A Cloud Platform for Service Oriented Software Development & Running

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Agenda

- Service oriented software development
- Service cloud platform
- iVIC project
- Summary
Service oriented software development

- Service-oriented software design & development
- Basic approach
  - Improve the productivity of software development through reusing of loosely-coupled services over Internet

Key issues
- Service management
- Service composition
- Runtime management
From WebSASE to XServices

1999

- XML Doc Security
- XKMS Service
- SAML Service
- XACL Service

2000-2002

- SOAP Protocol
- UDDI Protocol
- Web Service Object Container & Runtime Server
- Manage Console

2002 & 2003

- Web Service Portal & WSRP
- Web Service Workflow & Tool
- Web Service Transaction
- Web Service Runtime 1.5
- Web Console

2004-2006

- Web Service Application server - XService
- XLinker - Light Weight WSR
- Web Service Transaction
- Web Service Reliable Message
- Web Console 2.0

2007-2008

- AJAX UI
- WSRF
- Web Service QoS
- SOA/ESB
- Web Service Workflow 2.0
- Web Service Reliable Message
- Web Console 2.0

2009-2010

- WSRuntime
- BPELEngine
- BPMNEngine
- UDDI, SWSR
- WSDT
- BPELDesigner
- BPMNDeveloper
- WSManger
- ......

XML Information Process

<table>
<thead>
<tr>
<th>XML Information Process</th>
<th>WebSASE 1.0</th>
<th>XSercives 2.0</th>
<th>XServices 3.0</th>
<th>XServices 4.0</th>
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863 program

HGG program

2002

2003

2004

2005

2006

2007

2008

2009

2010
Success stories: applications

- **Application domains**: e-Government, Satellites, Remote Sensing, Health, Geology, ITS

- **7 applications**:
  - SOA based telecontrol and telemetering system of satellites
  - Remote sensing data public service platform
  - Management and service system of large scale spatial data
  - Collaborative visualization system of 3D geological data
  - Collaborative analysis system of medical data
  - Remote control services of microscope
  - Traffic information publishing system

- **12 Collaborating organizations**
  - **Nonprofit Orgs**: OW2 Opensource Consortium, Internet Open Standards Lab(ISOL)
  - **Companies**: French Thales Inc., CVICSE, InterVision, China Center for Resource Satellite Data & Application(CRESDA), Jandar, Petrochina Daqing Oilfield, Sinopec Shengli Oilfield
Trustie project & SOARWare

- Trustie project: a key 863 project from MOST
  - 2007-2010
  - Highly-trustworthy software production tools and environments

- For us: Beihang University
  - Focusing on service–oriented software design & development, and the trustworthy characteristics of software quality
  - **SOARWare**: Service oriented software production and running environment
    - Service resource management
    - Design and development
    - Runtime support
Architecture of SOARWare

SaaS-oriented Software Service Provisioning and Consuming Environment

Online modeling and development  Service access  Service provisioning

Service Oriented SPL

Business process modeling tool  Service choreography tool  Service test & verification tool

Service development tool  Service deployment tool  Other tools

deploy

Service Bus

Monitoring  Service evolution mgmt.

Service Container  Composite service engine

Service Reg./Discovery

Service info. collecting

Service Info. Mgmt.

Active service collecting

Service mining
ServiceXchange

A stable and simplified version of SOARBase

- [www.servicexchange.cn](http://www.servicexchange.cn)
- Not including business process resource management
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Reflections- many development supporting software involved

- **Tools**
  - Business process modeler
  - Service composition tool
  - Verification and test tool
  - Service deployment tool
  - Monitoring tool

- **Middleware**
  - Service container
  - Composite service execution engine (workflow engine)
  - Service bus
Problems

- The extra work for developers
  - Install and configure various development tools
  - Install and configure runtime supporting middleware
  - Obtain and maintain underlying resources
    - Machines
    - Networks

- However they should focus on “development”.
Our goal

- Building a cloud platform for service oriented software development
  - Instant development without installing tools
  - Instant deployment without installing middleware
  - Instant running without knowing the underlying resources
Moving towards a cloud platform

- Online application development: **SaaS**
  - Browser-based IDE
  - Business process centric development
  - Online sharing of software services
- Transparent deployment and running: **PaaS**
  - Similar to Google AppEngine, etc.
Some key issues

- On-demand hosting environment provisioning
- Load balancing
  - Clusters of service containers
- Fault tolerance and recovery
  - Service replication
- Security by separation
  - Service → runtime middleware
  - Service → Service
SCP: Service Cloud Platform

Online development

SaaS

ServiceXchange
MyCloud
AppStore

AppEngine (PaaS)

AS API
CS API
RM API

Trustworthiness
Service deployment
Service composition
SA org. and mgmt.
Scheduling, running & monitoring
Service Mgmt.

Software Appliance: Service Container, BPMNEngine, App Server

IaaS

Infrastructure resources (compute, storage, network...)
Software appliance provisioning

- Software appliance=VM/PM+ middleware
  - Dynamic provisioning
  - Manageability

- Functions
  - Dynamic deployment/un-deployment of SAs
  - Lifecycle management
  - Monitoring
  - Logging
AppEngine and SaaS tools

Online development

SaaS

Online App Access

ServiceXchange

MyCloud

AppStore

AppEngine (PaaS)

Atomic Service API

Composite Service API

Runtime API

… API
App Engine: hosting environment
MyCloud

- Personalized development environment
  - Service subscription
  - App development tools
    - Instant development tools: BPIDELite- a lightweight BPMN editor and service composition tool suite.
    - Instant deployment interface
  - Instant running-Virtual runtime environment
    - MyServiceContainer
    - MyBPMNEngine
    - Online monitoring tool
BPIDELite

- Flex-based development toolset
  - BPMN-based business process modeling
  - Service orchestration
  - Instant deployment
MyServiceContainer

- Virtual service container
  - Service deployment/un-deployment
  - WSDL file browsing
  - Service invocation
MyBPMNEngine

- Virtual composite service execution engine
  - BPMN compliant
  - CS deployment
  - BPMN model browsing
  - Service invocation
Online monitoring

- Flex-based composite service monitoring
  - Instance state
  - Intermediate state (similar to debugging)
App Store

- Application management
  - App publishing
  - App categorizing
  - App search
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Solution: iVIC – Towards Resource & Software Virtualization

- **iVIC**
  - The Internet-oriented Virtual Computing Infrastructure
  - Towards resource virtualization

- **Design Goals (**)**
  - Support resource allocation based on VM instances
    - To provide another software encapsulate method
      - Image creation, dissemination and optimization
      - Container for VM Images: Load VM images dynamically
    - To provide internet-scale resource allocation and adaption
      - Wide-Area Network VM Migration
  - Support the network application virtualization
    - Linking virtual machine instances via virtual network overlays
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- **vHaaS: virtualized Hardware as a Service**
  - Wide-Area Network VM Migration

- **vSaaS: virtualized Software as a Service**
1. vHaaS

- Assistant designing tools
- Integrated manage view
- Backend module

**iVIC: Towards Resource Virtualization**

- design
- deploy, monitor, schedule
- Virtual running environment
- Physical resources

**vHaaS** (Virtualized Hardware-as-a-Service)
VM Migration over WAN

**Motivation**

- To support wide-area resource sharing, like department, organization, city, or anything bigger than an office
- Underlying resource may not be in the same LAN (link, subnet)

**Current VM technology lacks in support of WAN Migration**

- Network Problem: VM’s IP address will be unavailable to other Internet host
- Storage Problem: Hosts must share a network storage, which is inefficient for WAN hosts

Migration transparent to User
Similar problem with Mobile IP
- Mobile IP deals with actual physical device movement
- VM migration only involve with runtime-state movement

Our solution: Hypervisor Controlled Mobile IP
- HyperMIP: Hypervisor Controlled Mobile IP
- Combine Proxy-mode mobile-ip stack with hosts VM Migration:
  - VM does not need to install Mobile IP stack
  - VMMs manage Network restoration for VM
Virtualized SaaS

iVIC Clients

vSpace Servers

vProcess Servers

vSpace User Storage

vStore (Software Libs)

Presentation Streaming

Application Streaming

Subscribe, Pay per use…
Linking to iVIC vSaaS

- **From you laptop**
  - By using *browser with iVIC Client Plugins*.
  - By plug a **USB Flash Disk** into any computer.

- **From you mobile phone**
  - By install an **iVIC Mobile Client**.
Summary of iVIC

■ iVIC Platform
  ◆ Programmable virtual computing environment
  ◆ Low cost, high flexibility and reliability
  ◆ Virtualized Software as a Service

■ Key technologies
  ◆ VM Migration over WAN
  ◆ P2P based iVIC-VPN
  ◆ VM high availability
  ◆ Software streaming

■ Applications
  ◆ Software lab
  ◆ Massive data processing (MapReduce)
  ◆ HPC - vCluster
  ◆ High scalability web hosting
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Service Cloud Platform

SaaS

PaaS

IaaS
Possible synergies with some OW2 project (1)

- With JASMINe
  - The OW2 JASMINe project aims to develop an administration tool dedicated to Java EE (Apache, JOnAS, EasyBeans, ...), MOM (JORAM, ...) or SOA distributed applications (Orchestra, Bonita, Petals, ...) in order to facilitate the job of the system administrator.
  - JASMINe *Design, Deploy, Monitoring* and *Self-management* can be used to improve our service cloud platform.
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Possible synergies with some OW2 project (2)

- With JOnAS
  - JOnAS is the basis of a more global middleware suite delivered within OW2. It is the cornerstone of the Service Oriented Architecture, which includes other famous OW2 projects like the workflow manager Bonita, the BPEL engine Orchestra or the portal eXo Platform.
  - JOnAS provides runtime support for Java EE-based service applications
  - We can adopt JOnAS clustering management and deployment technologies for services
Possible synergies with some OW2 project (3)

- With ProActive
  - ProActive features Java Parallel Programming seamlessly integrated with **Scheduling and Resource Management**. ProActive simplifies the programming and execution of parallel applications on Linux, Windows and Mac, together with the management of resources such as Desktop, Servers, Clusters, Enterprise GRIDs and Clouds.
  - Our service cloud platform focuses on PaaS and SaaS layers, thus ProActive can be leveraged to facilitate infrastructural resource management.
Thank you!

Q&A