GICTF Inter-cloud Interface Overview

July 25, 2012
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Global Inter-Cloud Technology Forum
*NEC Corporation
**Institute of Information Security
Overview

• Need for inter-cloud computing and networking
• GICTF overview
  – Related research project
• Inter-cloud interface overview
  – White paper
  – Information flows
  – Data model
• Standardization activities
  – Standardization in ITU-T
  – DMTF alliance
• Summary
Need for inter-cloud computing and networking

- Cloud service adoption in the field of Mission Critical Applications
  - National Administration
  - Medical Applications: EHR, PHR
  - Disaster Recovery Management

- Can “single cloud” solve severe requirements for mission critical applications?

⇒ Collaborative inter-cloud computing and networking are necessary
Lessons learned from Tohoku earthquake

*Flexibly reassigning resources among cloud providers and network providers on a global scale*

- Serious damage on ICT facilities in the disaster area
- Serious power shortage / rolling blackout in wide area of East Japan
Communication facilities were the worst affected

- Transmission lines: 90 routes were cut off
- 18 telco buildings were fully destroyed, and 23 buildings were flooded
- 65,000 telephone poles were destroyed by the flood
Case 1: Migrate lifeline services by accommodating cloud resources among cloud/network providers when disaster or massive breakdown occurs.

Case 2: Cloud providers re-assign their cloud resources in line with social importance, e.g. from amusement services to lifeline services, when necessary.
GICTF OVERVIEW
Mission

- Promotes the global open inter-cloud technologies and standardization through collaboration among academia, government and industry.

Cloud system A

Cloud system B

Applications

Standard “inter-cloud” interface

Application

Network

Virtualized Network on New Generation Network / Future Internet.
Activity summary

• Main activities:
  – Identify technical needs for secure “inter-cloud technology”
  – Raise awareness of users both in industry, government and communities

• Membership (as of July 2012)
  – 86 enterprises, 38 national laboratories and universities in Japan
  – Observer: MIC*, METI**

• Standardization/alliance partners
  – ITU-T SG13 (since January 2012)
  – DMTF (since June 2012)

*MIC: Ministry of Internal affair and Communication
**METI: Ministry of Economy, Trade and Industry
1. Collect and share information with organizations and at conferences related to cloud computing
2. Identify technical needs related to secure cloud interworking applicable to e-Government, etc.
3. Develop a standard set of specifications applicable to e-Government, etc. and propose it to relevant standards bodies
Major deliverables

• “Use case and functional requirements for Inter-Cloud Computing” E/Aug 2010

• “Inter-Cloud interface specification on protocols” J/Dec 2011, E/Apr 2012

• “Inter-Cloud interface specification on resources data model for network control” J/Dec 2011, E/Apr 2012

• “Network and technical requirements in support of Inter-Cloud” J/Dec 2011 E/Apr 2012
Related research project: Highly Reliable Inter-Cloud Systems*

*Funded by MIC

Cloud Resource Provisioning

Cloud Resource Federation and Reconfiguration

Dynamically Reconfigurable NW based on Open Flow

Real-time Sensor Node

Application

Server Storage

Network

Physical World

Sensor Node

Open Flow

Cloud System A

Cloud System B

GICTF

AP AP AP

Physical World

Real-time Sensor Node

Open Flow

Network

Sensor Node

Cloud System

Application

Server Storage
Inter-cloud interface design

Service provision requirements

Provisioning

Resource plan

Monitoring and control

Finding available resources

Policy negotiation

Resource reservation request

Dynamic reconfiguration of the server environment

Flexible resource allocation / reconfiguration

Servers and storages

Dynamic reconfiguration of the network environment

Network configuration / optimization

Intranet

Network

Monitoring and control

Inter-cloud monitoring and negotiation control

Monitoring and control

Policy negotiation

Resource reservation request

Finding available resources

Dynamic reconfiguration of the server environment

Flexible resource allocation / reconfiguration

Servers and storages

Dynamic reconfiguration of the network environment

Network configuration / optimization

Intranet
Inter-cloud interface and control mechanisms

Server control function

Inter-cloud control function

Resource allocation based on individual situations

Server allocation in heterogeneous clouds

Disaster

Inter-cloud disaster recovery

Increase of service demand

Inter-cloud scale-out

Cloud provider A

Cloud provider B

Cloud provider M

Cloud provider N

Backbone network

Backbone network

Backbone network

Backbone network

Network control function

On-demand development of overlay networks between clouds

Inter-cloud interface (ITU-T standardization promoted)

Access network

Switching

Cloud user
Use Cases and Functional Requirements for Inter-Cloud Computing

August 9, 2010

Contents

- Use cases of inter-cloud computing
- Procedures in use cases of inter-cloud computing
- Functional requirements for inter-cloud computing
- Functional structure and interfaces of cloud systems in inter-cloud computing

Use case example: disaster recovery

Discovering available cloud resources among clouds in other areas, then *dynamically* rebuilding cloud services in the event of a disaster or a large-scale failure.
Definition of Inter-cloud Interface

• The interface between two cloud systems administered by different operators

• Three layer model
  – Lower layer protocol: assumed as some XML message exchange, e.g., REST or SOAP
  – Inter-cloud protocol: Information flows, message semantics with associated parameters specified
  – Data models for network resources specified
  – Data models for computing and storage referenced to other SDO’s specifications
Information flow

• Definition of three resource states
  – unused, reserved, used

• Information flows between cloud providers
  – Notification of system activation and being ready
  – Resource discovery, reservation, usage monitoring, activation, and release
  – Data synchronization between cloud providers and delegation of the control

• Messages to be exchanged with their parameters
### Inter-cloud message examples

<table>
<thead>
<tr>
<th>Message Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICS Startup Notice</strong></td>
<td>Cloud A informs its partner (Cloud B) of its inter-cloud service start-up.</td>
</tr>
<tr>
<td><strong>Resource Information</strong></td>
<td>Cloud A requests available resource information to Cloud B.</td>
</tr>
<tr>
<td><strong>Resource Reservation</strong></td>
<td>Cloud A reserves Cloud B resources from derived resource information.</td>
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<tr>
<td><strong>Resource Reservation Cancellation</strong></td>
<td>Cloud A cancels the reservation of Cloud B resources.</td>
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<tr>
<td><strong>Resource Securing</strong></td>
<td>Cloud A secures Cloud B resources.</td>
</tr>
<tr>
<td><strong>Resource Monitoring</strong></td>
<td>Cloud A monitors the resource control status of Cloud B.</td>
</tr>
<tr>
<td><strong>Resource Switchover</strong></td>
<td>Cloud A requests resource switchover to Cloud B.</td>
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<tr>
<td><strong>Resource Switchover Preparation</strong></td>
<td>Cloud A requests resource switchover preparation to Cloud B.</td>
</tr>
<tr>
<td><strong>Resource Release</strong></td>
<td>Cloud A requests resource release to Cloud B.</td>
</tr>
</tbody>
</table>
Information flow example for resource reservation

Resource reservation

Cloud System A

Cloud System B

Network Resource

Data Center Resource

Resource Reservation Request

NW Resource Reservation Request

Server Resource Reservation Request

Resource Reservation

NW Resource Reservation Response

Server Resource Reservation Response

Messages

Resource Reservation Request

Resource Reservation Response

Parameters

- Request ID
- Cloud system A attributes
  - System name, URL, Provider ID, System configuration
- Cloud system B attributes
- Information for resources to be reserved
  - . . .
Data model

- Network resource model
  - Three-type network resources:
    - Network
    - Network Provider
    - User
  - Definition of classes and example descriptions in XML
STANDARDIZATION ACTIVITIES
Our target is an environment in which there are more than 10 distributed clouds, each consisting of several hundreds of applications and several thousands of virtual servers.
Inter-cloud related SDOs

DE-facto Standard
- OGF
- OMG
- Cloud Interoperability Roadmaps Session

De-jure Standard
- ITU-T SG13
- CC Standard Study Group
- ISO/IEC JTC SC38

Open Source Community
- OpenStack

Cloud Business
- Google, Salesforce, Amazon, etc.

US Government
- NIST CC forum

OGF - Europe
- SLG – Special Liaison Group member

DMTF

SNIA

Google, Salesforce, Amazon, etc. are examples of cloud businesses.
STANDARDIZATION IN ITU-T
Standardization process

- Outlines and key features of the GICTF White Paper was submitted to ITU-T FGCC and included in its deliverables.
- Y.ccic was organized in SG13 WP6, targeting to make a recommendation in 4Q of 2013.

<table>
<thead>
<tr>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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</table>

GICTF
- White Paper: “Use case and functional requirements”
- White Paper: “Inter-cloud Interface”
- White Paper: “Inter-cloud data-model”

ITU-T

FGCC: (Focus Group on Cloud Computing)
- Y.ccdef (Definition)
- Y.ccra (Reference Architecture)
- Y.cceco (ecosystem, etc.)
- Y.ccinfra (Infrastructure)
- Y.e2eccrmr (Resources Management)
- Y.ccic (Inter-cloud)
- Y.daas (DaaS)
Inter-cloud in Cloud Functional Architecture

User Layer
- End-User Function
- Partner Function
- Administrator Function

Access Layer
- Endpoint Function
- Inter Cloud Function

Services Layer
- SaaS / CaaS
- PaaS
- IaaS
- NaaS

Resources & Network Layer
- Resource Orchestration
  - Pooling & Virtualization
    - VN
    - VS
    - VM
  - Software & Platform Assets
  - Virtual Path Virtual Circuit
- Physical Resources
  - Intra Cloud Network
  - Storage
  - Computing
  - Core Transport Network
  - Inter Cloud Network

Cross-Layer Functions
- Operational Management Function
- Cloud Performance Function
- Security & Privacy Function
## SG13 WP6 discussion issues

<table>
<thead>
<tr>
<th>Priority</th>
<th>Rec.</th>
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<th>Short Title</th>
<th>Target for Consent</th>
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<tr>
<td>1</td>
<td>Y.ccdef</td>
<td>26</td>
<td>Cloud Computing Definition and Vocabulary</td>
<td>Q4 2013</td>
<td>Olivier Colas</td>
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<td>1</td>
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<td>Cloud Computing Reference Architecture</td>
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<td>Olivier LeGrand Mark Jeffrey</td>
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<td>Y.cceco</td>
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<td>Cloud computing: ecosystem, use cases, and general requirements</td>
<td>Q1 2013</td>
<td>Ying Chen</td>
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<td>Y.ccinfra</td>
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<td>Cloud Computing Infrastructure Functional requirements</td>
<td>Q1 2013</td>
<td>Yongshun Cai Emil Kowalczyk</td>
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<td>2</td>
<td>Y.e2eccrmr</td>
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<td>End to End Cloud Computing Resources Management Requirements</td>
<td>Q1 2013</td>
<td>Richard Brackney Yongxiang Wang</td>
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<td>3</td>
<td>Y.ccic</td>
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<td>Framework of Inter-cloud for Network and Infrastructure</td>
<td>Q4 2013</td>
<td>Naotaka Morita Weixiang Shao</td>
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<td>3</td>
<td>Y.daas</td>
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<td>Requirements and Architecture of Desktop as a Service</td>
<td></td>
<td>Myeong-Hoon Oh Aaron Zhang</td>
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Meeting schedules and working documents

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<tr>
<th>Year</th>
<th>4-6</th>
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<th>10-12</th>
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</tbody>
</table>

ISO/IEC JTC 1 SC38 WG3
- **May** (5/21-25) SC38 Berlin
- **Sept.** (9/24-28) SC38 Stockholm
- **April** (4/8-12) SC38 Madrid
- **Sept.** (9/xx) SC38 TBD

ITU-T SG13 WP6
- **April** (4/16-20) Cloud Qs Geneva
- **June** (6/4-15) SG13 Geneva
- **Oct.** (10/15-19) Cloud Qs, WS Geneva
- **Feb.** (2/18-3/1) SG13 Geneva
- **June** (6/xx) Cloud Qs, WS Geneva
- **Nov.** (11/4-15) SG13 Geneva

Cloud Collaborative Team

Working documents

【Group1】1) vocabulary and 2) architecture developed by two collaborative teams (CT) between ISO/IEC and ITU-T

【Group2】3) Y.cceco, 4) Y.ccinfra, 5) Y.e2eccrmr

【Group3】6) Y.ccic (cloud computing inter cloud) and 7) Y.DaaS
Current issues of Y.cccic

- **Use cases enhancement**
- Distinction between *cloud control* and *cloud management*, or clear definitions of them
- Model and terminology synchronization with ITU-T/ISO collaborative work
DMTF ALLIANCE
GICTF-DMTF alliance announced!

DMTF has announced that it is partnering with the Global Inter-Cloud Technology Forum (GICTF) to collaborate on the development and adoption of cloud management standards.

GICTF, organized with the approval of Ministry of Internal Affairs and Communications of Japan is a non-profit organization for development and standardization of cloud computing technologies and interfaces to achieve inter-cloud collaboration. DMTF has been working to develop and promote cloud standards, such as the Cloud Infrastructure Management Interface (CIMI) through their cloud management initiative, which includes contributions from various working groups.

Through this alliance partnership, the two organizations will collaborate on cloud standards development to coordinate their cloud model/terminology and their inter-cloud management use cases and resource models. Additionally, DMTF’s CIMI standard will serve as a good reference to connect GICTF’s inter-cloud interface to DMTF standards.

For more information on DMTF’s cloud work, visit http://dmff.org/cloud. For more information about GICTF, visit http://www.gicff.jp/index_e.html.
Issues to discuss

• Cloud management model/terminology
  – Cloud ecosystem, role and actor, etc.

• Inter-cloud management use cases and resource models:
  – Aligning with DMTF CIMI and other DMTF specifications

• Issues arising in SG13 WP6 discussions
  – E.g. Scope of cloud management model
Alliance benefits

• To GICTF
  – Accelerate ITU-T standardization by polishing the proposal technically sound and feasible

• To DMTF
  – Utilize inter-cloud use cases and models to enhance DMTF specifications

• To cloud communities
  – Promote inter-cloud related alliance in cloud SDOs and OSS communities
Summary

• Inter-cloud computing and networking are essential for achieving ‘lifeline’ or mission critical social services, and must be based on appropriate global standards.

• GICTF is a project-driven organization for the promotion and standardization of such inter-cloud interface and now working with ITU-T and DMTF.

• GICTF has been and will be contributing to inter-cloud technologies development and standardization, sharing the inter-cloud use cases and technologies with open alliance partners.
THANK YOU!