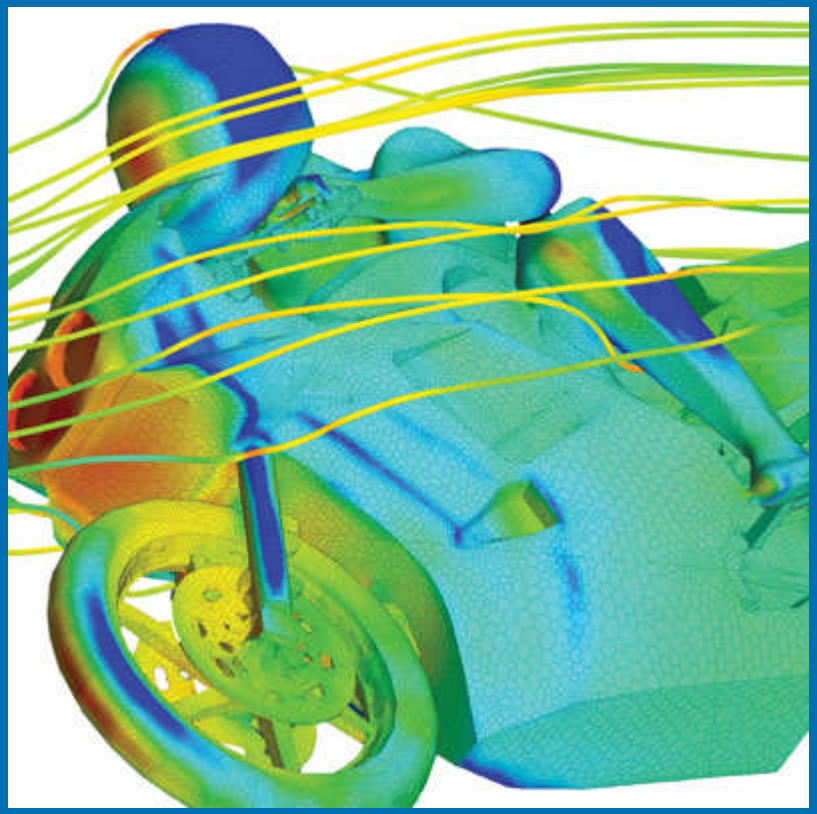
HP Solutions for CD-Adapco Applications



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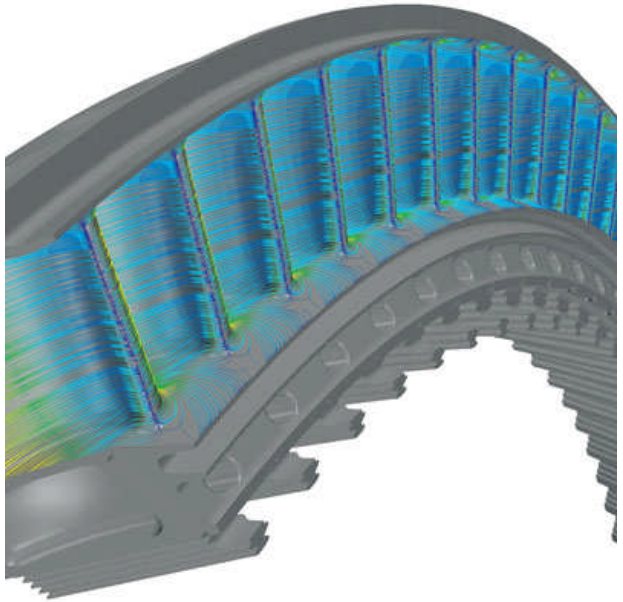
Accelerate **Innovation** Drive **Simplicity** Execute with **Confidence**

Engineering/IT Challenges in CAE

Meeting performance demands economically

- Increasingly complex CAE analysis
- Exponential growth in volume of data
- Many specialized applications
- Dizzying choices of new computing solutions



Flow, Thermal, Stress simulation of a gas turbine blade

Trends in Computation & Graphics

- Clusters of small systems gaining popularity over big, monolithic SMP systems.
- Multi core processors
- Virtualization and consolidation of compute resources
- Remote Computing and Visualization
- Increasing awareness on environment and “Go Green” Campaigns.
- Component level enhancements (Fully Buffered DIMM memory, SAS Disks, PCI-Express Gen2 Graphics)

HP CAE Solutions

- Broadest choice of solutions *based on industry standards*
  - ✓ Dual-core, Quad-core Xeon workstations
  - ✓ Dual-core, Quad-core Opteron workstations
  - ✓ Leadership C-Class BladeSystems
  - ✓ New Blade Workstations
  - ✓ Linux on 128-core Superdome
  - ✓ Dual-core, Quad-core Itanium, Xeon and Opteron clusters, and servers
- Largest portfolio of CAE applications
- Integrated Parallel Cluster File System
- Solution templates for configuration guidance

HP Blade Workstations

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Recommendations for Standard Clusters

- General/Common Components
  - All nodes contain 2 dual-core AMD or Intel Woodcrest cpu's (4 cores/node)
  - All nodes contain at least 2GB memory/core. As problems grow larger, it is usually better to deal with the increased size by adding more cores than by upping the memory/core. Adding more memory only allows you to solve a larger problem, but very slowly. 2Gb/core seems to be the "sweet spot" that balances scaling, turnaround time and reasonable size. One exception to this rule is problems with very large (>30) numbers of scalar fields to solve such as combustion problems. In this case, much more memory per cell is required than normal so extending to 4Gb/core probably makes sense.
  - Each node has minimum size local disks for OS and swap only. While STAR3 can benefit in speed by running each nodes data to a local drive, the increase in performance is not worth the management problem of monitoring and cleaning up N drives. Sending all data to 1 large location eliminates problems of nodes failing because their particular disk is filled.
- Upgrades
  - Use mirrored local drives on the head node and storage node to eliminate a location where a single drive failure can bring down the entire cluster.

HPC Americas
DATE: 4/3/2008
32 Node Xeon InfiniBand Cluster

QUOTATION NUMBER

QUOTE Summary: 128 Core Systems - IB

USD List price: $278,644.50

Hardware:

- 32 BL460c G1 Xeon Compute Servers each configured with:
  - 2 Xeon E5260 dual core 3.3 GHz CPUs
  - 8 GB RAM via 4 2GB DIMM kits (FBD PC2-5300 2X 1GB)
  - 1 60 GB 10K SATA hard drive
  - Ethernet connection through Nortel GbE2 switch
  - Cluster interconnect through 4X DDR InfiniBand Switch
  - Fiber storage connection through Brocade 4Gb 12 port SAN switch
- Network Equipment
  - 1 ProCurve 2824 Ethernet switch (Admin and Console)
- 9TB (raw) storage consisting of:
  - 1 MSA1500 storage controller
  - 3 MSA20 storage shelf with 12 250GB SATA drives each
- 1 42U rack, cables, 4 24A PDUs and TFT7600

Software:

- Red Hat 4 System Software, 1 year 9X5, 10 Incident

Services:

- Hardware factory integration
- AIC cluster staging, including software load
- GDS Installation at customer location

Solution Specifications:

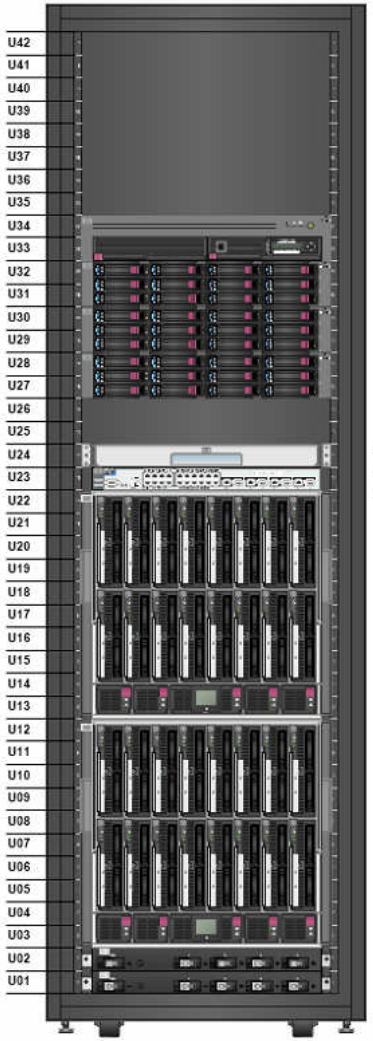
32 Node Configuration (Estimated Values)

	AMPs 208V	VA	WATTs Max	BTUs Max	Weight	L6-30P
Cabinet	67	12512	12176	41545	1359	4

HPC Americas
DATE: 4/3/2008
32 Node Xeon InfiniBand Cluster

QUOTATION NUMBER

Cabinet Drawing



MSA1500 Storage Controller

3 MSA20 Storage Shelf w/12 250 GB SATA Drives each – 9TB Raw

TFT7600 Monitor/Keyboard

ProCurve 2824 Ethernet Switch

16 BL460 G1 Blades 2 DC 3.33GHz 5260 CPUs, 8GB Mem, 1 60GB HD

16 BL460 G1 Blades 2 DC 3.33GHz 5260 CPUs, 8GB Mem, 1 60GB HD

4 24A PDU - 4 L6-30P Plug

32 Core System in a "Shorty" Rack

HPC Americas
DATE: 4/3/2008
8 Node Xeon InfiniBand Cluster

QUOTATION NUI

QUOTE Summary: 32 Core System

USD List price: $95, 543.70

Hardware:

- 8 BL460c G1 Xeon Compute Servers each configured with:
  - 2 Xeon E5260 dual core 3.33GHz CPUs
  - 8 GB RAM via 4 2GB DIMM kits (FBD PC2-5300 2X 1GB)
  - 1 60 GB 10K SATA hard drive
  - Ethernet connection through Nortel GbE2 switch
  - Cluster interconnect through 4X DDR InfiniBand Switch
  - Fiber storage connection through Brocade 4Gb 12 port SAN sw
- 3TB (raw) storage consisting of:
  - 1 MSA1500 storage controller
  - 1 MSA20 storage shelf with 12 250GB SATA drives
- 1 22U rack, cables, 1 24A PDU and TFT7600

Software:

- Red Hat 4 System Software, 1 year 9X5, 10 Incident

Services:

- Hardware factory integration
- AIC cluster staging, including software load
- GDS Installation at customer location

Solution Specifications:

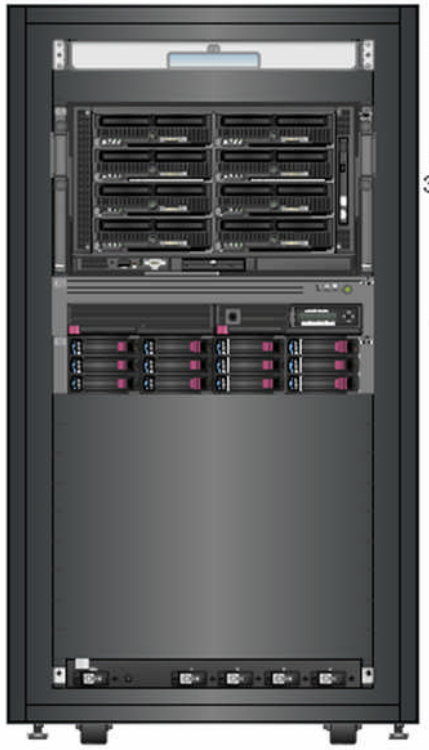
8 Node Configuration (Estimated Values)

	AMPs 208V	VA	WATTs Max	BTUs Max	Weight	L6-30P
Cabinet	20	3611	3522	12017	436	1

HPC Americas
DATE: 4/3/2008
8 Node Xeon InfiniBand Cluster

QUOTATION NUMBERS: HPC-00996-00
CD Adapco

Cabinet Drawing



TFT7600 Monitor/Keyboard

8 BL460 G1 Blades 2 DC 3.33GHz 5260 CPUs, 8GB Mem, 1 60GB HD

MSA1500 Storage Controller

MSA20 Storage Shelf w/12 250 GB SATA Drives – 3TB Raw

1 24A PDU - 1 L6-30P Plug

*With GigE USD List Price: $83,221.70

HP Supercomputer-in-a-box

The power of supercomputing outside the Data Center. Made simple with BladeSystem c3000 and HP Cluster Platform.

CP Workgroup System

HP BladeSystem c3000 enclosure + HP Cluster Platform

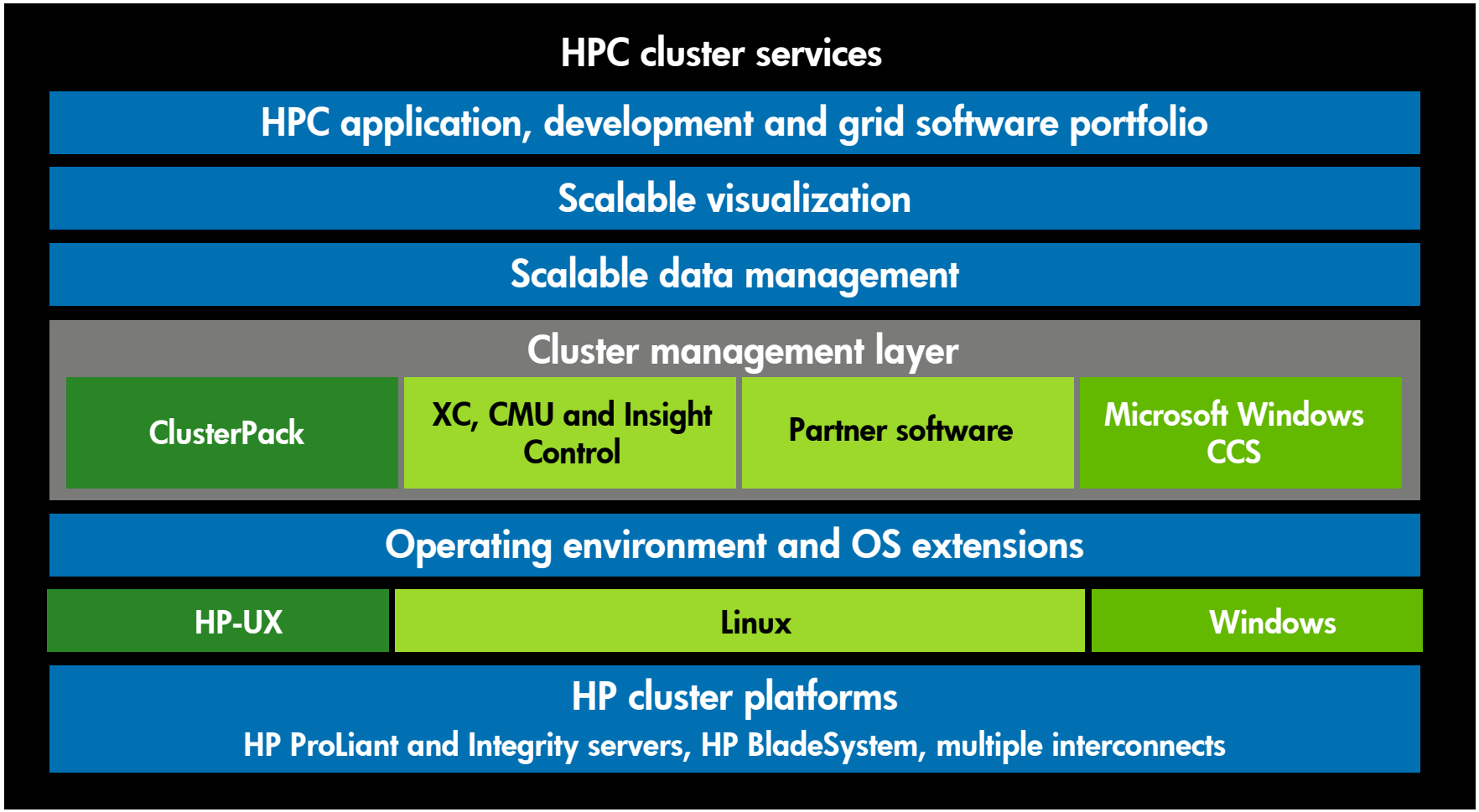
HP BladeSystem c3000	HP Cluster Platform (CP)
• Most versatile blade enclosure for SMB, remote sites, branch offices	• Standard 'cluster as a product' set the bar for HPC cluster deployments

- Nearly a **teraflop** of computing in a small footprint of only 2 square feet
- Plug into 110V or 220V wall power
- No special cooling required

Benefits

- Accelerate innovation
- Shorten time to market
- Reduce order and deployment complexity

Unified Cluster Portfolio



HP Cluster Platforms

Flexible, pre-configured designs scale up to 1024 nodes

	Compute Nodes	Interconnects
HP Cluster Platform 3000 and 3000BL	HP ProLiant DL160 G5	GigE, IB, Myrinet *
	HP ProLiant BL260c/ BL460c/BL480c	GigE, IB
HP Cluster Platform 6000 and 6000BL	HP Integrity rx2660 HP Integrity rx3600/6600* HP Integrity BL860c	GigE, IB and Quadrics* GigE, IB
HP Cluster Platform Workgroup System	Up to eight HP Integrity BL460c	GigE, IB
HP Cluster Platform Express	Single rack HP CP3000/ CP3000BL and HP CP4000/CP4000BL and CP Workgroup System	GigE, IB

Workstation nodes available for visualization

* By special request

HP Cluster Platforms: Turnkey solution for today's HPC workload

Typical cluster delivery

- Lots of choice but:
  - work
  - time
  - risk
- Not a reference design
  - Not characterized
  - Not documented
  - Software not qualified
  - Not vendor supported

HP Cluster Platforms Delivered

HP Cluster Platforms installed

HP = choice without the pain and risk

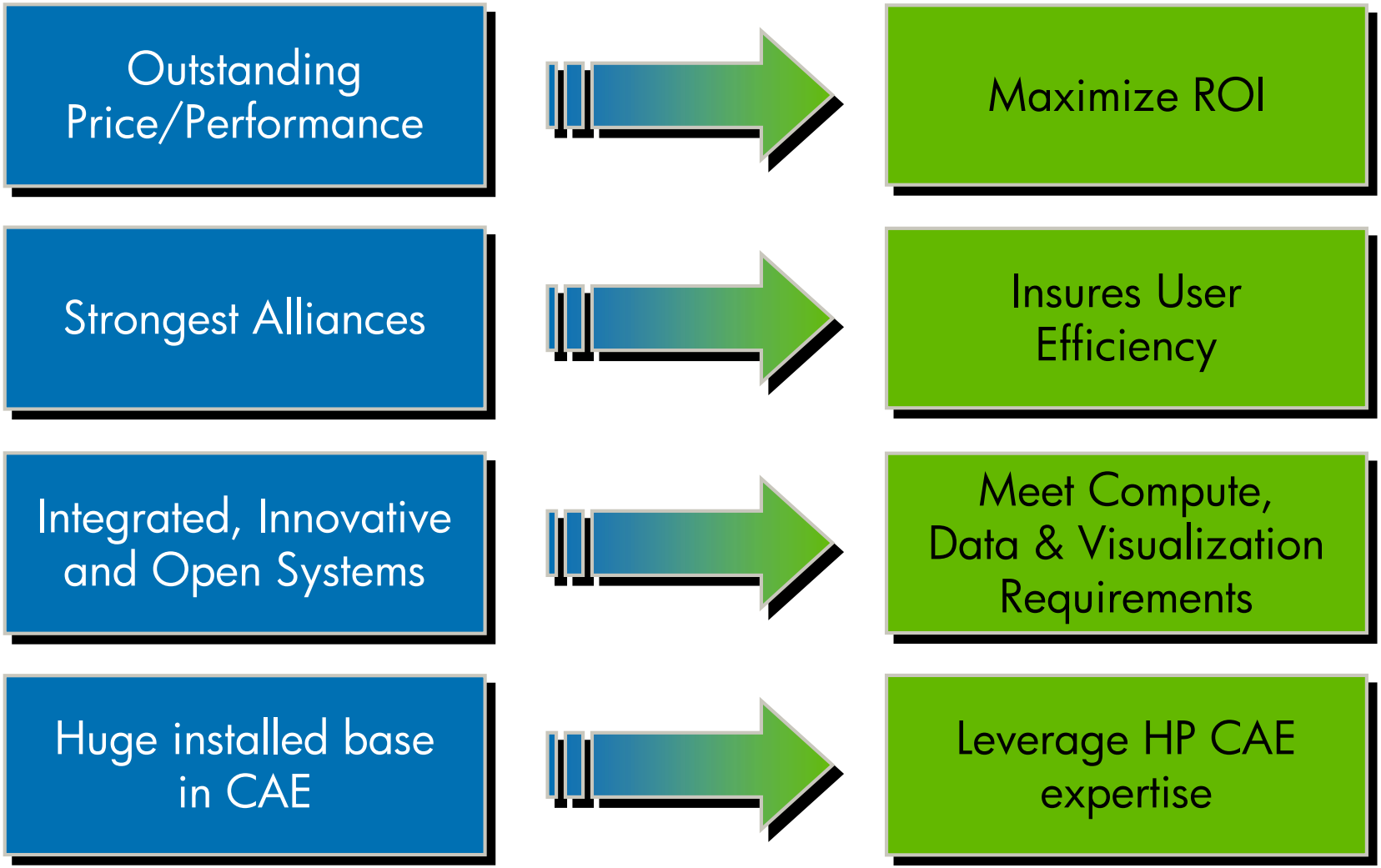
invent

High Performance Computing with HP BladeSystems

Density, Speed and Designed for Scale

- Scale clusters to the extent of your budget!
- With HP c-Class systems you get
  - Excellent scalability and ease of management
  - Fastest Blade interconnect on the planet with 4X DDR InfiniBand support
  - Smart power technologies and effective cooling
  - The latest processors from Intel (Xeon and Itanium)

Why HP for CD-Adapco?



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HP: Platform of Choice for CD-Adapco

www.hp.com/go/cae