Networking and Cloud Computing to Handle Big Data

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Drastic change of the ICT background occurred in 2011

Big Data expanding

1.8 Zetta (10^{21}) Byte generated in 2011

Explosion of smart phones and SNS services

488 Million Smartphones

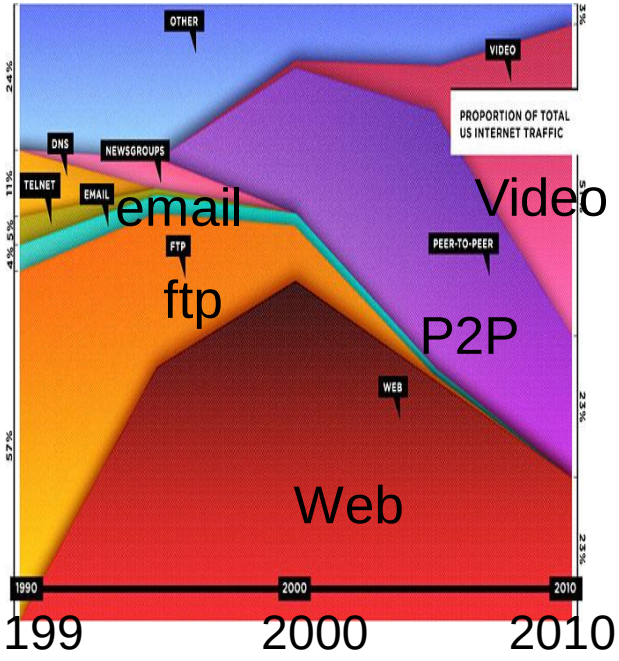
> 415 Million (PCs + Tablets) in 2011

Great East Japan Earthquake

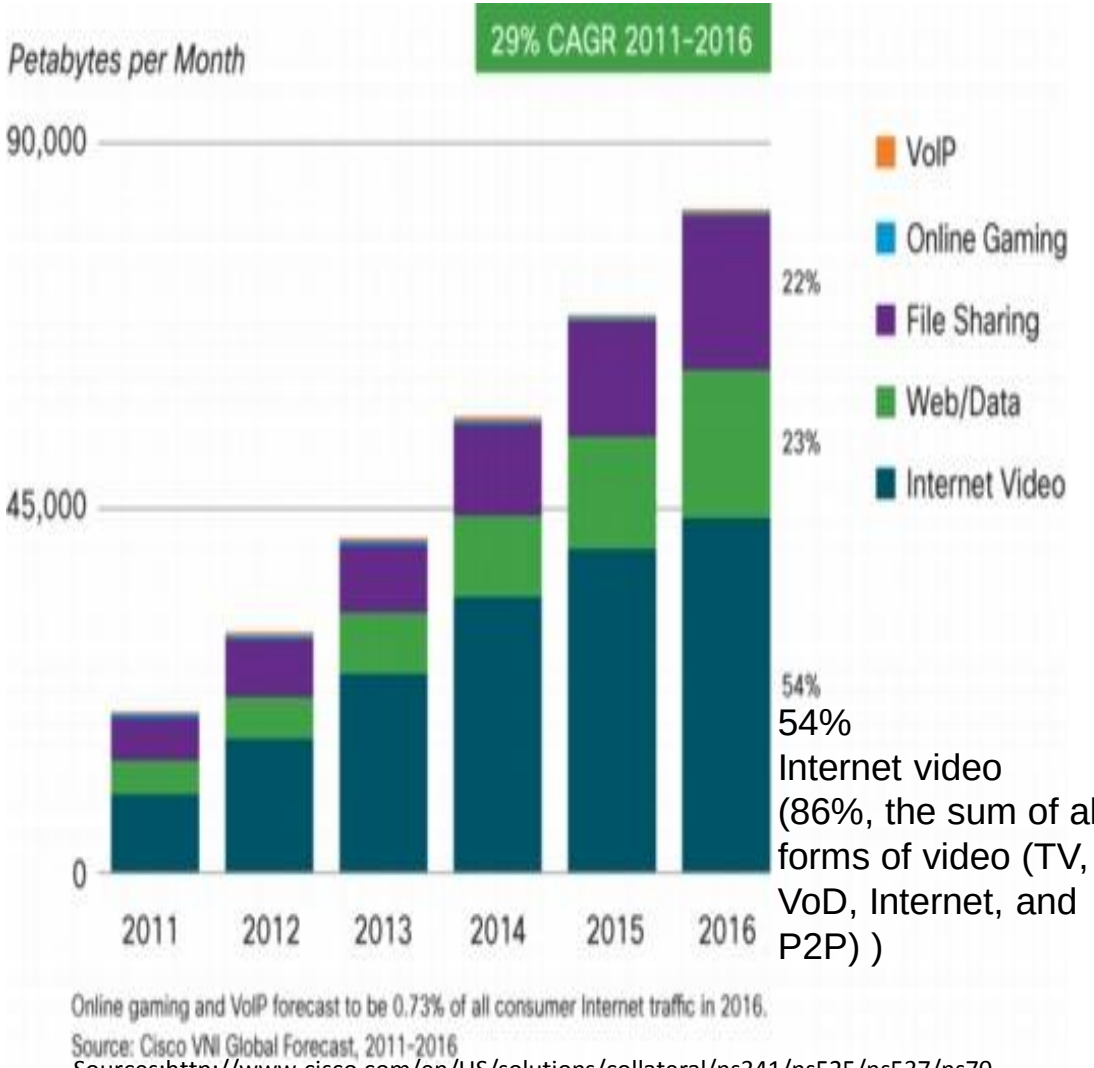
Recognition of importance for reliable networks, cloud services and electric power supply

Evolution of Big Data

Annual global IP traffic will pass the zettabyte threshold by the end of 2016, Internet Video Will Drive Most Consumer Internet Traffic Through 2016



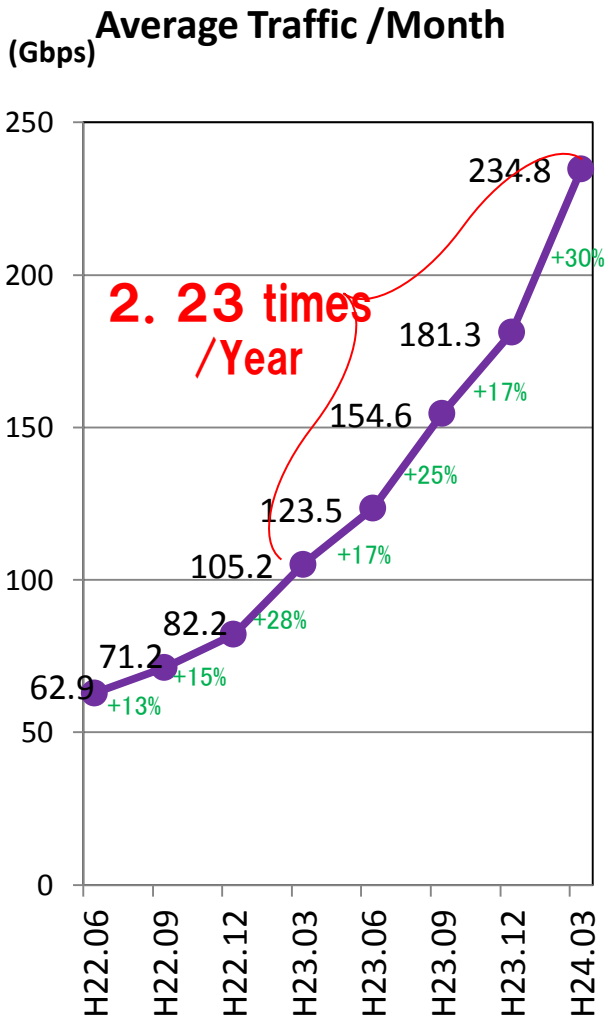
Sources: http://www.wired.com/magazine/2010/08/ff_webrip/
Cisco estimates based on CAIDA publications, Andrew Odlyzko

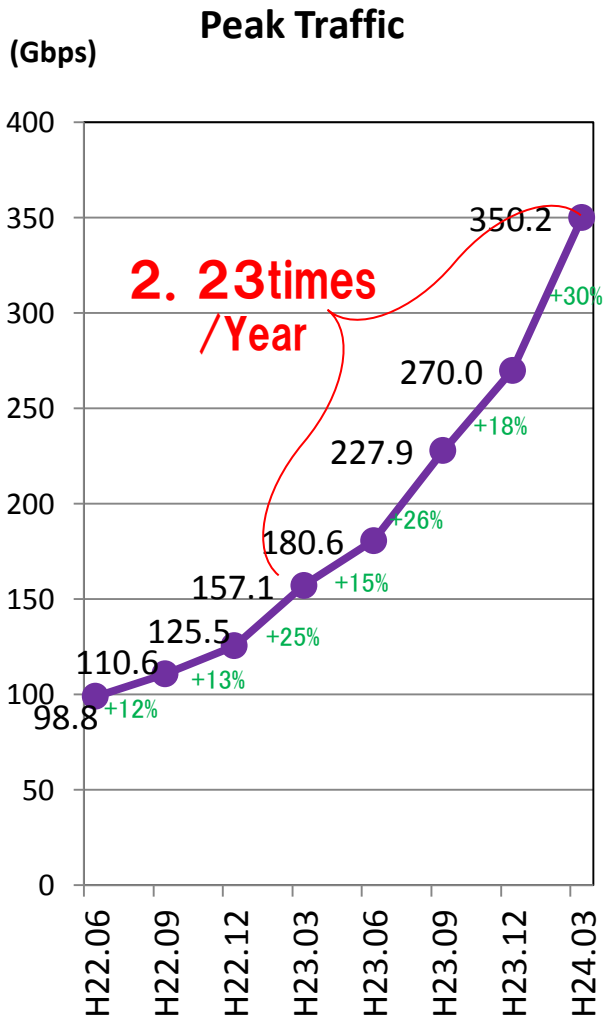


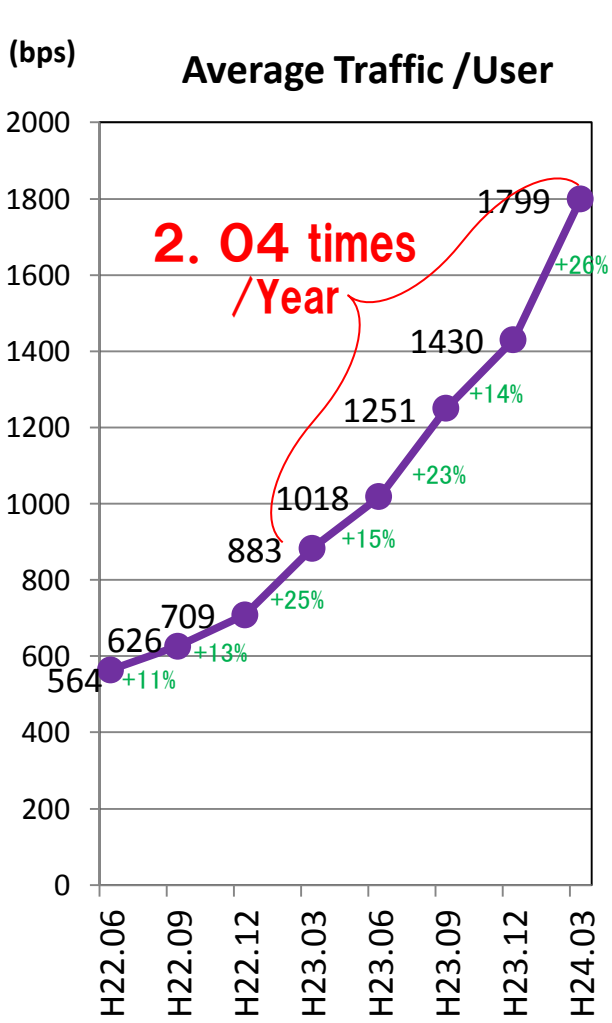
54% Internet video (86%, the sum of all forms of video (TV, VoD, Internet, and P2P))

Sources:http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/VNI_Hyperconnectivity_WP.html

Expansion of Mobile Traffic in Japan







〇年間約2．2倍のペースで移動通信トラヒックは増加している。

〇平成23年以降は、平成22年に比べ、より急激にトラヒックが増加している。

（各社のスマートフォン利用者数の増加や、動画等の大容量コンテンツの利用増加等が主要因と推測される。）

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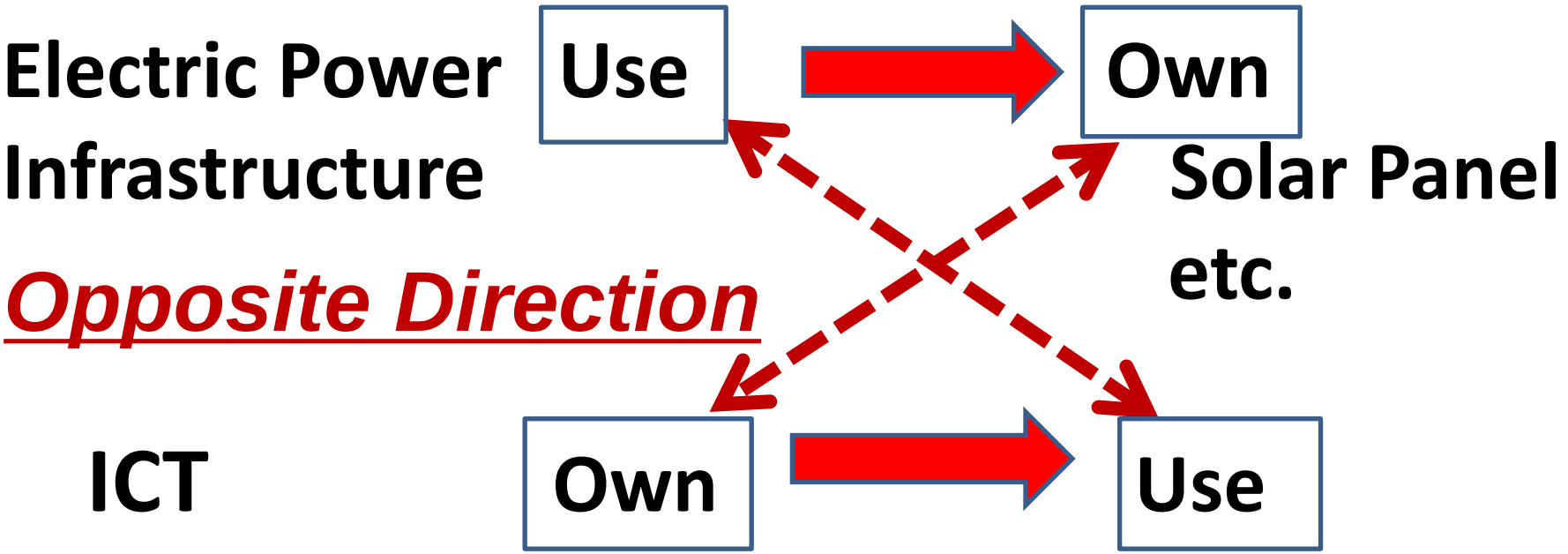
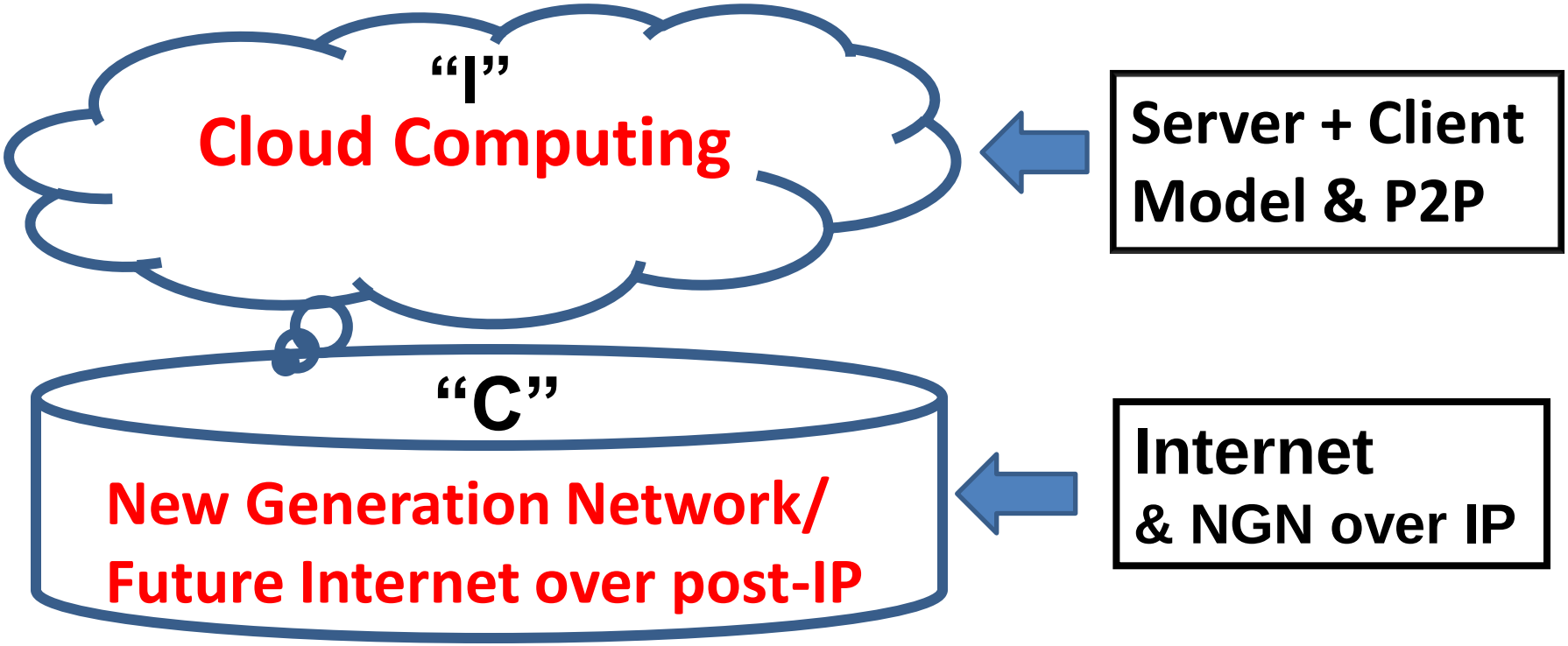
East Japan Great Earthquake accelerates the paradigm shift in social infrastructures

“ Smart Grid”

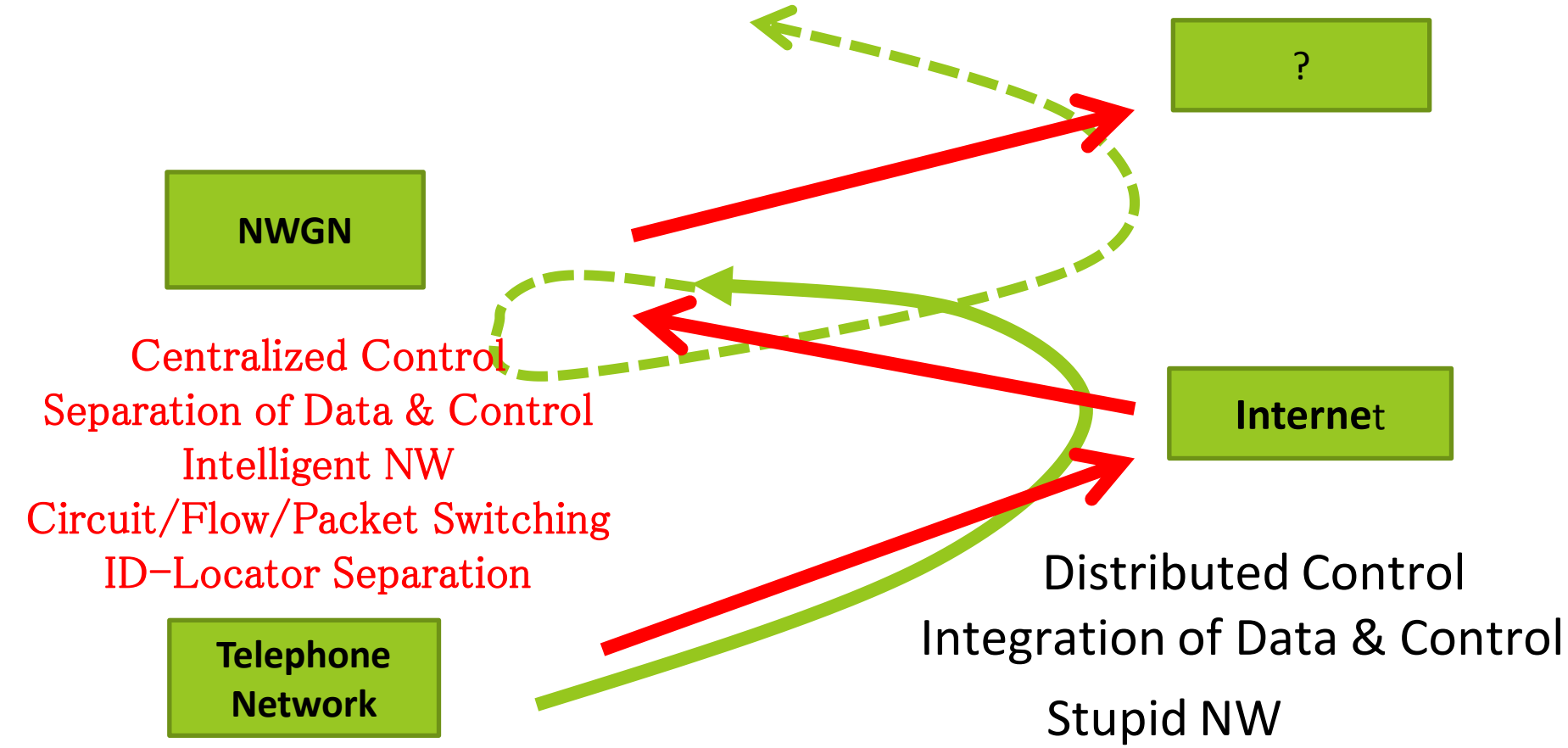


“Cloud Computing”

Both “I” and “C” will make the Paradigm Shift !



Spiral Progress of Networking Technology



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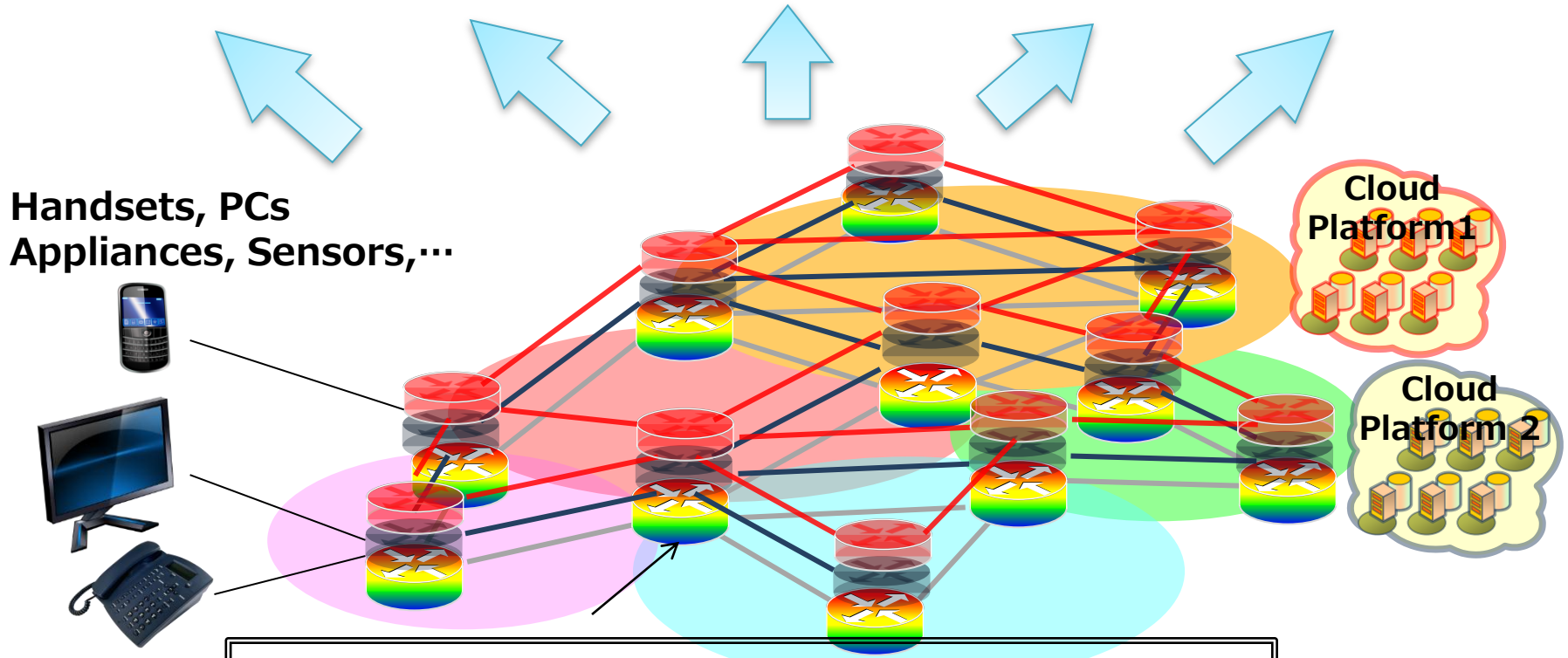
Network Virtualization Concept

SDN: Software Defined Network

Slice 1 **Slice 2** **Slice N**

Cache Oriented NW | Sensor Processing NW | Cloud Access NW | ID/Loc NW | Content Oriented NW | TV Broadcast NW | Legacy NW | Future NW

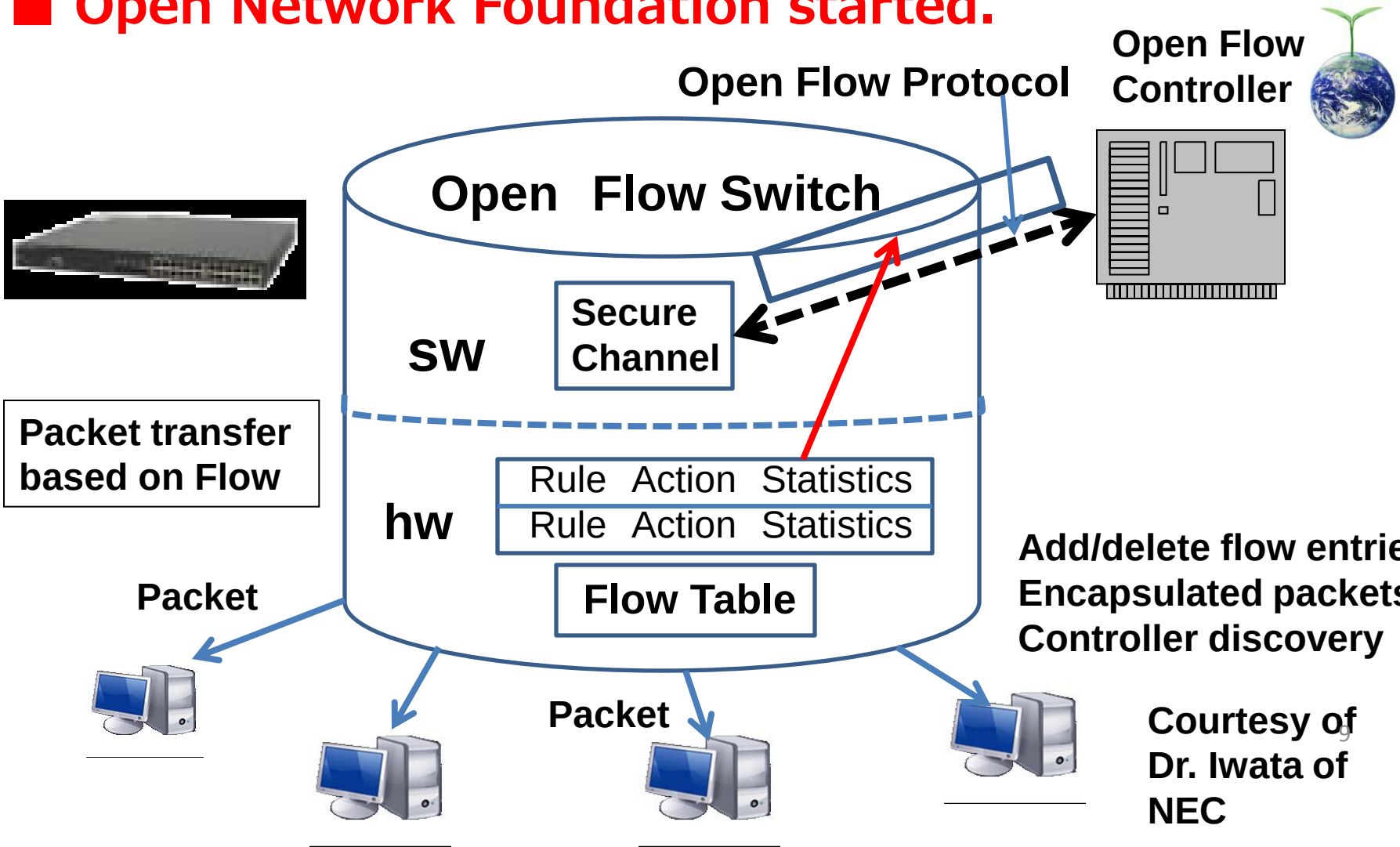
“Slices” accommodate diverse NWs for applications



Network Virtualization Infrastructure

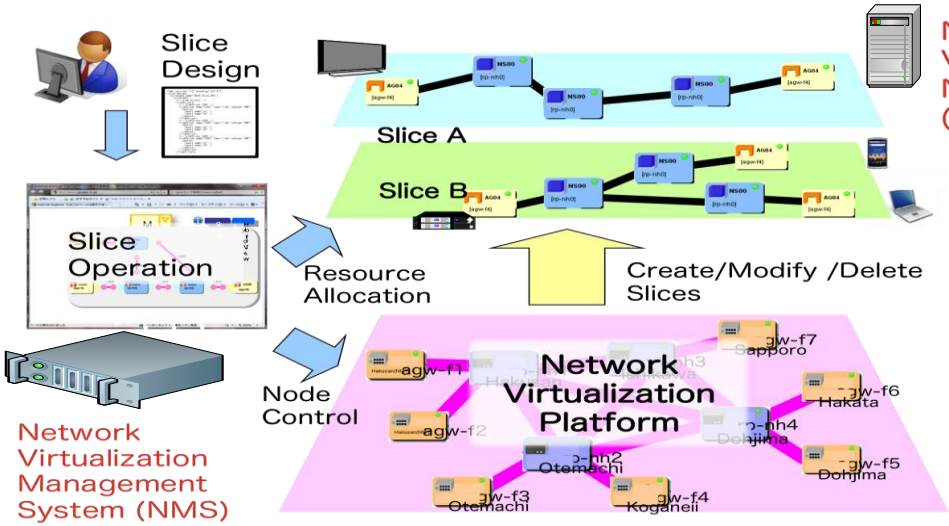
Open Flow

■Separate packet transfer function from routing control function
■Programmable flow-based routing, fault recovery, load balance, virtualization
■ Open Network Foundation started.

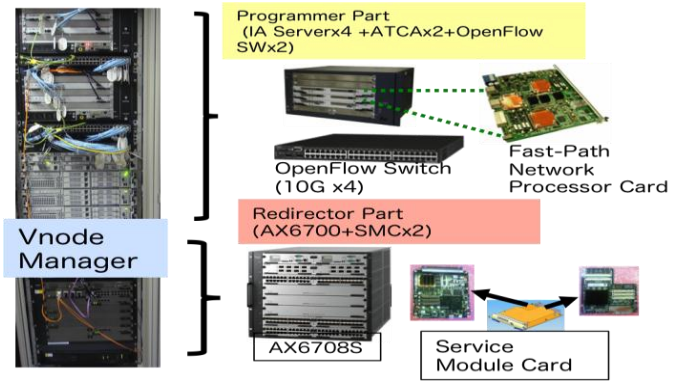


VNode Project for Network Virtualization

- Realizing Advanced Network Virtualization Infrastructure
- Enabling Meta-Architecture (Any Network In A Slice)
- **2008-2010 1st Phase Project (NICT/Utokyo/NTT/NEC/Hitachi/Fujitsu)**
- **2011-2014 2nd Phase Project (Utokyo/NTT/NEC/Hitachi/Fujitsu/KDDI) funded by NICT**



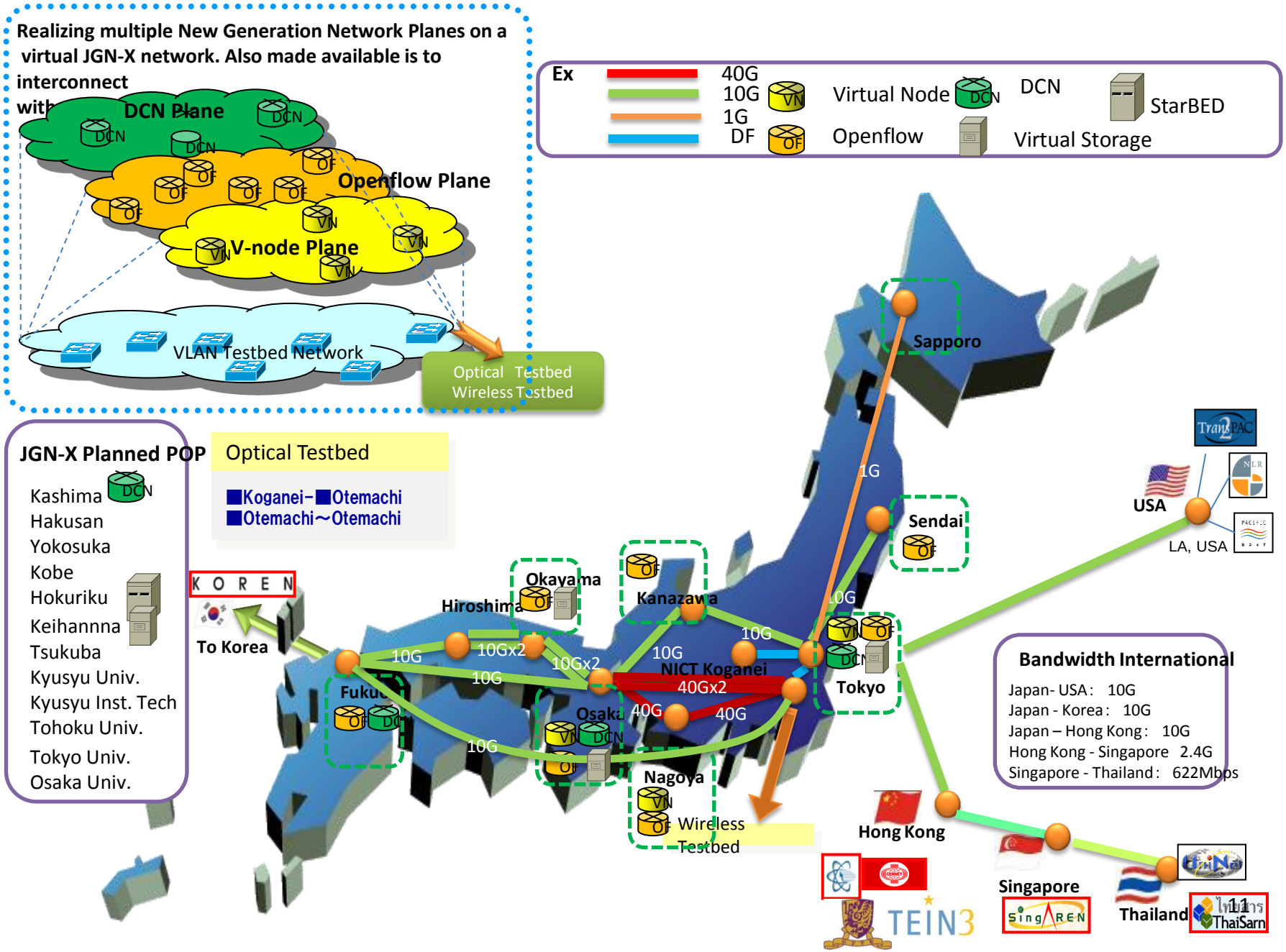
Courtesy of Prof. Aki Nakao (Univ. of Tokyo)



Abstraction	Isolation	Elasticity	Programmability	Authentication Authorization Accounting

Supporting All the Requirements for Advanced Network Virtualization

JGN-X Network Figure (from 2011/4)



Evolution of Cloud Computing

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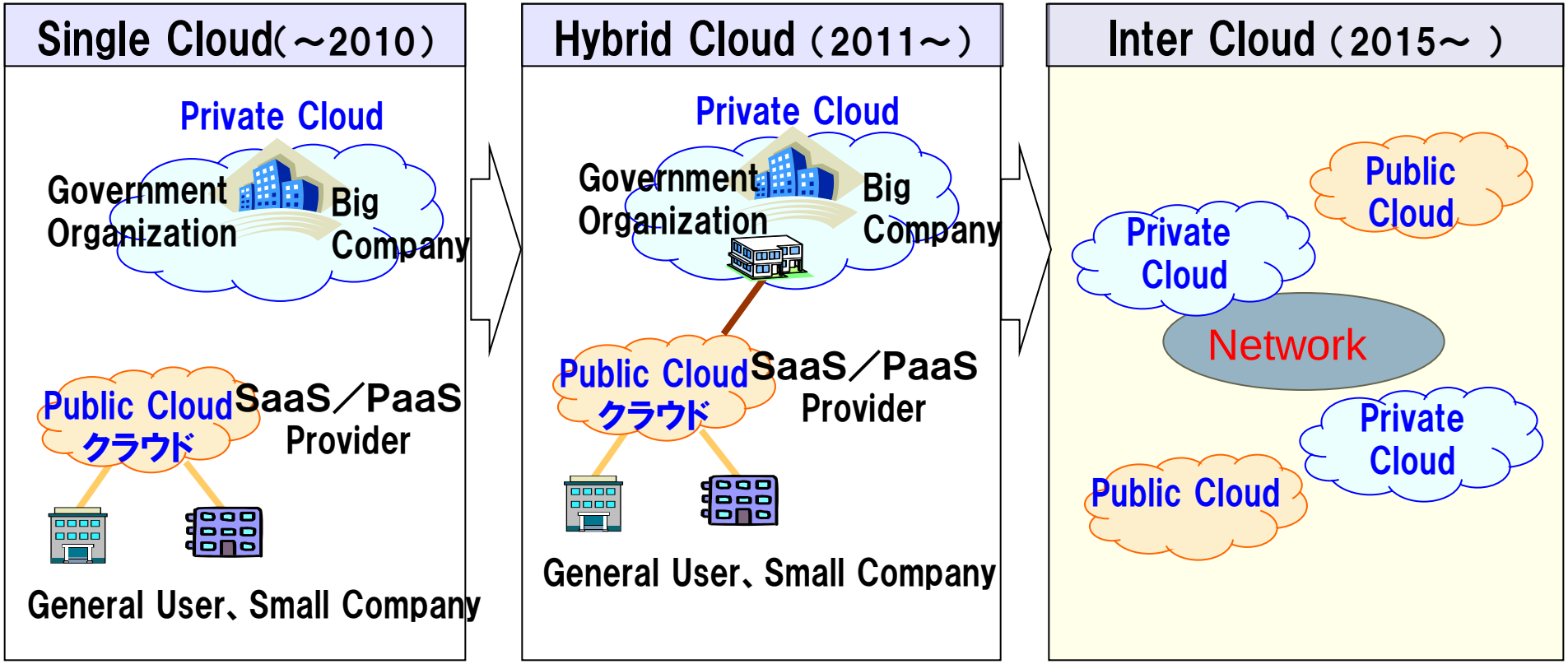
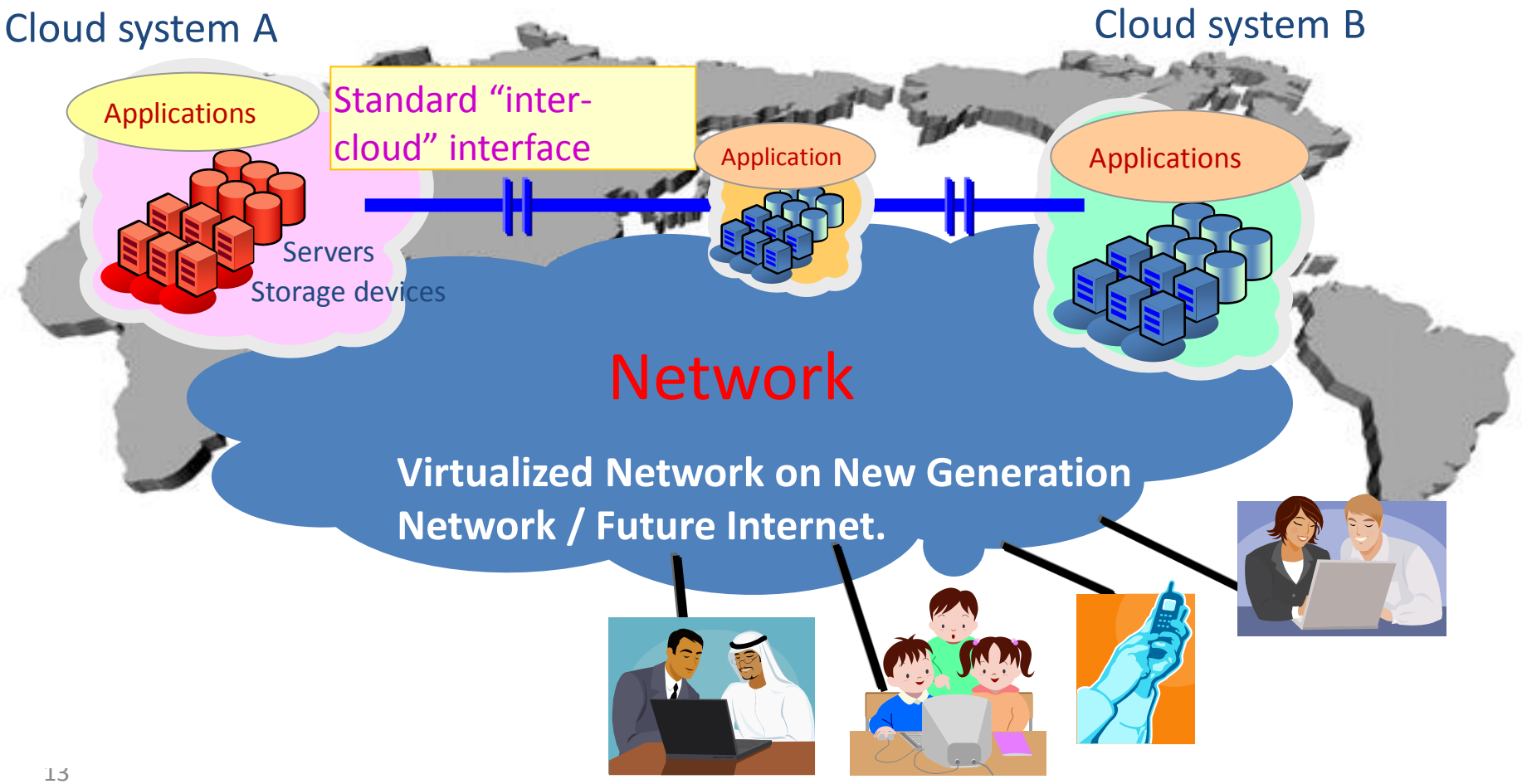
- From Single Cloud to Hybrid Cloud, which is a connection between Public and Private Cloud, and then to global Inter-Cloud Computing



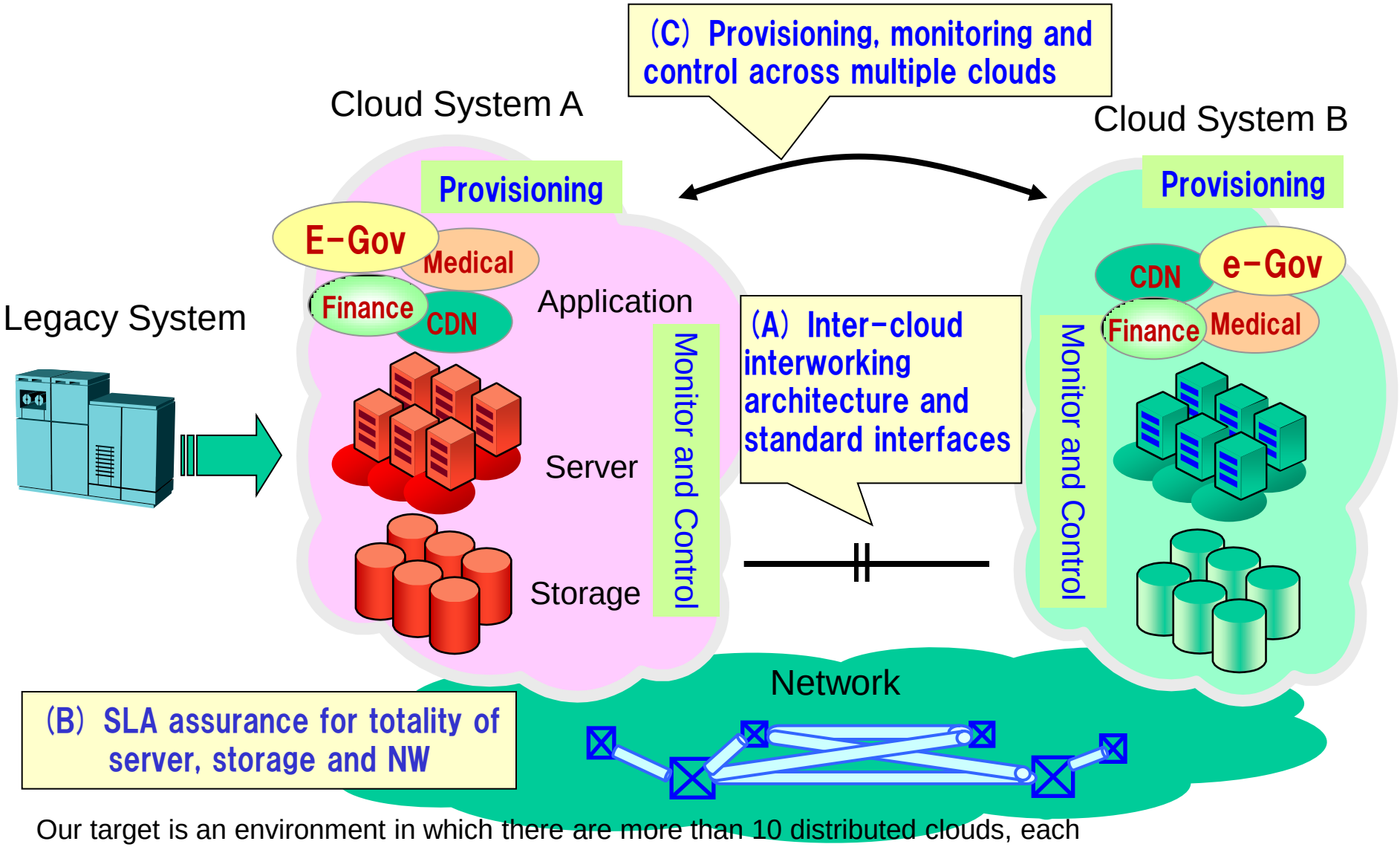
GICTF: A technology forum to promote “Inter-cloud”

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

Established on July 17th 2009



Key Issues for Inter-Cloud Service Federation



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.

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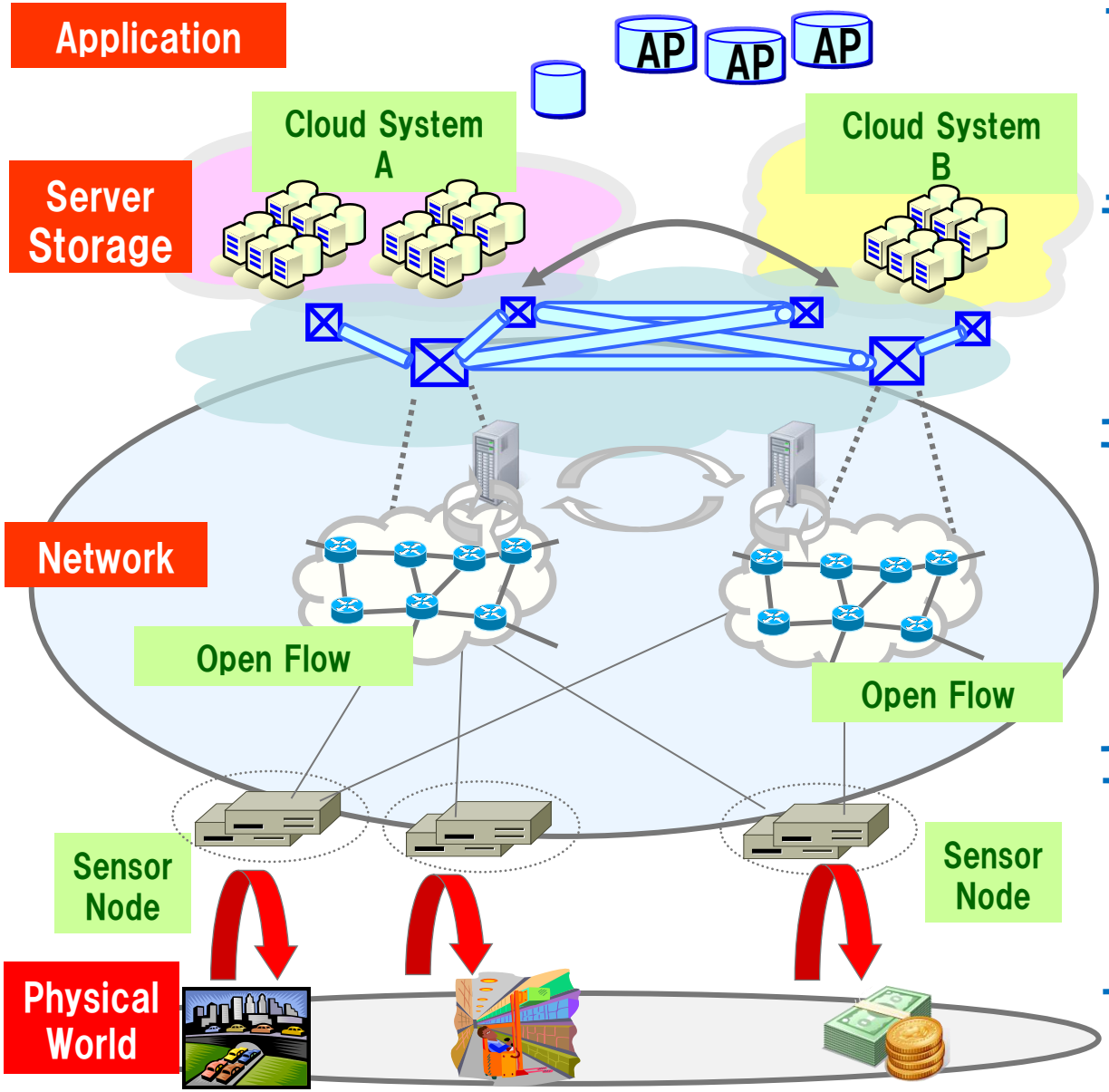
Highly Reliable Inter-Cloud Systems R&D project funded by MIC

<2009 - 2012: total 43M$>



Cloud Resource Provisioning

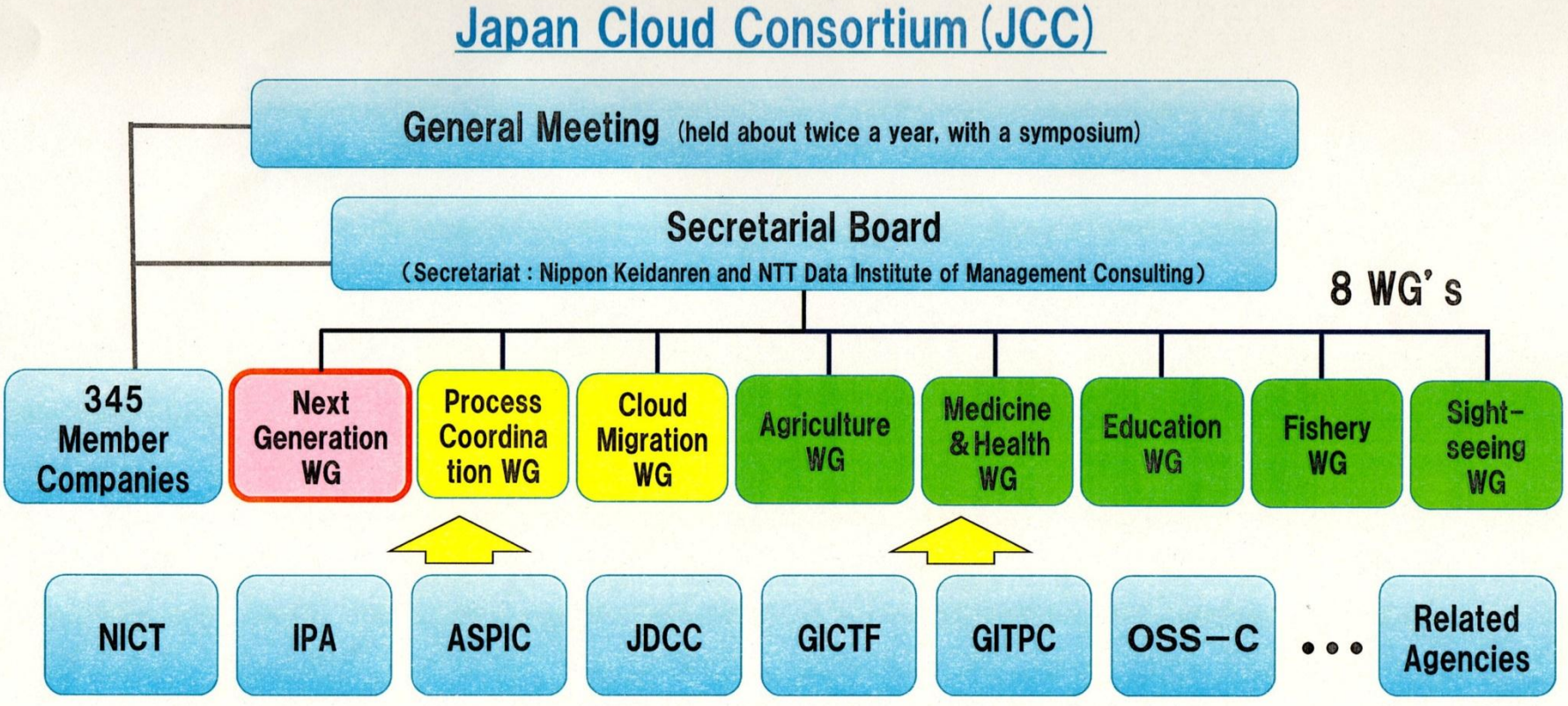
Cloud Resource Federation and Reconfiguration

Dynamically Reconfigurable NW based on Open Flow

Real-time Sensor Node

Japan Cloud Consortium (JCC) was established in December 2010

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. Both MIC and METI are supporting JCC !



Total number of members: 378 as of Dec. 2011

EU-Japan Collaboration for NWGN/FI and Cloud Computing

EU-Japan Symposium on Future Internet / New generation Network
October 20-21, 2010
Tampere, Finland

EU-Japan Symposium on Future Internet/ New generation Network
January 19, 2012 Tokyo, Japan

Joint proposal to FP7 Call 8
6 Projects


Thank you !
Asia
Pacific
Japan
Japan
US & EU
Global Inter Cloud

Appendix

GICTF: Global Inter Cloud Technology Forum

GICTF

General Assembly

Chair: Tomonori Aoyama

Board of Directors

http://www.gictf.jp/index_e.html

Technology Task Force

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

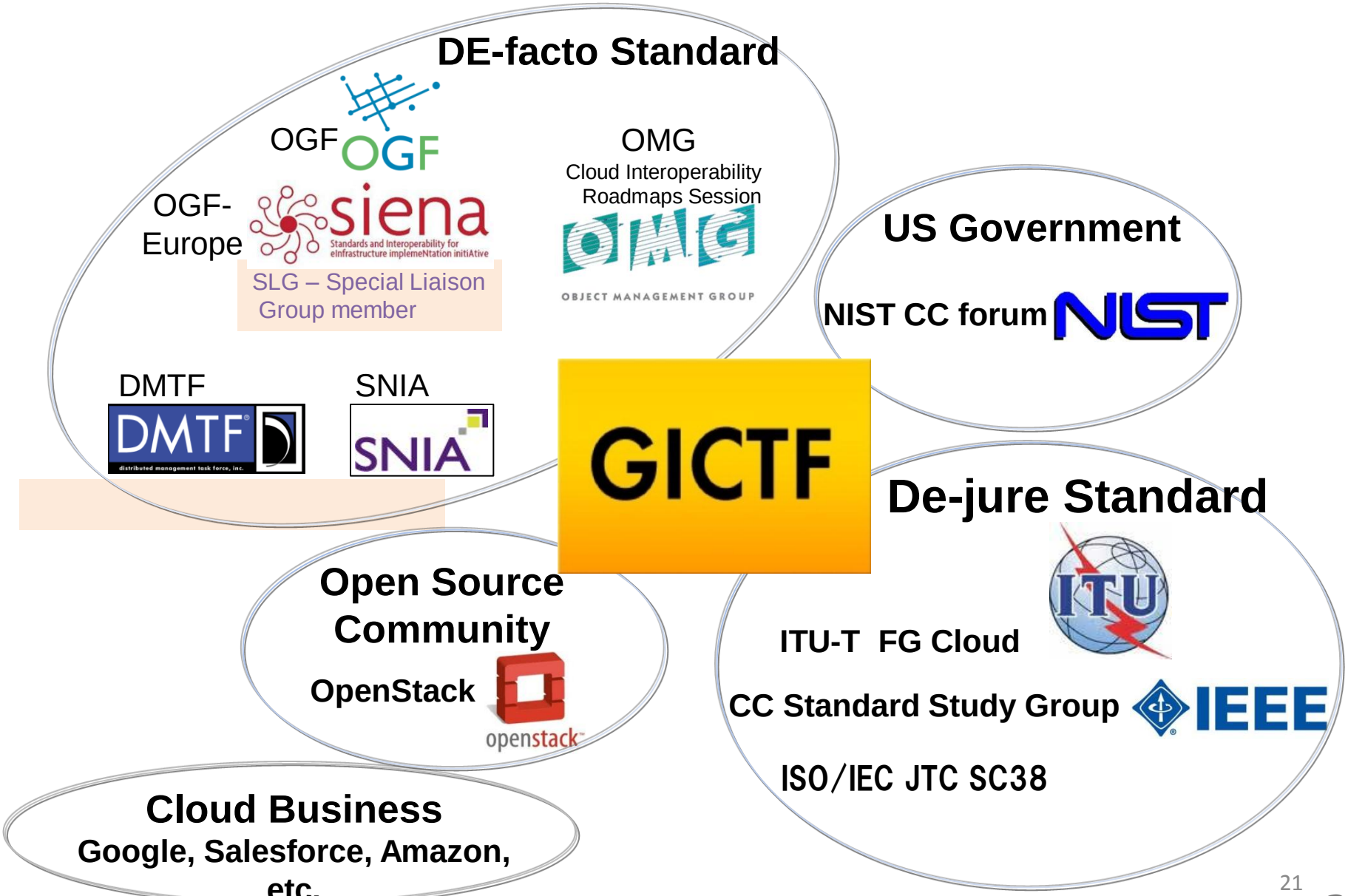
Application Task Force

1. Identify technical needs related to secure cloud interworking
2. Promote widespread use of cloud interworking technology

Member: 85 organizations

NTT, KDDI, NEC, Hitachi, Fujitsu, Toshiba, Microsoft, IBM, Oracle, Cisco, VMware, IIJ, BIGLOBE, NICT, NII, NRI, etc. , 38 members from Univ.

Collaboration among GICTF and various SDOs



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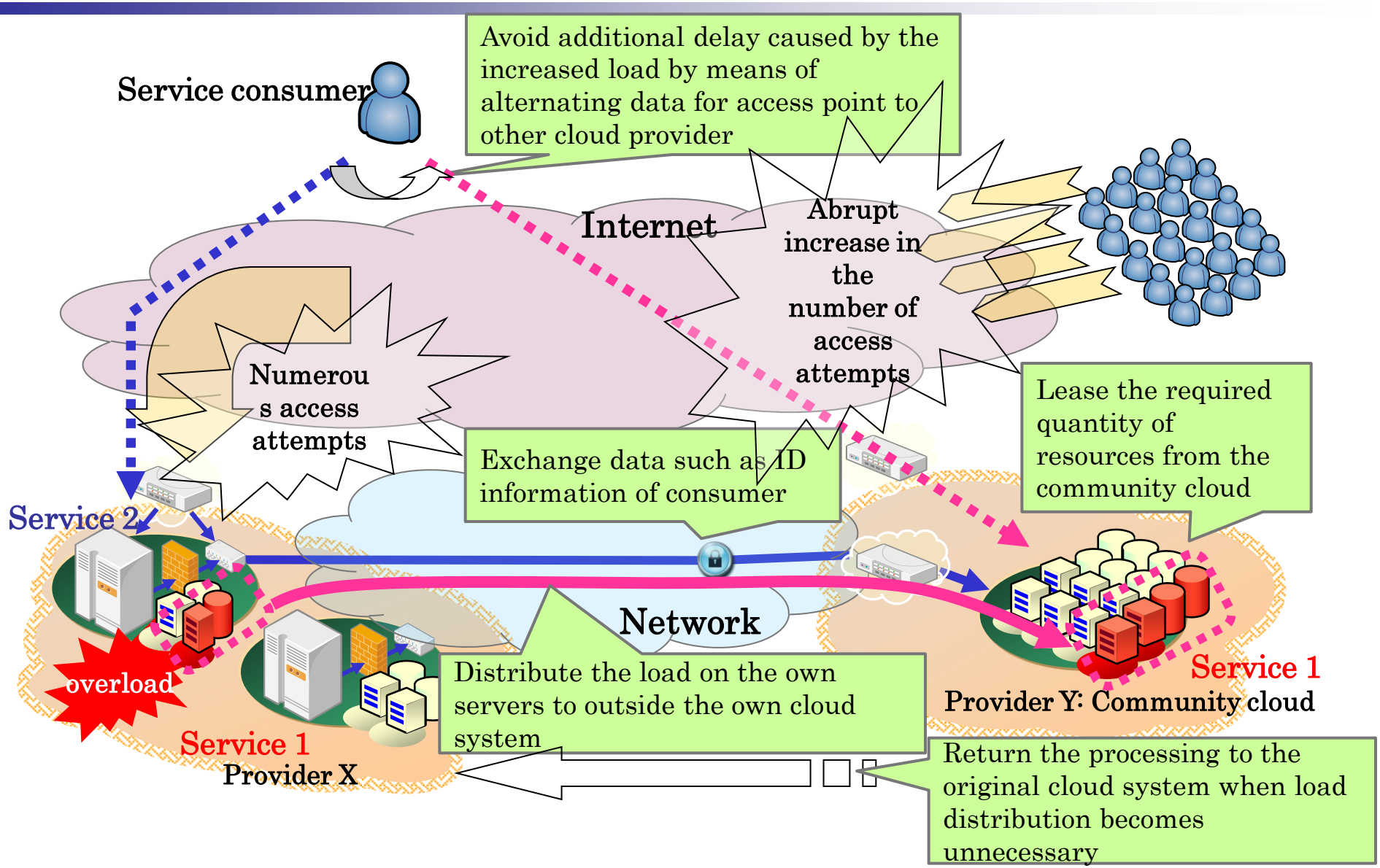
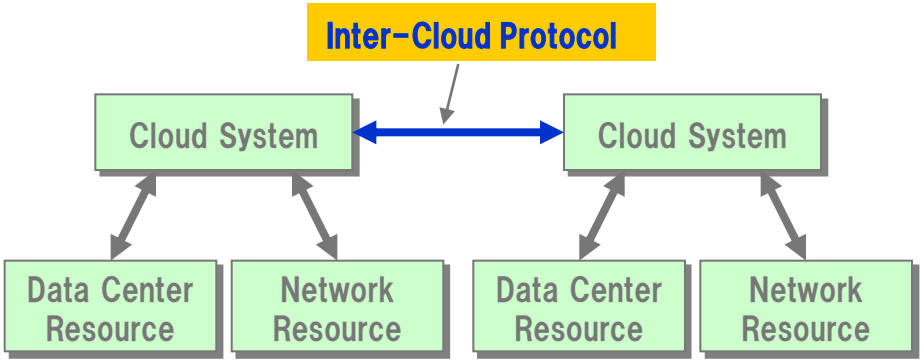
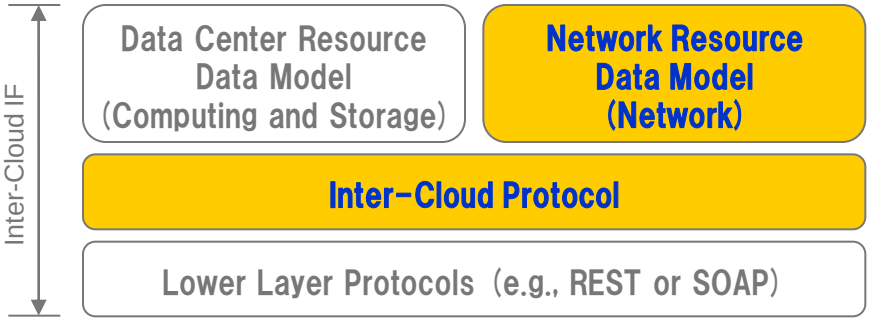
GICTF Use case of guaranteeing performance against an abrupt increase of the load



Framework of Inter-cloud Interface Specification

1. The interface between two cloud systems administered by different operators
2. 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





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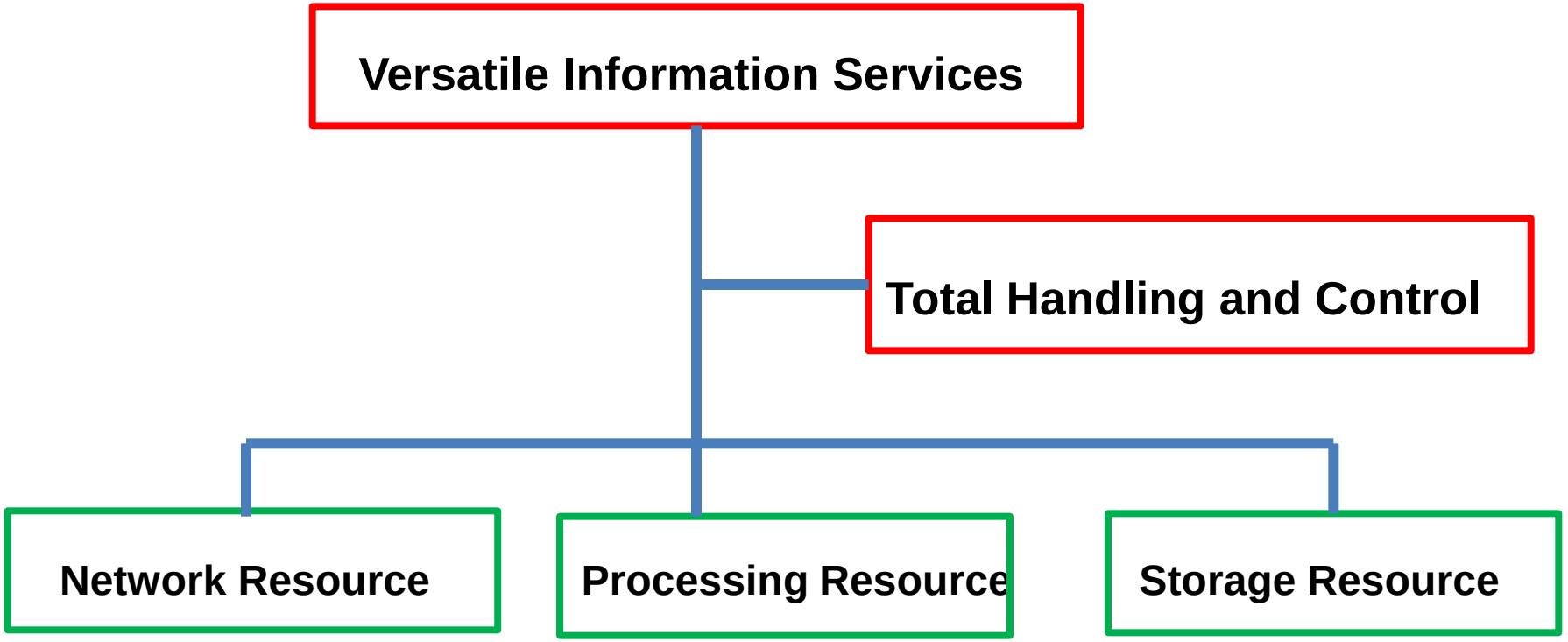
R&D topics on Integration of Inter Cloud and Network Virtualization



Important R&D target for Inter Cloud

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Technical Issues on Network Virtualization for Intercloud Cooperation

- **Resource Abstraction**
  - Hiding details of resources
  - Name resolving of resources
- **Resource Isolation**
  - Isolation among private virtual networks
  - QoS control to guarantee bandwidth or latency
- **Programmability**
  - Enabling creation of network functions based on new ideas (cache/encryption)
- **Elasticity**
  - Providing network resources on-demand
  - "Cloud networking among clouds"

Acknowledgement & Credits: The white paper of Network virtualization study group in 2010.