An Integrated Process and Technology Framework to Deliver Business Process in a Distributed, Scalable Execution Environment Parts I & II

George Brown
IT Research

Rob Carpenter
IT/Research/ Beta SI
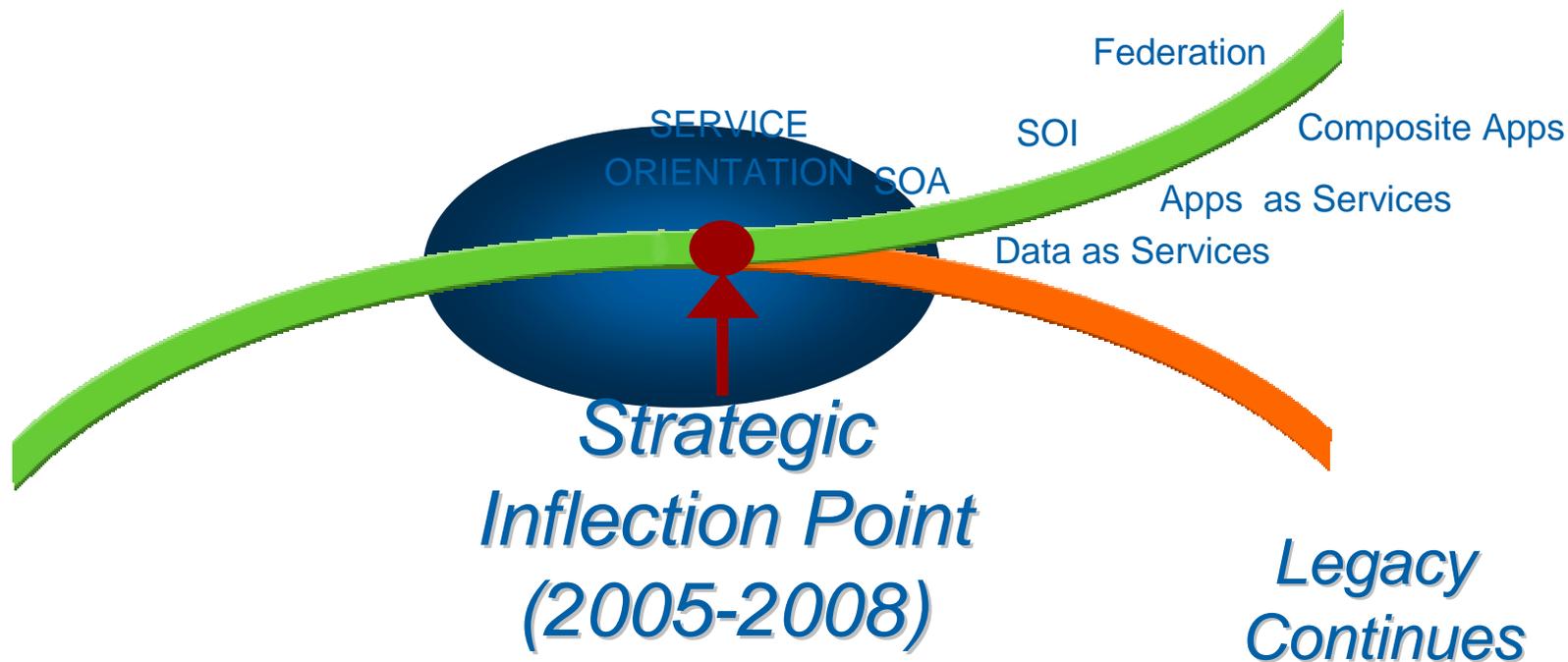March 29, 2006

Intel Information Technology

Agenda – Part I

- SOA as a strategic opportunity

- Challenges driving the need for SOA

- Shift required: business transformation framework

- Integrated Process and Technology Framework
  - Introduce VCOR
  - Introduce FERA
  - Introduce FERA-based SOA

- Mapping SOA to SOI

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Strategic Inflection Point ➤ Opportunity

New Usage and New Solution Architectures Flourish

Federation

SERVICE
ORIENTATION

SOI

Composite Apps

SOA

Apps as Services

Data as Services

Strategic Inflection Point (2005-2008)

Legacy Continues

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

How do the SOE pieces come together?

Composite Service-Based Applications
Composite Views
Customer Views
Supplier Views
Mobile Workers

Business Processes & Application Services
Service Support - Composite Systems - Service Delivery

Platformization SOI Artifact – Standards-based

Service Management & Orchestration
XML/Web Services
Configuration Management
MESSAGE BUS
Capacity Performance Management

MANAGEABILITY ONTOLOGY

Platform SOI Resource Management
Platform SOI Resource Repository

standard platform interface

Intel *T's & Platformization
Network
Server
Aggregation
Storage
Data Center

SOE
SOA
SOI

Intel Information Technology
innovative. strategic. solutions.

(intel)

Today's Challenges

Accelerated Technology Advancement

Regulation and Activism

Focus Shifting to End Customers

Shorter Product Life Cycles

Reduced time-to-market

Accelerated Quoting

Partner Network Getting More Complex

Increased Competition

Flexibility and agility to respond to changing business needs and to harness resources across global value chain partners

Contractors

OEMs

Customized Solutions & Consignment

Component Suppliers

Distributors & Resellers

Support / Retention

Outsourced manufacturing & fragmented inventory

Globalization

Multiple Sales & Support Channels

Distributed Product Design

Political Integration/ Disintegration

Natural Resource Availability

Wildcards Low Probability/ High Impact

George Bro... ...bert Carpenter

Int... Information Technology

innovative. strategic. solutions.

(intel)

Shift Required:
Business Transformation Framework

- Complexity of interactions is increasing throughout the value chain

- Common and normalized business semantics are needed for when describing processes internally and externally

- Quick and accurate response to business changes is needed while reusing functional and integration components

- The Service-Oriented Infrastructure is emerging as a critical value chain resource for managing global operations

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Integrated Process and Technology Framework
Supports the Business Transformation

Reconcile Business Semantics and Technology Semantics to map business processes to core collaboration capabilities for accurate, fast and flexible implementations in a SOA

Tier One

BPM (business process modeling):
- reference models (VCOR)
- benchmarking and requirements analysis
- simulation and use case analysis
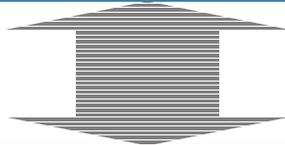
Tier Two

Conceptual Architecture:
- information model
- deployment framework (FERA)
- integration modes

- Business is represented by <u>business processes defined in terms of value chain reference models</u>

- The Technical Infrastructure can be represented by a conceptual architecture that allows <u>mapping collaborative process models to components</u> and to required resources with the SOA

Intel Information Technology
innovative. strategic. solutions.

(intel)

# Tier 1: VALUE-CHAIN OPERATIONS REFERENCE MODEL.

Unified, open standard business process framework for value chain management and implementation. The Value Chain Operations Reference-model (VCOR) is a key model of the Value Chain Group

Provides common and normalized business semantics

Supports value chain management for multiple centers of excellence

Defines use cases and collaborative process patterns for FERA mapping

www.value-chain.org

Intel Information Technology
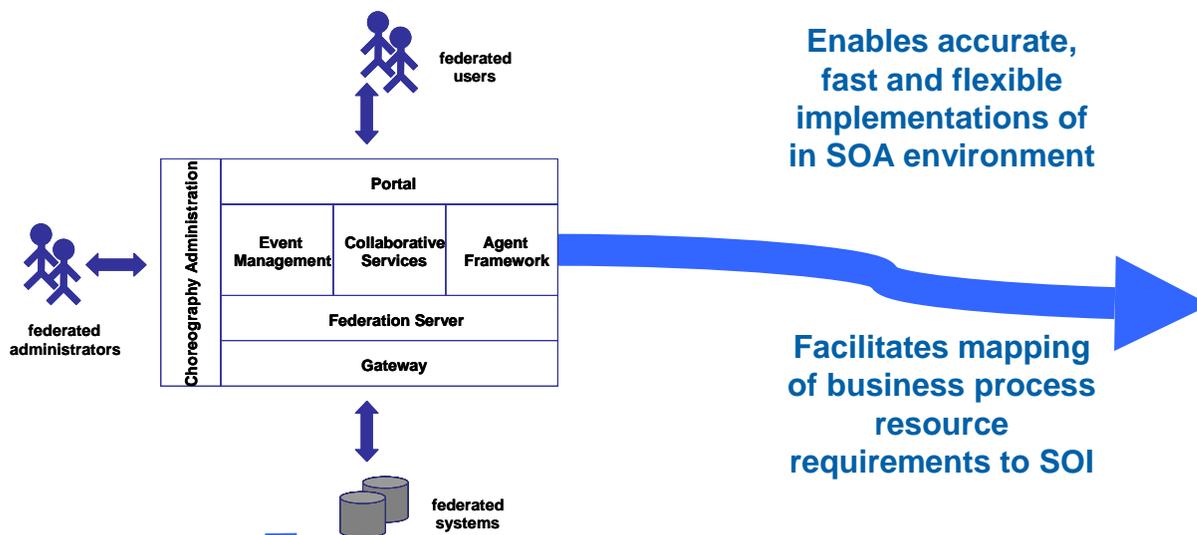innovative. strategic. solutions.

(intel)
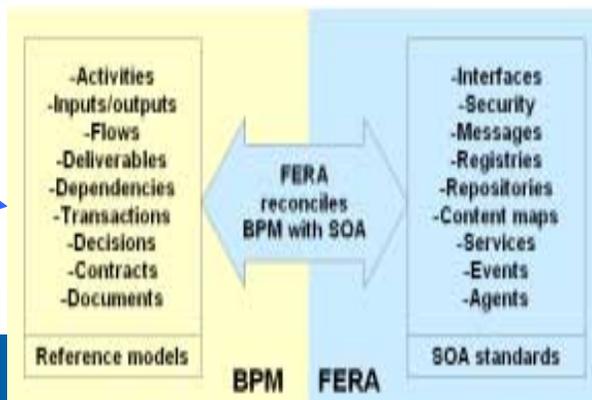
VCOR Can Be Useful At All Levels

- Enterprise Level
  - To help managers from different departments or companies to communicate
  - To establish a business process architecture (modeling)
  - To establish process performance measures
  - To identify priorities for process change

- Process Level
  - To help analyze existing processes and identify how the processes can be used as Services and improved (ideal process sequences and best practices)

- Implementation Level
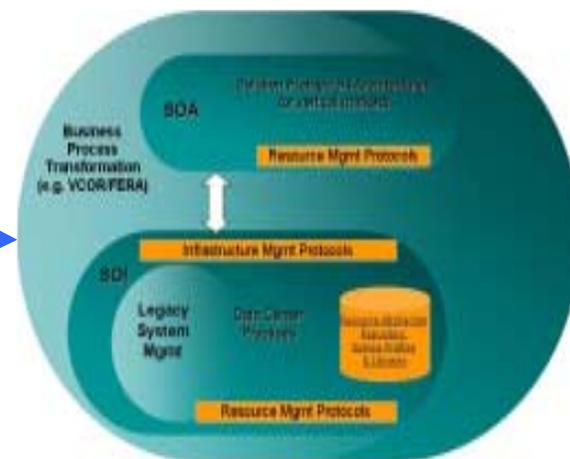 - To Help Organize Services and Rationalize ERP or Best Practice Applications

Intel Information Technology
innovative. strategic. solutions.

(intel)

Tier 2: FERA
FEDERATED ENTERPRISE REFERENCE ARCHITECTURE ™

An architectural framework that defines principles and provides guidelines for implementing service-oriented solutions for essential value chain collaborations

federated users

Enables accurate, fast and flexible implementations of in SOA environment

Choreography Administration

Portal
Event Management	Collaborative Services	Agent Framework
Federation Server
Gateway

federated administrators

Facilitates mapping of business process resource requirements to SOI

federated systems

Is the basis for new standards for SOA that drive convergence

FERA-based SOA

Thanks to Collaborative Product Development Associates and Semantion for their contribution to this research.

...ation Technology

innovative. strategic. solutions.

(intel)
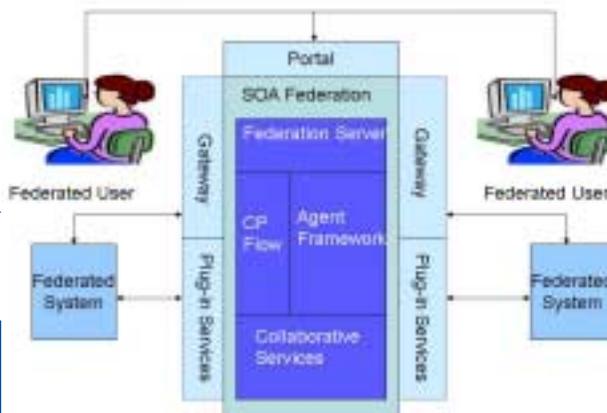
The Conceptual Architecture of Tier 2

- Federated Enterprise Reference Architecture™ (FERA) is an architectural framework that defines principles and provides guidelines for a service oriented solution for value chain collaboration

- FERA is based on loosely coupled business process integration, is agent powered and event driven

- FERA is abstracted into reusable patterns for deployment and templates for configuration that can map to BPM reference models via Guidelines

  - FERA defines four classes of collaborative processes

  - FERA recognizes eight defining characteristics of collaborative process flows

  - FERA defines eighteen patterns of collaborative process flows

March 29, 2006   George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

A Proposed Standard for SOA

FERA-based SOA

- Provides semantic integration for today's SOA

- Loosely coupled architecture that does not require coding

- Defines complete run-time architecture

- Currently in the process to be endorsed by OASIS as standard SOA architecture from its ebSOA TC

- Based on Federated Enterprise Reference Architecture (FERA) reference model

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel®)

Configuration Based Deployment

Intel Information Technology
innovative. strategic. solutions.

(intel)

Model for Mapping SOA to SOI

Context-awareness and Ontology Replenishment

March 29, 2006   George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.
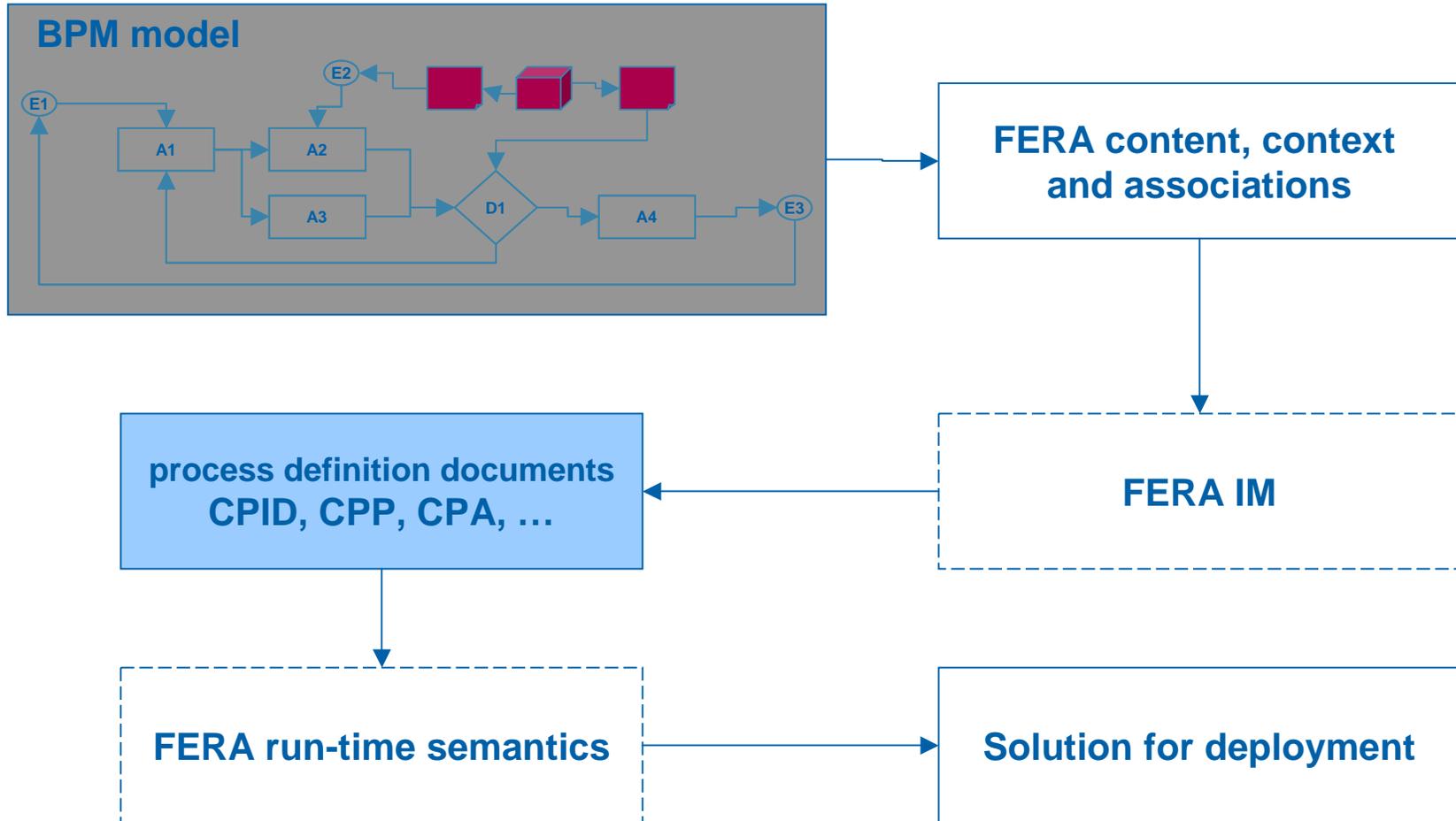
(intel)

Conclusions about Context-awareness
for mapping SOA to SOI

- Decisions about resource requests will be more effective with intelligence about the context within which services are used

- Patterns give you more intelligence about the type of processing because capacity requirements depend on processing logic
  - FERA patterns can be used to define resource manager requirements
  - FERA pattern attributes can be used to determine sourcing strategy for the resource pool
  - Resource request data model can utilize FERA ontology related parameters

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Agenda – Part II

- What is SOI ?

- SOI and Virtualization

- Layer 1: Console ←→ Server

- Layer 2: Biz-SOA ←→ Console

- Conclusion

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Evolving SOA to SOE

- A *Service-Oriented Architecture [SOA]* is an architectural style whose goal is to achieve loose coupling among interacting software agents - i.e. services.

- A *Service-Oriented Enterprise [SOE]* is an enterprise that implements and exposes its business processes through an SOA and that provides frameworks for managing its business processes across an SOA landscape.

- What's Missing?: To support a **Integrated Process and Technology Framework,** one needs a scalable, dynamic infrastructure which can respond to the demands of the business layer [Biz-SOA] – i.e. a Service Oriented Infrastructure – SOI

SOI is infrastructure designed and built to be the
Business Process Platform [BPP] for the enterprise

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Putting SOI in perspective

Abstraction separates

"What" which Biz-SOA cares about from

"How" which SOI cares about

Left diagram

SOE

Virtual Corp
- Federation of Enterprises
- Extended Process Services — Security
- Extended Collaboration

Abstraction Layer

Biz-SOA
- Process Manageability — BAM, Process Analytics, Process Autonomics
- Process Orchestration — End-to-End Processes, Process Interoperability
- Applications & Services — Apps, WS, Data, Security, etc.
- Application Virtualization

Abstraction Layer

SOI
- Infrastructure Virtualization
- Infrastructure Manageability — monitoring, management, security
- Compute Infrastructure — processing, storage, network, etc.

Right diagram

Biz-SOA

→ESB
→OPs

SOE

SOI

Abstraction Layer

CMDB
Resource Mgmt Abstraction
SOI Service Bus
Pre-Integrated

Network Mgmt
Storage Mgmt
Compute Mgmt

Discrete Resources
Utility Resources
Grid

SOI

Intel Information Technology
innovative. strategic. solutions.

(intel)

Key Principles

- **Cheaper:** The infrastructure must drive better TCO

- **Agile:** The infrastructure environment must promote agility through scalable and dynamic provisioning

- **Distributed:** The infrastructure must support service distribution
  - Geographically distributed execution, particularly for collaboration
  - Service partitioning, particularly "in house" and "out sourced" execution

- **Process Aware:** The infrastructure must be abstracted and process aware

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Why Enterprise Virtualization?

Maturity Model

What's Evolving
- Service Oriented Management – SOM: IT service management, provisioning, monitoring will continue to mature.
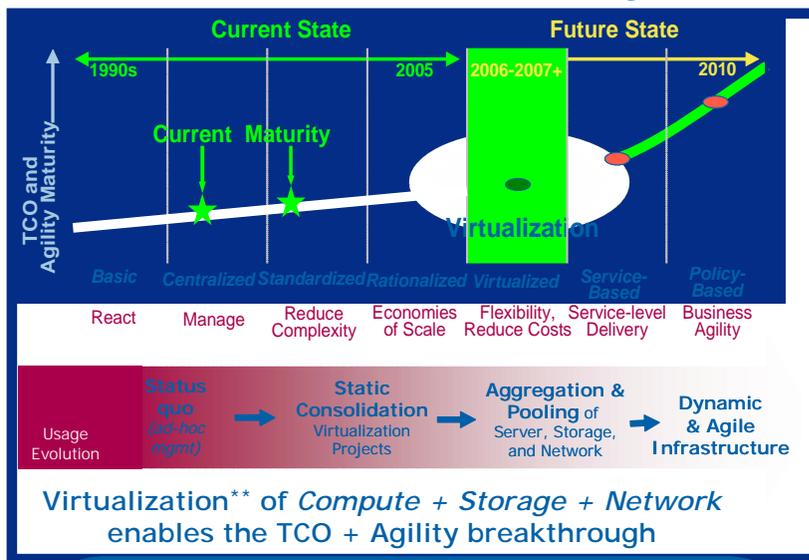
What's Emerging
- Virtualization
- GRID

What's Missing
- Maturity
- A general architecture for services in the emerging environment

Barriers to Adoption

- Cost
- Perceived Maturity
- Management Complexity
- Adequate risk mitigation
- Application Readiness

- **Adoption is growing** – estimate >half of Fortune 100 companies are either thinking about or executing projects
- **Scope is growing** – originally rooted in scientific applications, data grids and financial grids are now not uncommon
- **Vendors are beginning to support GRID** - for their applications. General purpose grid vendors are making headway
- **Enterprise GRID** – awareness is growing

Current State — 1990s — 2005
Future State — 2006-2007+ — 2010

TCO and Agility Maturity

Current Maturity

Virtualization

Basic	Centralized	Standardized	Rationalized	Virtualized	Service-Based	Policy-Based
React	Manage	Reduce Complexity	Economies of Scale	Flexibility, Reduce Costs	Service-level Delivery	Business Agility

Usage Evolution: Status quo *(ad-hoc mgmt)* → Static Consolidation / Virtualization Projects → Aggregation & Pooling of Server, Storage, and Network → Dynamic & Agile Infrastructure

Virtualization of *Compute + Storage + Network* enables the TCO + Agility breakthrough

At a recent Gartner Symposium/ITxpo, Gartner Inc. vice president John Enck called virtualization a "megatrend."

"*We see virtualization being extremely important across all server types*" and "*virtualization is the best tool you have right now in the market to increase efficiency and drive up the utilization of your servers,*" said Enck.

↑
Convergence of Thinking
↓

Virtualization as an integral component of enterprise computing, utility and GRID computing models is being embraced through expansion of VM capabilities by vendors and growing of acceptance as the basis of GRID
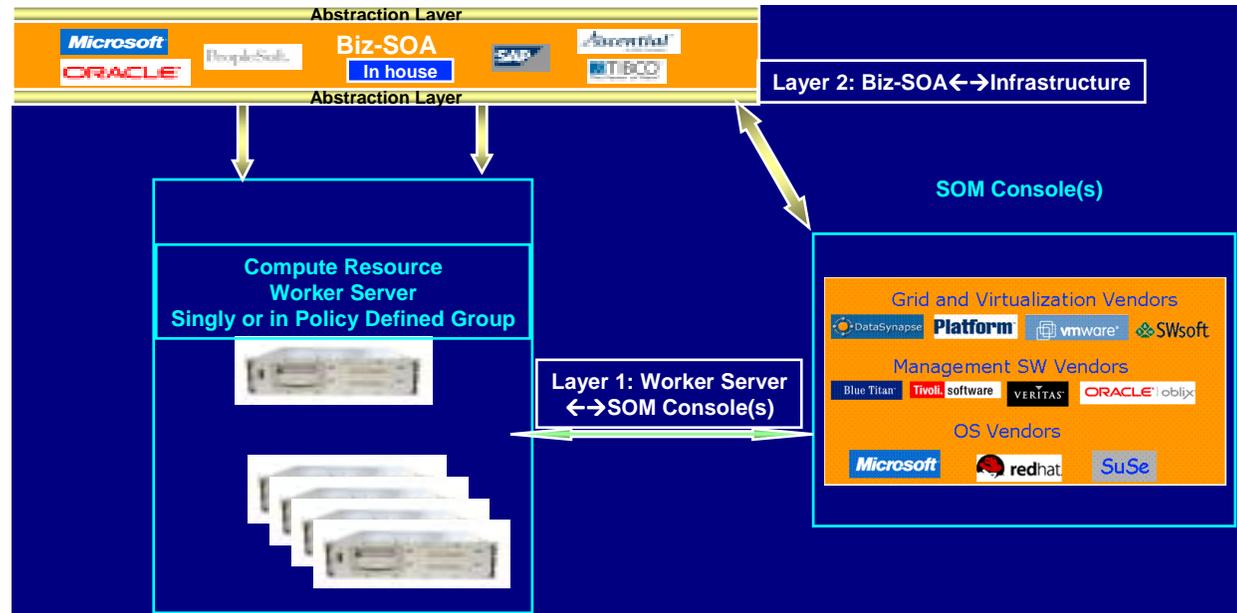
Intel Information Technology
innovative. strategic. solutions.

(intel)

There are different virtualization styles

- ## VM style virtualization provides:
  - OS partitioning with a machine
  - Higher utilization of resources – drives server consolidation
  - Dynamic re-allocation of resources to meet varying capacity demands
  - Job and task isolation
  - Custom environments for enhanced security
  - Improved migration paths

- ## GRID style virtualization provides:
  - Ability to provide scalability
  - Complex mapping of jobs to resources [n→1 and 1→n]
  - Potential for dynamic re-allocation of resources to meet varying capacity demands and geographically distributed optimization
  - New and improved models of fault tolerance and disaster recovery

Typical Virtualized Server

System Utilization Statistics

VM n
VM 2
VM 1

Service VM

Grid Engine
Grid Agent
SPI Logic

App/Service Execution Stack
App₁ ... Appₙ
Service₁ ... Serviceₙ
Mgmt Agents
OS

Platform Mgt Agents

Web Server /XML parser

Virtual Machine Monitor/OS

- Initially, drives usage models around server consolidation, etc.

←

- Ultimately must support scale up and scale out as well

↓

see David Kra, Six strategies for grid application enablement, Part 1:, 2004
http://www-128.ibm.com/developerworks/grid/library/gr-enable/

Over time, VM-style and GRID-style will merge
see, Figueiredo, Dinda and Fortes, A Case For Grid Computing On Virtual Machines, Technical Report TR-ACIS-02-001, August 2002
http://citeseer.ist.psu.edu/cache/papers/cs/27378/http:zSzzSzwww.cs.northwestern.eduzSz~pdindazSzPaperszSzicdcs03.pdf/figueiredo03case.pdf

Intel Information Technology
innovative. strategic. solutions.

(intel)

Virtualization: The premise

- A VM container is right:
  - For general purpose computing across a datacenter infrastructure
  - As the basis of GRID computing

- The VM container as the basis of job and service computing enables
  - "That which executes in a VM" as the logical unit of work
  - The definition of a service unit tied to the VM for monitoring & billing – i.e. resource utilization SOI within SOA
  - A correlation scheme between executing services

- Model
  - Console(s) drive "worker servers"
    - Highly flexible – data center, SMB, down the wire, etc.
    - Ultimately, self-organizing, peer grids
  - VM is the ubiquitous container and the basis of LUW
    - Basis of legacy, utility and GRID execution models
    - Basis of metering/monitoring

> **The use of a VM like container as the basic unit of execution in a virtualized normalizes the architecture**
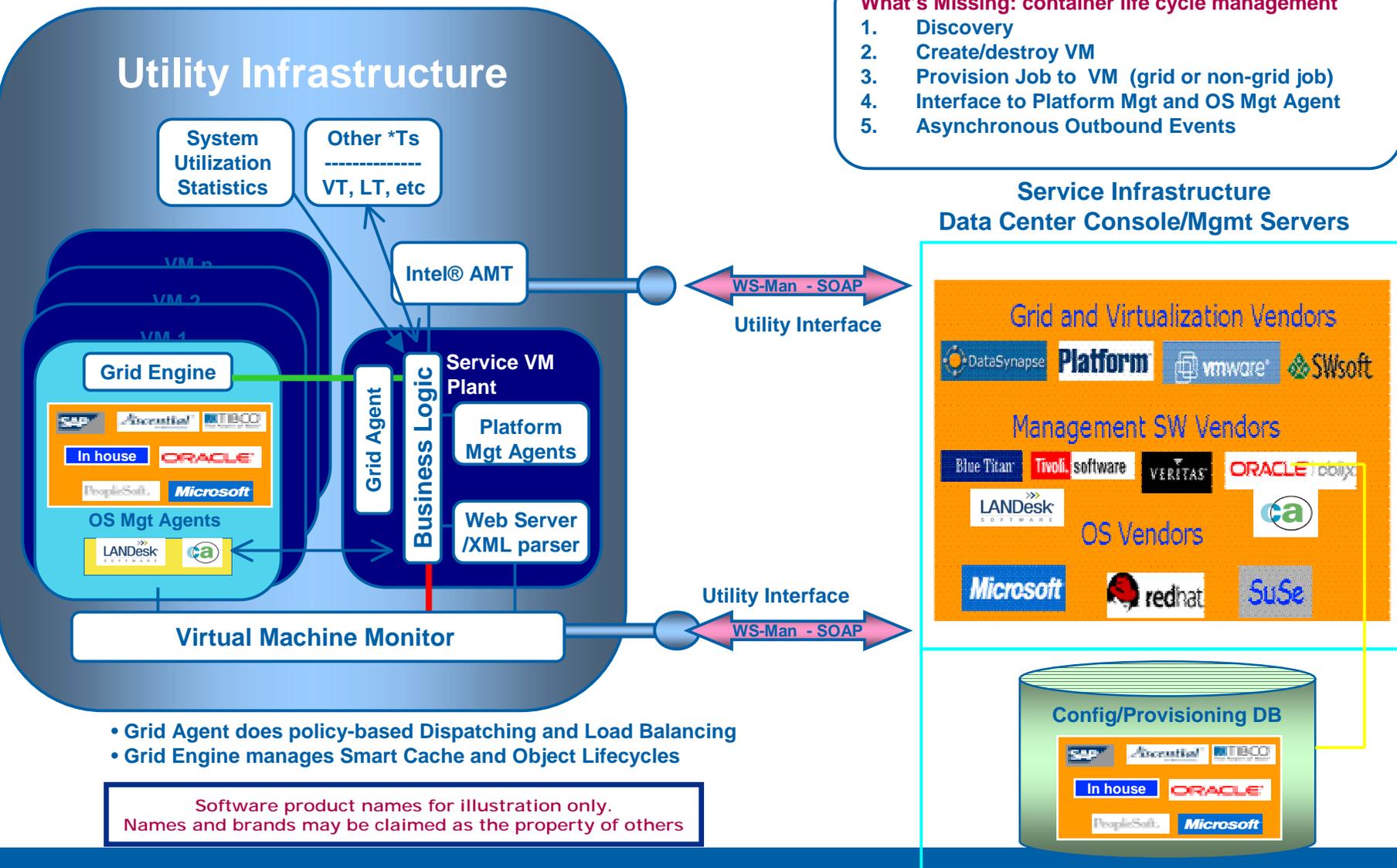
Intel Information Technology
innovative. strategic. solutions.

(intel)

The basic SOI model

- **Key elements**
  - Biz-SOA
  - Consoles
  - Resource Cloud

- **Layer 1**
  - VM/GRID life cycle mgmt
  - Operations

- **Layer 2 – Biz-SOA←→Console**
  - Job submission
  - Sizing
  - Response to SOI Errors

Abstraction Layer

Microsoft
ORACLE
PeopleSoft
Biz-SOA
In house
SAP
Ascential
TIBCO

Abstraction Layer

Layer 2: Biz-SOA←→Infrastructure

SOM Console(s)

Compute Resource Worker Server Singly or in Policy Defined Group

Layer 1: Worker Server ←→SOM Console(s)

Grid and Virtualization Vendors
DataSynapse Platform vmware SWsoft

Management SW Vendors
Blue Titan Tivoli software VERITAS ORACLE oblix

OS Vendors
Microsoft redhat SuSe

**Software product names for illustration only.
Names and brands may be claimed as the property of others**

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Layer 1 - Utility Interface

Utility Infrastructure

System Utilization Statistics

Other *Ts -------------- VT, LT, etc

VM n

VM 2

VM 1

Grid Engine

SAP | Ascential | TIBCO

In house | ORACLE

PeopleSoft. | Microsoft

OS Mgt Agents

LANDesk SOFTWARE | ca

Grid Agent

Intel® AMT

Business Logic

Service VM Plant

Platform Mgt Agents

Web Server /XML parser

Virtual Machine Monitor

- **Grid Agent does policy-based Dispatching and Load Balancing**
- **Grid Engine manages Smart Cache and Object Lifecycles**

Software product names for illustration only.
Names and brands may be claimed as the property of others

What's Missing: container life cycle management
1. **Discovery**
2. **Create/destroy VM**
3. **Provision Job to VM (grid or non-grid job)**
4. **Interface to Platform Mgt and OS Mgt Agent**
5. **Asynchronous Outbound Events**

Service Infrastructure
Data Center Console/Mgmt Servers

WS-Man - SOAP

Utility Interface

Grid and Virtualization Vendors

DataSynapse | Platform | vmware | SWsoft

Management SW Vendors

Blue Titan | Tivoli. software | VERITAS | ORACLE Toolx

LANDesk SOFTWARE | ca

OS Vendors

Microsoft | redhat | SuSe

Utility Interface

WS-Man - SOAP

Config/Provisioning DB

SAP | Ascential | TIBCO

In house | ORACLE

PeopleSoft. | Microsoft

Intel Information Technology
innovative. strategic. solutions.
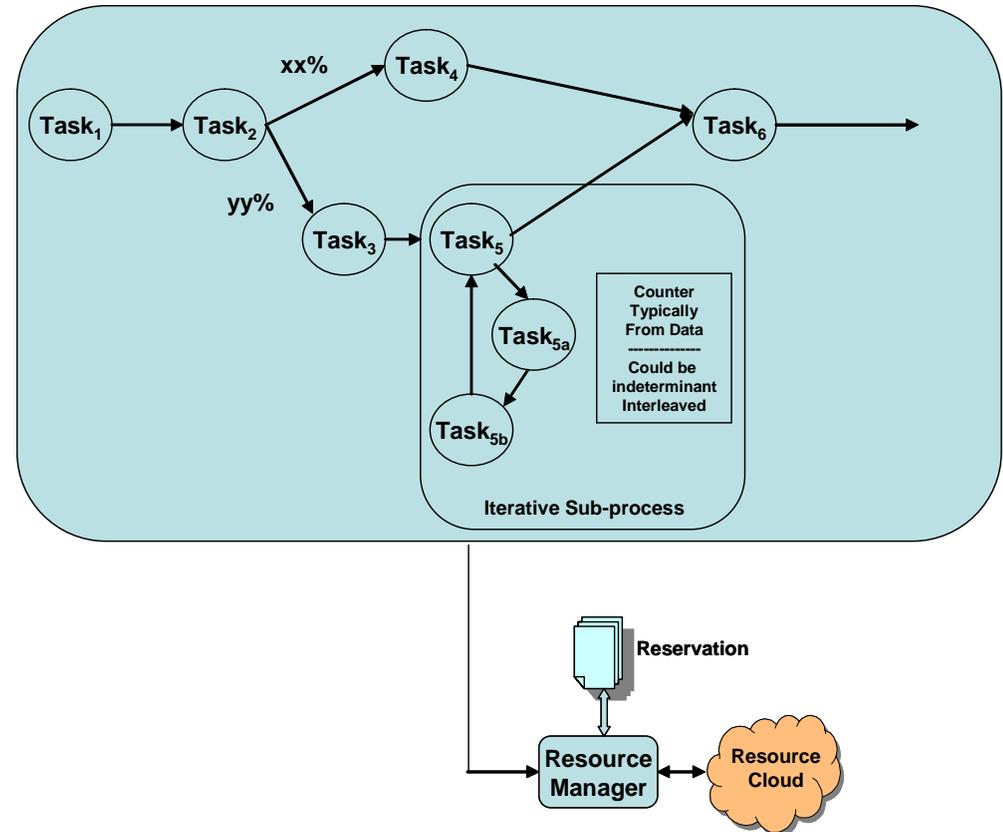
(intel)

Layer 2: Making resources responsive

- **Trigger**
  - Standard Batch
  - Event Driven

- **Type**
  - Static Job
  - Service
  - Service with possible cascade
  - Controlled process

- **Resource Control**
  - Thermostat model
  - Historical trending model
  - Business Demand Model
    - Wait and See
    - Static reservation
    - Advance Reservation
    - Statistical Map
    - Process map

Data to correlate biz process with resource consumption

Semantics ?

Job Manager

Resource Manager

Predict Demand

Analytical Models

←Observed Workload

Predicted Workload

Resource Identified→

Monitor Workload

New Allocation

Policy Engine

Historical Data

SOI

Virtualization provides:
- Std. environment,
- Container for LUW,
- Basis for
  - QoS
  - Scale Up
  - Scale Out

Utility Infrastructure

System Utilization Statistics

intel® AMT

Grid Engine

Service VM Plant

Platform Mgt Agents

OS Mgt Agents

Web Server /XML parser

Virtual Machine Monitor

Workload Measurements

Intel Information Technology
innovative. strategic. solutions.

(intel)

Layer 2 – What's Missing

- Sophisticated
  - advance reservation structure
  - *a posteriori* statistical models to estimate consequences of invoking a service
  - *a priori* mapping of processes to resource consumption [XMI - XML Metadata Interchange helps – but much work remains around resource mapping to process]

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

Conclusions

- Building SOI, i.e. a Business Process Platform, will drive

  1. Virtualization as the fundamental technology and VMs as the building blocks and GRID built upon virtualized service models

  2. Enhanced Console resource semantics to enable to become the SOI layer provides a an abstracted, virtualized, managed, high performance environment for the execution of business processes and services.

  3. Enhanced biz-SOA to SOI semantics to enable the independence of the application or service running on top - whether scientific HPC, WS SOA, or Legacy

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel)

About the Presenter, Part II

Robert E. Carpenter joined Intel in 1997 after a 20-year career as an attorney, retiring as district attorney of Greene County, NY in 1996. For many years, he taught mathematics at Bard College and later law at Albany Law School. Today, after serving as the Business Process Automation architect within IT, he is the IT architect for SOE [Service Oriented Enterprise] working closely with the platform groups sharing time between Beta SI and IT Research. His e-mail is robert.e.carpenter at intel.com.

Intel Information Technology
innovative. strategic. solutions.

(intel)

About the Presenter, Part I

George W. Brown joined Intel in 1994 as Principal Software Scientist within Corporate Information Technology. Currently a Senior Program Manager within IT Research group responsible for working with senior management of Intel business units and application groups to define business strategy, architecture of business applications, and strategies for applying information technology to improve Intel competitiveness. Special focus has been given to methods and tools to ensure Intel reaches its goals in Value Chain Management. He served as Chair of the Supply Chain Council and the SCC R&D Strategy Committee. George Is currently Chair of the Board of Directors for the Value Chain Group. Before joining Intel worked as a Senior Staff Specialist and Software Architect at GDE Systems, inc., a Senior Program Manager at SAIC and a Principal Software Engineer at Digital Equipment Corporation. George has advanced degrees in Aerospace Engineering from Georgia Institute of Technology.

George Brown & Robert Carpenter

Intel Information Technology
innovative. strategic. solutions.

(intel®)