Cyber Science Infrastructure and NAREGI Grid middleware

Kento Aida

National Institute of Informatics

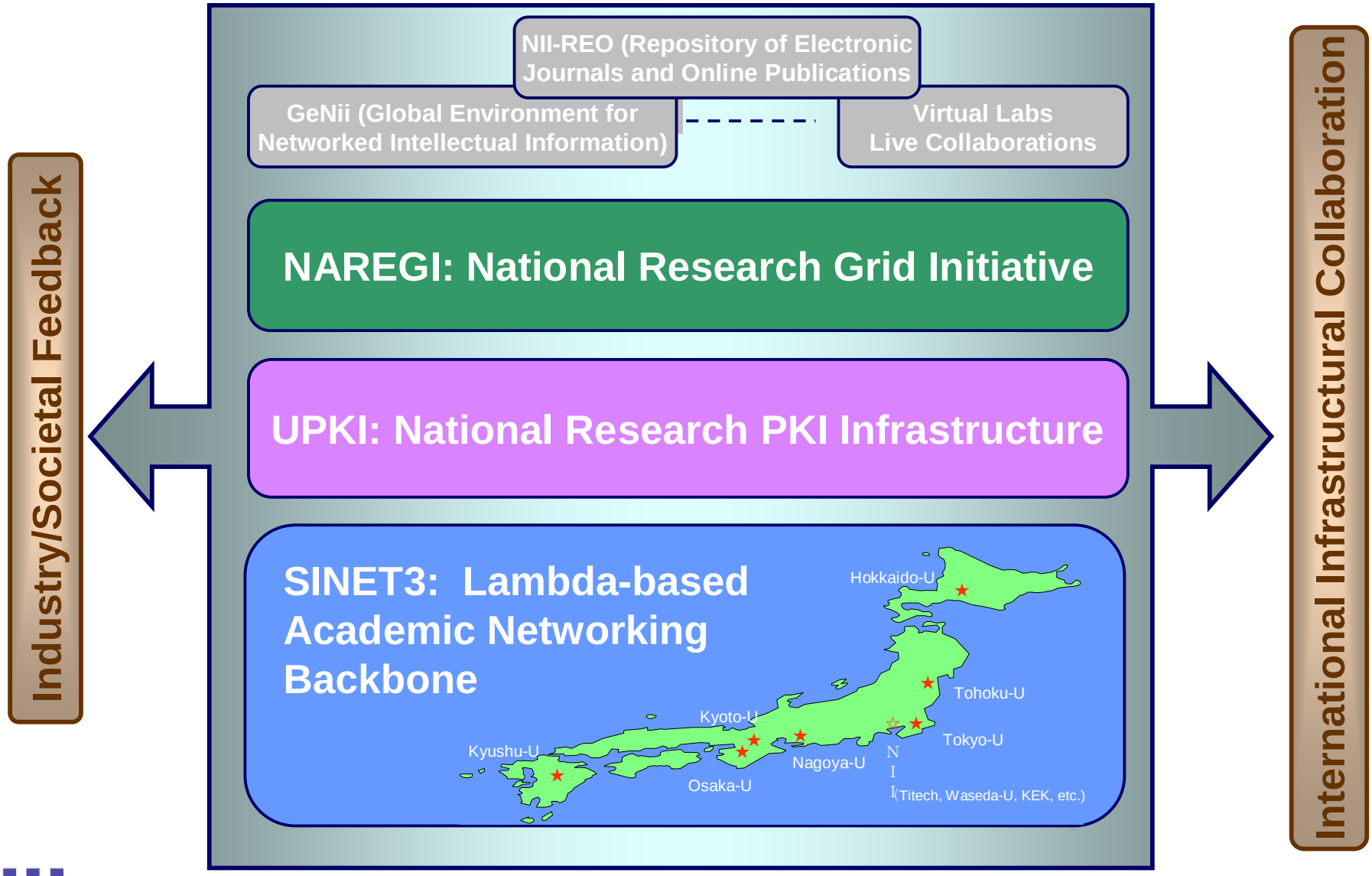
Outline

- overview of Cyber Science Infrastructure (CSI)
- grid infrastructure in CSI
  - NAREGI Grid Middleware
  - deployment and user support
- summary

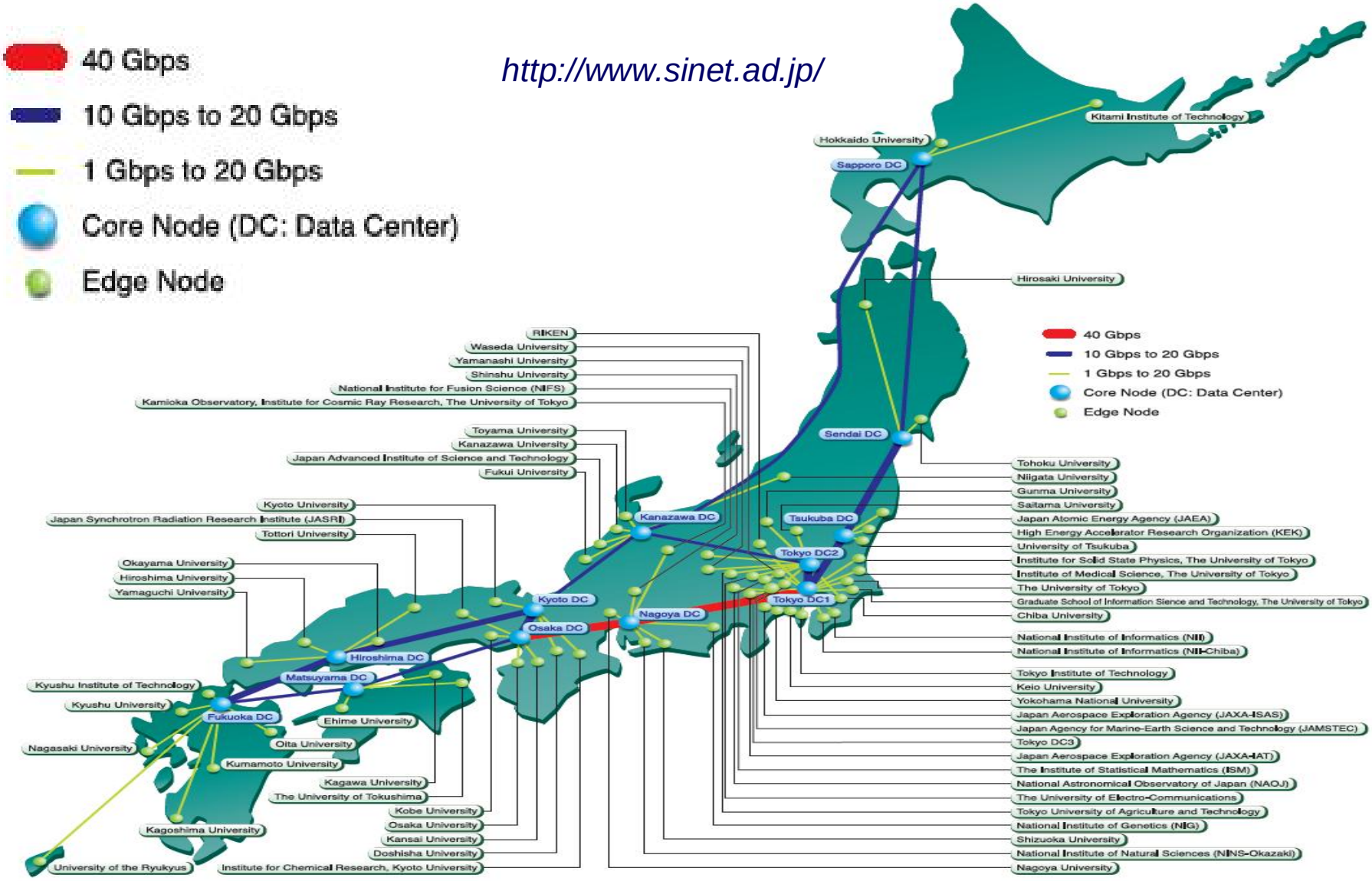
Cyber-Science Infrastructure (CSI)

- new information infrastructure to boost today's advanced scientific research
  - integrated information resources and systems
    - ✓high-performance computing/storage resources
    - ✓software
    - ✓databases and digital contents
    - ✓"human" and research processes themselves
- services
  - networking : SINET3
  - federated ID management : UPKI
  - grid : NAREGI

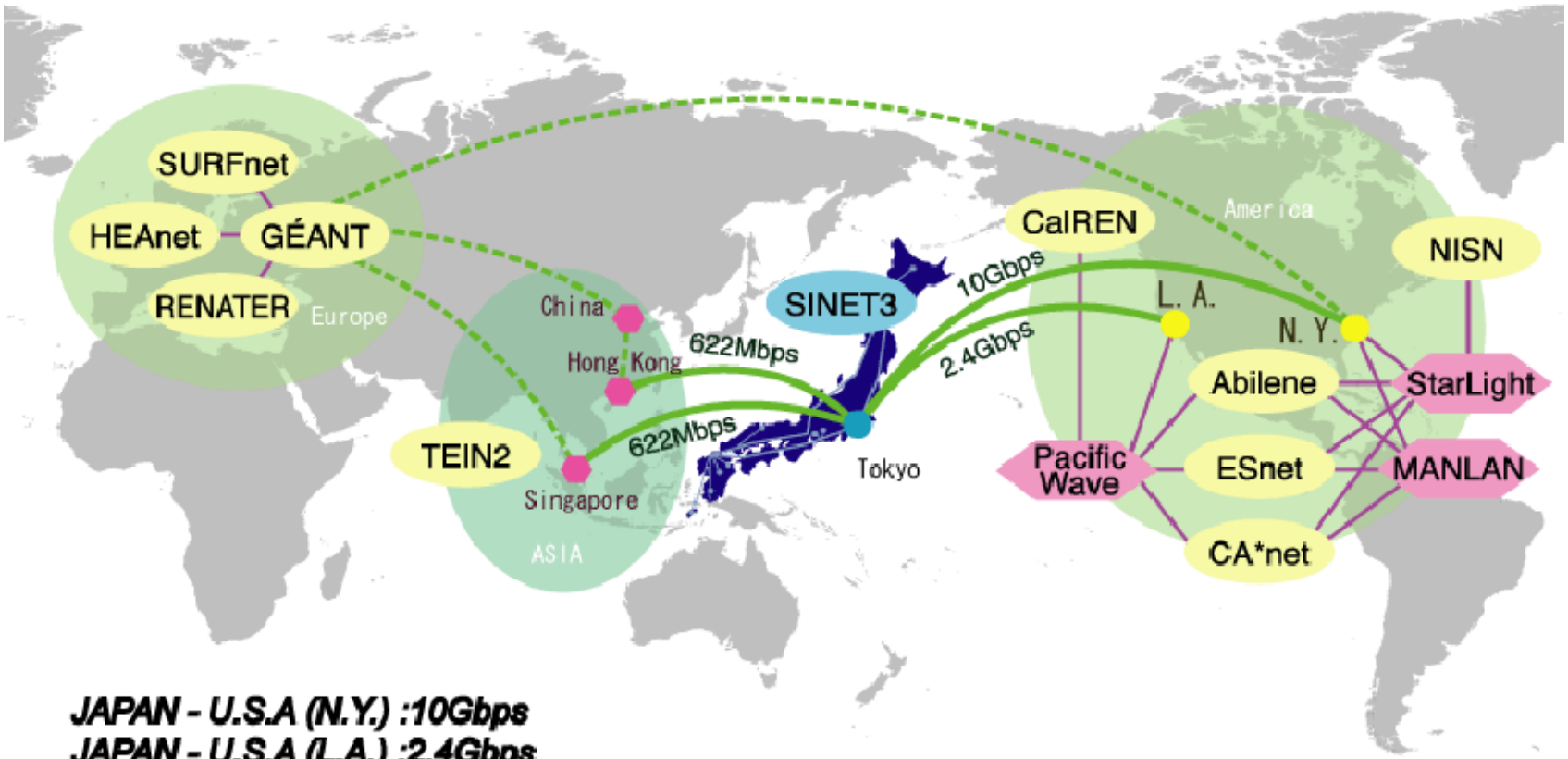
CSI (cont'd)


Industry/Societal Feedback
NII-REO (Repository of Electronic Journals and Online Publications
GeNii (Global Environment for Networked Intellectual Information)
Virtual Labs Live Collaborations
NAREGI: National Research Grid Initiative
UPKI: National Research PKI Infrastructure
SINET3: Lambda-based Academic Networking Backbone
Hokkaido-U
Tohoku-U
Kyoto-U
Tokyo-U
Kyushu-U
Nagoya-U
Osaka-U
NII
(Titech, Waseda-U, KEK, etc.)
International Infrastructural Collaboration

Network (SINET3)



SINET3 International Connectivity

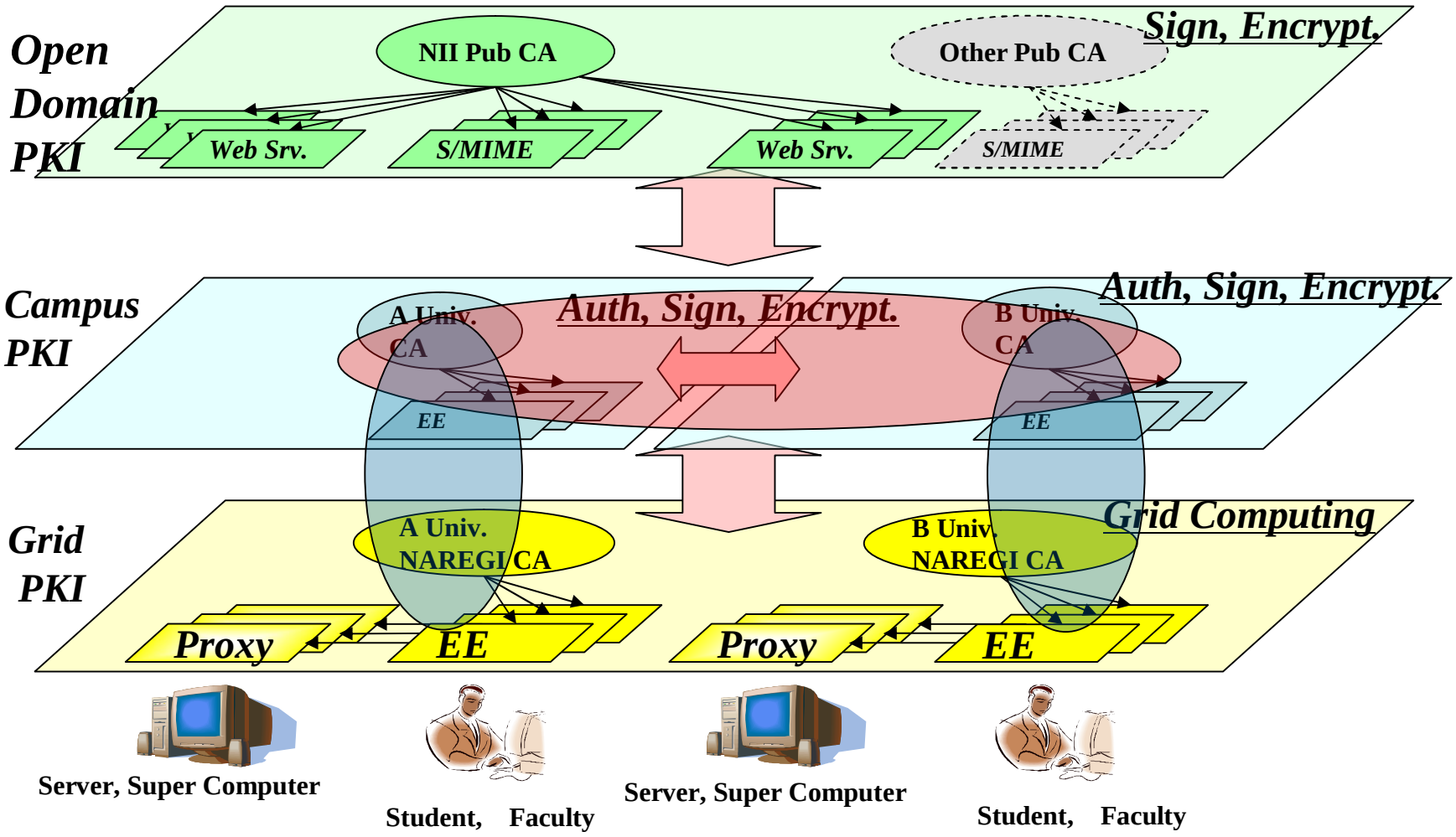


JAPAN - U.S.A (N.Y.) :10Gbps
JAPAN - U.S.A (L.A.) :2.4Gbps
JAPAN - Singapore :622Mbps
JAPAN - Hong Kong :622Mbps

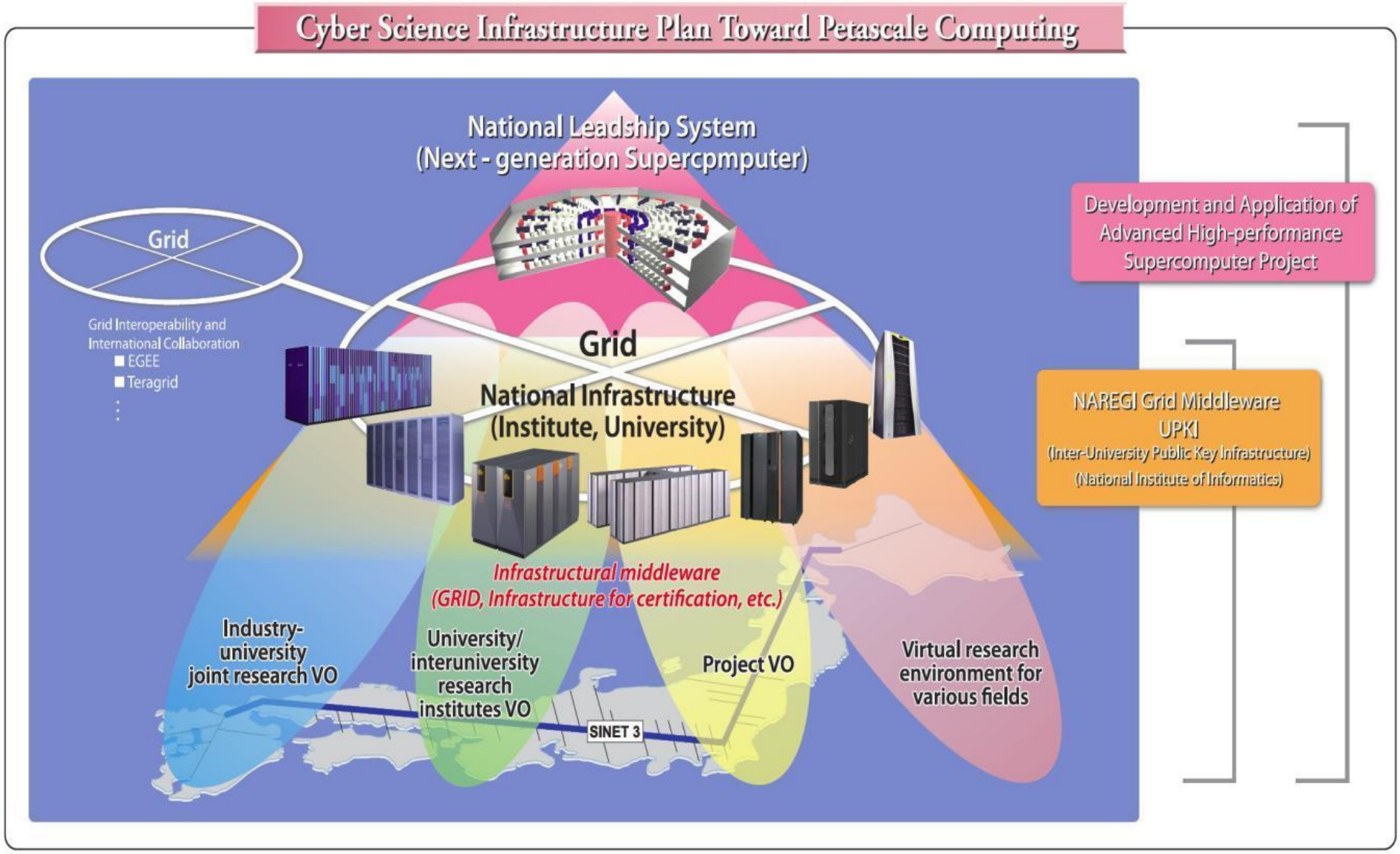
International network collaboration

http://www.sinet.ad.jp/

UPKI

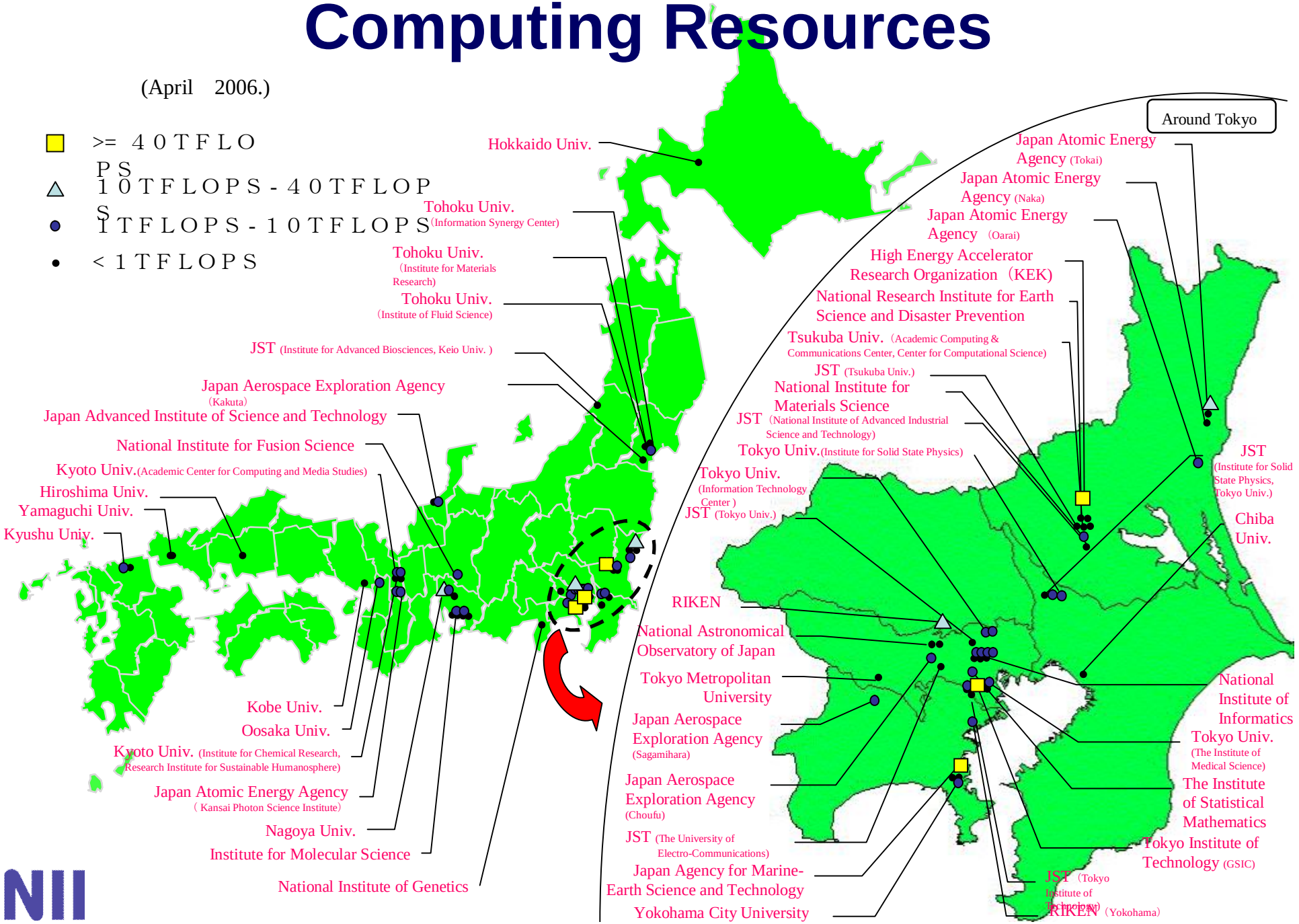

Open Domain PKI
NII Pub CA
Other Pub CA
Sign, Encrypt.
Web Srv.
S/MIME
Web Srv.
S/MIME
Campus PKI
A Univ. CA
Auth, Sign, Encrypt.
B Univ. CA
Auth, Sign, Encrypt.
EE
EE
Grid PKI
A Univ. NAREGI CA
B Univ. NAREGI CA
Grid Computing
Proxy
EE
Proxy
EE
Server, Super Computer
Student, Faculty
Server, Super Computer
Student, Faculty

Grid


Cyber Science Infrastructure Plan Toward Petascale Computing
National Leadship System
(Next - generation Supercpmputer)
Grid
Grid Interoperability and
International Collaboration
EGEE
Teragrid
Grid
National Infrastructure
(Institute, University)
Infrastructural middleware
(GRID, Infrastructure for certification, etc.)
Industry-
university
joint research VO
University/
interuniversity
research
institutes VO
Project VO
Virtual research
environment for
various fields
SINET 3
Development and Application of
Advanced High-performance
Supercomputer Project
NAREGI Grid Middleware
UPKI
(Inter-University Public Key Infrastructure)
(National Institute of Informatics)

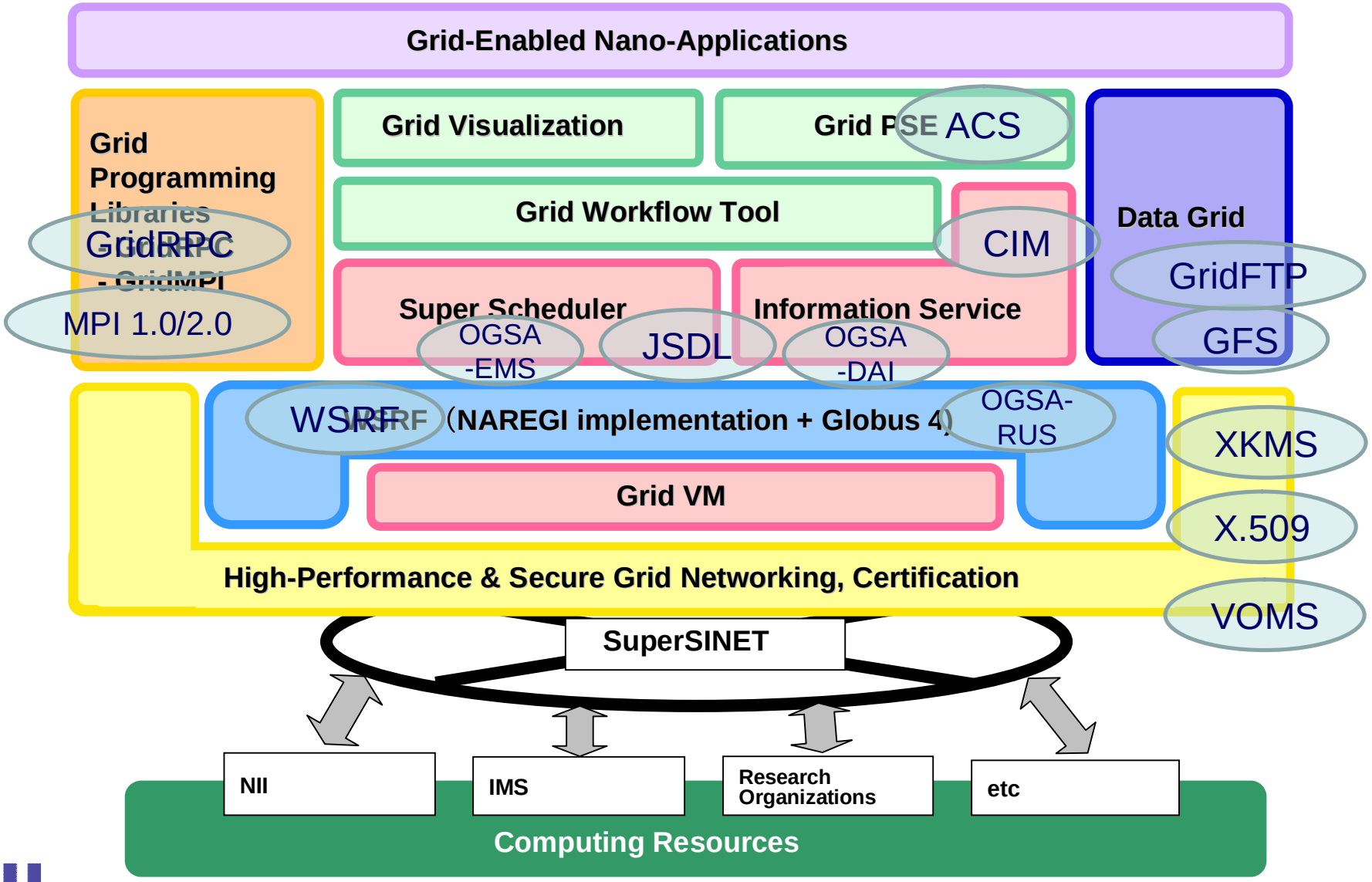
Computing Resources

(April 2006.)

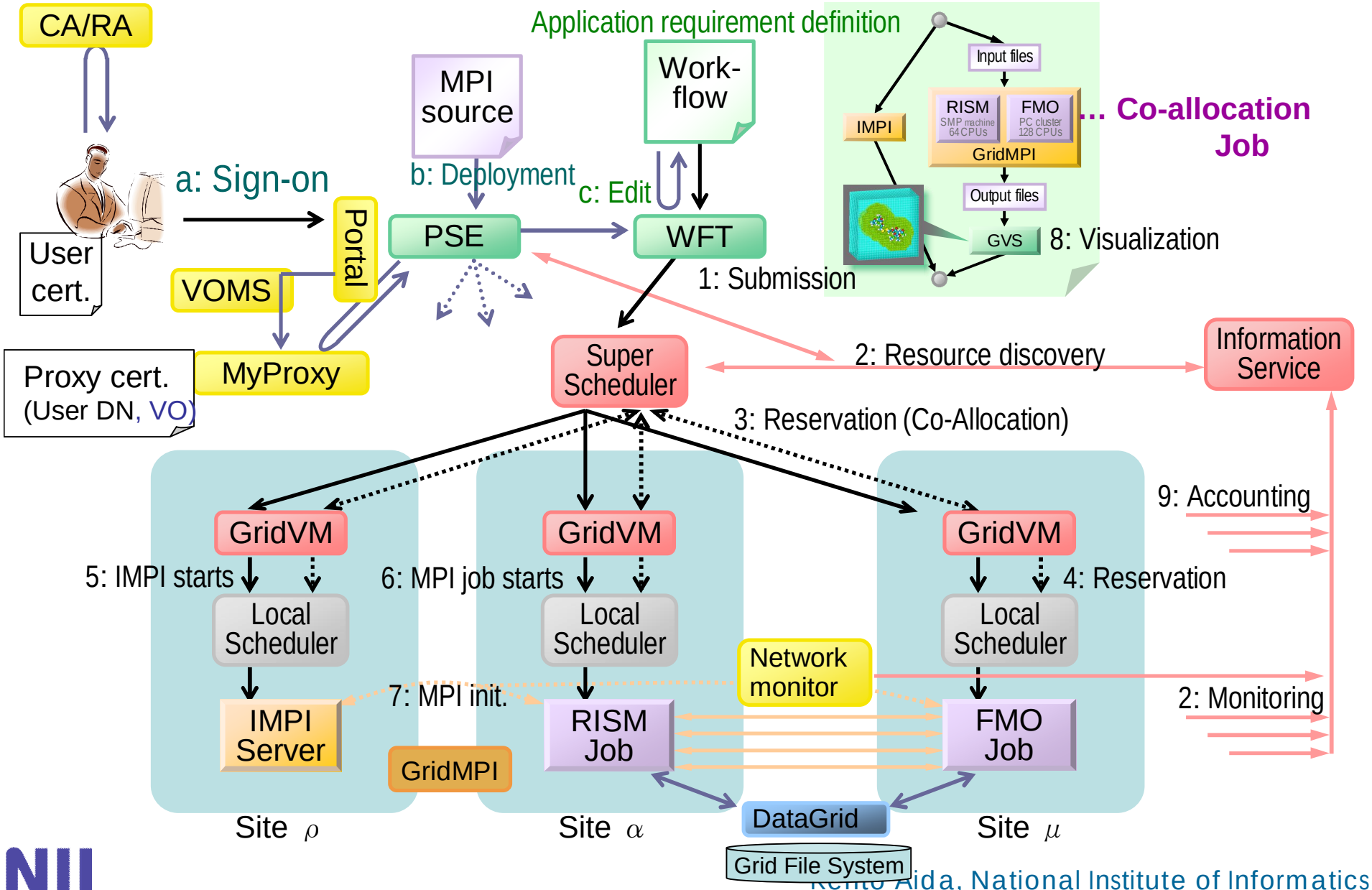


NII

NAREGI Grid Middleware

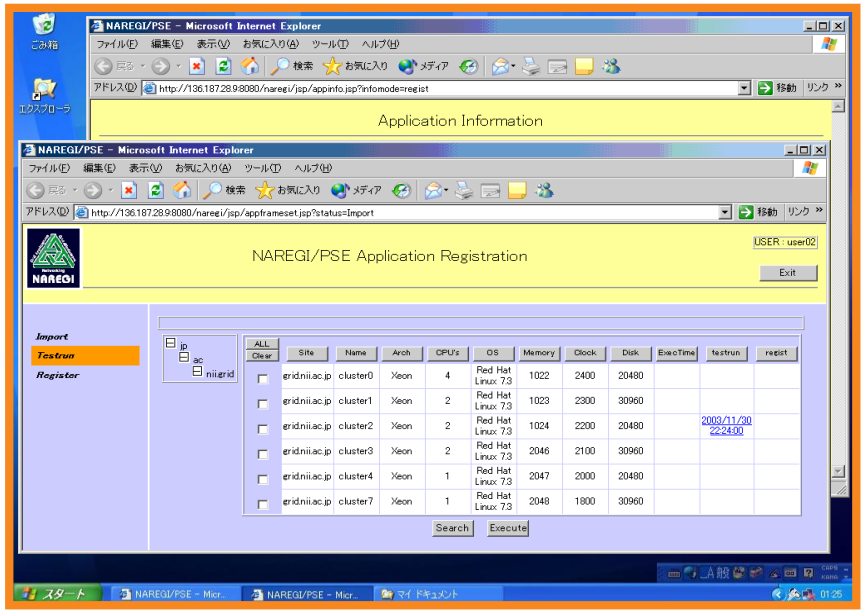


Job Execution Scenario

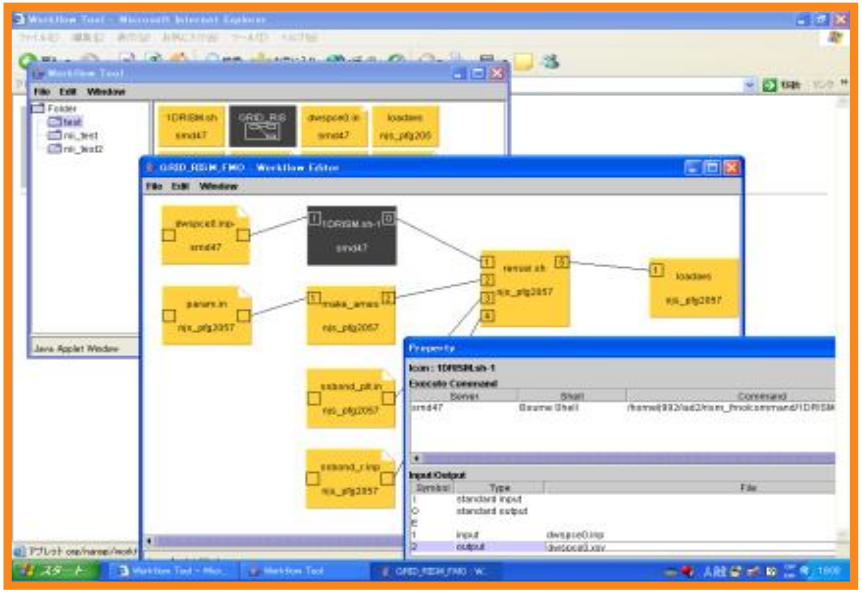


User-Level Grid Tools & PSE

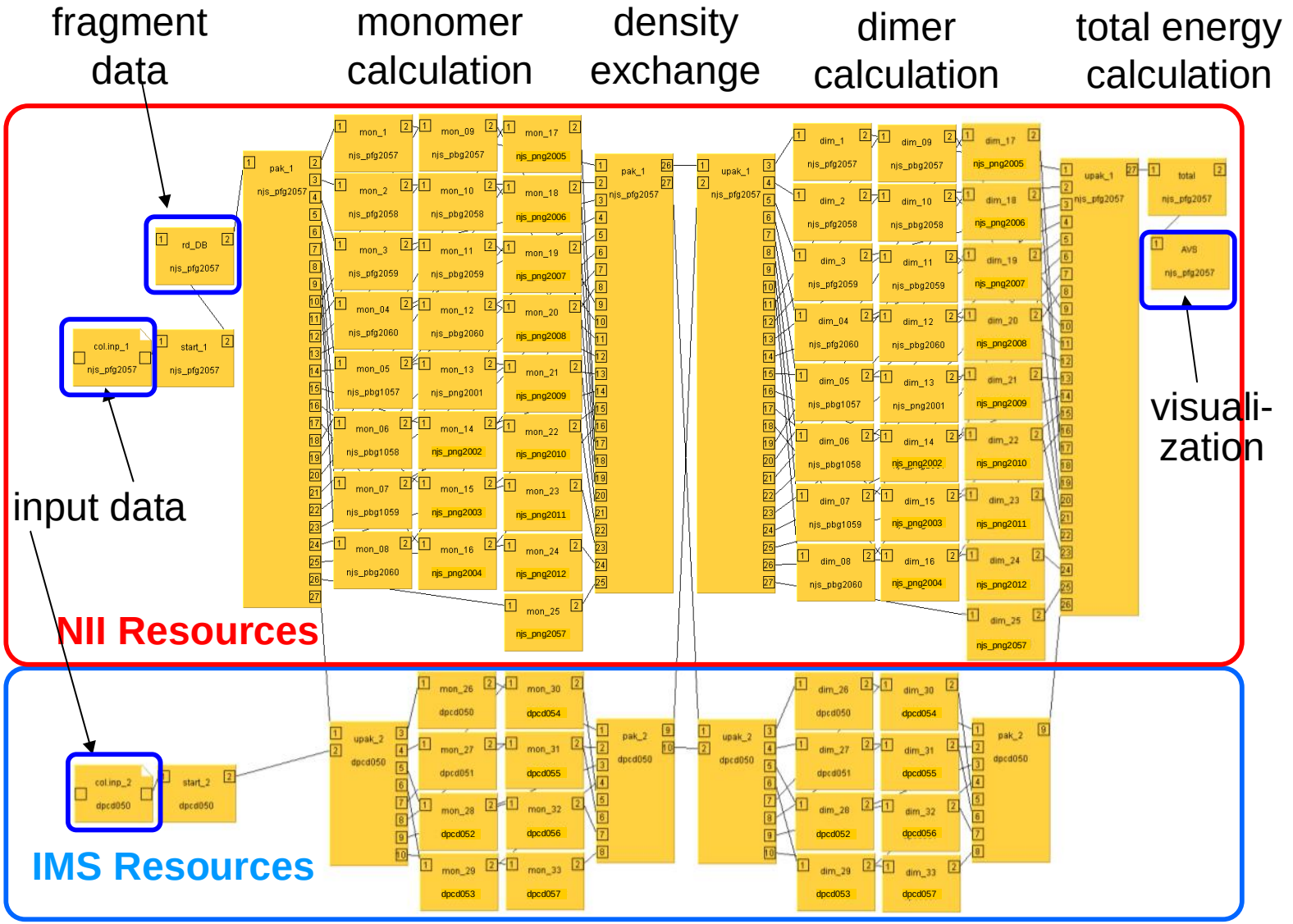
- Grid PSE
  - support for compilation and deployment
  - execution support



- Grid Workflow Tool
  - workflow language
  - GUI

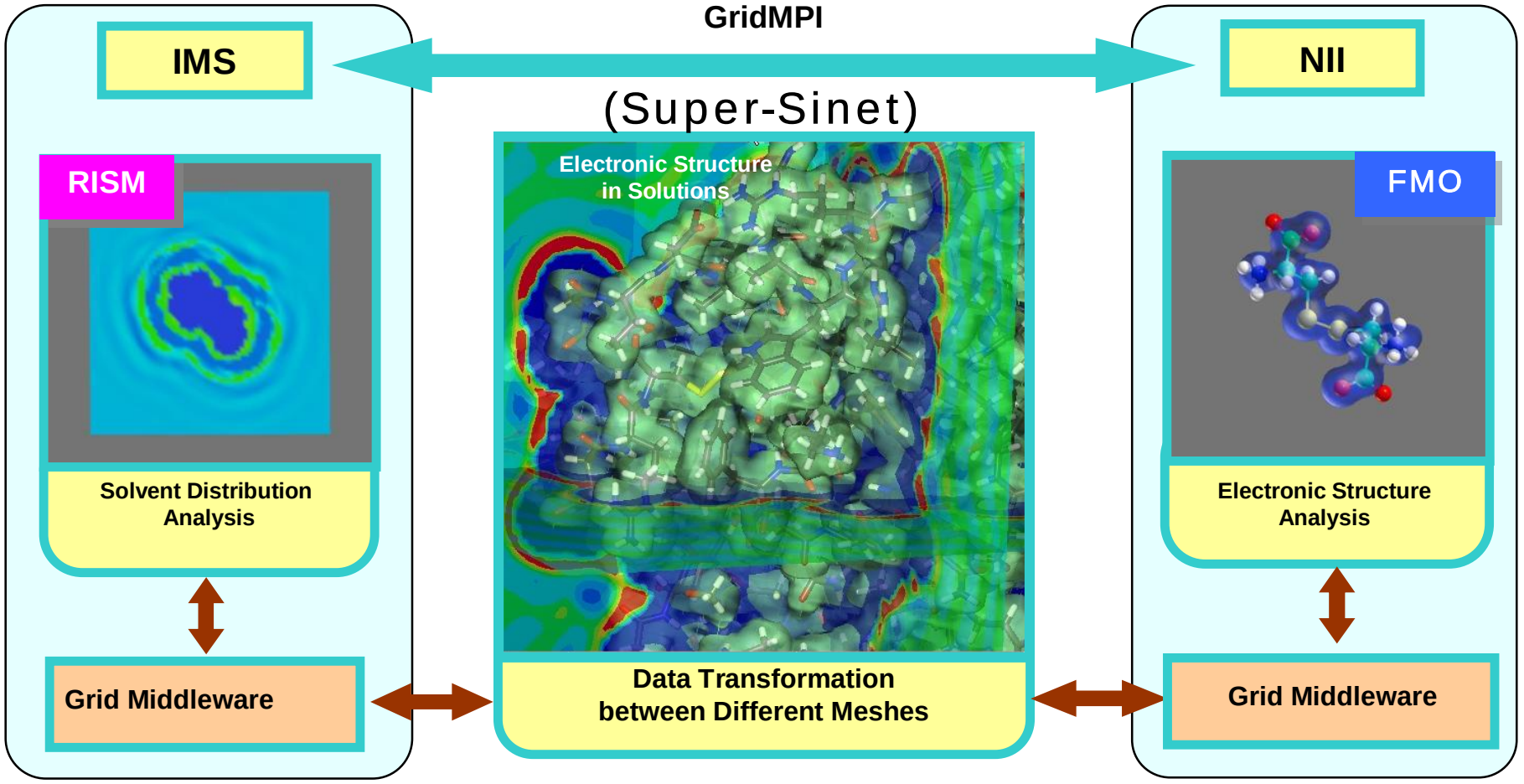


Workflow based Grid FMO Simulations of Proteins



source: Prof. Aoyagi (Kyushu Univ.)

Adaptation of Nano-science Applications to Grid Environment



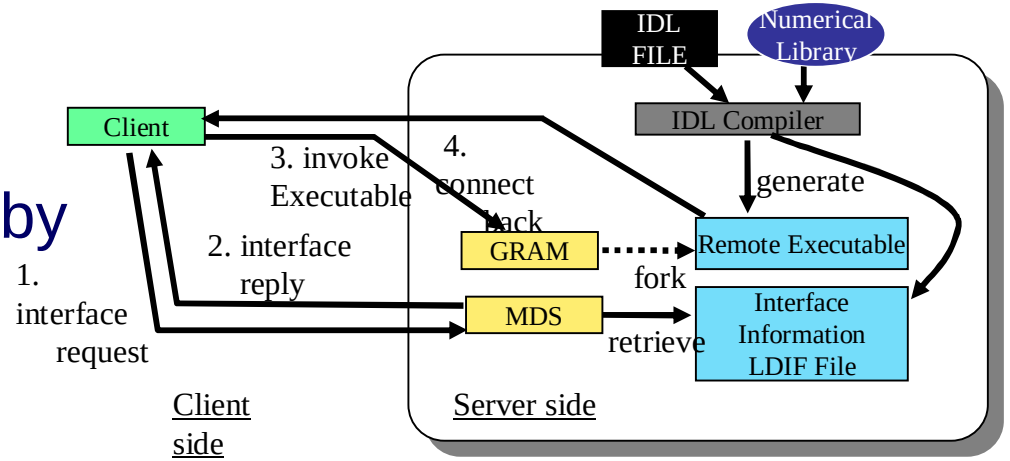
RISM Reference Interaction Site Model

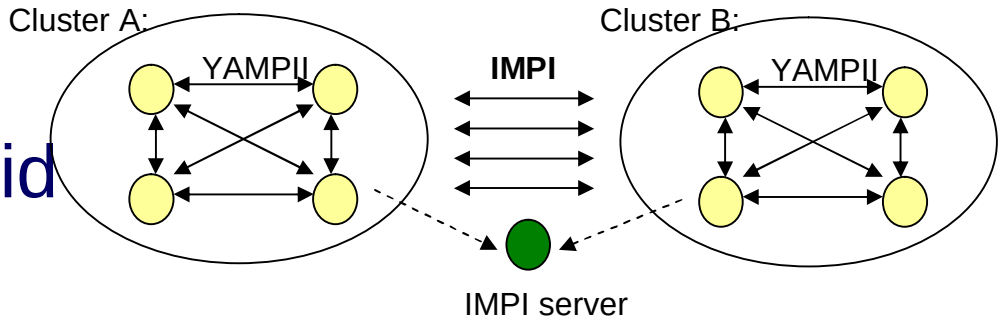
FMO Fragment Molecular Orbital method

source: Prof. Aoyagi (Kyushu Univ.)

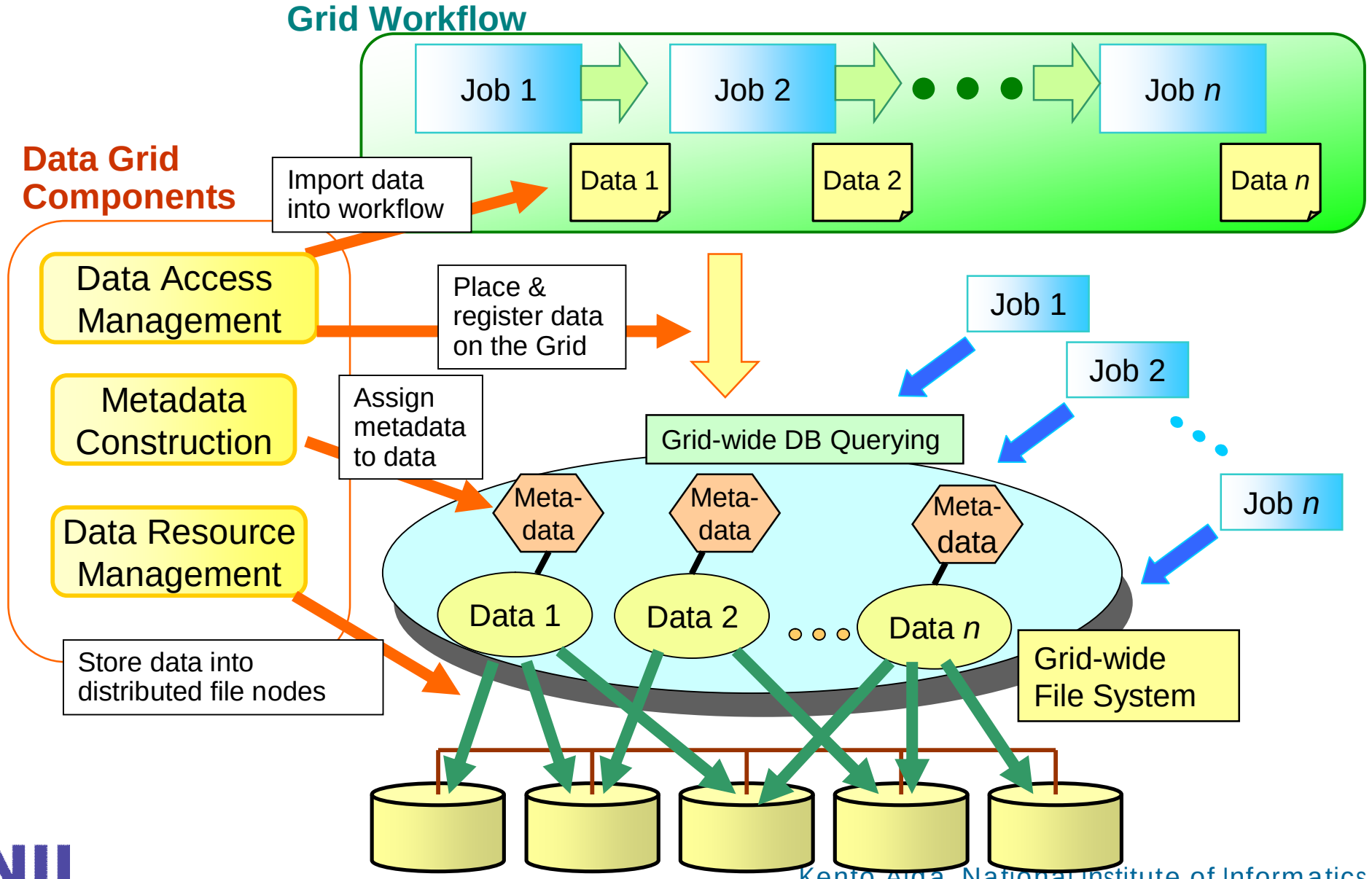
Programming

- GridRPC
  - RPC on the grid
    - ✓API standardization by OGF
  - Ninf-G
    - ✓a reference implementation of GridRPC API
- GridMPI
  - MPI library on the grid
    - ✓MPI communication between parallel systems on the grid



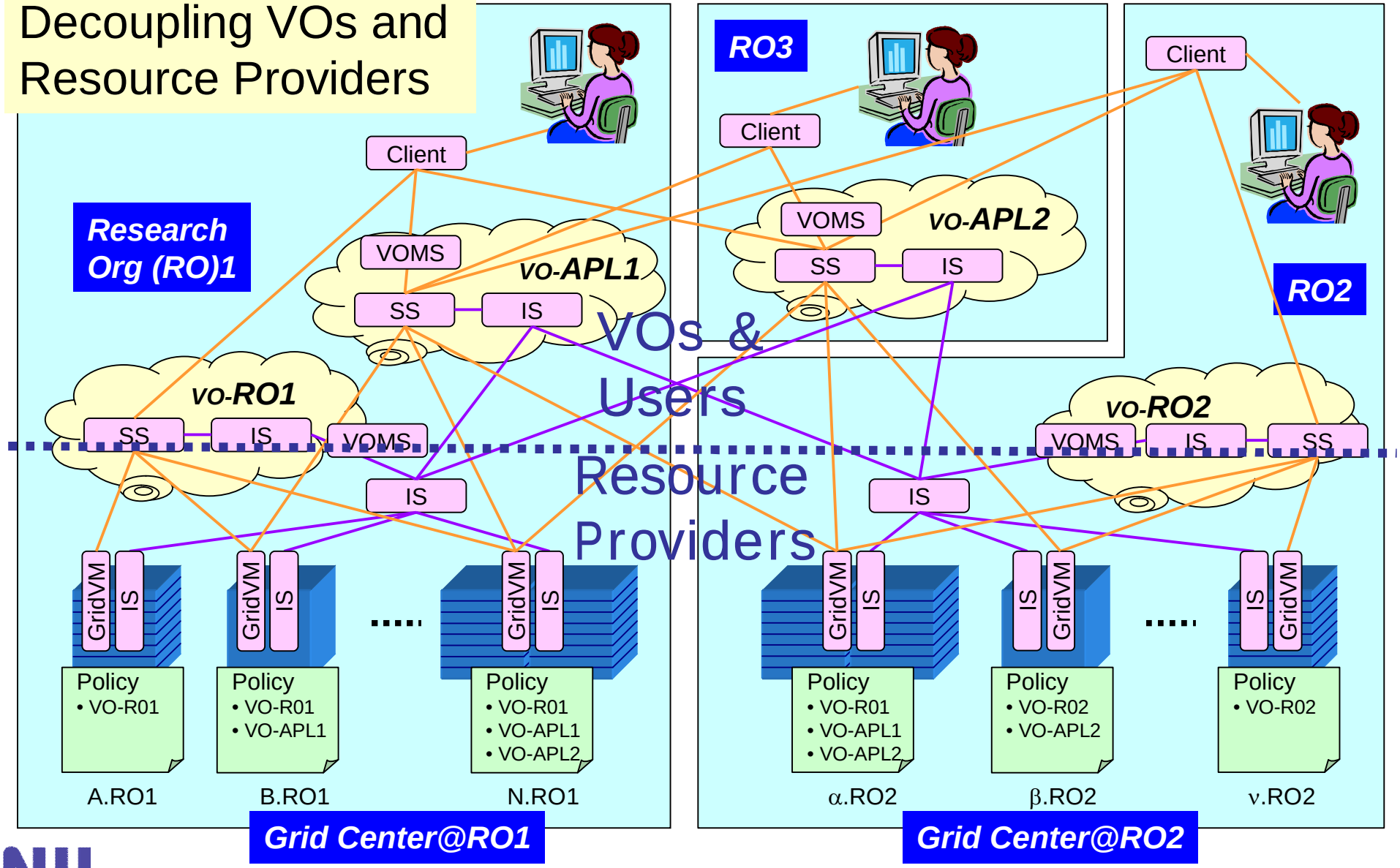


NAREGI Data Grid Environment



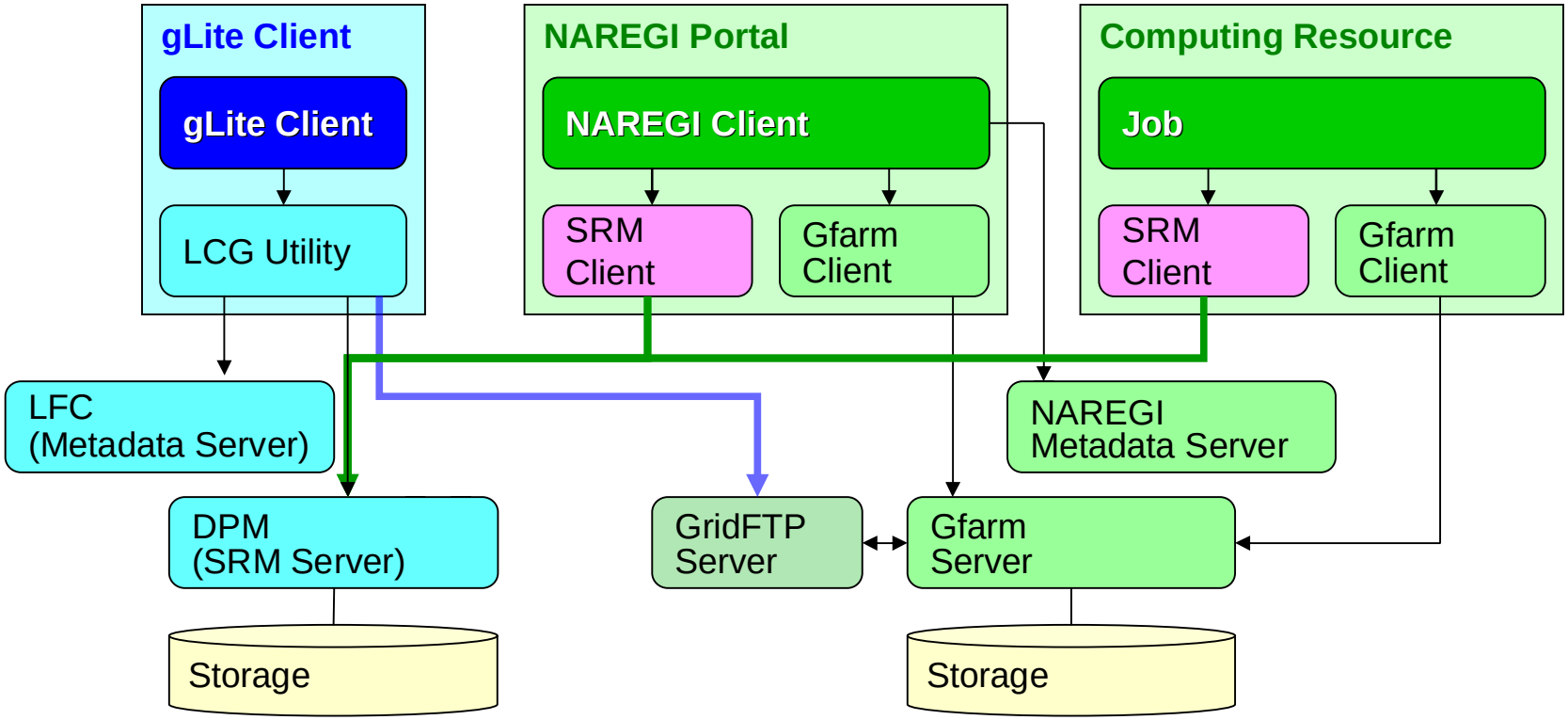
VO Service

Decoupling VOs and Resource Providers



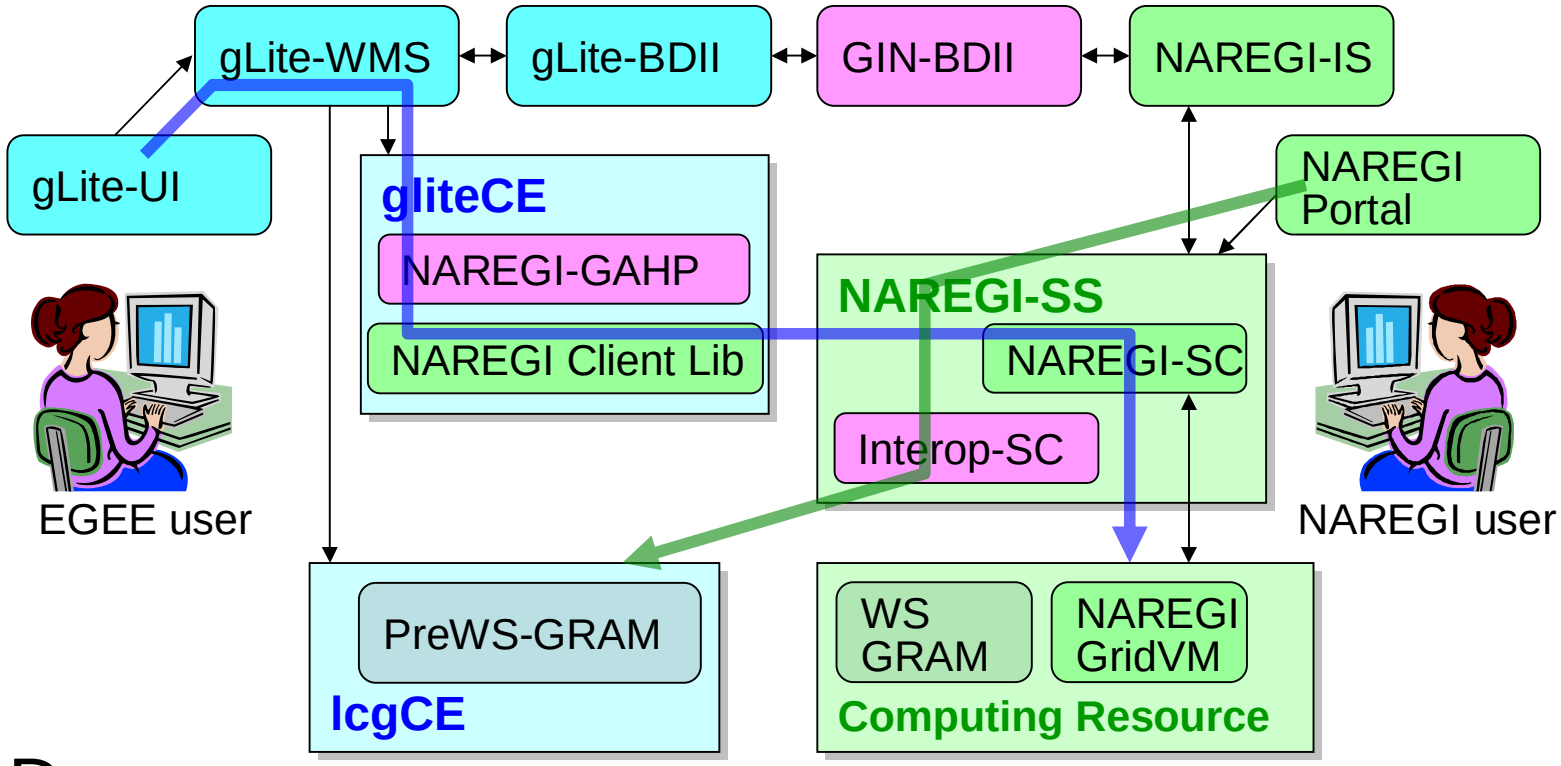
NAREGI-EGEE data Sharing (GIN)

- NAREGI and EGEE gLite clients can access to both data resources (e.g., bi-directional file copy) using SRM interface.
- GridFTP is used as its underlying file transfer protocol.
- File catalog (metadata) exchange is planned.



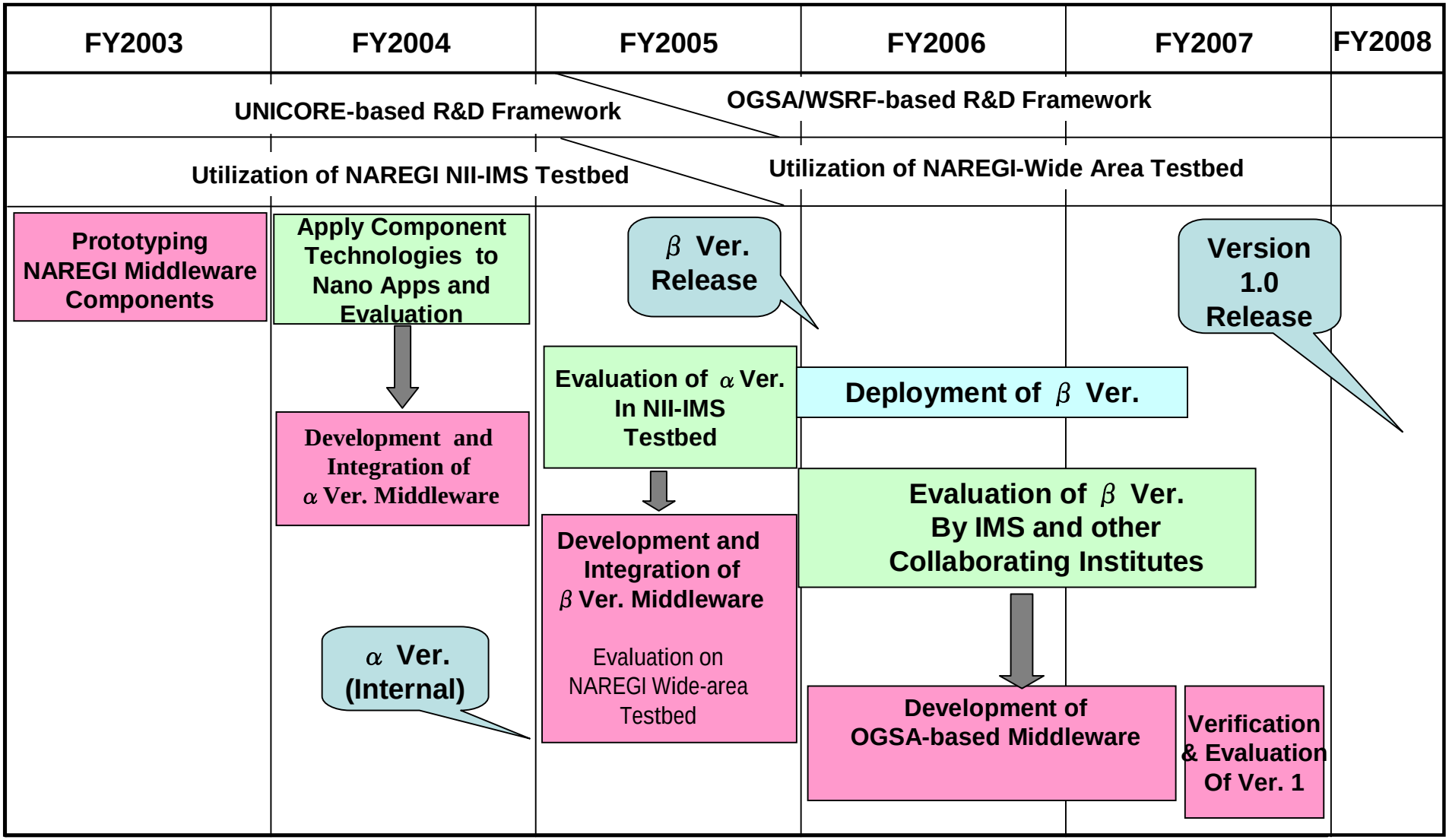
NAREGI-EGEE Job Submission (GIN)

- Architecture



- Demo
  - NAREGI → EGEE: using NAREGI Workflow
  - EGEE → NAREGI: using glite WMS commands

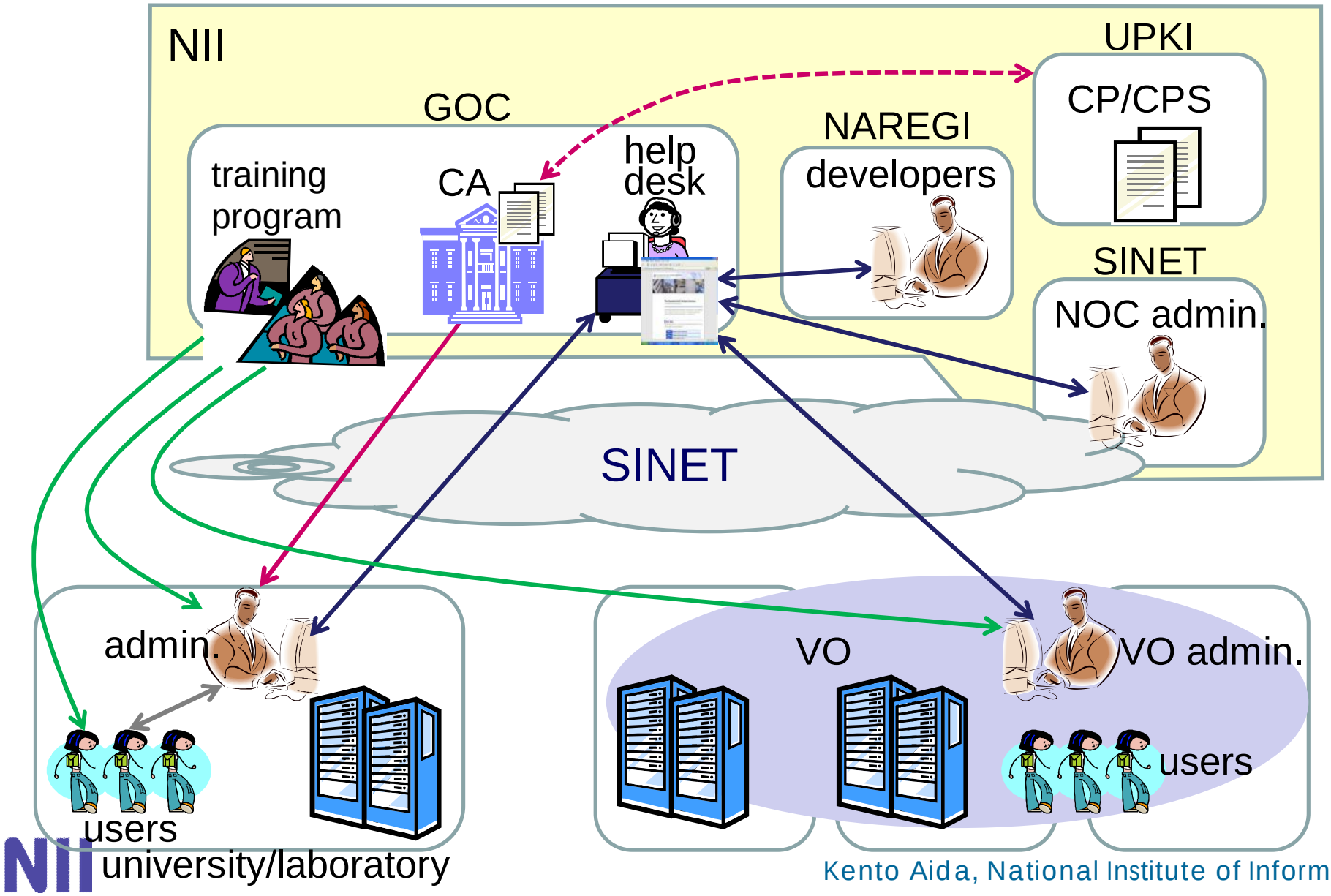
Roadmap of NAREGI Grid Middleware



NAREGI Deployment

- High Energy Accelerator Research Organization (KEK)
  - HEP application
- National Astronomical Observatory of Japan
  - virtual observatory
- Institute for Molecular Science
  - nano-science application
- Osaka University
  - computing service, certificate authority
- Tokyo Institute of Technology
  - computing service on TSUBAME

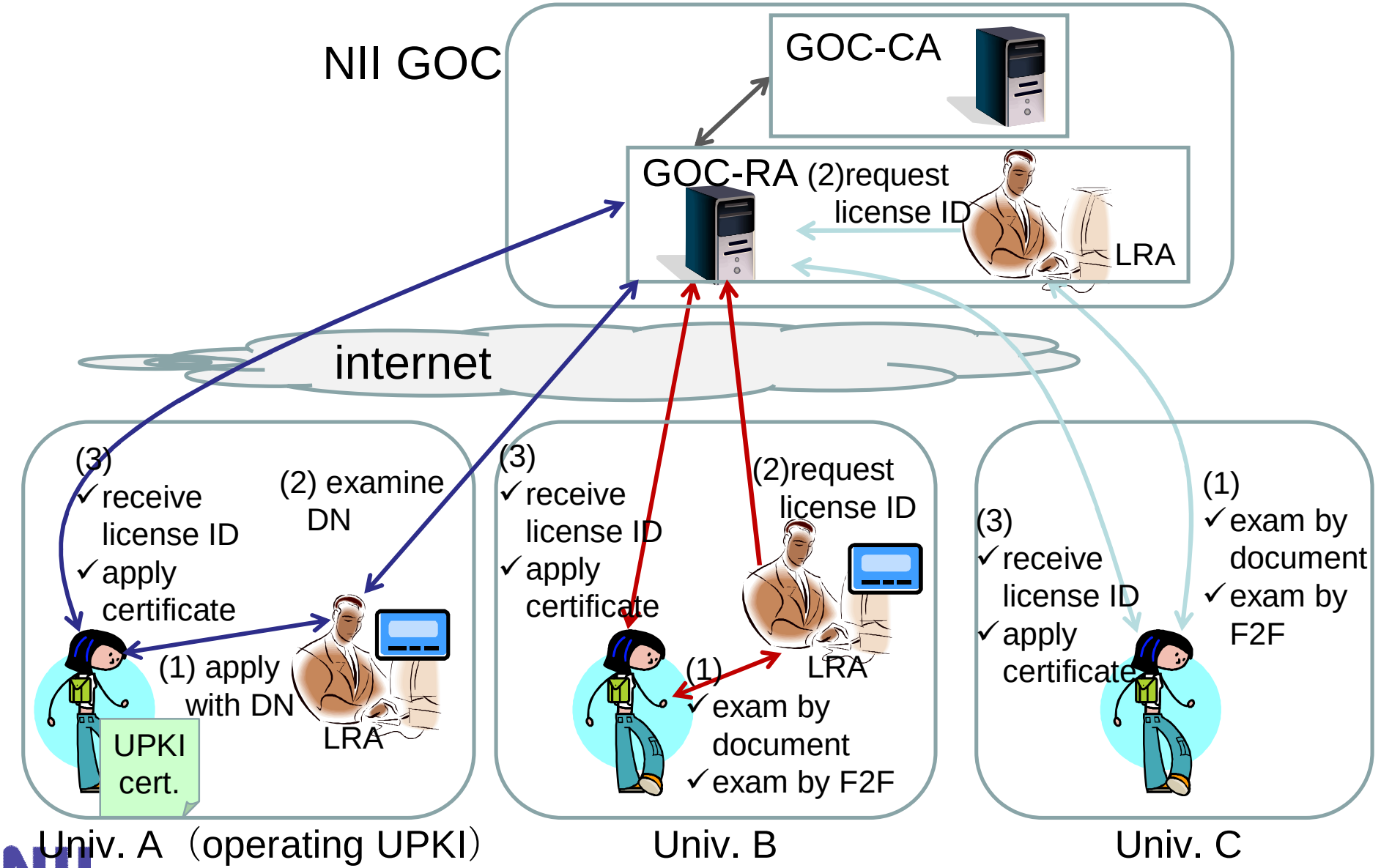
Grid Operation Center



Grid CA (NAREGI CA)

- operation of Grid CA for CSI participants
- issuing internationally valid grid certificates
  - ApGrid PMA
- cooperation with computing centers (planed)
  - Local Registration Authority (LRA) at computing centers in universities/laboratories
- cooperation with UPKI (planed)
  - issuing grid certificates from UPKI certificates

Issuing User Certificate (planed)



Summary

- CSI is a new information infrastructure to boost today's advanced scientific research in Japan.
  - networking, federated ID management, grid
- NAREGI grid middleware realizes to built a virtual single computing environment on geographically distributed and storage resources.
  - NAREGI middleware ver.1 will be released in May 2008.
- next step
  - The NAREGI deployment phase is starting in 2008.
  - NII plans to run GOC.