



Grid Computing

# IBM Grid Technical Strategy & Related Research Projects

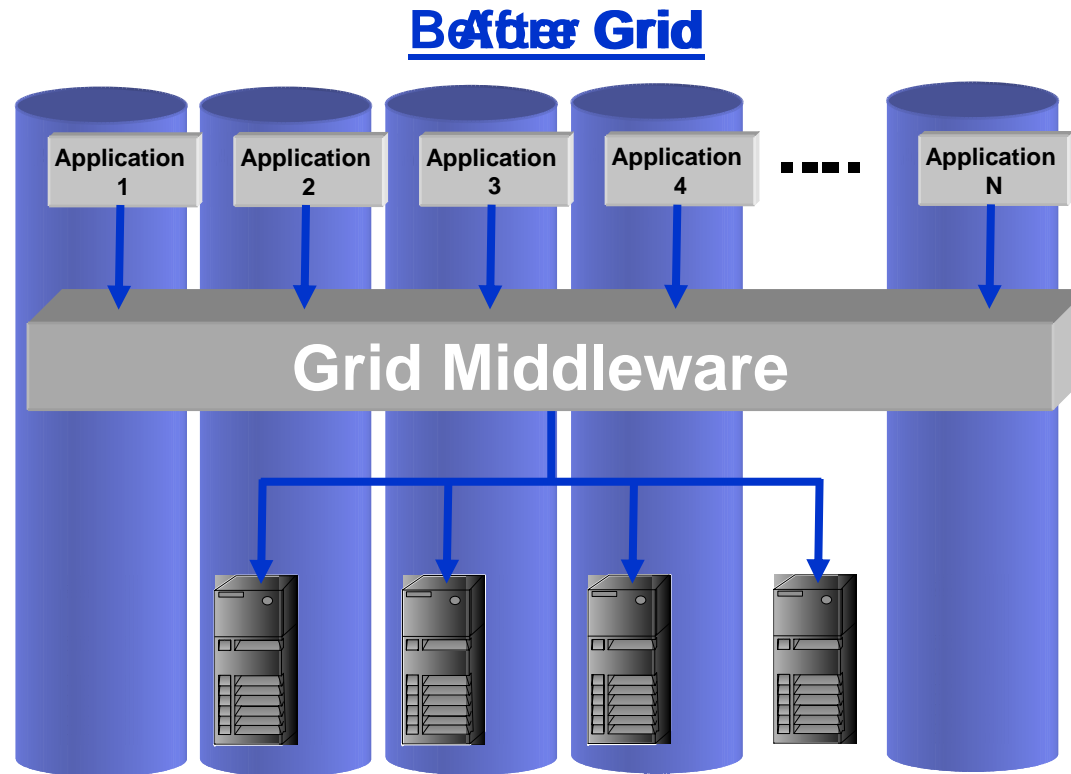
*Jean-Pierre Prost*  
*Senior Technical Staff Member*  
*IBM Montpellier, France*



## Outline

- Grid and Virtualization
- Examples of Commercial Grids
- Grid Components and IBM Grid Strategic Directions
- IBM Grid Research Projects

# Grid Computing: Enabling an On Demand Infrastructure

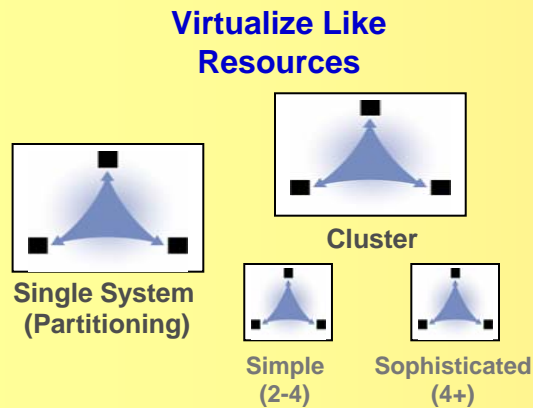


## “Virtualized” Infrastructure:

- Creates higher utilization (operating storage & limited pooling of IT assets) across silos
- Virtualizes applications, services, organization
- Dynamically fulfills requests via virtual resource provisioning
- Offers an adaptive, self-managed operating environment that offers high availability

# Grid and Virtualization

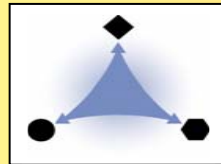
**IBM** is focused on solutions that help clients realize value from the full spectrum of grid computing solutions



Homogenous systems, storage, and networks

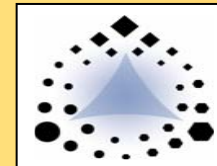
Homogenous Single Organization Tightly Coupled

## Virtualize Unlike Resources



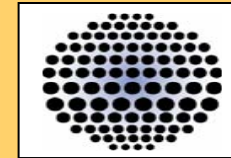
Heterogeneous systems, storage, and networks; Application-based Grids

## Virtualize the Enterprise



Enterprise wide Grids, Information Insight, and Global Fabrics

## Virtualize Outside the Enterprise

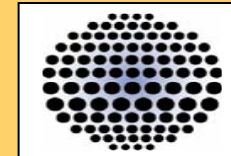


Suppliers, partners, customers and external resources

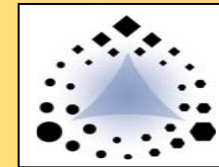
Heterogeneous Multiple Organizations Loosely Coupled

# Realizing Increasing Levels of Business Value

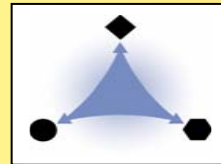
Virtualize Outside the Enterprise



Virtualize the Enterprise



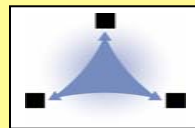
Virtualize Unlike Resources



Virtualize Like Resources



Single System (Partitioning)



Cluster



Simple (2-4)



Sophisticated (4+)

**IT Simplification for Enterprise Optimization**  
Asset Utilization  
Workload Prioritization

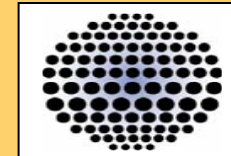
**Infrastructure Flexibility**  
Enabling Business Resiliency

**Aggregating Information**  
Business Insight and Collaboration

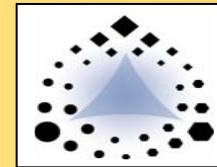
**Application Acceleration**  
Time to Results and Higher Quality

# Characteristics of Grid Evolution

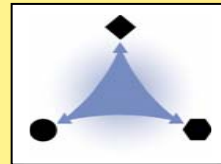
Virtualize Outside the Enterprise



Virtualize the Enterprise



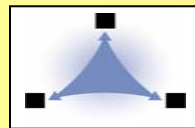
Virtualize Unlike Resources



Virtualize Like Resources



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Sophisticated (4+)

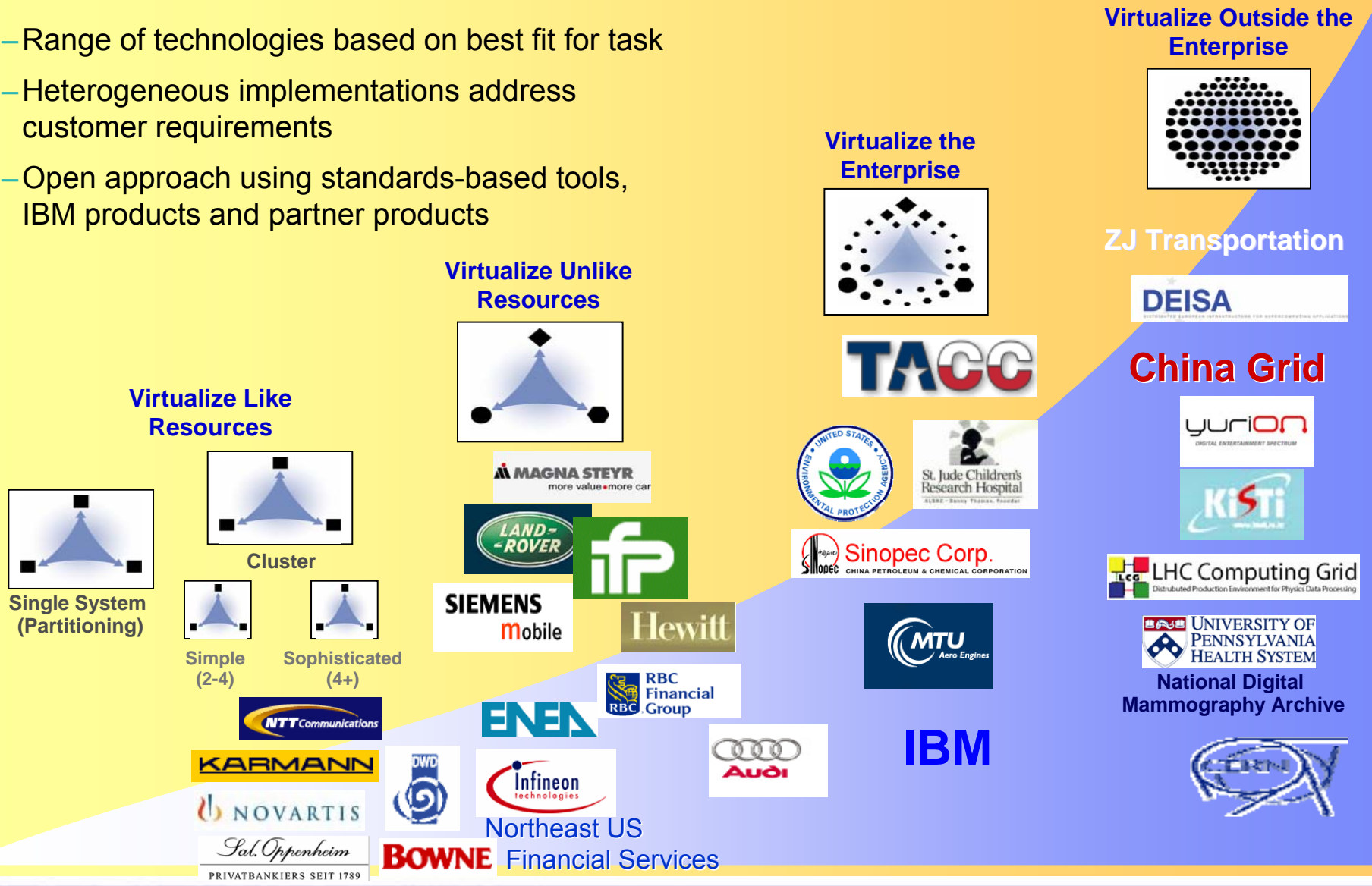
- Advanced Scheduling
- Multiple Apps/Resources
- Integrated Security
- Provisioning
- Workload Management
- Information Virtualization

- Multiple Organizations
- Meta-scheduling
- Workload Prioritization
- SLA Attainment
- Orchestration
- Information On Demand

- Cluster Scheduling
- Single Application
- Homogenous
- Storage/File Virtualization

# Across the Spectrum: IBM Customer References

- Range of technologies based on best fit for task
- Heterogeneous implementations address customer requirements
- Open approach using standards-based tools, IBM products and partner products



Engineering and Design  
Automotive

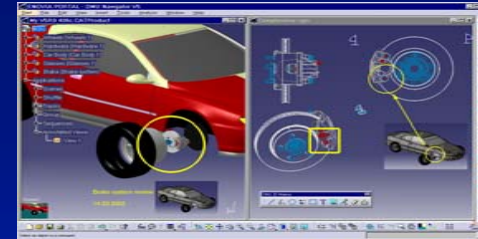
# MAGNA STEYR

## Challenge

- ▶ Too much time required to effectively run clash tests between complex sub-assemblies which impacts quality of the end product and getting the product to market on time.
- ▶ Too much administrative time required from design engineers

## Solution

- ▶ Grid enabled clash environment. IBM developed code and services using Platform Computing LSF w/ Dassault Systemes CATIA & ENOVIA DMU applications providing clash detection analysis.



## Benefits:

- Significant performance improvement (72 – 4hrs)
- Risk and Error Reduction
- Cost Reduction
  - ▶ Increased accuracy of data improves quality and reduces late changes)

## Improved Time to Market

- Faster evaluation of design alternatives
- More accurate and timely product development

**“Grid technology from IBM and Platform Computing reduced the time required for our clash testing from 72 – 4 hours and contributed significantly to enhancing our design quality,” said Dr. Heinz Mayer, MAGNA STEYR.**



# Audi/MSI/IBM Proof of Concept Distributed Simulation Data and Process Management

## Enterprise Optimization Automotive



### Challenge

- ▶ Reuse defined simulation schemes to enhance engineer productivity and innovation. Improvement of integrated, secure and collaborative design environment across the distributed enterprise
- ▶ Shared access for engineers from all enterprise sites to all simulation data from cars. Central coordination point for data and content
- ▶ Data sharing and data exchange capability for multi site collaboration to be implemented between Audi and SEAT

### Solution

- ▶ An information grid enabling collaborative engineering
- ▶ Multi site engineering data sharing based on:
  - MSC.SimManager
  - IBM eServer and TotalStorage
  - IBM Data Management replication and federation technology based on WebSphere Information Integrator and WebSphere MQ
  - IBM integration services



### Technology Benefits:

- A robust, scalable multi site Simulation Data and Process Management (SDM) infrastructure
- Usage of standard applications to design a multi site collaboration environment

### Business Opportunities:

- Flexibility to handle more projects, scale up engineer and design work
- Global view of all CAE data to assess entire vehicle at any given time in the design process
- Reuse design work, maintain historical data on all analysis generated
- More accurate and timely product development
- Improved productivity of the Engineering Analysis Office
- Improved Time to Market and faster evaluation of design alternatives in collaborative tasks

***“Collaborating with our engineering team at SEAT will become more and more important due to the common activities inside the Audi brand group. The new technology we are developing with IBM and MSI Software will help us collaborate more effectively and build a real global engineering collaboration, reducing travel and taking both time and cost out of the product development process”***

***-- Dr.-Ing. Ulrich Widmann, head of functional design crash, occupant safety, NVH analysis AUDI AG***

# Sal. Oppenheim

## Business Analytics Financial



### ▪ Challenge:

- ▶ Sal. Oppenheim is one of the leading independent private banks in Europe. Sal. Oppenheim is upgrading its pricing system for equity derivative trading.
- ▶ Traditional dedicated compute resources handle the dynamic structure of the large amount of risk and pricing calculations.
- ▶ Unbalanced peak performance sized solutions would be too inefficient in terms of price performance.
- ▶ The grid has to deliver a service level based risk and price calculation solution.

### ▪ Solution:

- ▶ one of a kind flexible grid system developed by Sal. Oppenheim, Platform Computing, the IBM business partner Morse and the IBM Grid computing team.
  - IBM @server<sup>®</sup> x336
  - IBM Cluster Management Software
  - Platform Symphony

*Sal. Oppenheim*

### Technology Benefit

- High performance grid cluster based on latest Platform Symphony grid software and IBM cluster technologies.
- Solution is integrated into the IT management concept of Sal. Oppenheim

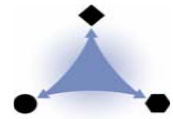
### Business Benefit

- Product development for equity derivatives
- Flexible high speed grid solution which can grow with the demands of trading volumes.
- The service level based risk and pricing solution guarantees performance and availability of the critical business application

**“„Our financial trading teams are working in a very volatile and extremely demanding market. Processing of large amounts of data and numerical intensive simulations in highest quality and speed decide between win and loss. With the introduction of the grid solution we believe to be able to fulfill the demand we are getting from the business side. With the grid solution, we will have in the mid-term an IT infrastructure that will allow us to react flexibly and grow as demand grows with acceptable cost“, said Arno Radermacher, Head of IT Investment Banking at Sal. Oppenheim.**

# Hewitt Associates LLC

Business Analytics  
Financial



## ■ Challenge

- ▶ Create Grid Computing environment to:
  - Contain expenses for CalcEngine valuations
  - Maintain or improve availability, response time & scalability
  - Insure personal-data security
  - Capitalize on existing application code
  - Cooperate with z/OS Sysplex CICS Calling Environment
  - Enable smooth and orderly migration to change

## ■ Solution

- ▶ Development of cross z/OS and x-Series platform environment to enable more efficient and faster running of application with compute-intensive process.
- ▶ Includes DataSynapse GridServer

**Hewitt** a global HR outsourcing and consulting firm

### Benefits:

- Efficiently uses of the combined processing power of their heterogeneous environment
- Experienced an immediate 10% faster response time with the first application deployment
- Open architecture enables Hewitt to easily deploy additional applications
- Increased processing speed reduced cost per transaction
- Reduced operational costs improves competitiveness in their industry segment

***“IBM the BladeCenters running Linux allowed us to quickly migrate proprietary applications using Smalltalk. In the first day, we were able to handle 8,000 client pension calls--on-demand.”***

--Perry Cliburn, CIO of Hewitt Associates



# SIEMENS Mobile

## Challenge:

- ▶ Increasing demand for rapid development of mobile phone software caused a continuous growth of compute and storage infrastructure
- ▶ The existing IT architecture and the current set up of the software revision system were not scalable enough for a predictable quality of service.

## Solution:

- ▶ IBM Global Services to implemented a "Compile Grid" based on industry standards Grid software
- ▶ IBM xSeries e325 dual Opteron servers
- ▶ SUSE Linux
- ▶ Platform LSF

## Benefits:



- Siemens Mobile can now set up a scalable system which with the potential to adapt to their current and future demands for mobile phone software development.
- Potential for better manageability and failure detection as the critical set up of the individual development environments is now decentralized and distributed to the individual grid nodes
- The compute intensive compilations are separated from the centralised CVS installation. This allows the compute intensive compilation workload to be distributed to the least used resource in the Grid

*"We chose a Linux grid on an IBM eServer system for our phone software development to help us increase our quality of service levels. This fits to our continuous growth perfectly"* Ulf van Laak, Engineer of Development at Siemens ICM Kamp-Lintfort

# Yamanouchi Pharmaceutical Co., Ltd

Research & Development  
Pharmaceutical



## Challenge

- Increase the speed of analysis processing for *in silico* drug discovery

## Solution

- Virtualize a large number of office PCs by using the Grid Middleware. This provides a distributed high-speed, large volume processing system for the drug discovery research system.
  - ▶ H/W: IBM xSeries Linux Cluster, ThinkPad®
  - ▶ Grid Middleware : Platform ActiveCluster
  - ▶ Application : *in-silico* screening



## Technology Benefits:

- Shorten the process time from 3-4 weeks to 3-4 days

## Business Benefits:

- Expedite the research into drug discovery
- Improve TCO by utilizing existing IT resources.

***“The IBM Grid Computing implementation, based on existing IT resources, allows us to accelerate our research in the drug discovery process through large scale analysis.”***

***Masaya Orita, Ph.D.  
Institute for Drug Discovery Research  
Yamanouchi Pharmaceutical Co., Ltd***

# IT Frontier Corporation

Enterprise Optimization

**Grid Delivery Technology realized higher quality contents distribution system with minimum investment**

## ● Challenge

Verification and utilization of the higher quality contents distribution system which used the existing IT infrastructure effectively.

## ● Solution

“IBM Peer-to-Group Media Broadcast (IBM P2G)” virtualized and optimized the existing network and the distribution server and enabled higher quality contents distribution

- ✓ IBM Peer-to-Group Media Broadcast (IBM P2G)
- ✓ Client : 100 office PCs
- ✓ Contents : Education Materials (Movie)  
Live Broadcasting (400Kbps)



IT Frontier

## *Technology Benefits:*

### By IBM P2G

- Dynamic load sharing of Network and distribution server
- Distribute high quality and large volume contents with existing IT infrastructure.

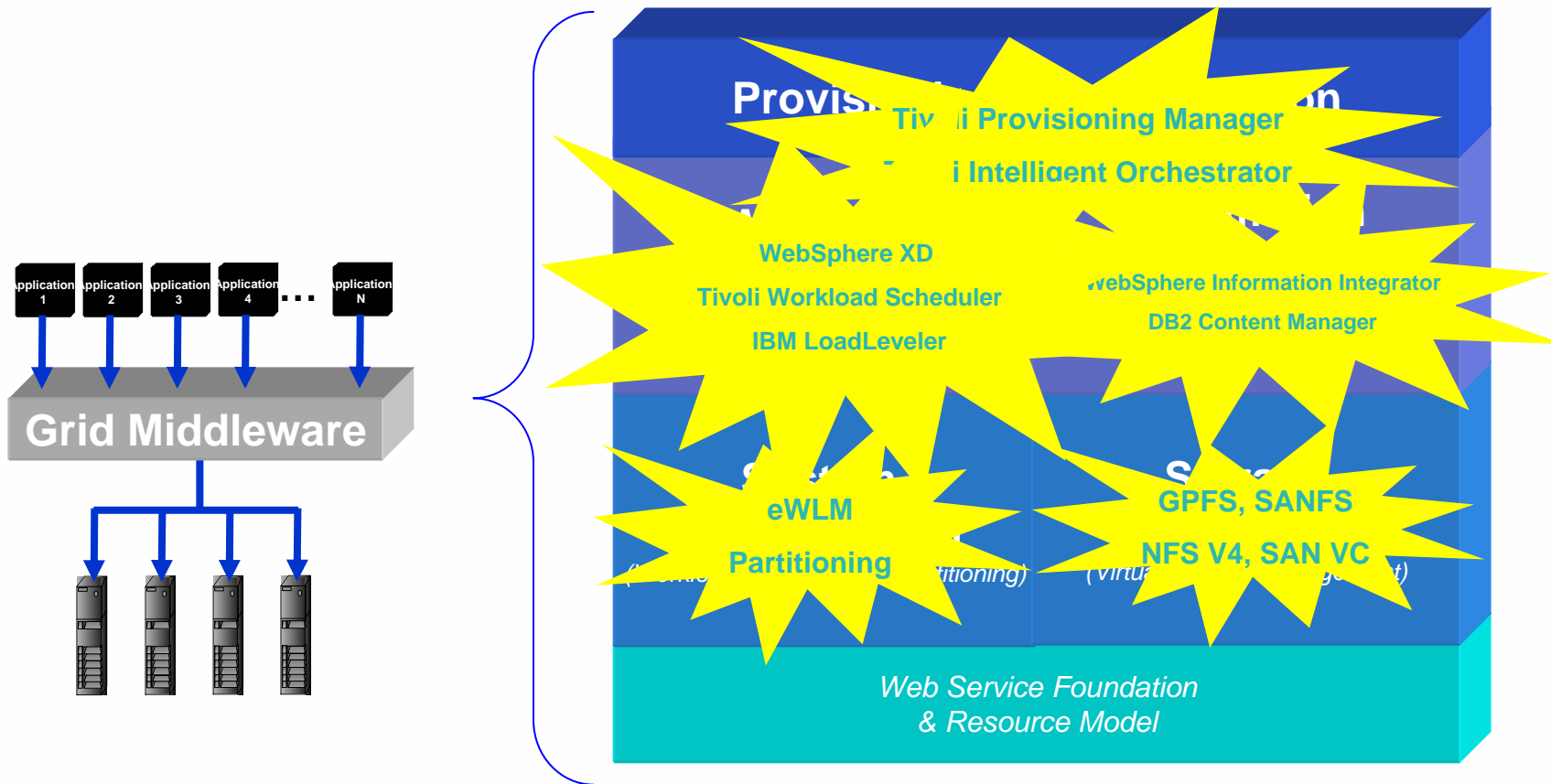
## *Business Benefits:*

- Improve internal communication and responsiveness of Enterprise by real time information sharing.

***IBM P2G which enable quality animation distribution using the existing infrastructure have a potential of changing fundamentally the way that should be information shared in an organization.***

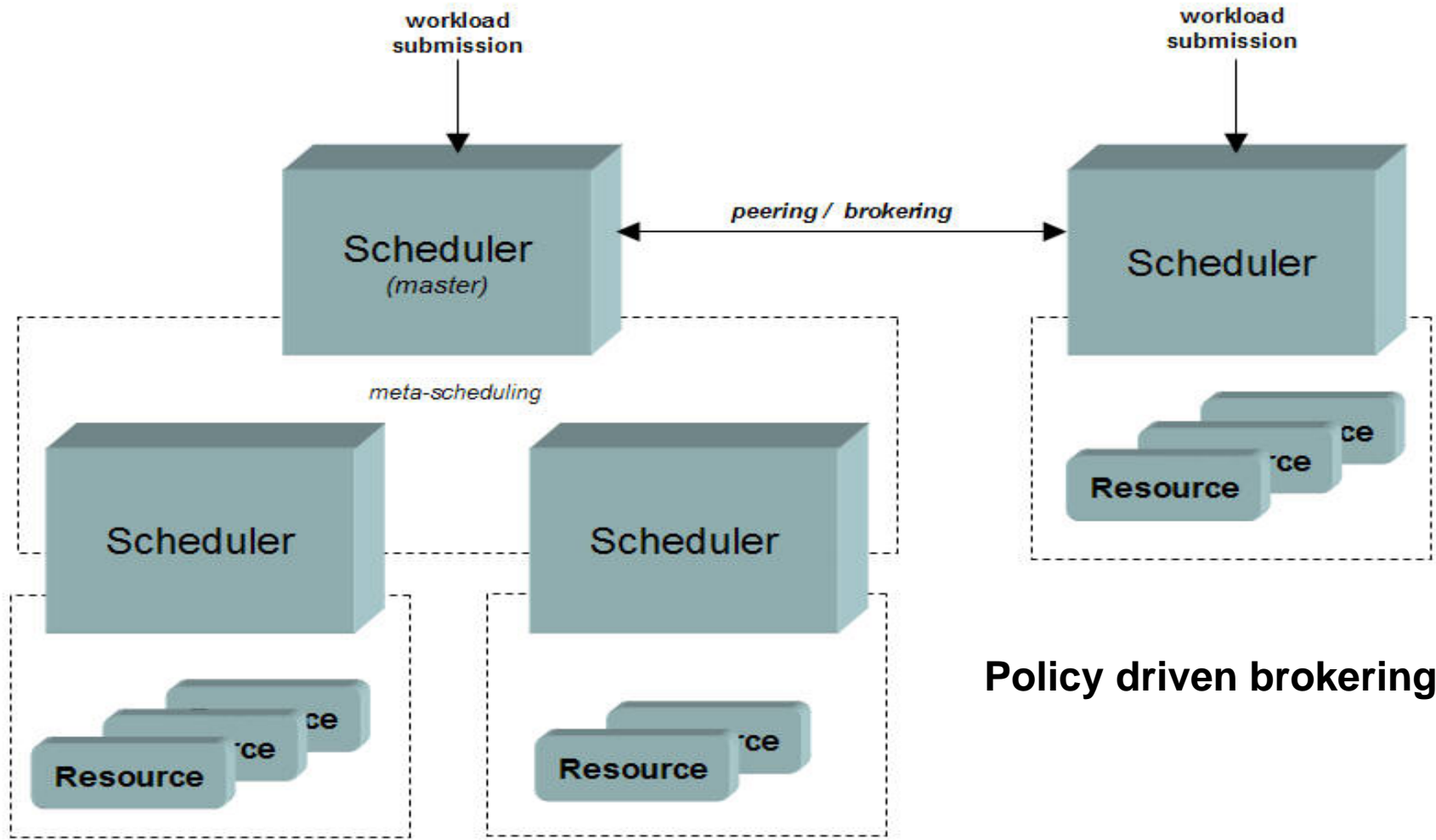
***IT Frontier Corporation Network Division General Manager Mr. Niwa***

# IBM Grid Components



Workload  
Virtualization

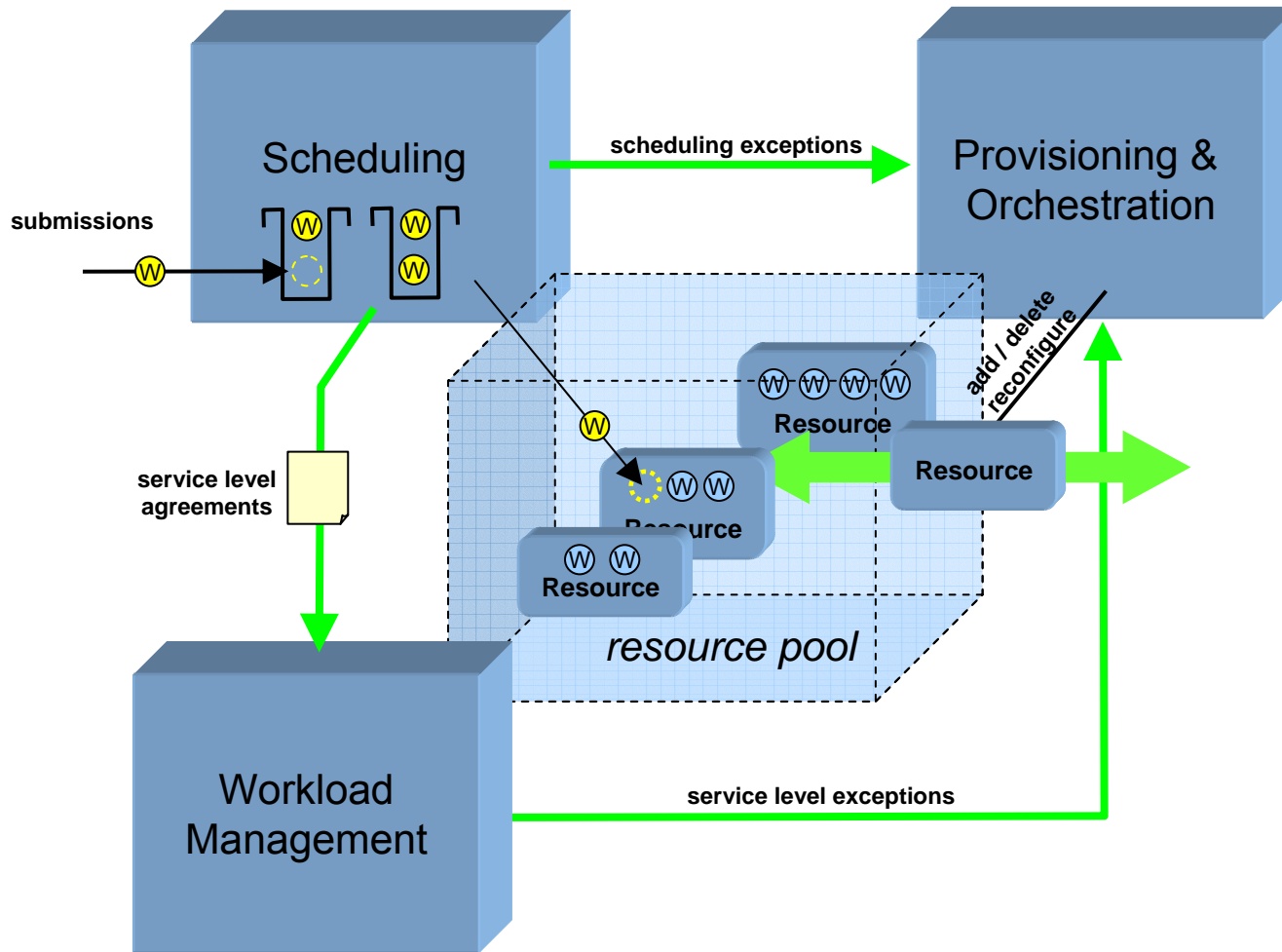
# Distributed Network of Schedulers





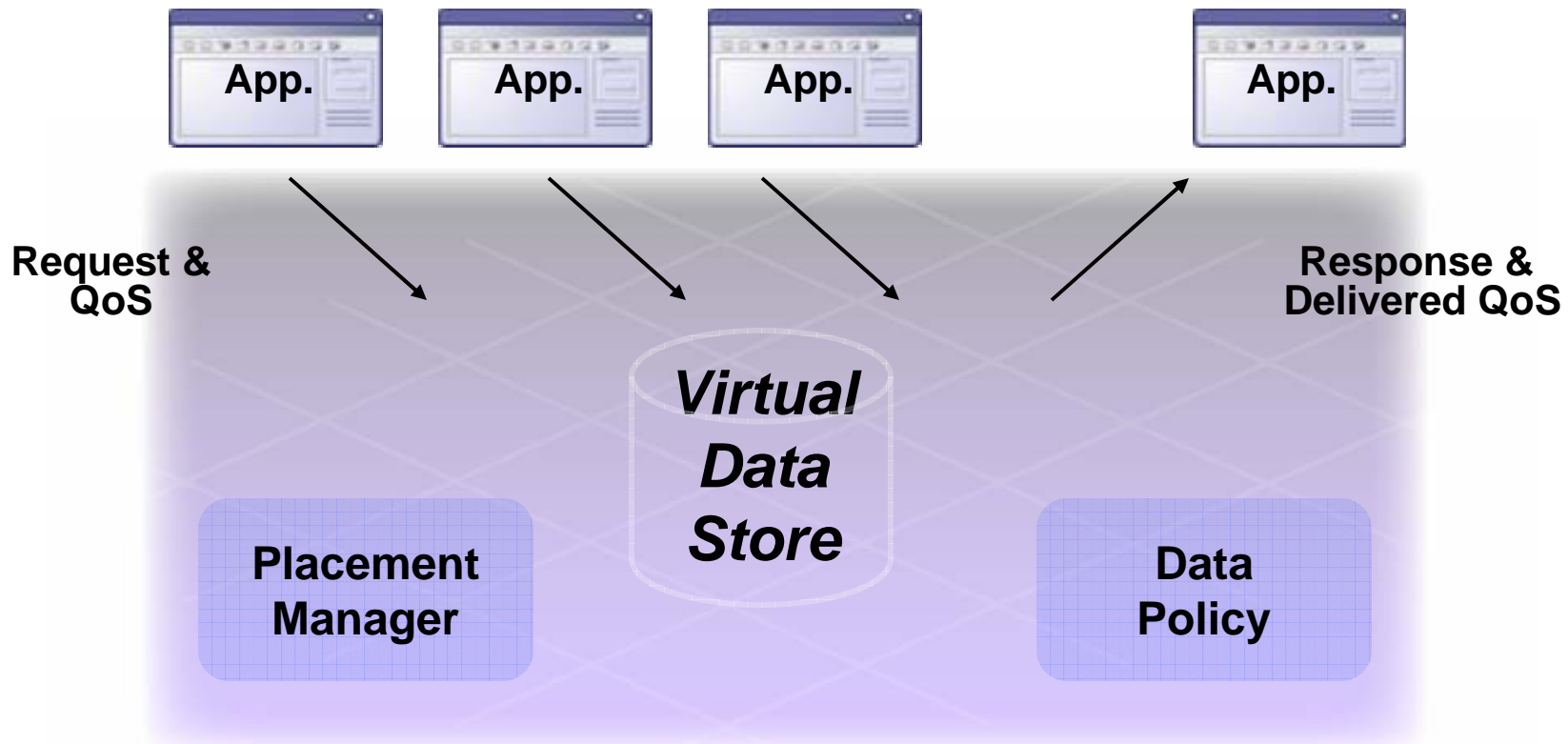
**Workload  
Virtualization**

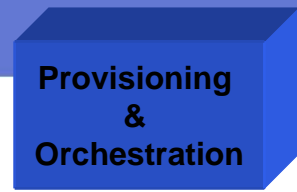
# Integration



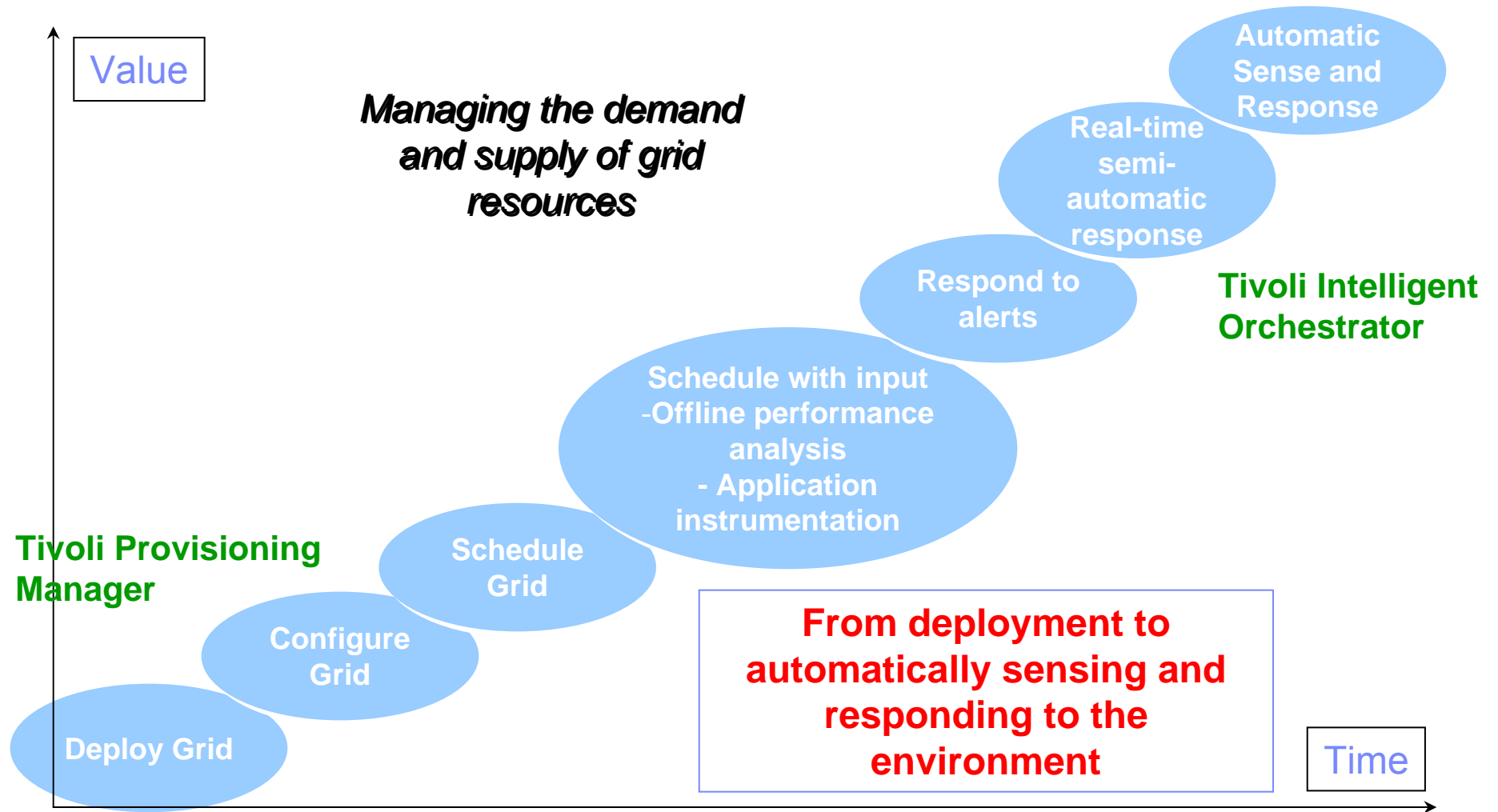
## Information Virtualization Direction

- Policy-driven cache and replica management
- Autonomic data placement
- Federation of data stores to utilize existing resources





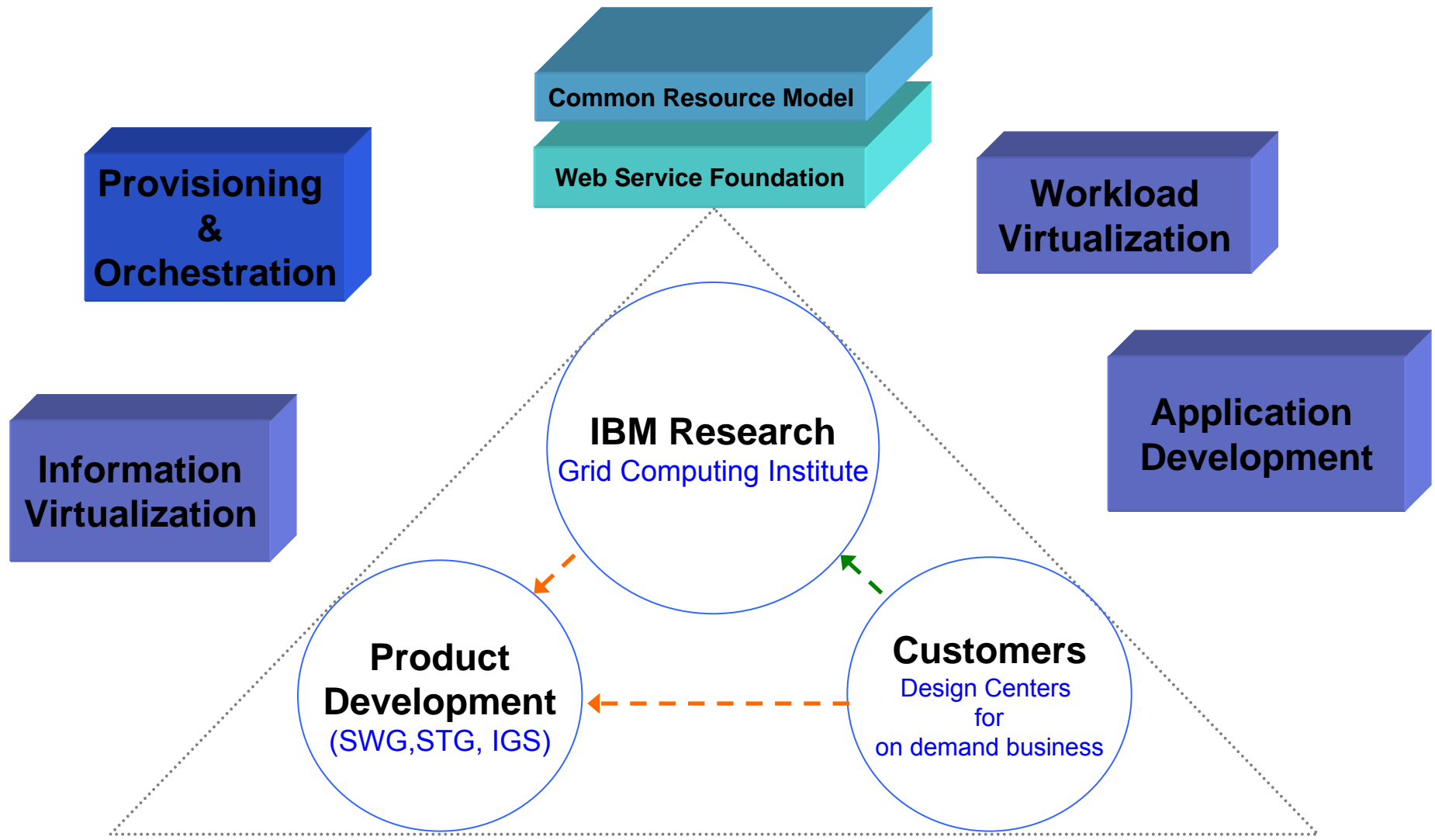
# From Provisioning ... to ... Orchestration



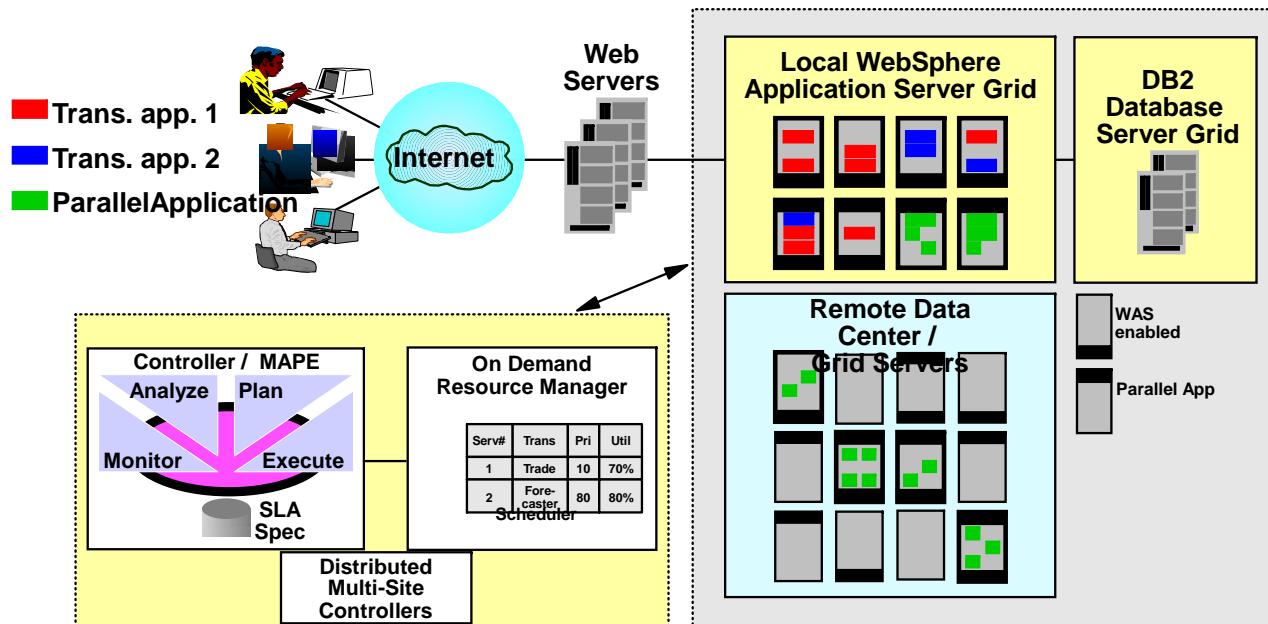
# Standards Body Cooperation



# Aligning IBM Research with the Grid Strategy, Product Development, and Customer Needs

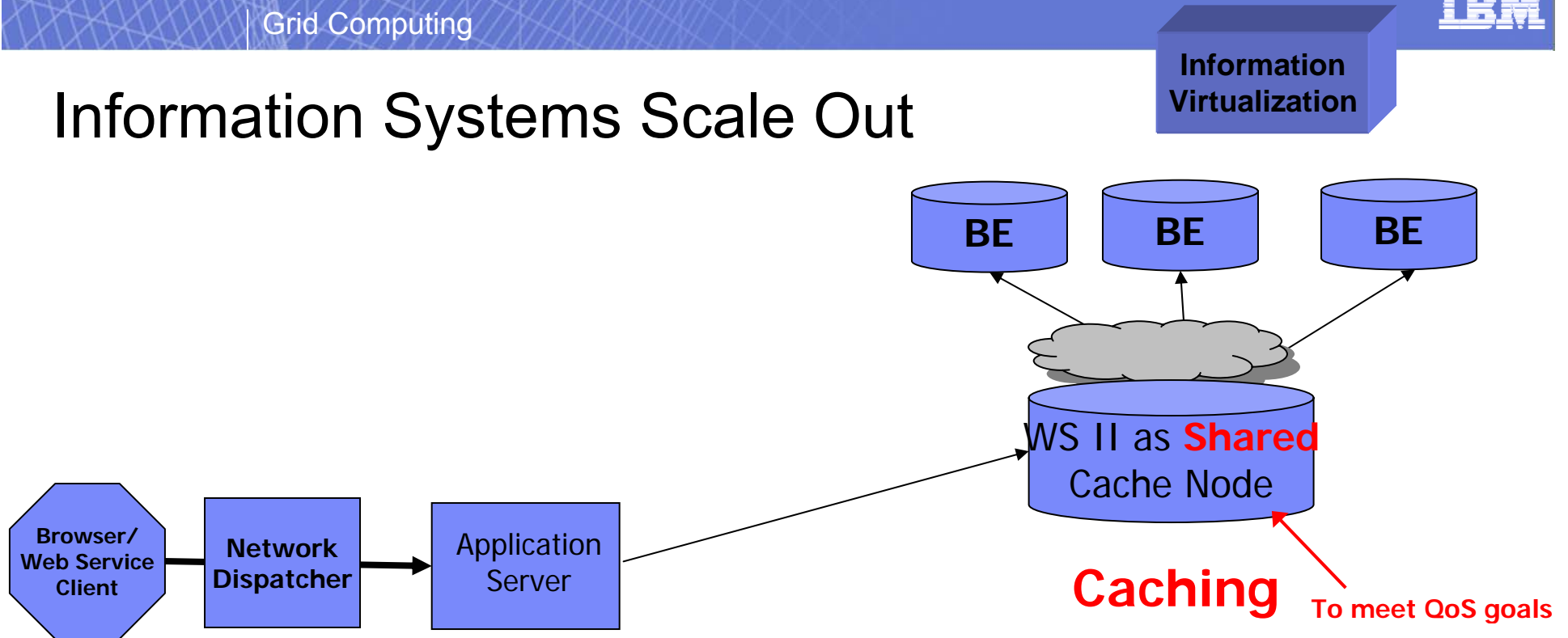


## Grid Dynamic Resource Allocation

Workload  
Virtualization

- Dynamic on-demand provisioning and resource allocation for Transactional Grids**
- Dynamically use servers needed for current load and SLA**
- Detect a surge, and reconfigure system to handle surge**
- Use capacity available when applications have different times for surge**
- Use multi-site / multi-datacenter resources to support load**
- Allows configuration close to average rather than peak traffic for each workload**

# Information Systems Scale Out



## Challenge: What to Cache?

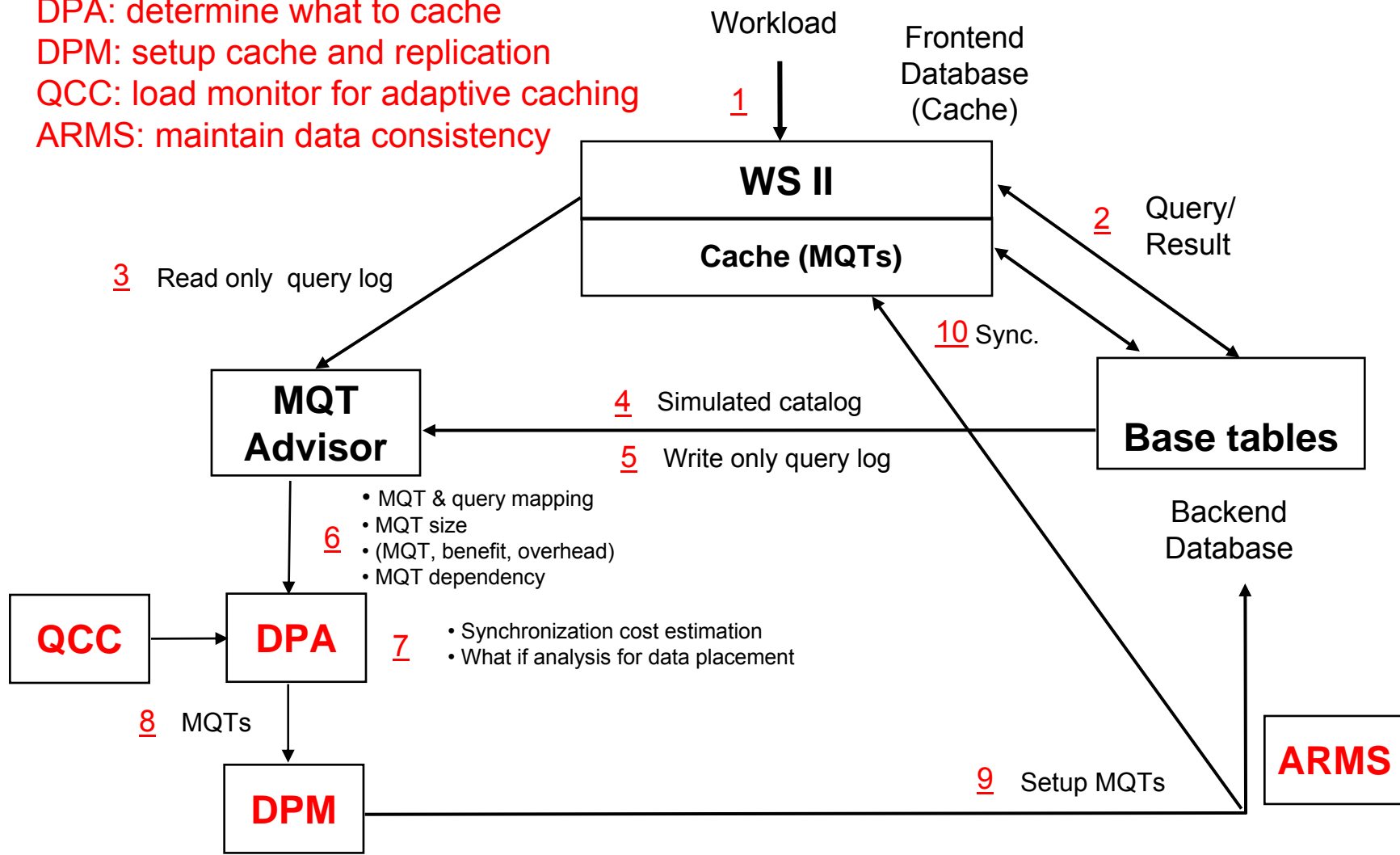
Approach: Intelligent and Adaptive Caching (closer to App srvr)

## Components:

- Data Placement Advisor (DPA) for Intelligent Caching
- Monitoring for Adaptive Caching
- Autonomic Replication Management Service for maintaining Cache Consistency

# Information Systems Scale Out

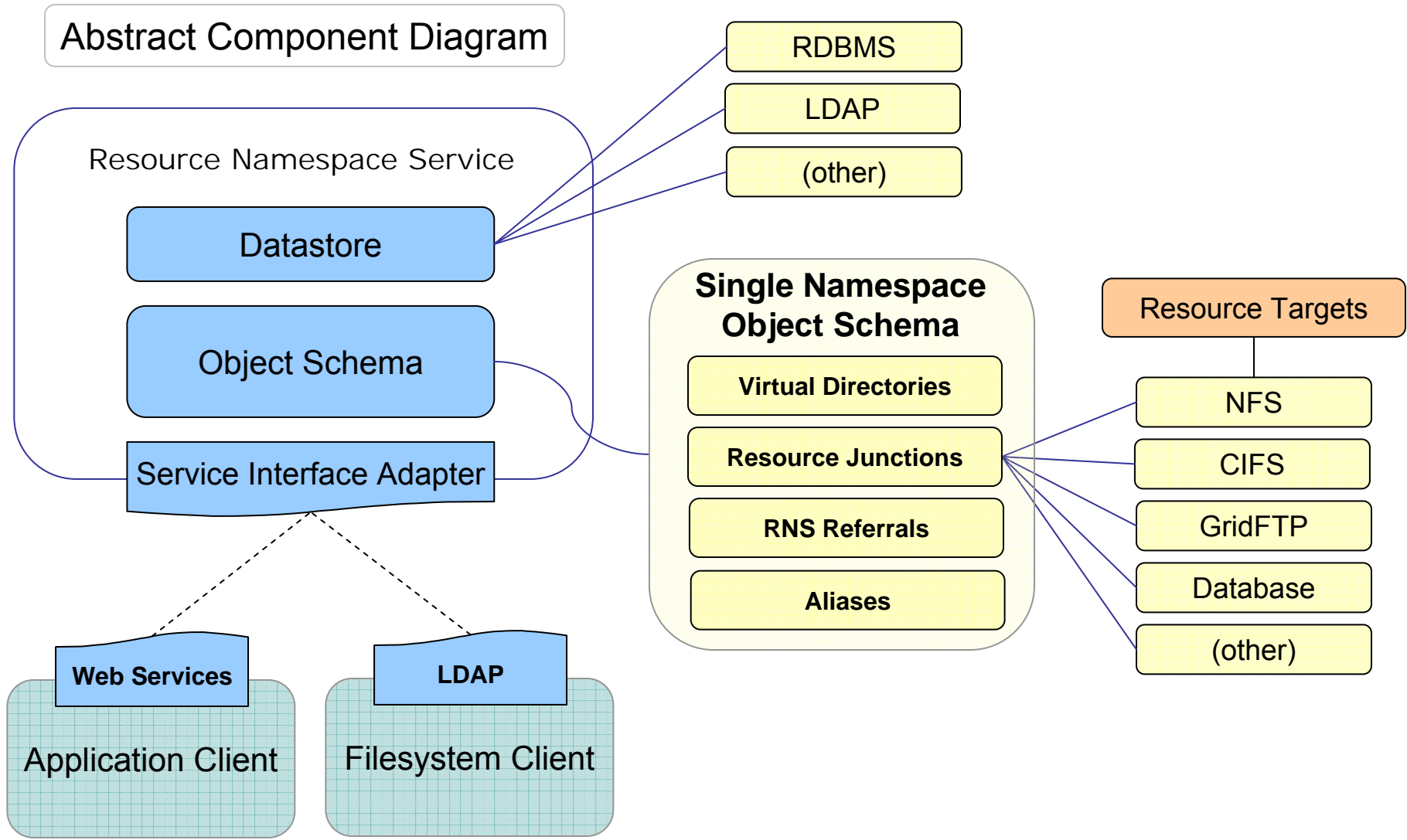
DPA: determine what to cache  
 DPM: setup cache and replication  
 QCC: load monitor for adaptive caching  
 ARMS: maintain data consistency





# Resource Namespace Service (RNS)

Abstract Component Diagram

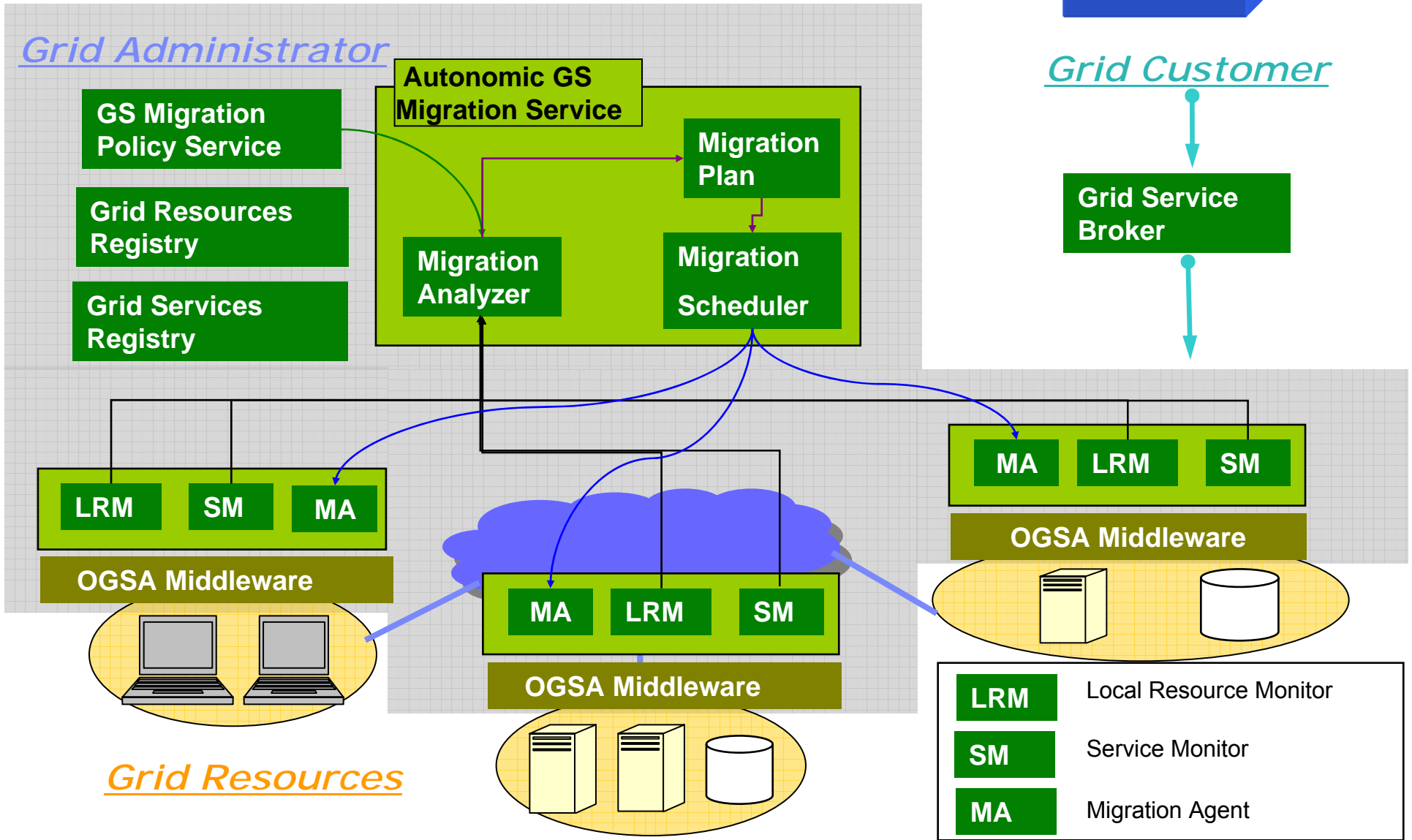


# Resilient Grid Service Provisioning

Provisioning & Orchestration

## Grid Administrator

## Grid Customer



<b>LRM</b>	Local Resource Monitor
<b>SM</b>	Service Monitor
<b>MA</b>	Migration Agent

# COMFORT

Provisioning & Orchestration



Software Developer



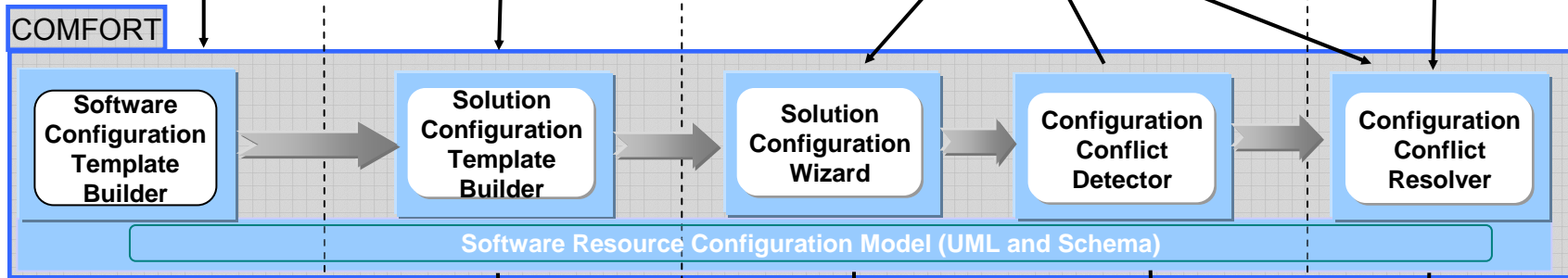
Solution Integrator



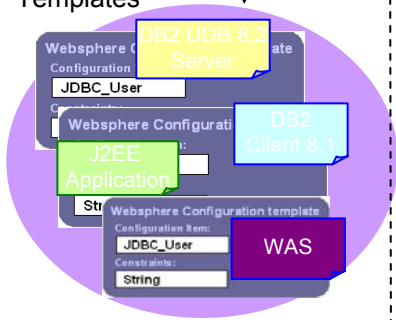
Solution Deployer



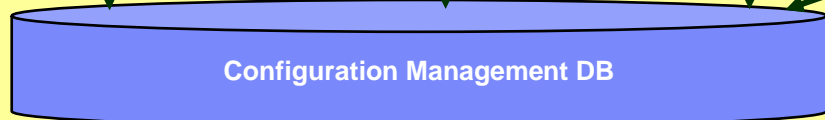
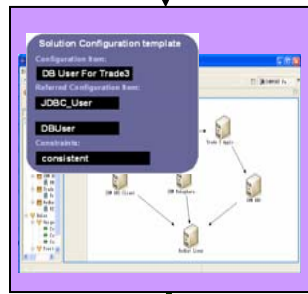
DataCenter Operator



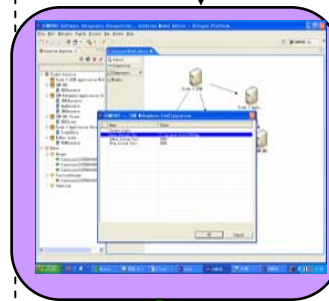
Software Configuration Templates



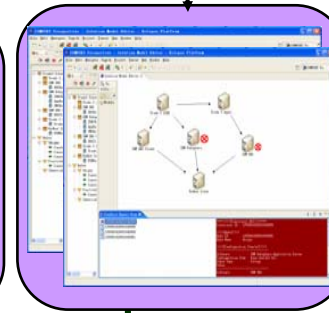
Solution Configuration Templates



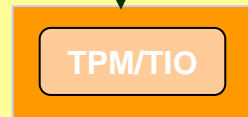
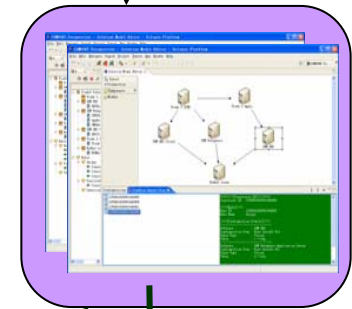
Configuration Item Value



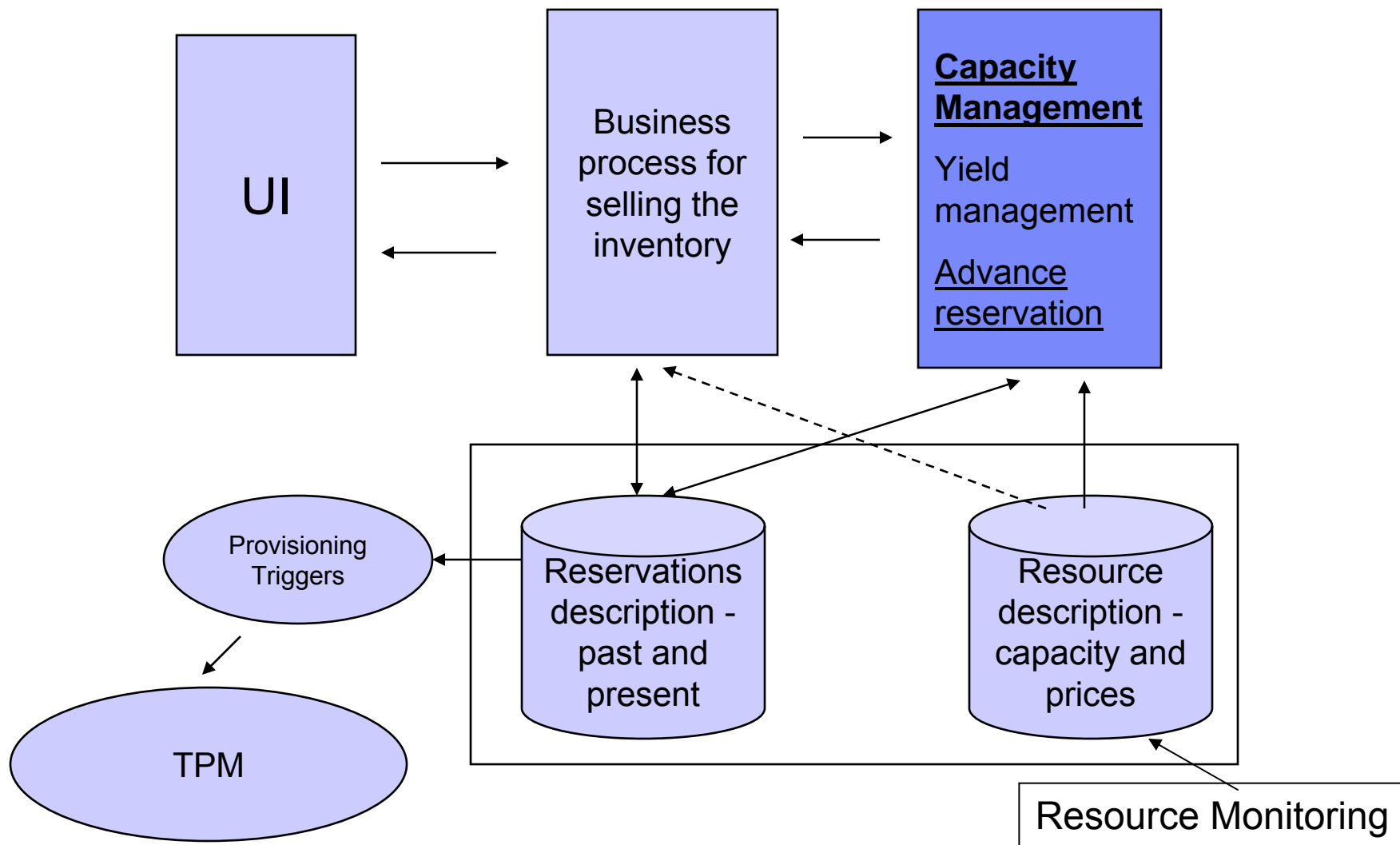
Configuration Conflict Report



Conflict-free Configuration



# Advance Reservation



# IBM's Breadth of Capabilities for Grid & Virtualization



# Thank You

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