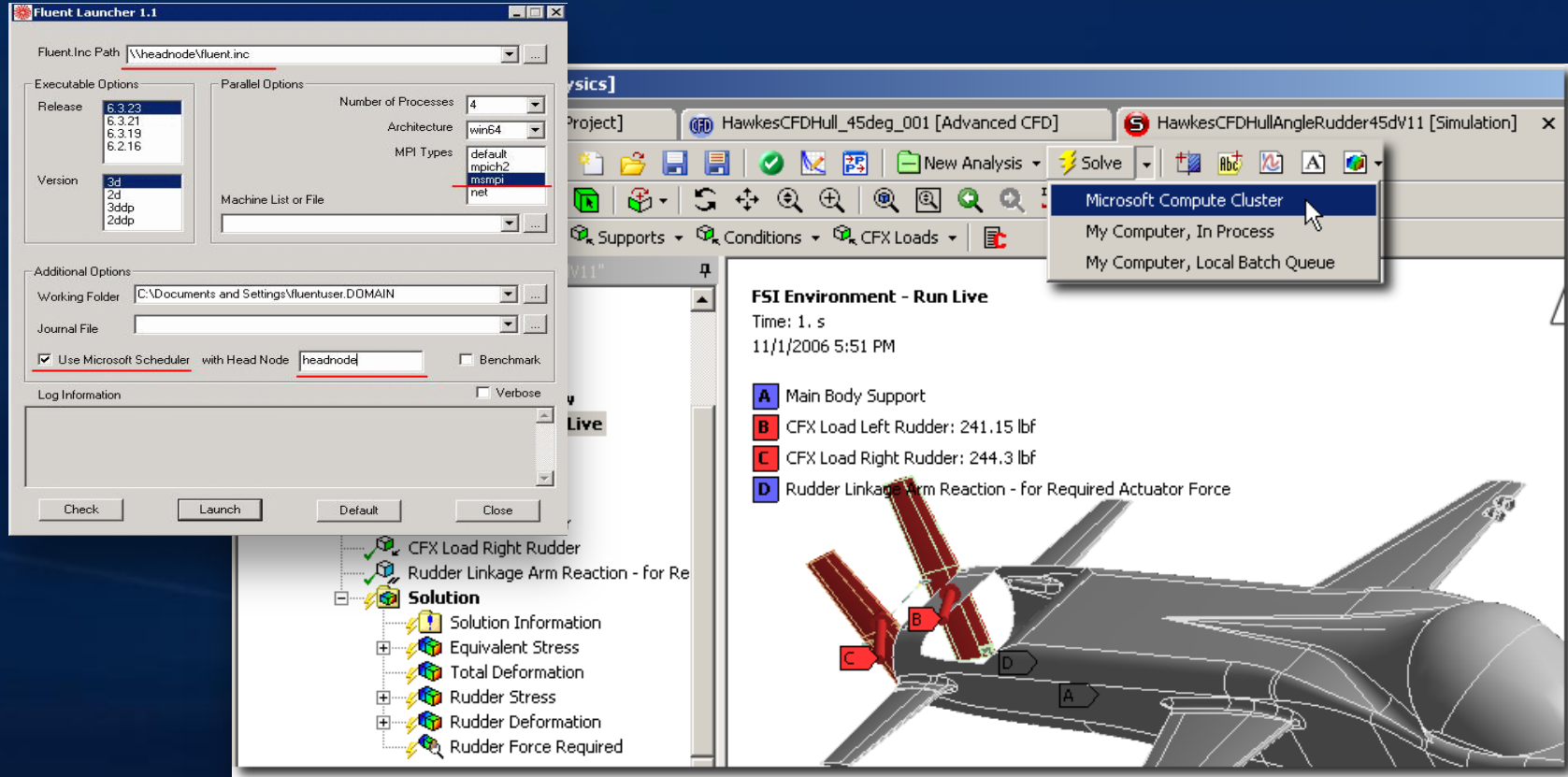
Monitoring

Node Management

Diagnostics

Job Management

The screenshot displays the Windows HPC Server 2008 management console. It features several tabs: Configuration, Monitoring, Node Management, Diagnostics, and Job Management. The Job Management tab is active, showing a list of jobs with columns for Job ID, Job Name, Status, Owner, Priority, Sub Time, Execution Time, and Error Message. The interface includes various toolbars and side panels for managing the HPC environment.



## Windows HPC Server和仿真软件无缝结合

- 用户不用离开熟悉的CAD/CAE即可“一键”提交并行任务
- 给仿真任务分配所需资源，跟踪与作业相关的处理器
- 仿真计算完成时，解除资源分配
- 甩开繁复的命令和脚本编辑工作



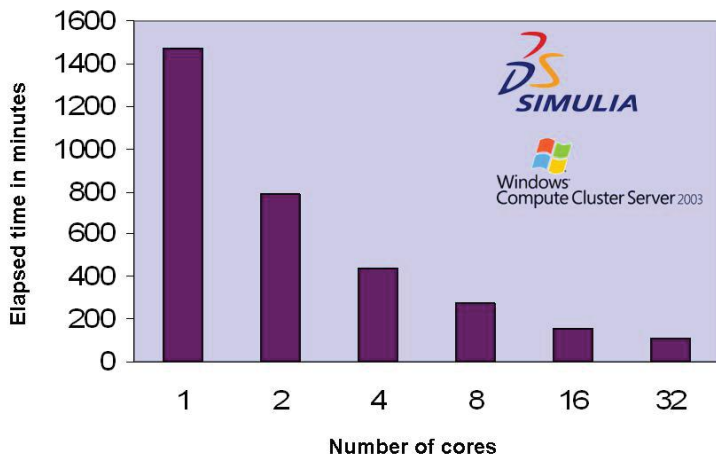
# 微软HPC合作伙伴

Windows HPC Server 2008



Windows HPC Server 2008

# 微软高性能计算的卓越性能



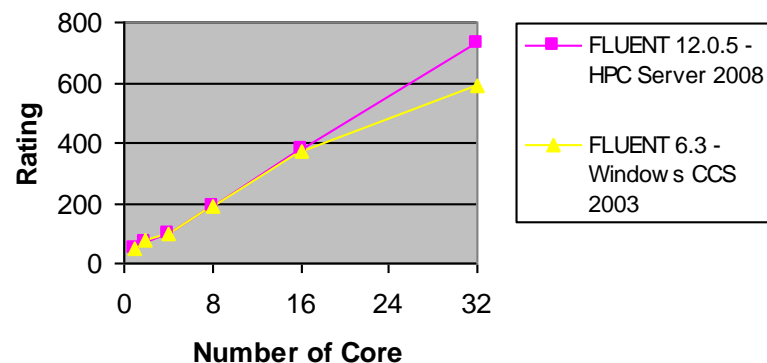
The table above shows execution times for an Abaqus/Explicit job running on a WCCS cluster of 2P/dual core Opteron nodes with Infiniband interconnect. The results show that 1 day of execution can be reduced to 2 hours using this hardware setup.

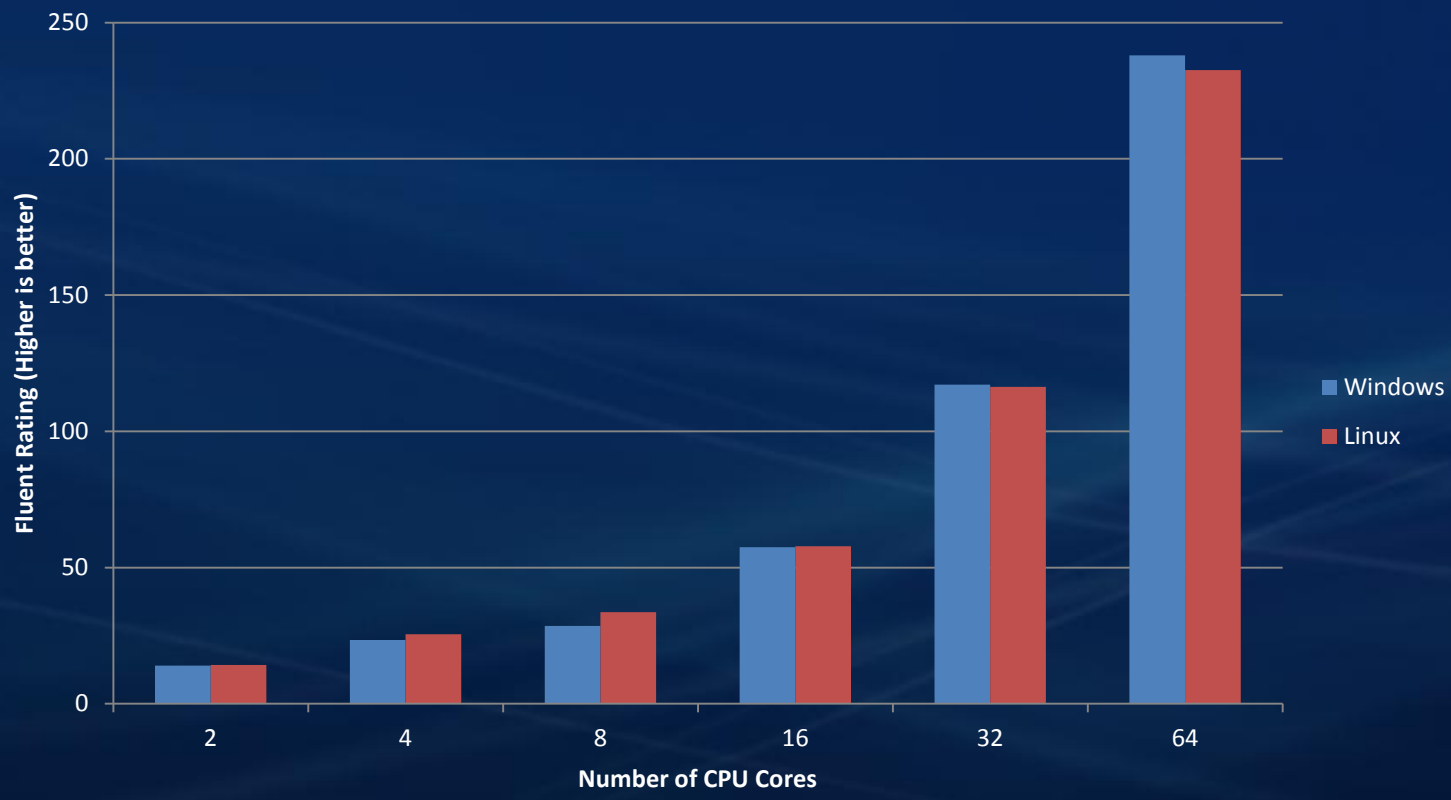
- 32路并行时性能提升达24% !  
(受益于HPC Server 和FLUENT新版本)。



汽车外流场, 3.6M cells  
湍流压力耦合

## Parallel Scaling Improvement on Windows HPC Server 2008



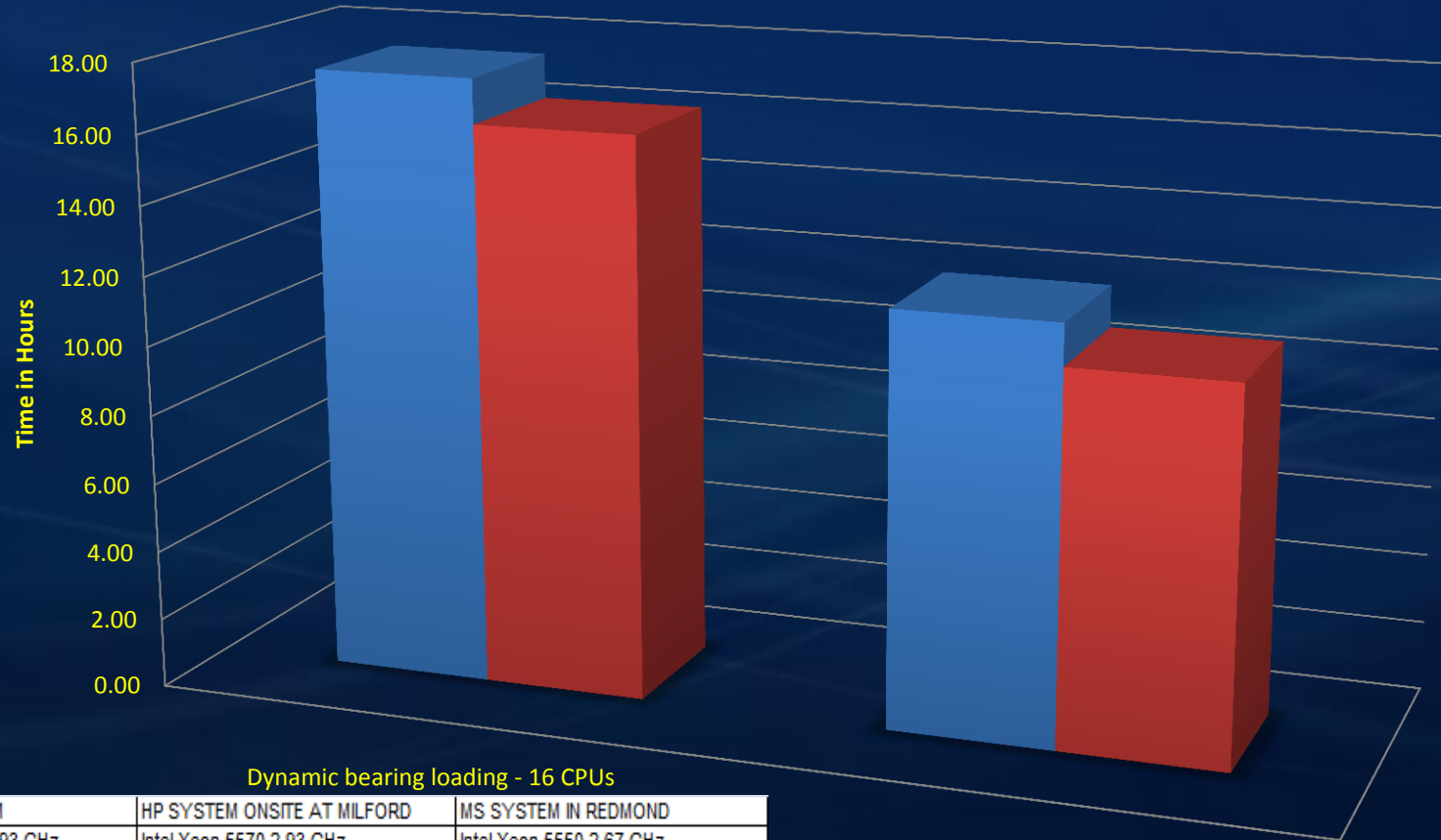


### Conclusions:

For ANSYS FLUENT 12.0, Windows HPC Server 2008 is delivering the same or faster performance than Linux on the same hardware (HP BL2x220 3GHz with 16GB memory per node and InfiniBand interconnect).

Reference: 卡车车身外流场, **14M cells**, public benchmark. ANSYS FLUENT 12.0 data posted at <http://www.fluent.com/software/fluent/fl6bench/new.htm> Windows HPC data run with pre-release ANSYS FLUENT 12.0.16. Results run by HP and submitted/approved by ANSYS.

## ABAQUS explicit benchmarks Bearing crush model



HP LABS SYSTEM	HP SYSTEM ONSITE AT MILFORD	MS SYSTEM IN REDMOND
Intel Xeon 5570 2.93 GHz	Intel Xeon 5570 2.93 GHz	Intel Xeon 5550 2.67 GHz
48 GB M EMORY	96 GB M EMORY	24 GB M EMORY

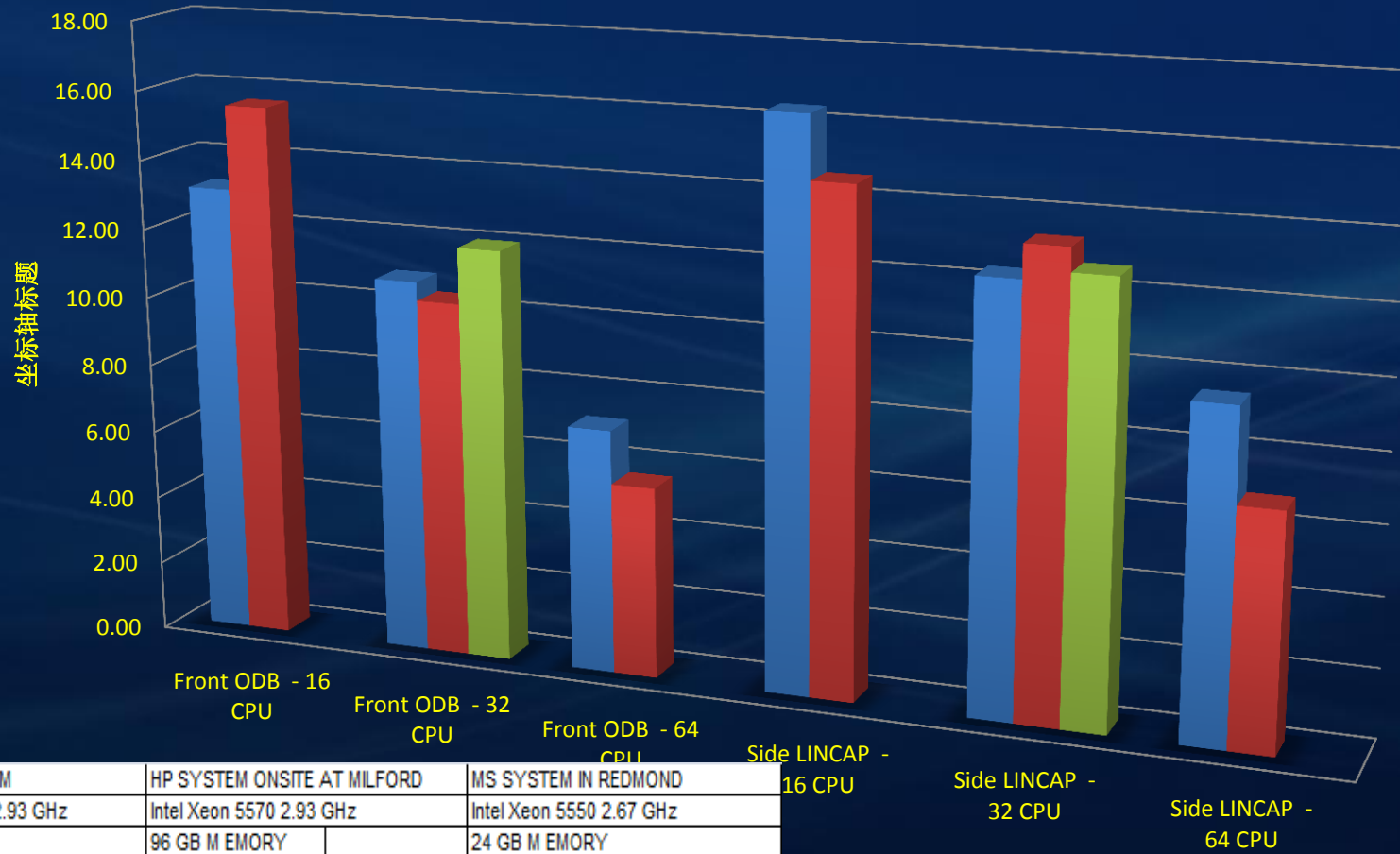
Dynamic bearing loading - 32 CPUs

Dynamic bearing loading - 16 CPUs

Dynamic bearing loading - 32 CPUs

	Dynamic bearing loading - 16 CPUs	Dynamic bearing loading - 32 CPUs
Linux	17.48	11.95
Windows	16.2	10.75

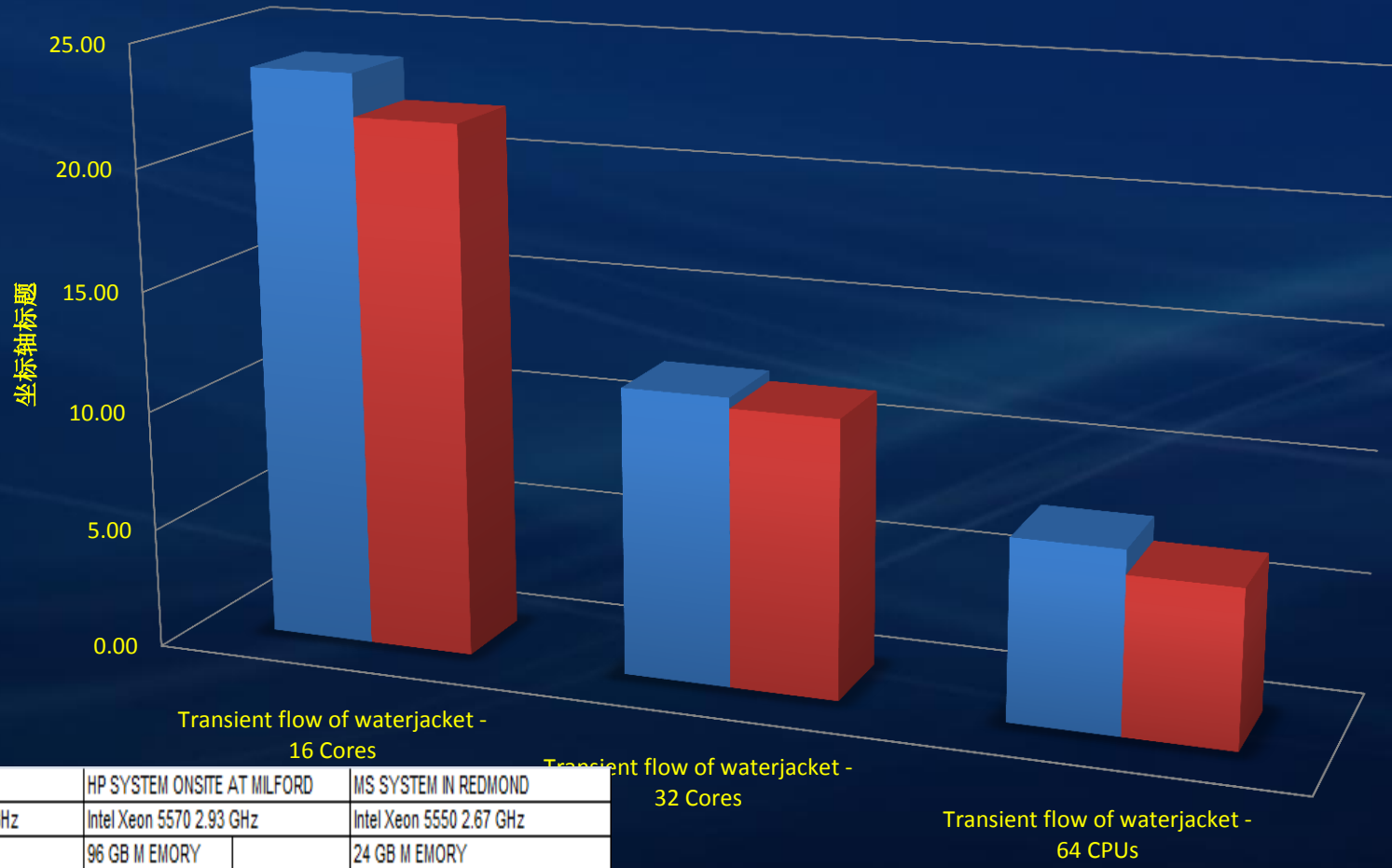
## LS-DYNA Results



HP LABS SYSTEM	HP SYSTEM ONSITE AT MILFORD	MS SYSTEM IN REDMOND
Intel Xeon 5570 2.93 GHz	Intel Xeon 5570 2.93 GHz	Intel Xeon 5550 2.67 GHz
48 GB M EMORY	96 GB M EMORY	24 GB M EMORY

	Front ODB - 16 CPU	Front ODB - 32 CPU	Front ODB - 64 CPU	Side LINCAP - 16 CPU	Side LINCAP - 32 CPU	Side LINCAP - 64 CPU
HP LINUX	13.14	10.89	7.11	16.37	12.35	9.49
Windows on MS CLUSTER	15.57	10.36	5.57	14.57	13.31	6.8
Windows on HP Cluster	-	11.98	-	-	12.63	-

## Fluent Benchmarks

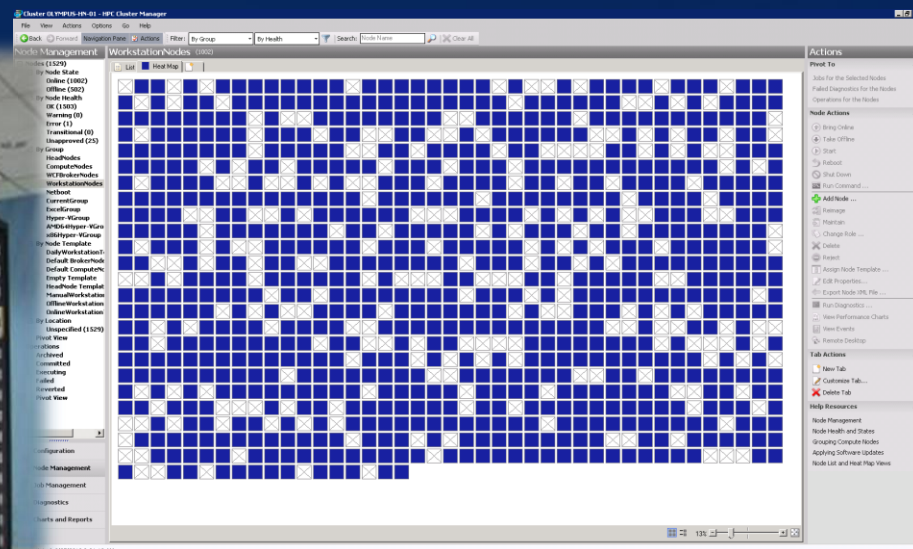


HP LABS SYSTEM	HP SYSTEM ONSITE AT MILFORD	MS SYSTEM IN REDMOND
Intel Xeon 5570 2.93 GHz	Intel Xeon 5570 2.93 GHz	Intel Xeon 5550 2.67 GHz
48 GB M EMORY	96 GB M EMORY	24 GB M EMORY

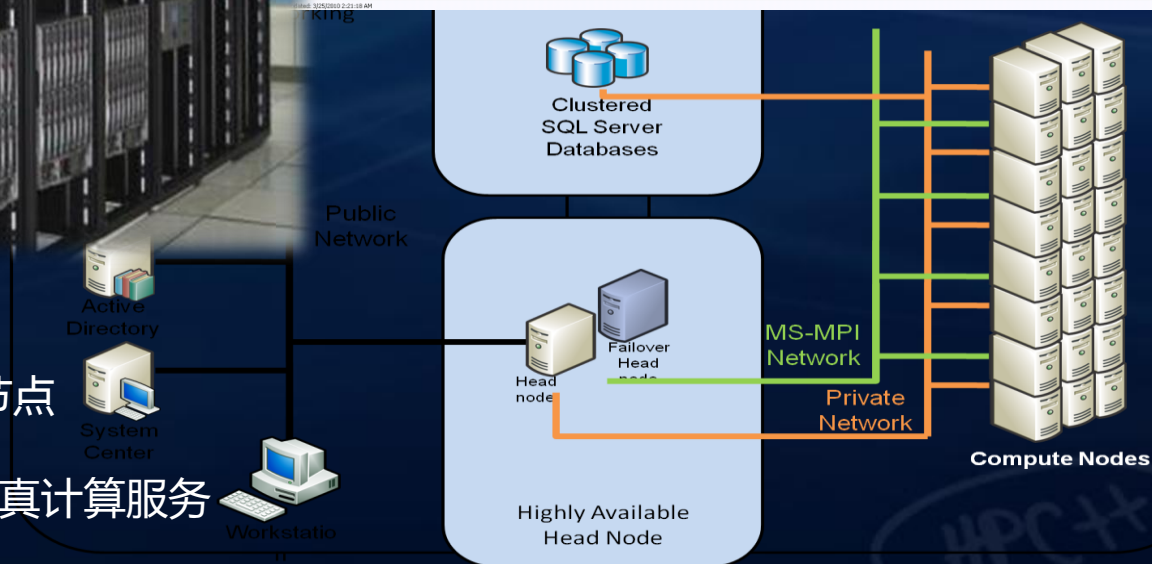
	Transient flow of waterjacket -16 Cores	Transient flow of waterjacket - 32 Cores	Transient flow of waterjacket -64 CPUs
HP LINUX	23.76	11.94	7.50
Windows on GM Demo HP Cluster	22	11.51	6.5



# 案例：公共超算中心



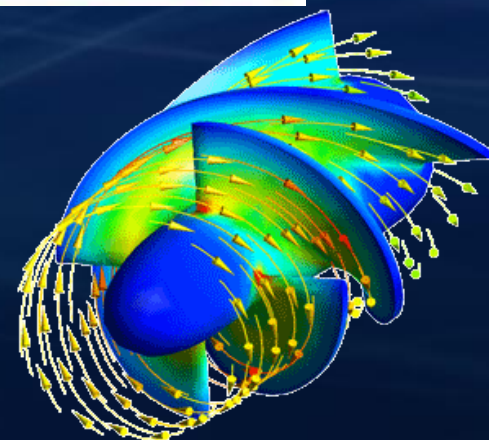
1. 超过2000个以上的节点
2. 可为公众用户提供仿真计算服务



# 案例：企业研发门户

The screenshot shows a web browser displaying the 'CAE高性能计算门户' (CAE High-Performance Computing Portal). The page includes a navigation menu on the left and a main content area with a table of project details. Below the table, there are diagrams of server infrastructure including SharePoint, Application Servers, SQL Database Cluster, and BIG-IP Local Traffic Manager.

项目编号	名称	状态	创建者	优先级	提交时间	使用节点	错误消息	操作
1853	File	成功	HPChangq...	Normal	2009-9-4	COMPUT...		取消任务 详情
1851	File test	成功	HPChangq...	Normal	2009-9-4	COMPUT...		取消任务 详情
1849	G	成功	HPChangq...	Normal	2009-9-3	COMPUT...		取消任务 详情
1845	Rent job	失败	HPChangq...	Normal	2009-9-3	COMPUT...	Cancelled dur...	取消任务 详情
1841	Rent job	失败	HPChangq...	Normal	2009-9-3	COMPUT...	Cancelled dur...	取消任务 详情
1838	Rent job	成功	HPChangq...	Normal	2009-9-3	COMPUT...		取消任务 详情
1835	Rent job	成功	HPChangq...	Normal	2009-9-3	COMPUT...		取消任务 详情
1832	Rent job	成功	HPChangq...	Normal	2009-9-3	COMPUT...		取消任务 详情
1800		失败	HPChangq...	Normal	2009-9-3	COMPUT...	Failed to st...	取消任务 详情
1597		成功	HPChangq...	Normal	2009-9-3	COMPUT...		取消任务 详情
1595		成功	HPChangq...	Normal	2009-9-3	COMPUT...		取消任务 详情
1588	MTask	成功	HPChangq...	Normal	2009-9-3	COMPUT...		取消任务 详情



1. 基于微软HPC方案；
2. 利用Share Point快速开发，有效整合现有PLM/PDM/PSM系统
3. 统一管理计算资源：硬件和多种仿真软件资源



当前时间: 2010年11月18日, 星期四,  
10:18:36

用户: **quezhengpeng** [注销](#)

## 仿真云计算平台管理系统



我的首页

项目空间

管理空间

帮助

### 我的项目

所有项目	排队项目	正在运行	已经完成	取消项目	失败项目
8	0	0	8	0	0

### 资源统计

总核数	在线核数	空闲核数	分配核数	已用核数	可用(分配)核数
6	4	4	16	0	16

### 集群当前运行状态

求解器	排队作业	运行作业
Abaqus 6.9-1	0	0
Fluent 12.0	0	0

### 用户信息

基本信息 [Edit](#)

姓:	que
名:	zhengpeng
电子邮件:	platoque@live.cn
电话:	607

### 用户权限

失效日期	11/30/2010
核数:	16
最大核数:	18
Abaqus 6.9-1:	32
Fluent 12.0:	16

# HPC无缝对接企业现有IT基础架构

### Development Tools

Visual Studio: C#, C++, WCF, OpenMP, MPI, MPI.NET	Trace Analysis
Numerical Libraries	Profiling
Fortran	MPI Debugging
	MPI Tracing

### Clients/Job Submission

Batch Applications	SharePoint
WCF Applications	Excel
CCS Job Console	Windows Workflow Foundation
CCS Scripts	

### Administration

- Windows® HPC Server 2008 Administration Console: System, Scheduling, Networking, Imaging, Diagnostics
- Windows Powershell
- System Center Operations Manager
- System Center Data Protection Manager
- System Center Configuration Manager
- Windows Server Update Services
- Software Protection Services
- 3<sup>rd</sup> Party Systems Management Utilities

### Existing Cluster Infrastructure

UNIX/Linux System

HPC Profile

### Windows® HPC Server 2008

Job Submission APIs	Job Scheduler w/ Failover	Administration APIs
	<p>Compute Nodes</p> <p>Node Manager</p> <p>Applications: WCF, C#, C++, Fortran</p> <p>New TCP/IP    MPI w/Network Direct</p>	
WCF Router		

### Key

- Partner
- Microsoft
- HPC Server 2008

### Storage

Parallel/Clustered Storage

### Storage

SQL Structured Storage

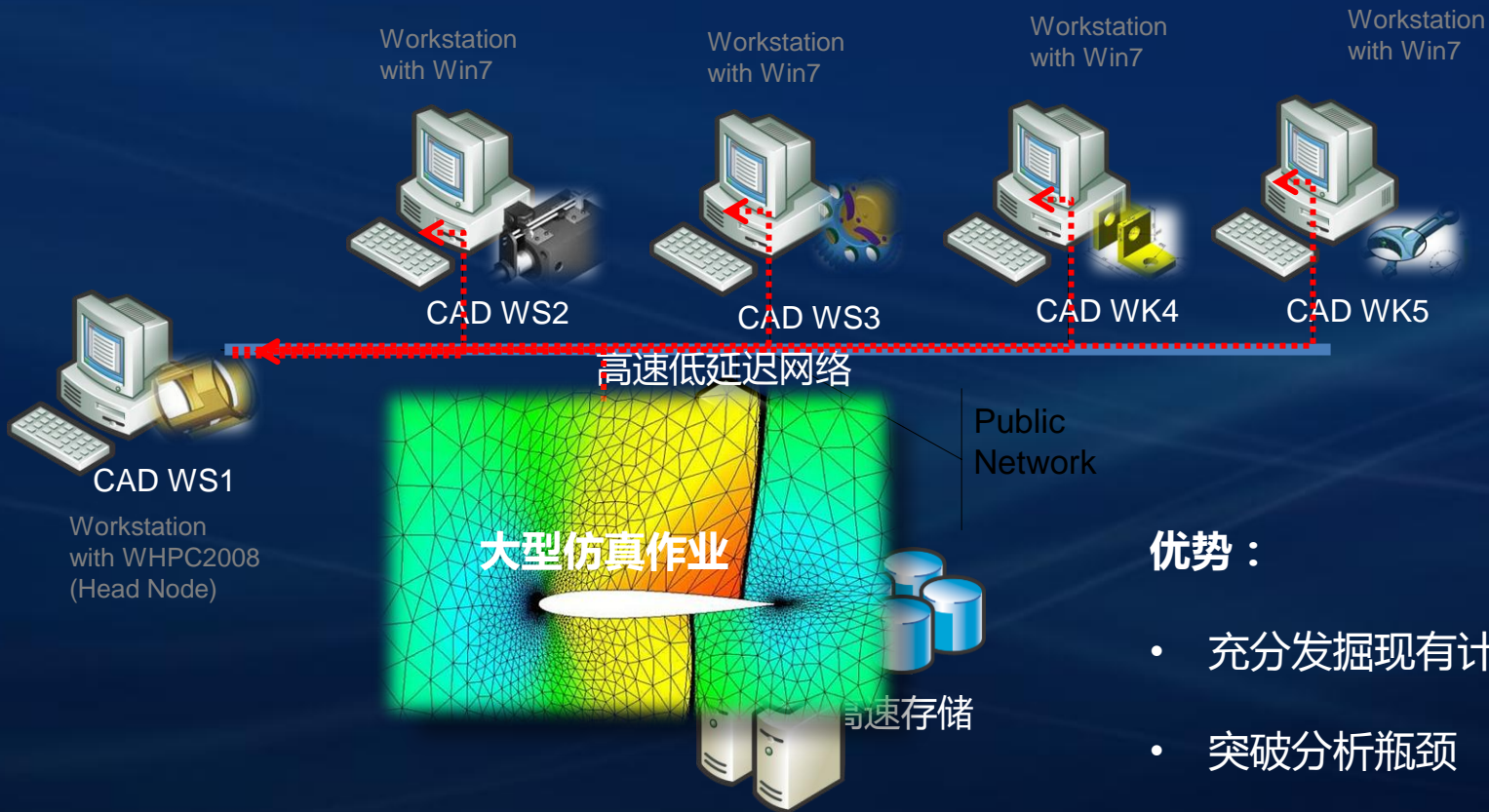
### Storage

Windows Storage Server with DFS

### Business Intelligence

SQL Server Integration Services

SQL Server Analysis/Reporting



## 优势：

- 充分发掘现有计算资源潜力
- 突破分析瓶颈
- 适合仿真中心的起步
- 适合专业部门和中小企业

并行计算  
从今天晚上开始 ...



- 微软HPC方案是一个集成高效的仿真基础平台
- 微软HPC方案完美搭建企业仿真管理平台
- 并行仿真，从今天开始，从微软开始

# Microsoft®

*Your potential. Our passion.™*

HPC++