Cloud Computing Model as Service Oriented Architecture

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Content Summary

■ Rationale
■ Cloud computing in the evolution of Enterprise IT
■ The challenges in enterprise cloud computing adoptions
■ EA, SOA, and Cloud Computing
■ Cloud computing model in terms of SOA
■ Shared service domain in enterprise
■ Cloud computing as an integral part in the new generation IT operating Model
■ Conclusion
Rationale

- Cloud computing is a natural step further from EA and SOA
  - EA has been practiced visibly for over 10 years, necessity is well recognized, but success is limited
  - SOA is a good concept, but also has limited success
  - Cloud computing is a new spin for enterprise IT efficiency, enables an more effective technical implementation of SOA, i.e. shared services.

- The major challenges
  - New paradigm in organization structure and culture towards shared service and collaboration
  - Architectural leadership and stakeholder participation
  - Engineering discipline that follows architectural models
  - Cloud service lifecycle management and governance

- Intention of this presentation
  - Put cloud computing in the context of SOA and EA
  - Integrate cloud computing into the new generation IT operating model
The Evolution of Enterprise IT

- **IT in Business**
  - *Past*
    - Operation support
    - Individual project based decision
    - Ad hoc and technology driven implementation
  - *Current Trend*
    - Involved into business strategies and decisions (the agility of business depends heavily on the flexibility of IT for decision support and automation)
    - Have long-term blueprint and big pictures as guidance (strategic plan and EA)

- **IT Infrastructure**
  - *Past*
    - Hardware, software, network components
    - Infrastructure silos
  - *Current Trend*
    - IT infrastructure is a line of business; is a segment in Enterprise Architecture
    - Service Oriented Infrastructure (infrastructure as a commodity service)
    - Cloud Computing (continue the trend with technical means)
Business Evolution Associated with IT

1. Business Online
   - Web access via static web pages
   - Web access with web applications
   - Online transactions with connections to backend applications
   - Online presentation

2. Integrated Business
   - Backend IT system integration (interoperation across Systems, e.g. EAI)
   - Business integration (EA efforts across organizational stove pipes, SOA)
   - Integration of both business and IT

3. Business On Demand
   - Shared services on demand
   - Flexible and commoditized IT infrastructure
   - Agile business with dynamic and adaptive business processes
   - Collaborative and dynamic business

The Evolution Path

Enhanced IT Role in Business

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Cloud Computing Concept

- It is an evolution and re-packaging from what we have experienced already, not initiated with any new technology, but is a new practice mechanism that can expect more new technologies along the road.

- **Prior-Art:** Grid computing, utility computing, virtualization, SOA, SOI, Web Service, Application Service Provider (ASP), multi-tenant software applications, etc.

- **Composition (extended from NIST draft):**
  - Characteristics: on-demand service, ubiquitous network access, location independent resource pooling, rapid elasticity, measured service.
  - *Optional characteristics:* multi-tenant enabled, resource virtualization, etc.
  - Delivery Models: software as a service, platform as a service, infrastructure as a service.
  - *Additional delivery models:* business process as a service, data as a service, human service behind cloud.
  - Deployment Models: private cloud, community cloud, public cloud, hybrid cloud.
  - *Additional deployment model:* Peer-to-peer cloud (more suitable for IPv6).

- It enhances Service Oriented Infrastructure, and is a continuous evolution towards Service Oriented Architecture.

- New innovations can be expected to benefit this new paradigm.
The Challenges in Enterprise Cloud Computing Adoptions

- Understand the impact of the new paradigm
  - Separate common services from unique functions
  - Maximize loosely coupled services to reduce complexities and lessen the impact of changes
  - Identify cloud suitable common services, and cloud service types

- Organization structure
  - Loosely coupled service organizations break stove pipes and promote collaboration
  - Dynamic relationships between service providers and service consumers

- Organization culture
  - Transform vertical connections to horizontal collaborations
  - Change management style from command and control to motivation, facilitation, and collaboration

- Adoption of new tools
  - Enable effective common service adoption
  - Enable collaboration inside and beyond enterprise
The Progress in Federal Enterprise Architecture

- **EA Federation**
  - The federation model fits federal government organization structure
  - It provides horizontal partition to the complete EA domain

- **EA Segmentation**
  - Segments are defined based on the lines of business (LoB)
  - It provides vertical partition to the complete EA domain

- **Service Orientation**
  - As an architectural style and approach, is well adopted in architectural practice and solution implementation
  - A practical approach to bridge business and technologies, and enables EA to reach program/project implementation

- **Cloud Computing**
  - It is one form of the technical implementations of SOA concept, with loosely coupled and sharable resources and services
  - It further enhances segmentation and federation implementation by enabling shared services and resources across organizations and segments
The Practice of EA, SOA, and Cloud Computing

- **EA, SOA, cloud computing:** EA has been practiced visibly for over 15 years, necessity is well recognized, but success is limited; SOA bridges EA with solutions, but has implementation challenges; cloud computing provides a more effective technical means.

- **The major challenges:** architectural leadership; stakeholder participation; the discipline in implementation -> the integrated cohesive efforts across EA, SOA, Cloud Computing.

- **Lessons learned:** Need to have target vision as a soul, and need core ideas for the art of creation, e.g. need to have a target architecture for a practical roadmap.

- **Action need:** Establish clear vision via EA, solidify the core ideas with architectural guidance, have a roadmap for the efforts, promote a balanced approach (top-down + bottom-up) for success.
SOA Conceptual Model

- **Service Provider**: who publish services to Service Registry
- **Service Consumer**: who find services from Service Registry and use (or “bind” to) them
- **Service Registry**: where contains information for available services.
- **Publish**: providers announce service availability to consumers via Service Registry
- **Find**: consumers discover available services inside Registry
- **Bind**: a service provider and a service consumer reached agreement, and the consumer connected to the service to consume it.
Cloud Computing Model

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Cloud Service Model

Cloud Service Provider

Cloud Service Registry

Cloud Service Consumer

Publish

Find

Bind
Federated Cloud Service

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Cloud Services Broker

Event Handling Middleware

Cloud Governance Policy

Cloud Service Registry & Metadata Repository

External Event

Internal Event

Service Consumer A

Service Consumer B

Service Component A

Service Component B

Service Component C

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What the Service Broker Means for Cloud Service Registry & Metadata Repository

Service Consumer A
Service Consumer B

Orchestration & BPM
Security
Transformation
Management
Content-based Routing
Transport

Governance Policy
Service Registry & Metadata Repository

Event Handling Middleware

External Event
Internal Event

Service Component A
Service Component B
Service Component C
Infrastructure Cloud Service (IaaS)

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Service Consumer A

Service Consumer B

Governance Policy

Service Registry & Metadata Repository

Service Component A

Service Component B

Service Component C

Event Handling Middleware

External Event

Internal Event

Cloud Infrastructure Services Broker

Event Handling Middleware

External Event

Internal Event

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Infrastructure as a Service (IaaS)

- **Infrastructure Cloud Service Registry**
  - Infrastructure cloud services will be part of infrastructure service portfolio
  - Infrastructure cloud services can be searchable through the Registry, and be federated if necessary
  - The service terms and data should be in the Metadata Repository

- **Service Providers**
  - Infrastructure cloud service providers can be one or multiple vendors
  - Service providers and their services will be registered in the Registry, and relevant service data will be stored in the Metadata Repository

- **Service Consumers**
  - Search available services in the Registry and Metadata Repository
  - Establish relationships with selected service providers for implementation, services can be automated, semi-automated, or human involved
Platform Cloud Service (PaaS)

Cloud Platform Services Broker

Service Consumer A

Service Consumer B

Service Component A

Service Component B

Service Component C

Governance Policy

Service Registry & Metadata Repository

Event Handling Middleware

External Event

Internal Event

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Platform as a Service (PaaS)

- **Domain Specific Cloud Platform Service Registry**
  - Suitable common services for a business domain can be shared in a platform, which can be an integral part inside domain service portfolio
  - Platform services can be searchable through the Registry, and federated if necessary
  - The service terms and data should be in the Metadata Repository

- **Service Providers**
  - Platform cloud service providers can be from multiple vendors with multiple service software (provided in the form of SaaS)
  - Service providers and their services will be registered in platform service registry, and relevant service data will be stored in the Metadata Repository

- **Service Consumers**
  - Search available services in the platform Registry and Metadata Repository
  - Establish service connections at development or run-time
Software Cloud Service (SaaS)

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Software as a Service (SaaS)

- **Software Service Registry**
  - Cloud suitable software services (e.g. multi-tenant enabled) will be shared via the software service registry
  - Cloud software services can be federated via service registry
  - The service terms and relevant usage data should be in the Metadata Repository

- **Service Providers**
  - Cloud software service providers can be multiple vendors with multiple service software (provided in the form of SaaS)
  - Service providers and their services will be registered in the Registry, and relevant service usage data will be stored in the Metadata Repository

- **Service Consumers**
  - Search available services in the Registry and Metadata Repository
  - Establish service connections at development or run-time
The Relationship of Cloud Service Layers

Cloud Platform Service (PaaS)

- Cloud Infrastructure Service (IaaS)
- Infrastructure Services Not on Cloud

- Cloud Software Service (SaaS)
- Software Services Not on Cloud

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Shared Service Domain in Enterprise

Shared Business Services
- Business service on Cloud

Shared Information/Data Services
- Info/data service on Cloud

Shared System Services
- System service on Cloud

Shared Infrastructure Services
- Infrastructure service on Cloud

Business

Systems

Info/Data

Infrastructure
## The New Generation IT Operating Model

### IT Operating Reference Model

<table>
<thead>
<tr>
<th>Plan</th>
<th>Build</th>
<th>Run</th>
<th>Stakeholders</th>
</tr>
</thead>
</table>
| • External and Internal drivers  
• Strategies and objectives  
• Economics and business cases  
• Business plan and models  
• Architectures in IT domains  
• Performance measurement model | • Business processes & services  
• Applications, systems & services  
• Info/data & services  
• Infrastructure & services  
• Servers, storages, networks & services  
• Data center facilities | • System operation & management  
• IT service management (ITIL)  
• Service Lifecycle  
• Business transformation  
• Change management  
• Contractual management | • Business decision makers  
• Resource owners  
• Service providers  
• Service consumers  
• Governance and regulatory bodies  
• Industry associations and standards groups |

### Governance

- Security
Conclusion

- Cloud computing is a natural step further follows EA and SOA
- SOA concept and structure can be applied to cloud computing model very well, in all three layers
- Cloud computing can be integrated into the current enterprise architecture and IT management efforts with a new generation IT operating model
Back up Slides
The Benefits of Cloud Computing

- Efficiently share common services for all potential service consumers
- Separate business efforts from technology enablement
- Reduce burden to enterprise IT, maximize resource sharing, increase professionalism in IT operations, and enable high quality of service
- Continue evolution for current business and IT to better fit Internet era and to take more advantages from Internet applications and the connected world
- Enable cost reduction and overall performance improvement from enterprise global optimization. Enable the use of IT effectively and efficiently across enterprise and beyond, so to improve business decision making and automation opportunities