Platform™

Powering High Performance

Using VM and Cloud in HPC

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Date: April 2009

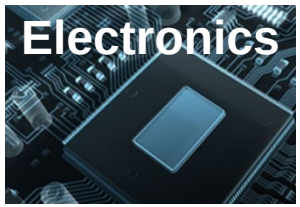
Platform Computing

- **Recognized leader and pioneer in grid computing and HPC**
  - 17 years solving the most challenging enterprise distributed computing problems
  - Global offices, resellers and partners
  - 24x7 worldwide service, support, and consulting
  - Continual innovation in new product development & open standards
  - Close to 500 employees worldwide
  - Growing and profitable since its inception

Winner of Gartner's "Cool Vendor, 2006"
Platform Computing awarded "Cool Vendor in IT Operations Mgmt, 2006"

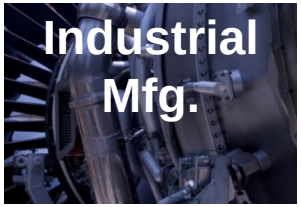
Platform Computing in Top 10 Virtualization Vendor to Watch in 2008:
http://www.cio.com/article/160951

Industries Served by Platform



- AMD
- ARM
- Broadcom
- Cadence
- Cisco
- Infineon
- MediaTek
- Motorola
- NVidia
- Qualcomm
- Samsung
- Sony
- ST Micro
- Synopsys
- TI
- Toshiba

- BNP
- Citigroup
- Fortis
- HSBC
- KBC Financial
- JPMC
- Lehman Brothers
- LBBW
- Mass Mutual
- MUFG
- Nomura
- Prudential
- Sal. Oppenheim
- Société Générale



- Airbus
- BAE Systems
- Boeing
- Bombardier
- Deere & Company
- Ericsson
- Honda
- General Electric
- General Motors
- Goodrich
- Lockheed Martin
- Nissan
- Northrop Grumman
- Pratt & Whitney
- Toyota
- Volkswagen

- Agip
- BP
- British Gas
- China Petroleum
- ConocoPhillips
- EMGS
- Gaz de France
- Hess
- Kuwait Oil
- PetroBras
- Petro Canada
- PetroChina
- Shell
- StatoilHydro
- Total
- Woodside

- CERN
- DoD, US
- DoE, US
- ENEA
- Georgia Tech
- Harvard Medical School
- Japan Atomic Energy Inst.
- MaxPlanck Inst.
- MIT
- SSC, China
- Stanford Medical
- TACC
- U. Tokyo
- Washington U.

- Abott Labs
- AstraZeneca
- Celera
- DuPont
- Eli Lilly
- Johnson & Johnson
- Merck
- National Institutes of Health
- Novartis
- Partners Health Network
- Pharsight
- Pfizer
- Sanger Institute

Other Industries

AT&T Bell Canada DreamWorks Animation SKG GE
IRI Telecom Italia Telefonica Walt Disney Co.

Solutions with Partners

Platform OCS 5 and Platform Manager integrated in Dell cluster systems

Platform LSF, Platform Manager form key parts of Unified Cluster Portfolio

Platform enterprise solutions support a wide range of IBM HPC systems

Platform delivers first certified Intel® Cluster Ready solution, Platform OCS 5

Integrates Platform LSF and Platform Symphony in grid solutions

Platform OCS 5 powers the Red Hat® HPC Solution

OEMs Platform's core technology in SAS® applications

Evolution of HPC Adoption

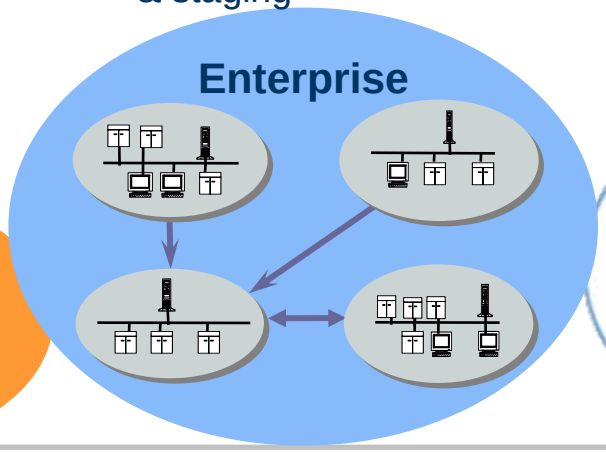
Scope of sharing

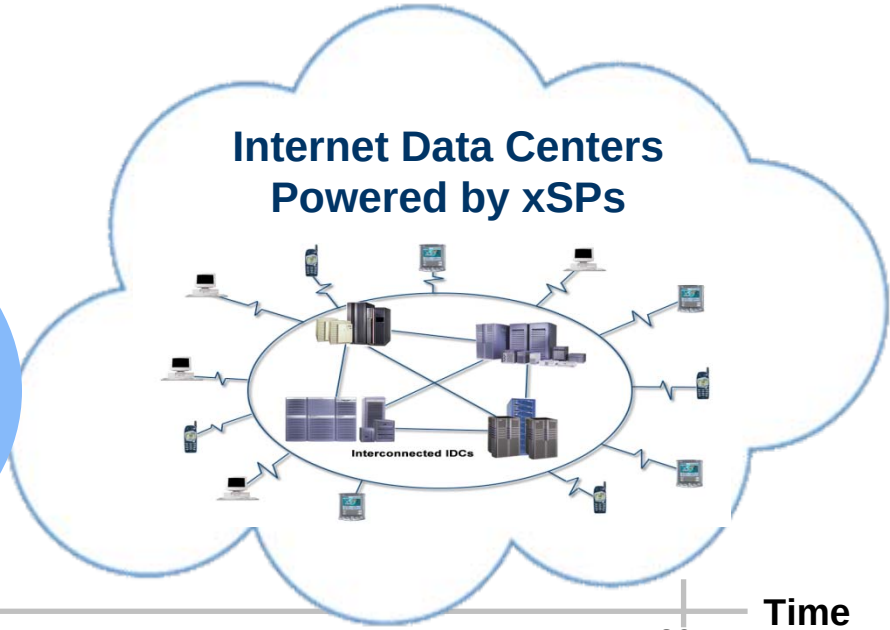
Utility Grid / Cloud

- Virtualization of services
- Dynamic service provisioning
- On Demand, Utility
- SaaS, SOA

Enterprise HPC / Internal Cloud

- Cluster-to-cluster sharing management
- Reliable file transfer & staging





Distributed Clusters

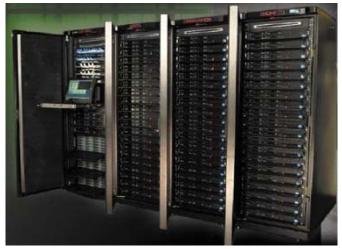
Time

1990

Today

2015

HPC systems, application clusters



Common Practice:
HPC resources are acquired for specific purpose. They are typically dedicated for single type of work

Capacity limit

- The total capacity is limited by the size of the system or cluster

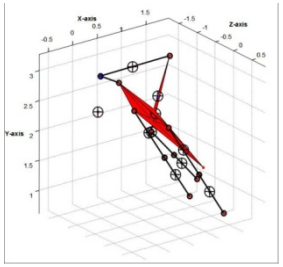
Utilization

- Provisioned for peak load
- Even if it is not fully utilized, it can't be repurposed for other applications

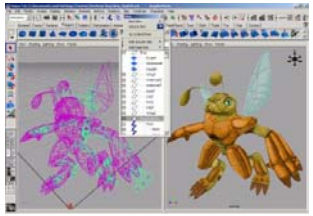
Quick Resource Provisioning

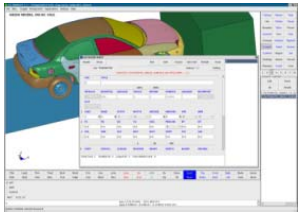
- Users compare their own HPC resource with external "cloud"

The Concept of Cloud



o Unlimited application resources
o Instant resource availability
o Ease of use





Providing application or compute resource as a service

Matching Supply & Demand

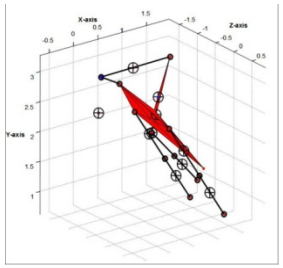
DEMAND

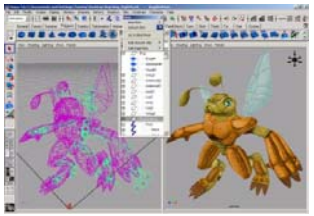
SUPPLY

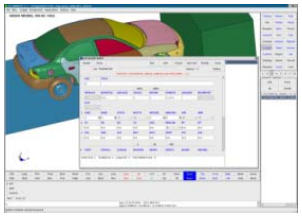
Mixing grid

- Workload ma
- Cluster mana
- Dynamic VM management
- Accounting &

End Users







Modeling

Cloud Environment

Dynamic resource management

ysis

Internal and External Cloud

External Cloud by Service Providers

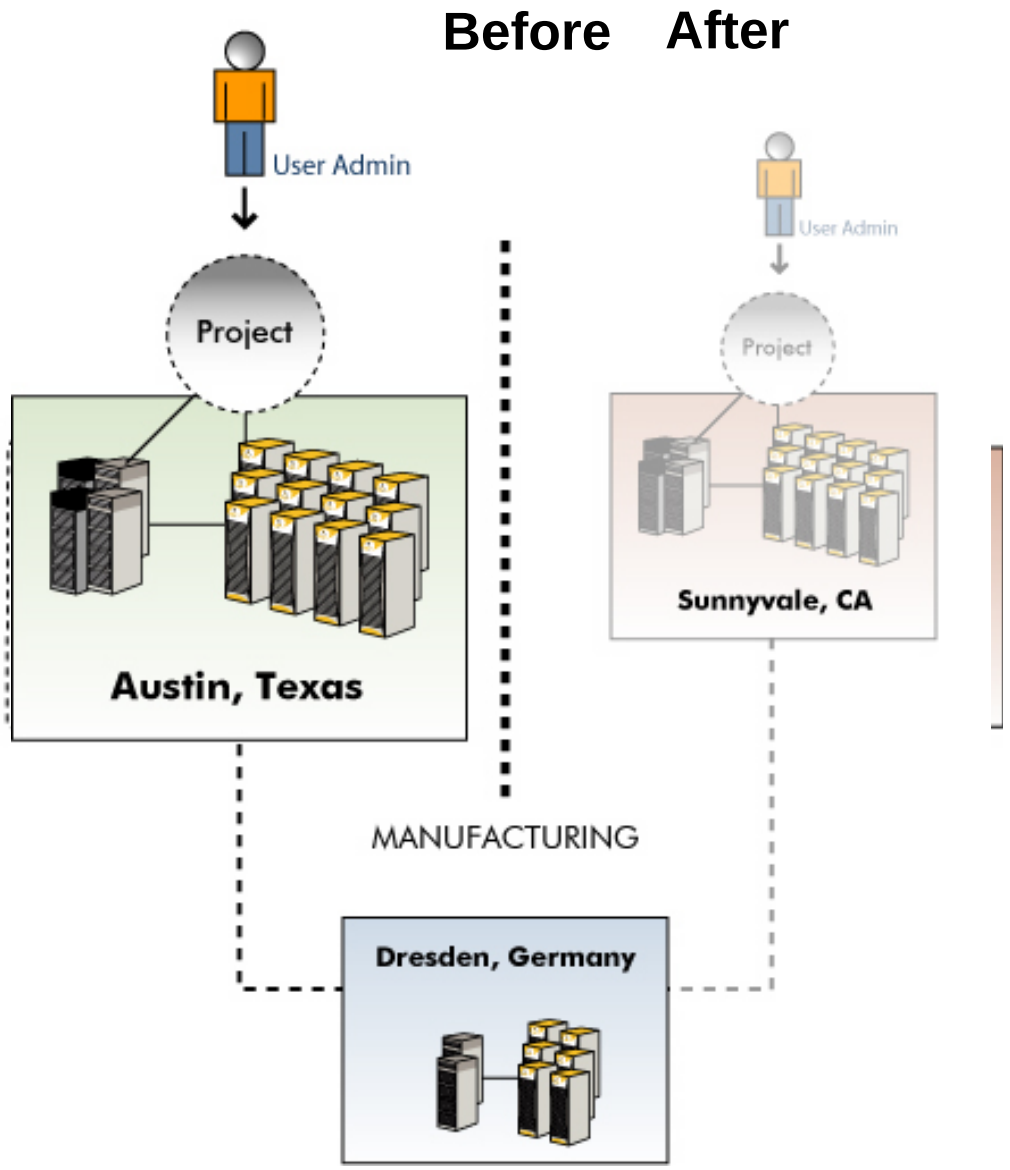
- CapEx reduction
- Non-mission critical SLAs
- In-house IT has limited scale, scope or expertise

Internal Cloud by HPC Center

- CapEx and OpEx reduction
- Maximize value of underutilized resources
- Mission critical SLAs
- High security requirements
- Enterprise-specific services
- Less legal issue for application licenses

AMD HPC environment

- More design, simulation & verification – faster
- Better utilization of resources in an always-available computing environment
- Better products to market faster and at lower cost



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Citi – Corporate Shared HPC Services

FX derives Pricing & Hedging

Converts Pricing & Hedging

Enterprise Mkt Risk

Credit Derivs, Pricing/Hedging

Counterparty Credit Risk

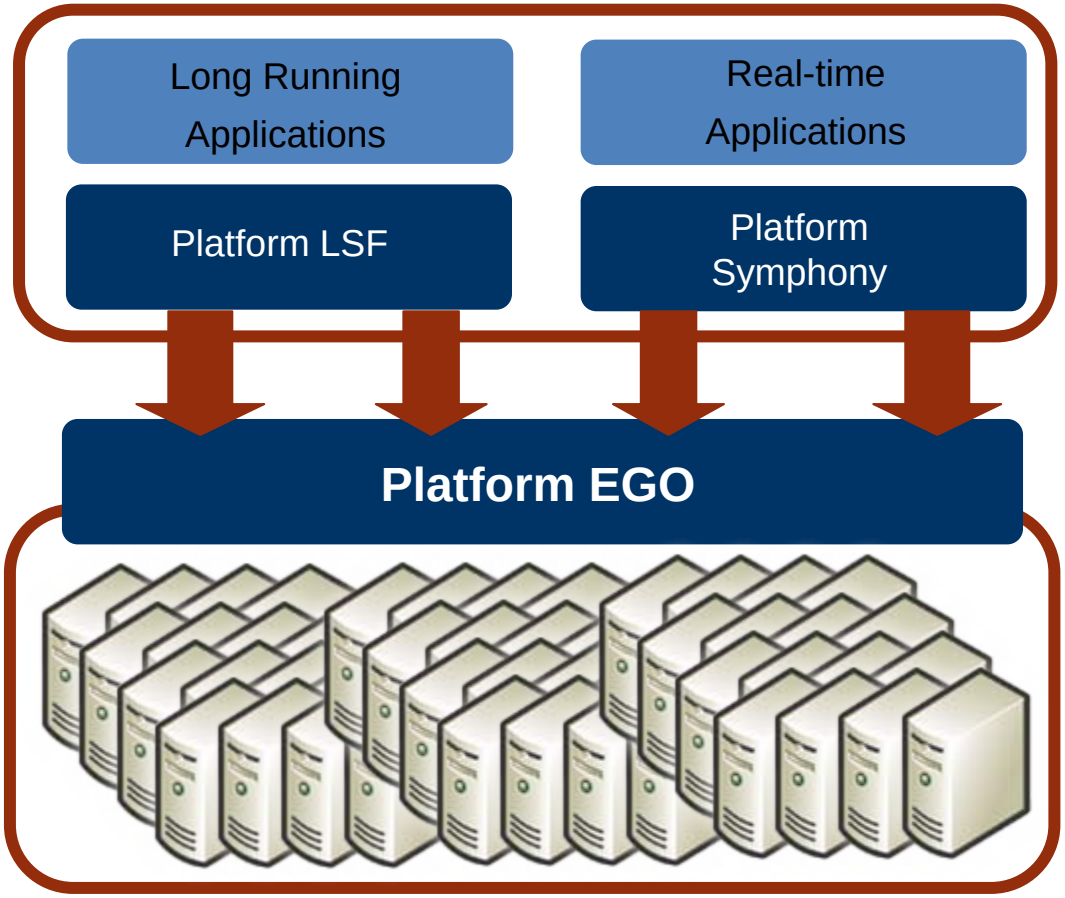
Fraud, Anti-Laundering

Acc'ting, Actuarial Analysis

Operational Risk

CRM, Data Mining, Credit Scoring

More & more apps from LOB silos



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Platform Dev Test Environment

Software build and QA environment

- A Dozen Products
- 5 dev centers distributed globally
- Products need to support 30 different x86/64 OS

Internal test cloud for x86/64 OS

- Engineers request OS through web portal
  - Define environment
  - Define schedule
  - Define size
  - Define physical machine or VM
- Resources are provisioned automatically
- Next step: Extending the solution for technical support and field engineers

Resources ready in minutes vs. 2 days

Cloud Infrastructure Requirements

Isolated application run time environment

- Different applications can run concurrently on a multi-core node/server
- Problem in one application does not affect the others
- Create personal/group cluster

Change node/server personality

- Re-domain a server/node
- Switch OS, particularly between Windows and Linux
- Running a legacy OS on the latest hardware

Reduce resource fragmentation

- Application migration

Capacity Planning

- "What if" analysis

Solution for HPC Cloud

Workload scheduler

Schedule jobs

Cloud Portal

- Provision OS/VM
- Migrate VM

HPC Systems

Dynamic provisioning scheduler

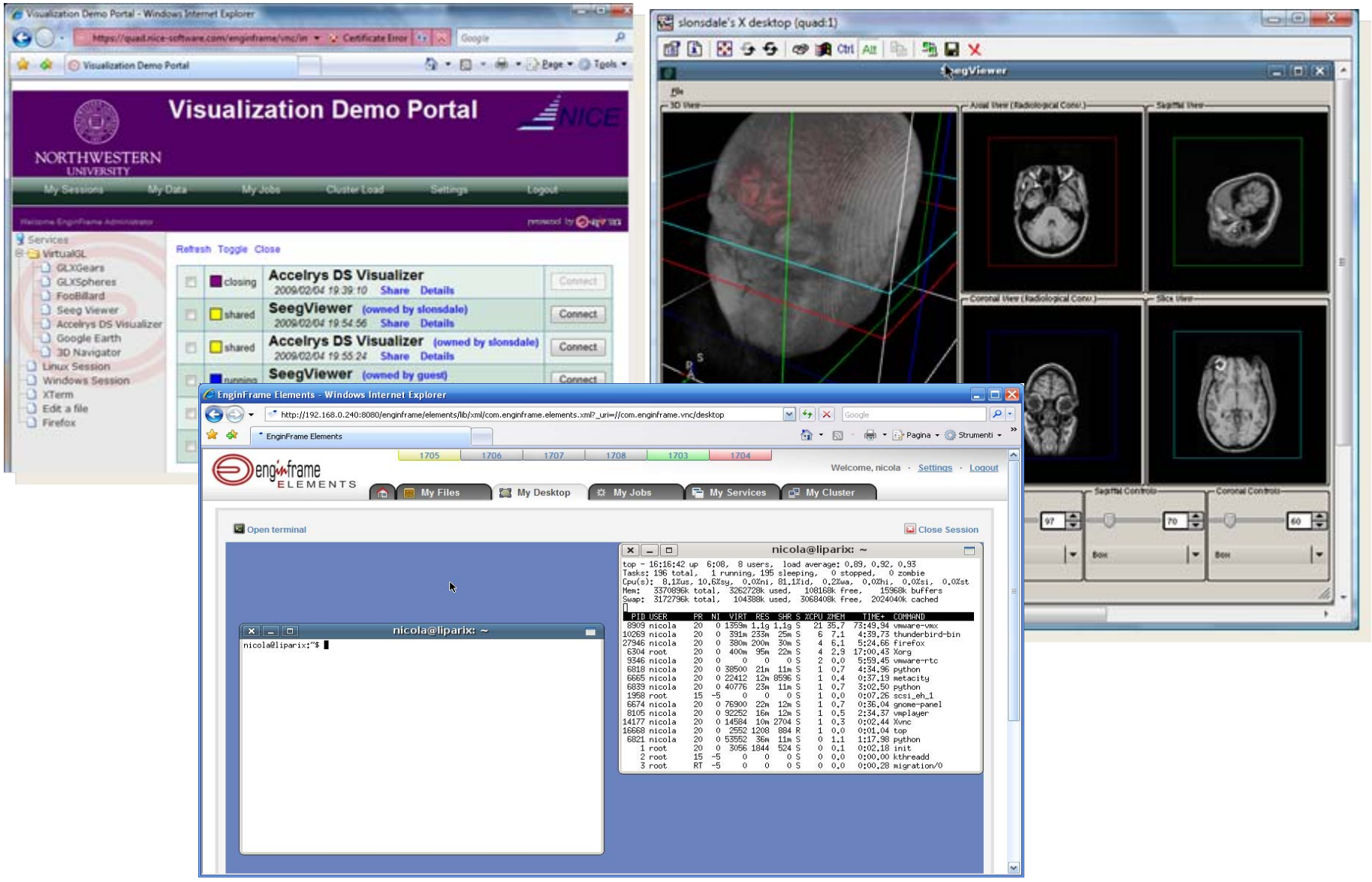
OS or VM Image database

The solution can be extended to deploy multiple virtual clusters

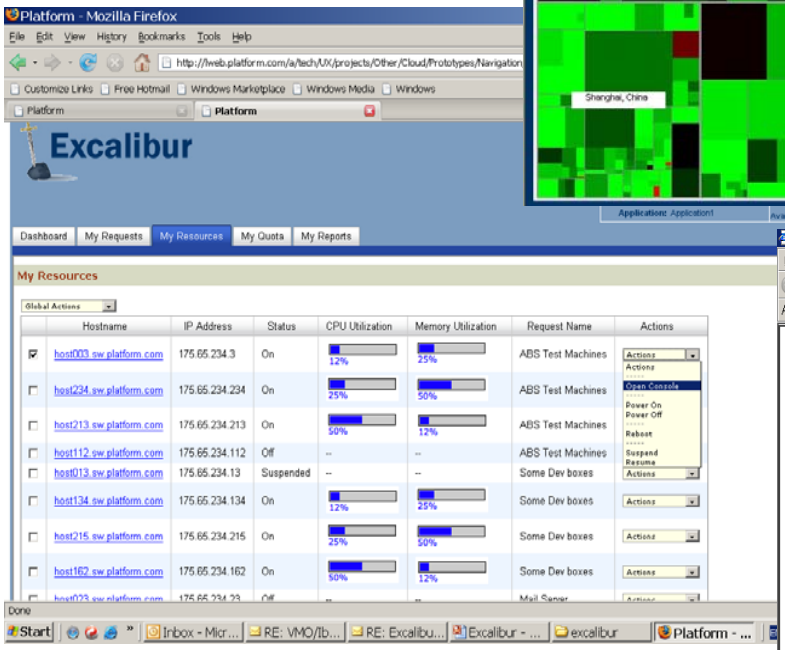
PROs & CONs of VM vs PM

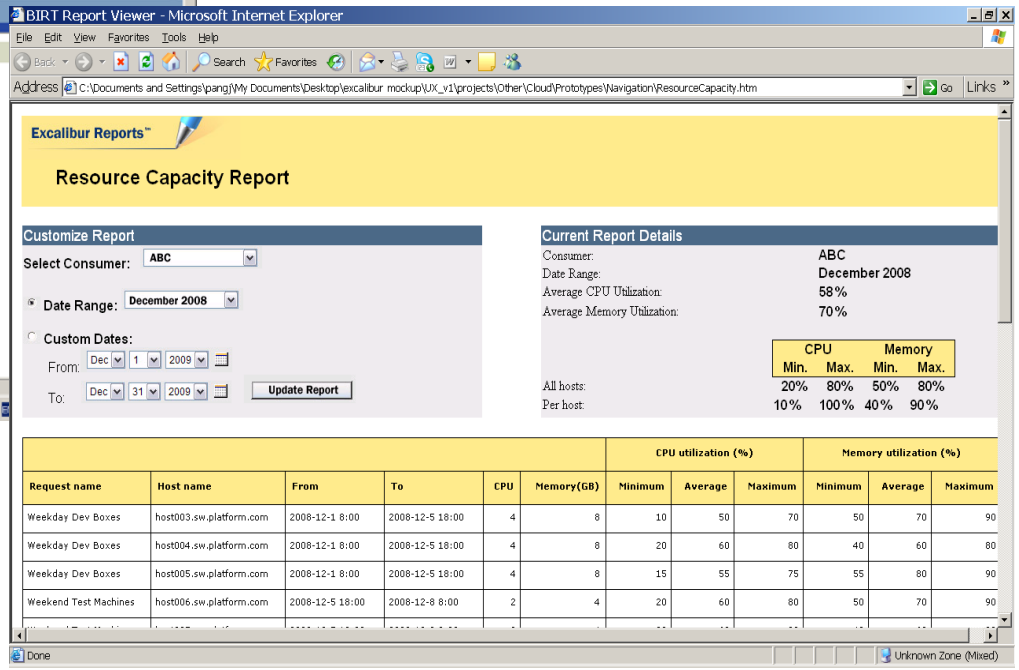
	VM	PM
PROs	- Reliability • Isolated from hardware • Checkpointing - SLA • Quick provisioning - Resource utilization • Job migration	- Application Performance - No need to have special infrastructure
CONs	- Performance cost (=application cost) Getting better - Infrastructure cost	- Application reliability - Slow provisioning - Resource utilization

User Interface – Hide Complexity

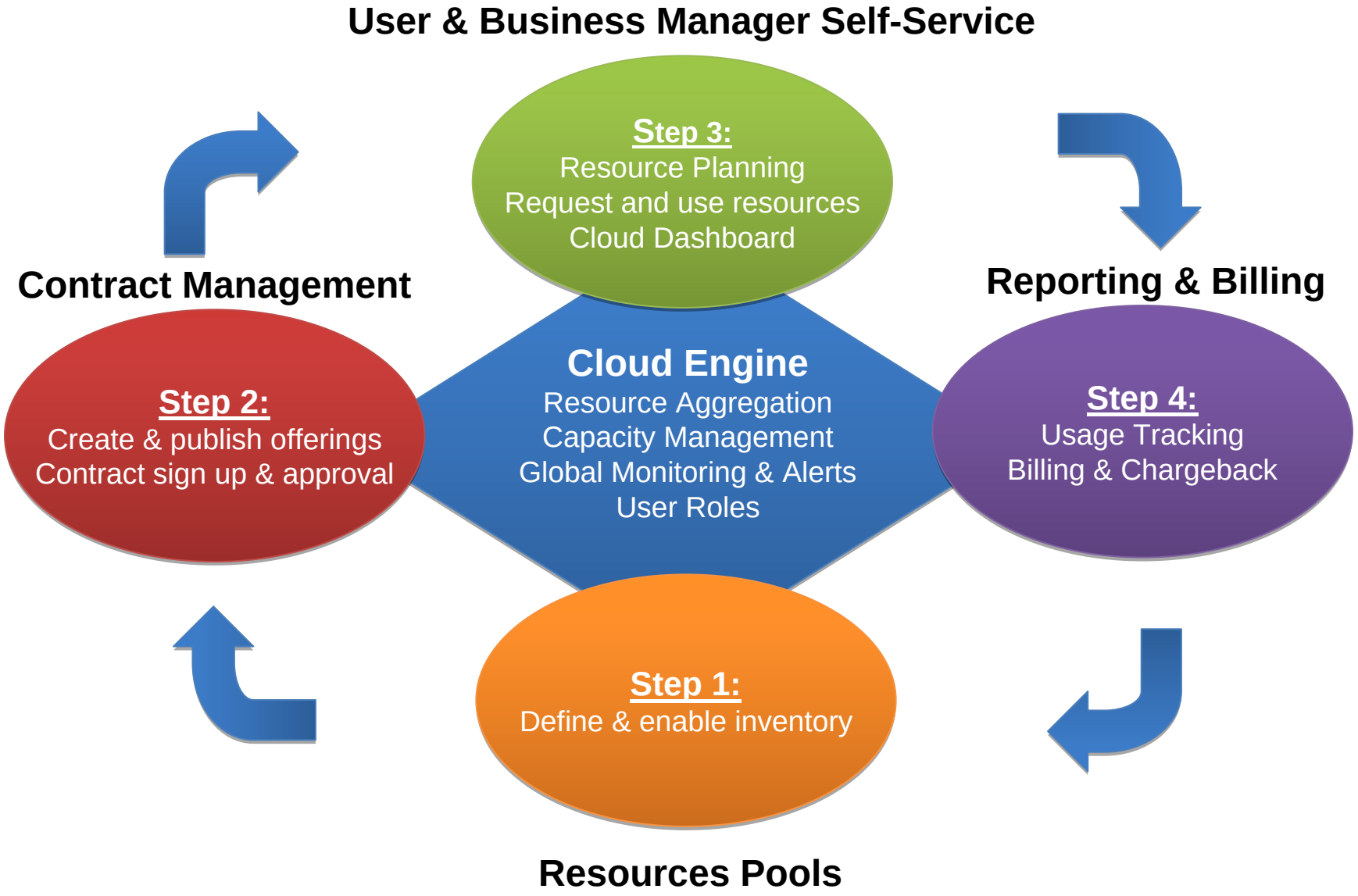


Admin Interface – Monitoring & Reporting





Cloud Implementation Approach



Summary

- Many organizations started to implement internal HPC cloud
- Dynamic provisioning and configuration are key technology to get the infrastructure cloud ready
- We see more VM use cases in HPC
- Platform Computing is ready to partner with customers to deploy cloud computing solutions

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Thank you

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