

# Inter-cloud computing: Use cases and requirements for Social Infrastructures

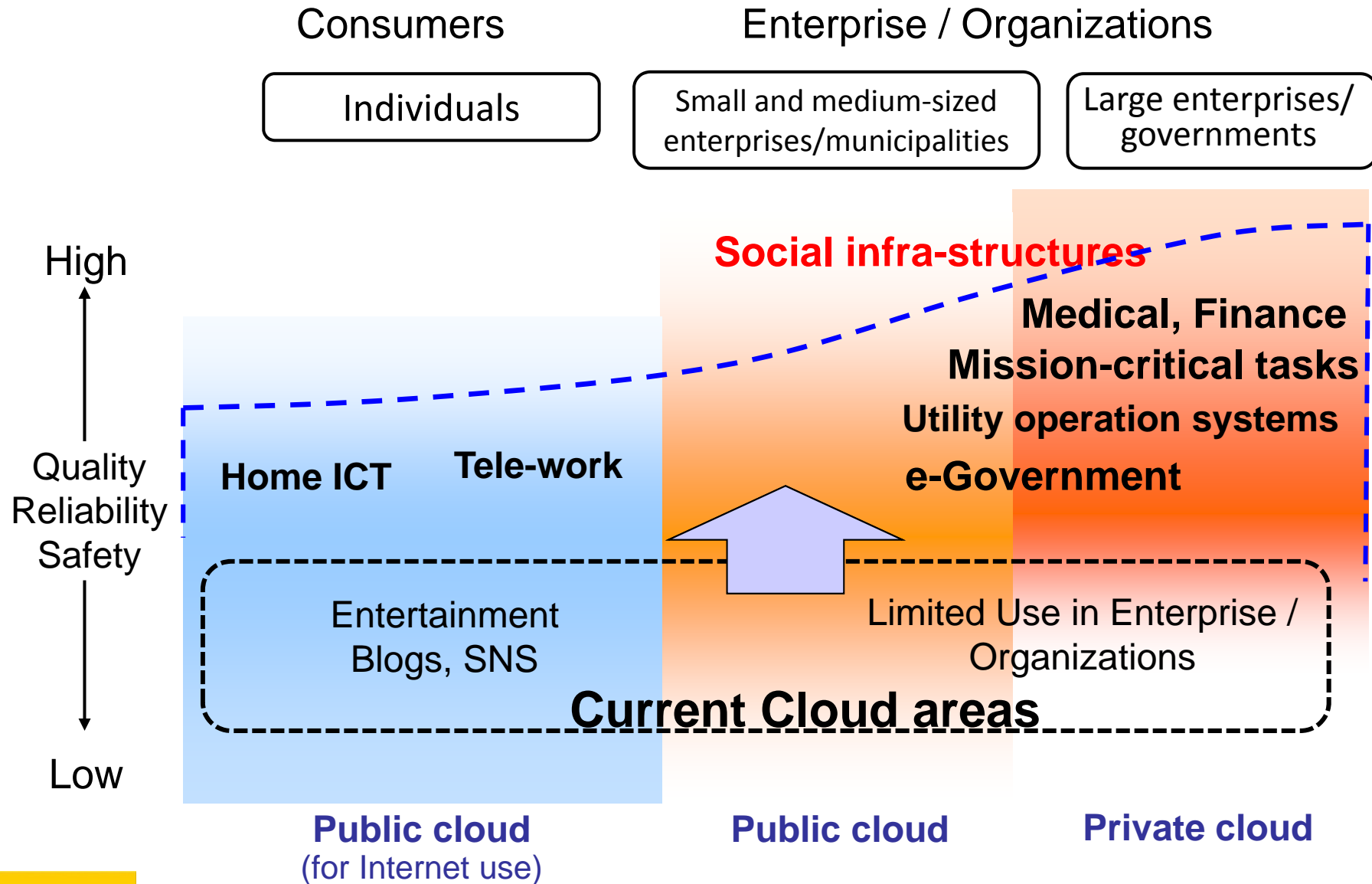
Feb 24, 2012

Global Inter-Cloud Technology Forum (GICTF)

Institute of Information Security (IISEC)

Atsuhiko Goto

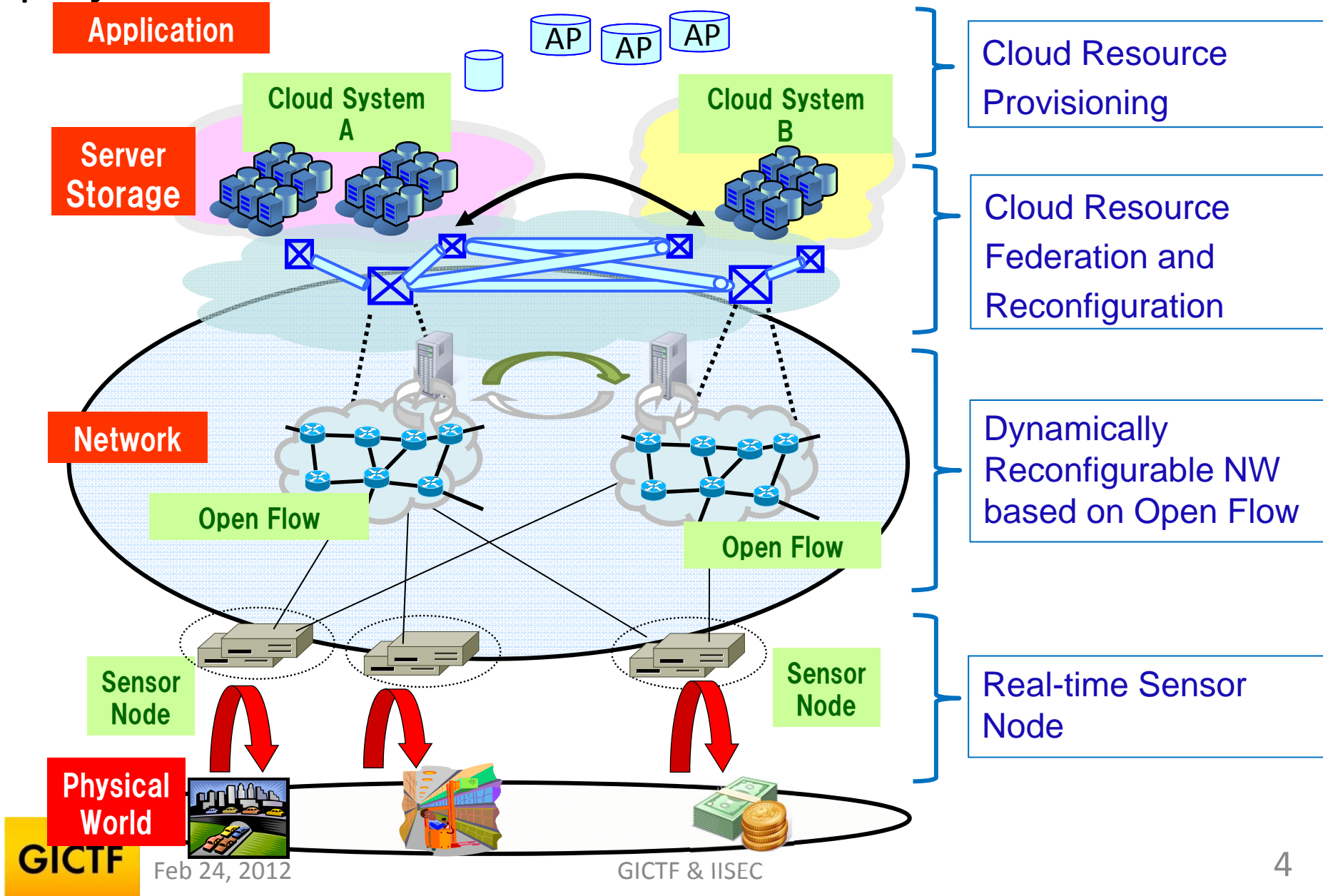
# Secure cloud computing is needed



- Highly Reliable ***Inter-Cloud*** Systems R&D project, a national project in Japan
- Global ***Inter-Cloud*** Technology Forum (GICTF)
- ***Inter-Cloud*** for secure “Lifeline Services”
  - Lessons learned from the East Japan Earthquake

# Highly Reliable Inter-Cloud Systems R&D

project funded by Japanese government <2009 - 2012: total 43M\$>



# Global Standardization of “Inter-Cloud”

## Global Inter-Cloud Technology Forum (GICTF)

### Main activities:

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

### Membership (as of December 2011)

- **80** enterprises, National laboratories, and academia
- Observer: MIC, METI

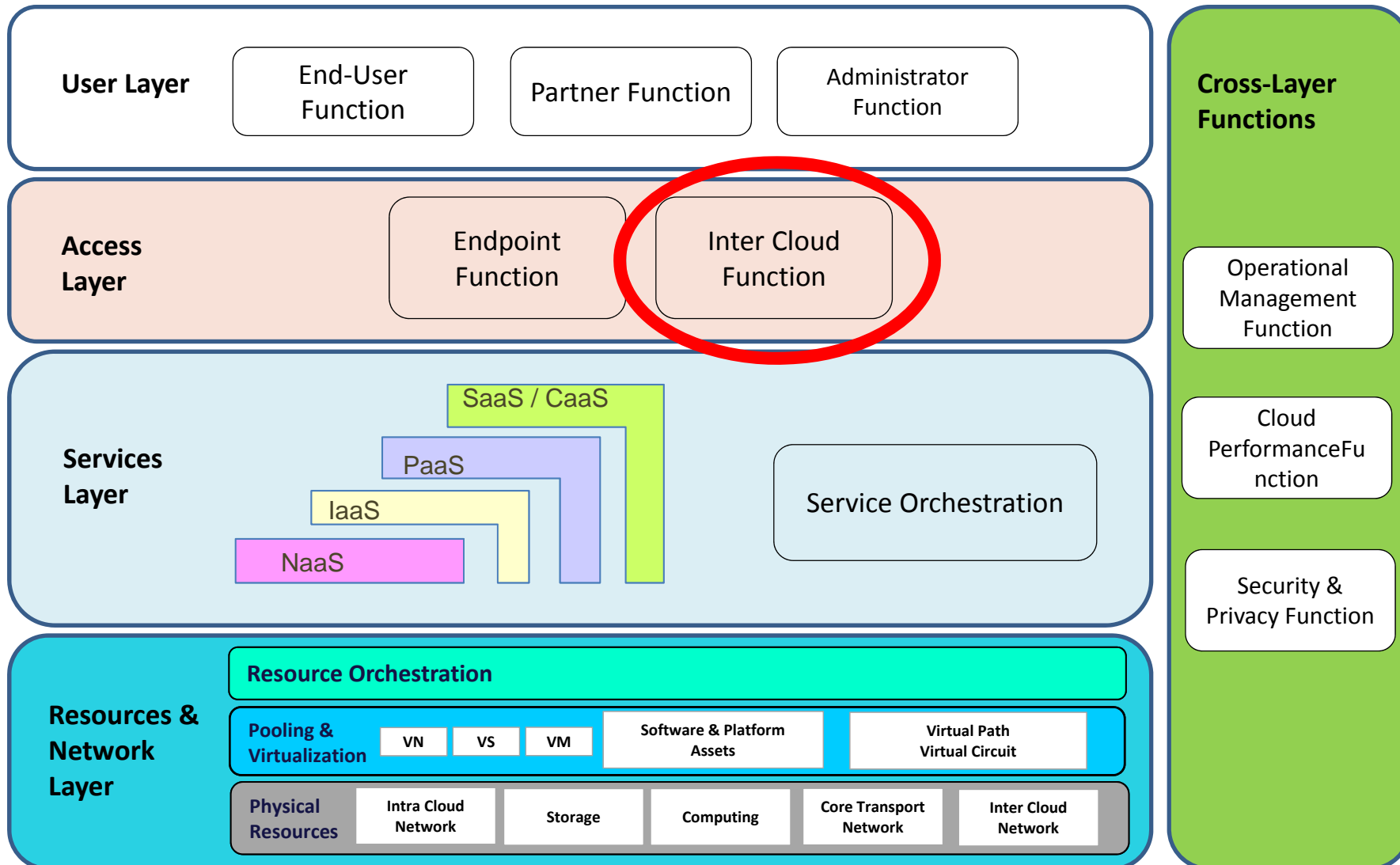


## ➤ Major Deliverables

- I. *“Use case and functional requirements for Inter-Cloud Computing”* E/Aug 2010 
  - II. *“Inter-Cloud interface specification on protocols”* J/Dec 2011, E/Mar 2012
  - III. *“Inter-Cloud interface specification on resources data model for network control”* J/Dec 2011, E/Mar 2012
  - IV. *“Network and technical requirements in support of Inter-Cloud”* J/Dec 2011 E/April 2012
- Promote international standardization of “inter-cloud” interface through **cooperation with standards bodies**

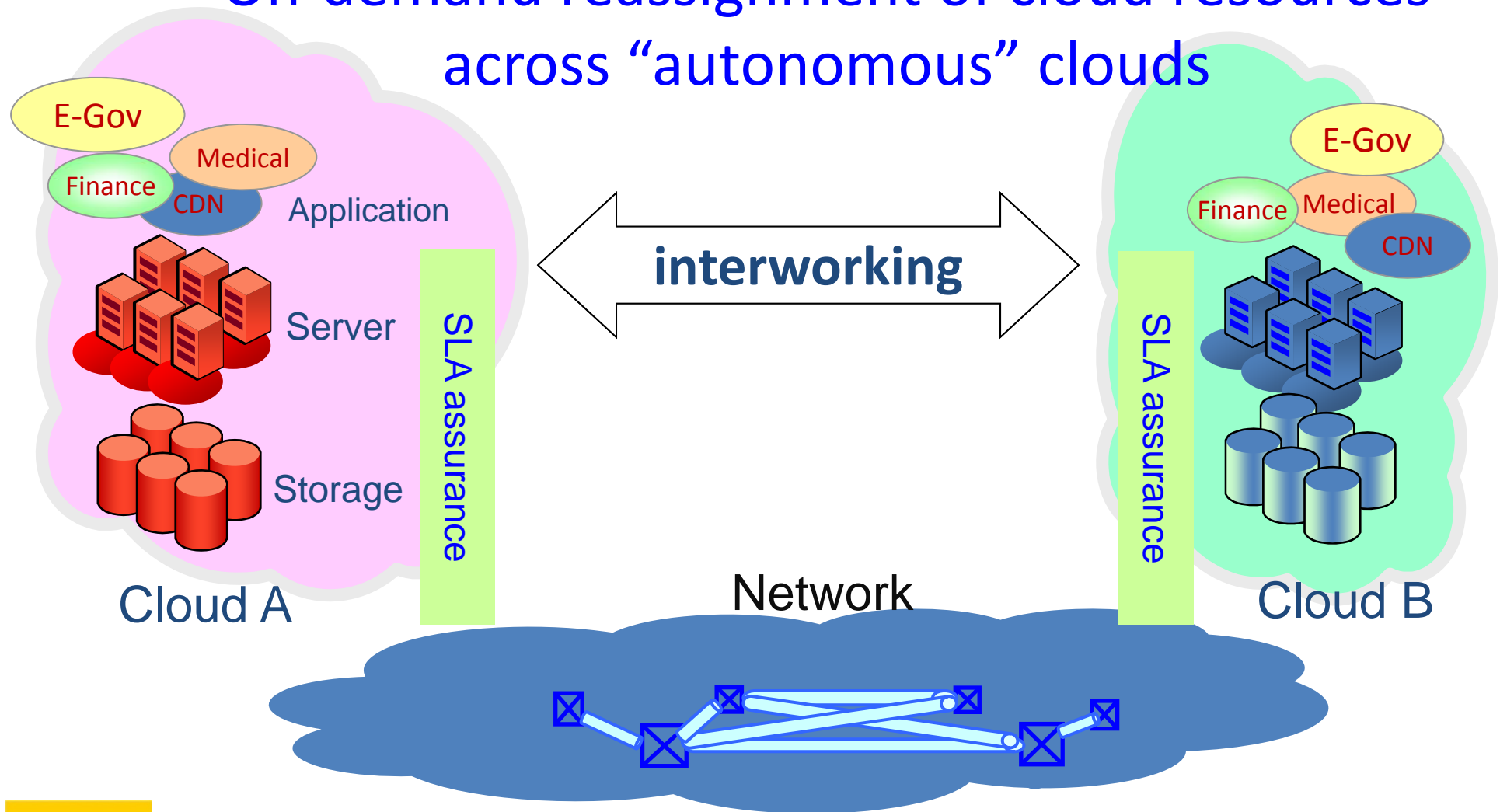
# Cloud Functional Architecture

First Cloud ICT architecture



# Inter-cloud Computing

On-demand reassignment of cloud resources  
across “autonomous” clouds

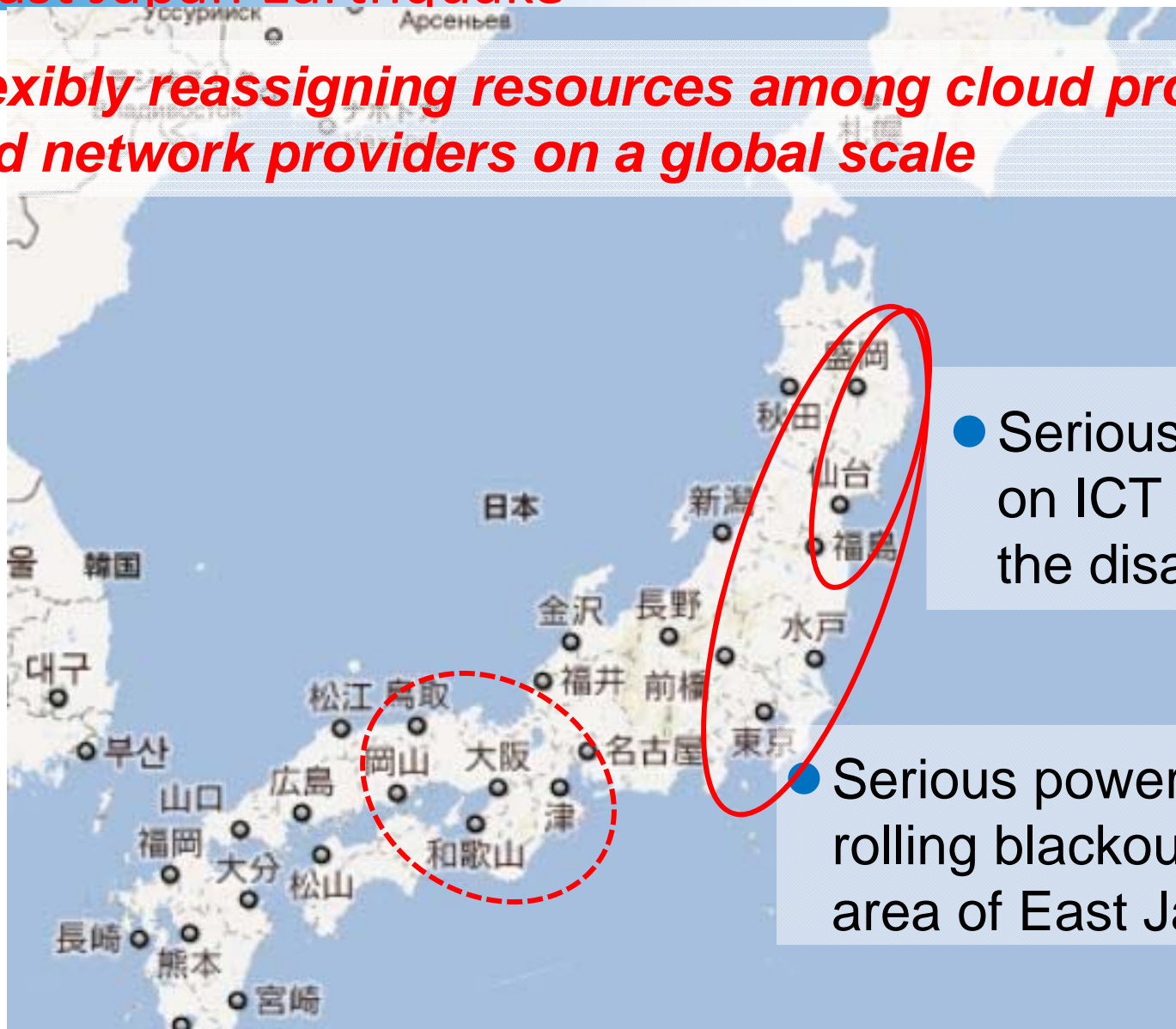




# Lessons learned :

## The East Japan Earthquake

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

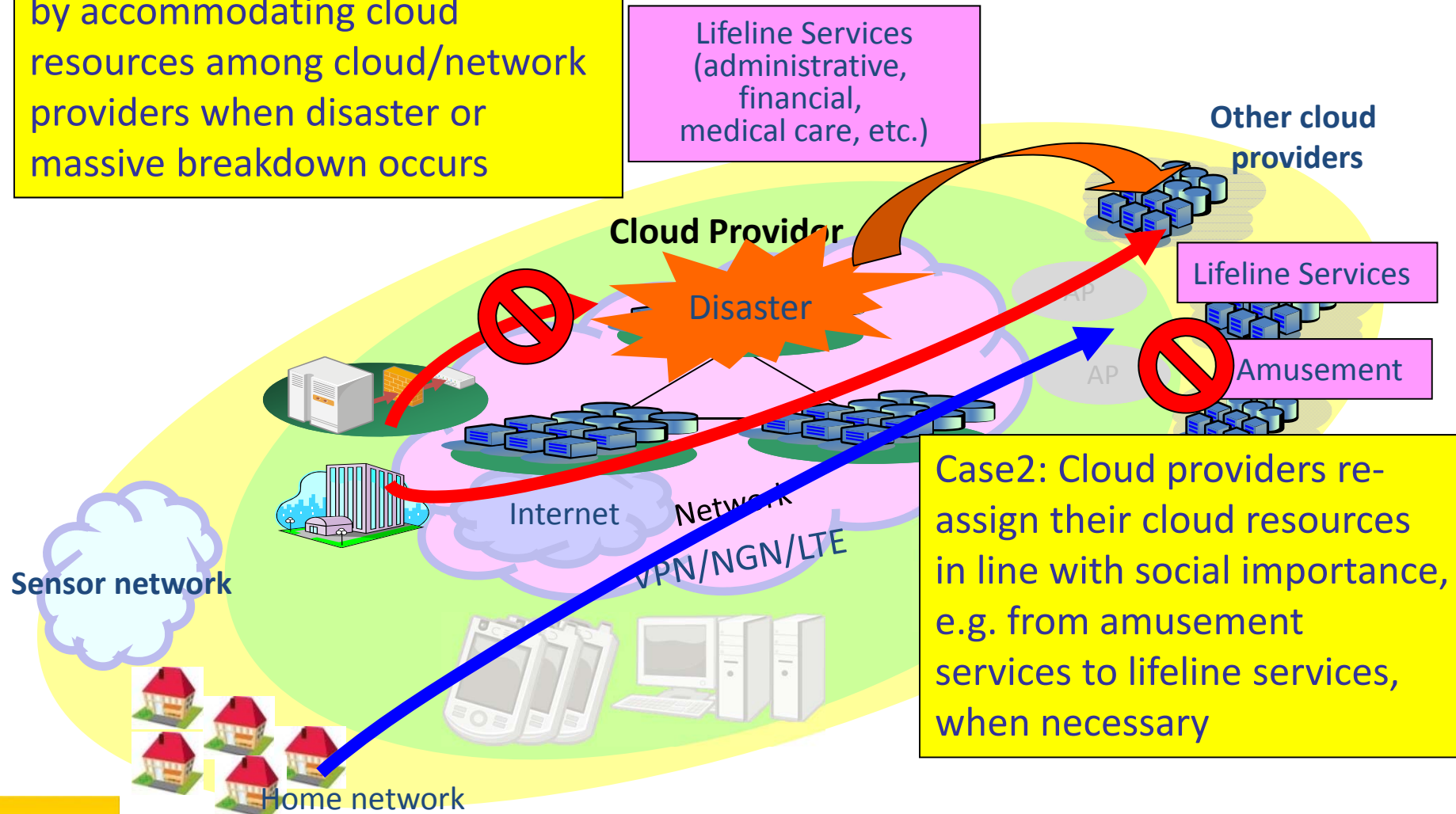


● Serious damage on ICT facilities in the disaster area

● Serious power shortage / rolling blackout in wide area of East Japan

# Secure Inter-Cloud for “Lifeline Services”

Case1: Migrate lifeline services by accommodating cloud resources among cloud/network providers when disaster or massive breakdown occurs



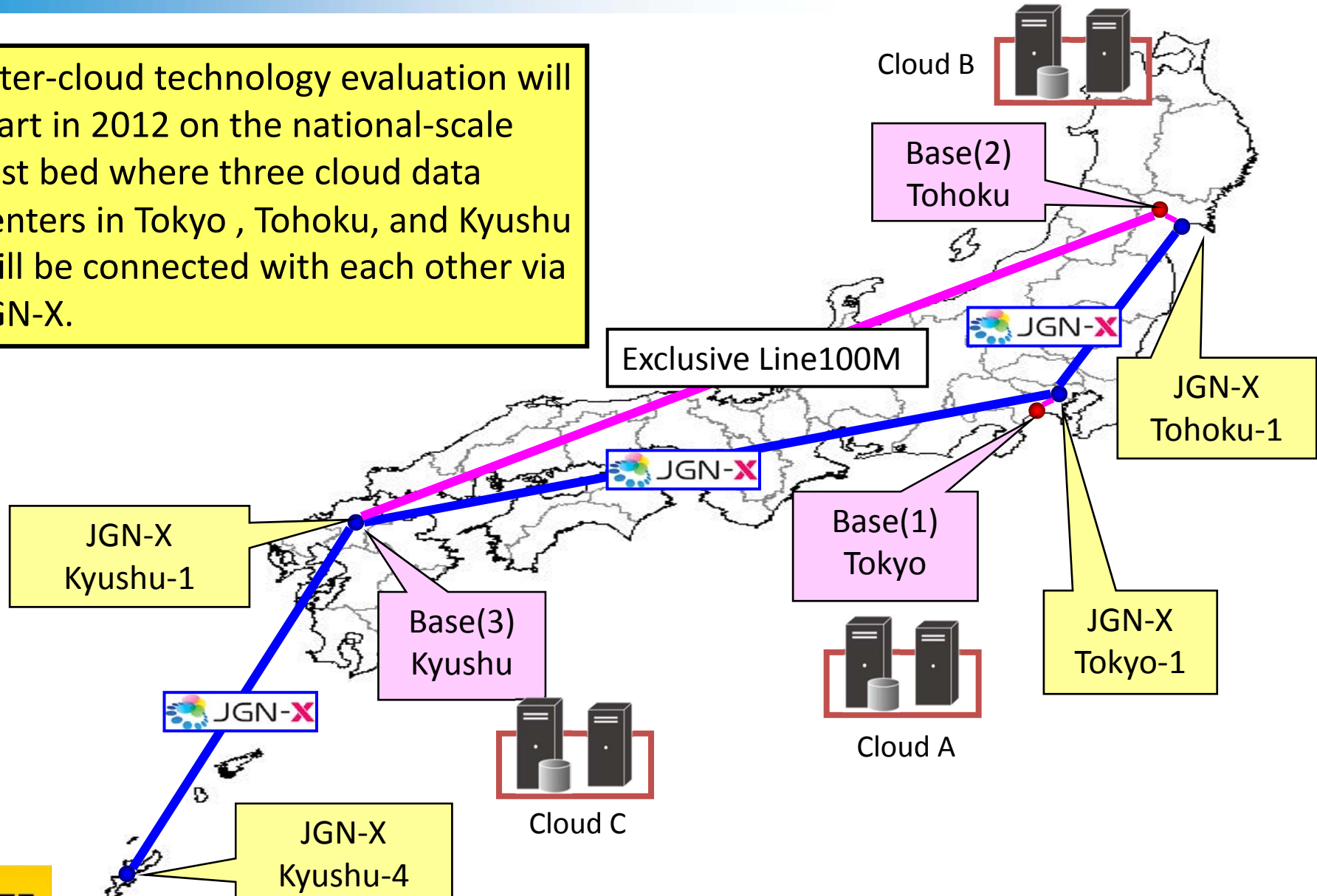
Case2: Cloud providers re-assign their cloud resources in line with social importance, e.g. from amusement services to lifeline services, when necessary

- The future social infrastructures based on cloud computing and networking systems must be based on appropriate global standards.
- GICTF has been and will be contributing to inter-cloud technologies development and standardization.
- Now, technology evaluation efforts are very important
  - By global collaboration projects with EU and other regions
  - By encouraging users to join the evaluation via GICTF Application TF and JCC.

# BACKUPS

# Inter-cloud test bed planned in 2012

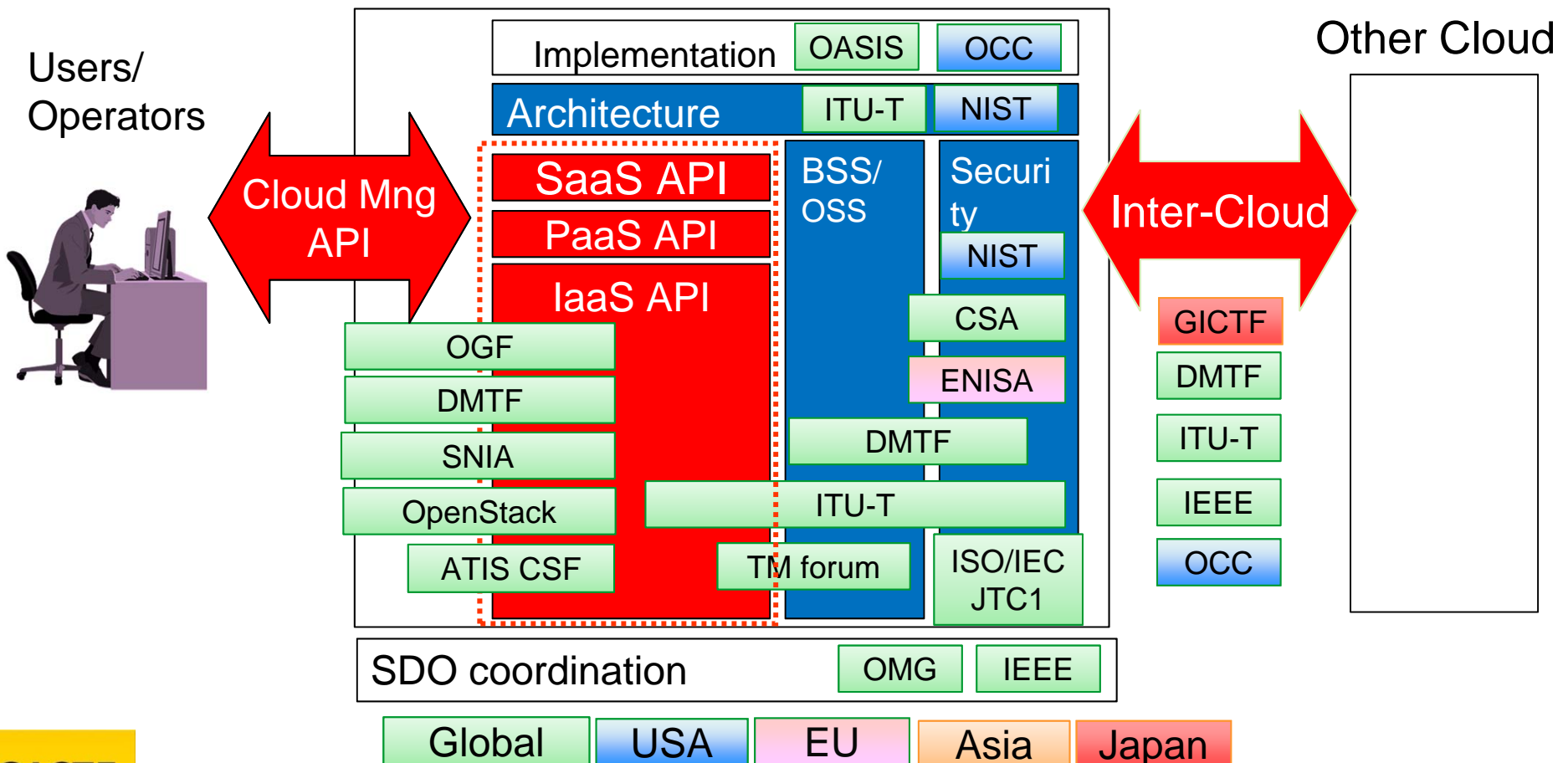
- Inter-cloud technology evaluation will start in 2012 on the national-scale test bed where three cloud data centers in Tokyo, Tohoku, and Kyushu will be connected with each other via JGN-X.



# Cloud Standardization Status

|  |                      |       |      |     |       |
|--|----------------------|-------|------|-----|-------|
| Taxonomy, Use cases, SLA, Requirements |                      |       |      |     |       |
| NIST                                   | ISO/IEC JTC1         | ETSI  | KCSA | CCF | GICTF |
| ITU-T                                  | Open Cloud Manifesto | SIENA | OGC  | CBA |       |

## Cloud



# GICTF Organization

General Assembly

Chair: Tomonori Aoyama  
V.Chair: Atsuhiko Goto

Board of Directors

Technology Task Force

1. **Exchange and share information** with relevant standards bodies, academia and communities
2. **Identify technical needs** related to secure inter-cloud technology applicable to e-Government, etc.
3. **Develop a standard set** of specifications applicable to e-Government, etc. and propose it to relevant standards bodies

Application Task Force

1. **Identify technical needs** related to secure inter-cloud technology
2. **Promote widespread use** of inter-cloud computing technology

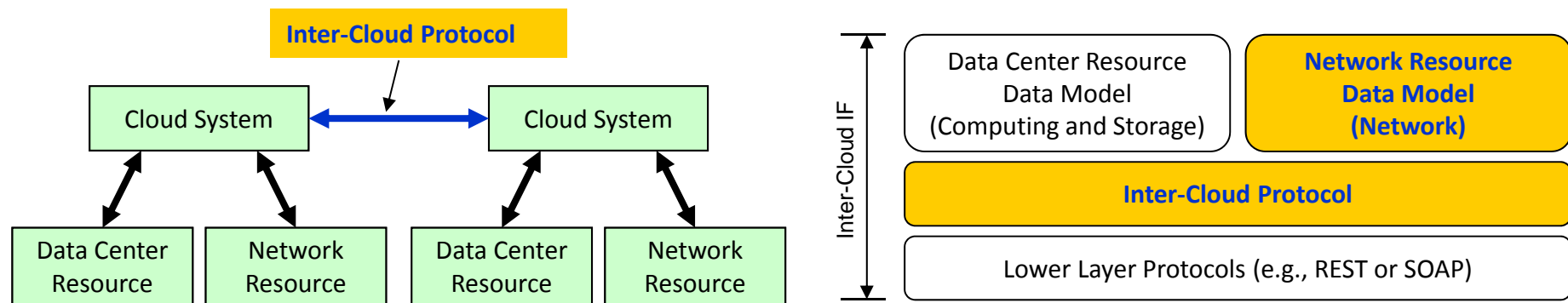
# Four white papers produced by GICTF

1. Use cases and functional requirements for inter-cloud computing, Aug 2010.
  - Six use cases and requirements
2. Network and technical requirements in support of inter-cloud, Apr. 2012.
  - Detailed study on required network functionalities in three timeframes
3. Inter-cloud interface specification on protocols, Mar. 2012.
  - Information flows between two cloud operators
4. Inter-cloud interface specification on resources data model for network control, Mar. 2012.
  - Data semantics between two cloud operators



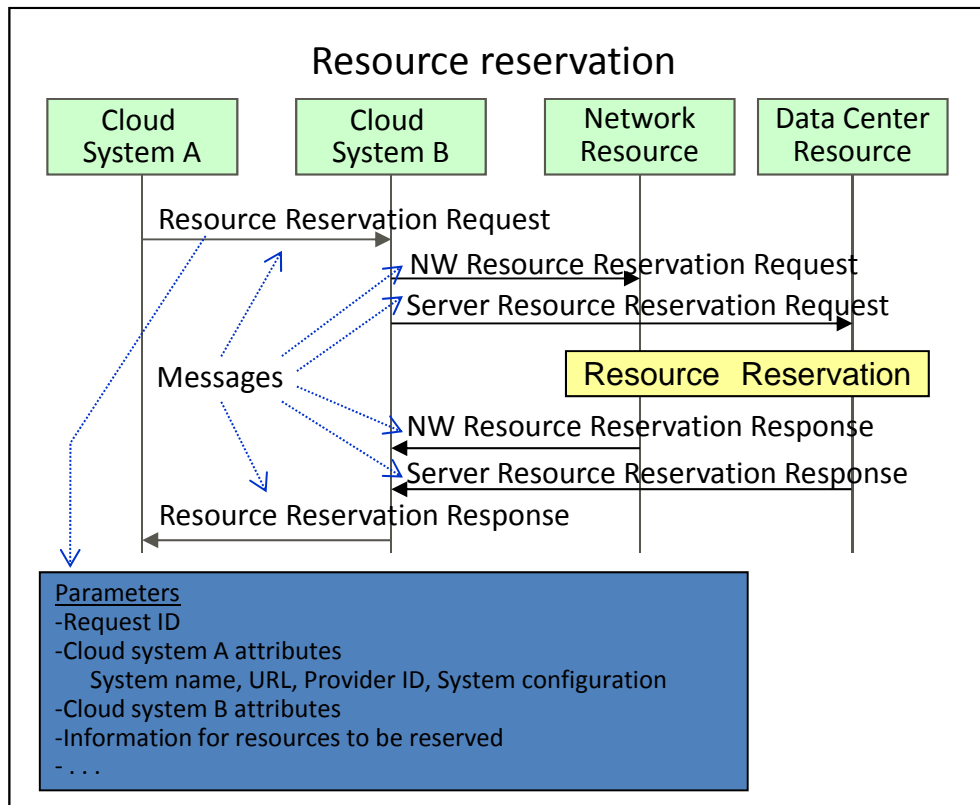
# Framework of Inter-cloud Interface Specification

- The interface between two cloud systems administered by different operators
- Three layer modeling
  - Lower layer protocols 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

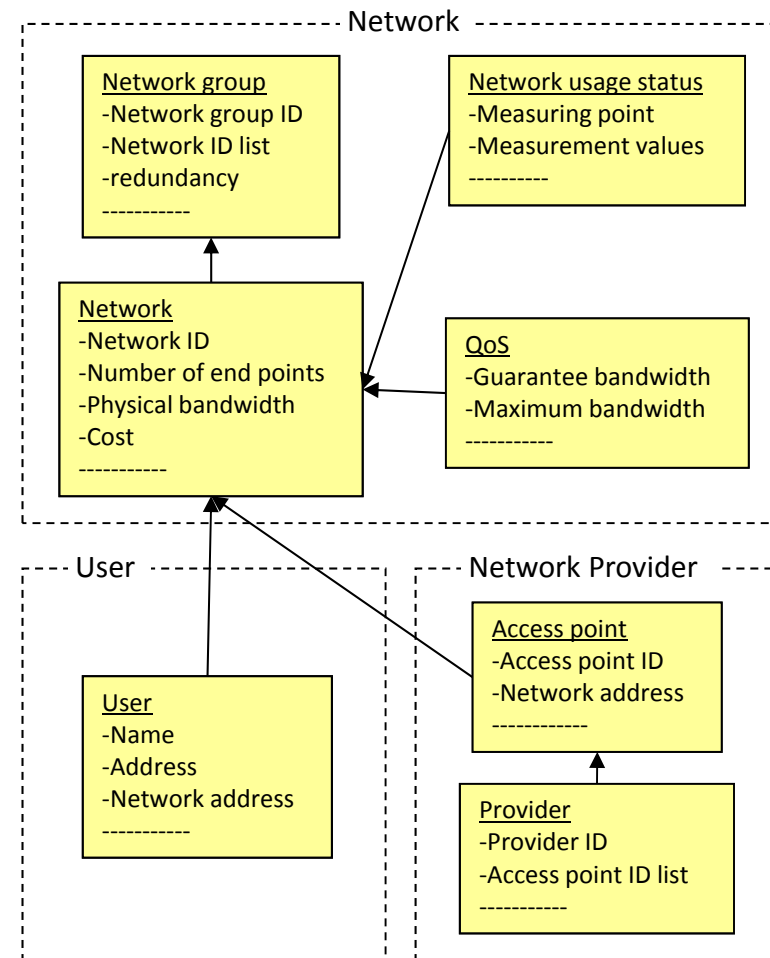


# Examples of information flow and data model

- Information flows
  - Definition of three resource states. i.e., unused, reserved, and 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



- Resource data model
  - Three-type network resources: network, provider, and user
  - Definition of classes and example descriptions in XML



# Results of ITU-T FG cloud computing

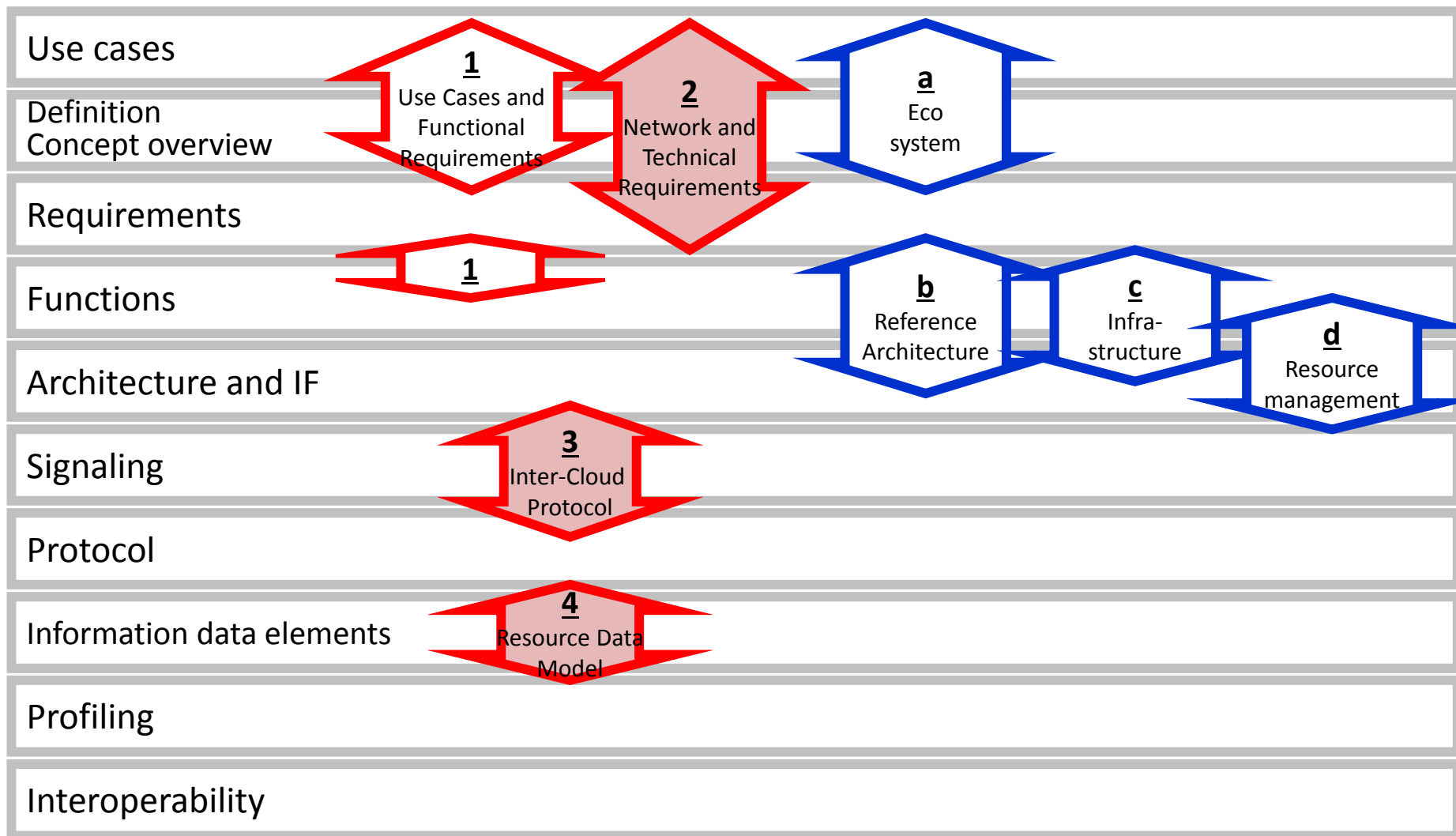
- Seven deliverables produced by two-year activities and eight meetings
- Potential drafts for Recommendations provided: Ecosystems, Reference Architecture, Infrastructure, and Security
- Identification of study items in the final FG-Cloud report including Inter-Cloud stating that “Procedures and interfaces are required for...”
- Nomination of SG13 as the lead Study Group in ITU-T cloud computing
- Joint Coordination Activity (JCA) to be established, which should coordinate cloud computing studies with SDOs beyond ITU-T

|   | Deliverable  | Target SG | Contents  |
|---|--|-----------|---|
| a | Introduction to the cloud <b>ecosystem</b> : definitions, taxonomies, use cases, and high level requirements | SG13      | Definitions, actors and roles, use cases, and high level requirements<br>NOTE: Intercloud aspect has been incorporated in use cases, high-level requirements, and scenarios |
| b | Functional Requirements and <b>Reference Architecture</b>  | SG13      | Layers and their functions.<br>NOTE: Access layer contains Inter-Cloud function.  |
| c | Requirements and framework architecture of <b>cloud infrastructure</b>                                       | SG13      | Lower network parts<br>NOTE: Functional requirements includes functional requirements for the inter-cloud network   |
| d | Cloud <b>Resource Management</b> Gap Analysis  | SG13      | Gap analysis on resource management   |
| e | Cloud Security   | SG17      | Security considerations and current practices   |

# Comparison between four GICTF white papers and four FG Cloud deliverables

## GICTF 4 White Papers

## FG Cloud Main 4 Deliverables



# Japan Cloud Consortium

The private organization of a “Japan Cloud Consortium” is established to promote the dissemination/development of cloud services in Japan in an industry-academia-government collaboration of various industries, organizations, and businesses.

## Japan Cloud Consortium

●Members  
Total 378

(including  
Enterprises 307,  
Organizations, 59,  
Experts 12)  
(Dec, 2011)

General meeting (About twice a year)

Secretarial Board  
(a secretariat consisting of Nippon Keidanren and  
several other enterprises/organizations)

WG

WG

WG

WG

...

NICT

IPA

ASPIC

JDCC

GICTF

GIPC

OSS-C

...

Related  
organiza-  
tions

# Communication facilities were the worst affected

- Transmission lines: 90 routes were cut off
- 18 buildings were fully destroyed, and 23 buildings were flooded
- 65000 telephone poles were destroyed by the flood

