

**RENKEI:
REsources liNKage for E-science**

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Resource Federation for e-Science

■ e-Science

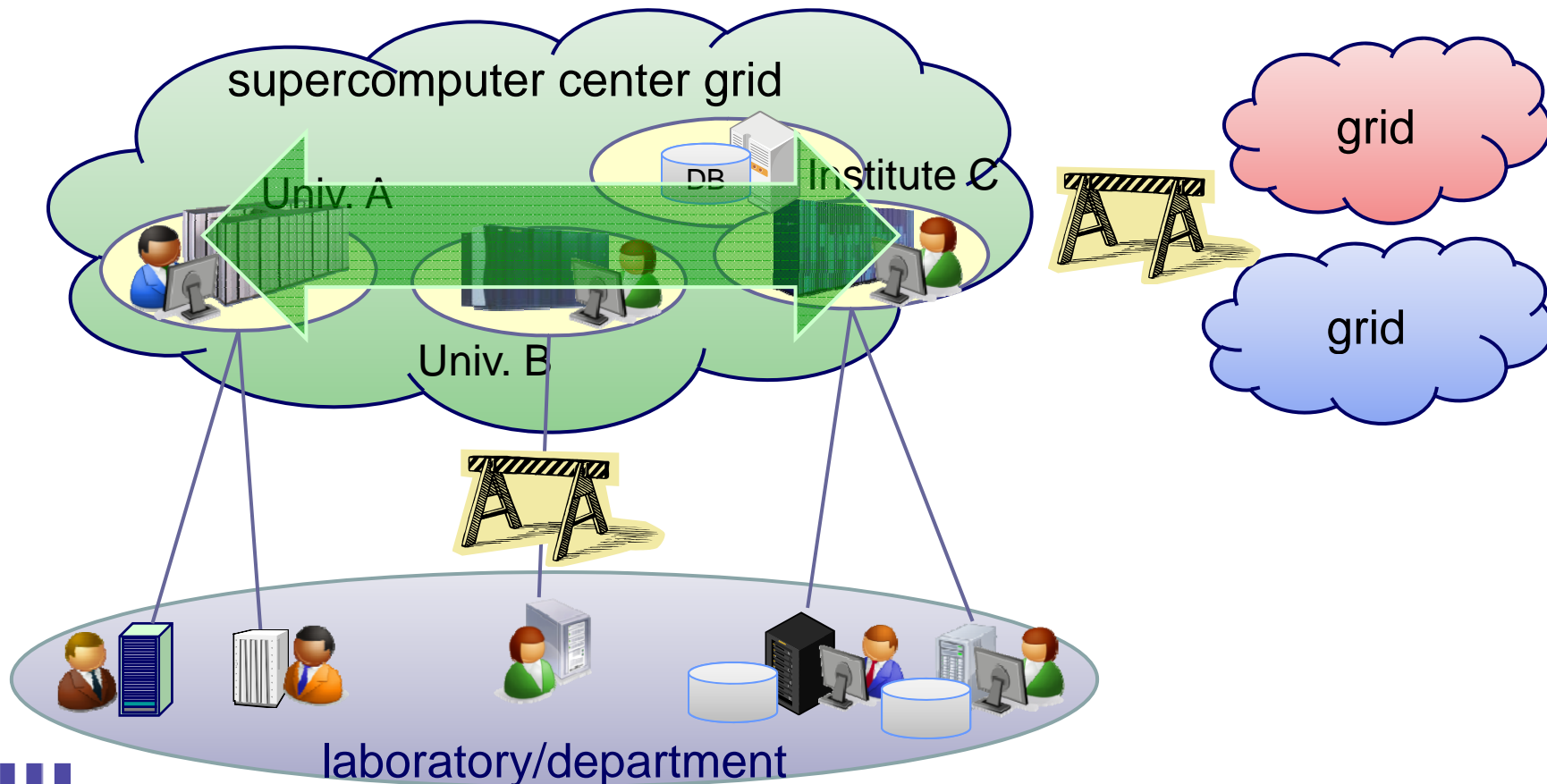
A new scientific research method to process multidisciplinary data using advanced IT in order to achieve new scientific discoveries.

■ Key technology

federation of various resources on network, e.g. computers, data storages, databases, applications, ...

Is (current) grid enough for e-Science?

- There still exist barriers for more federation.
 - supercomputer center grid vs. laboratory/department
 - grids with different middleware



REsources liNKage for E-science (RENKEI)

■ more resource federation

- Resource federation in a single grid is not enough.
- More resource federation is needed for e-Science.

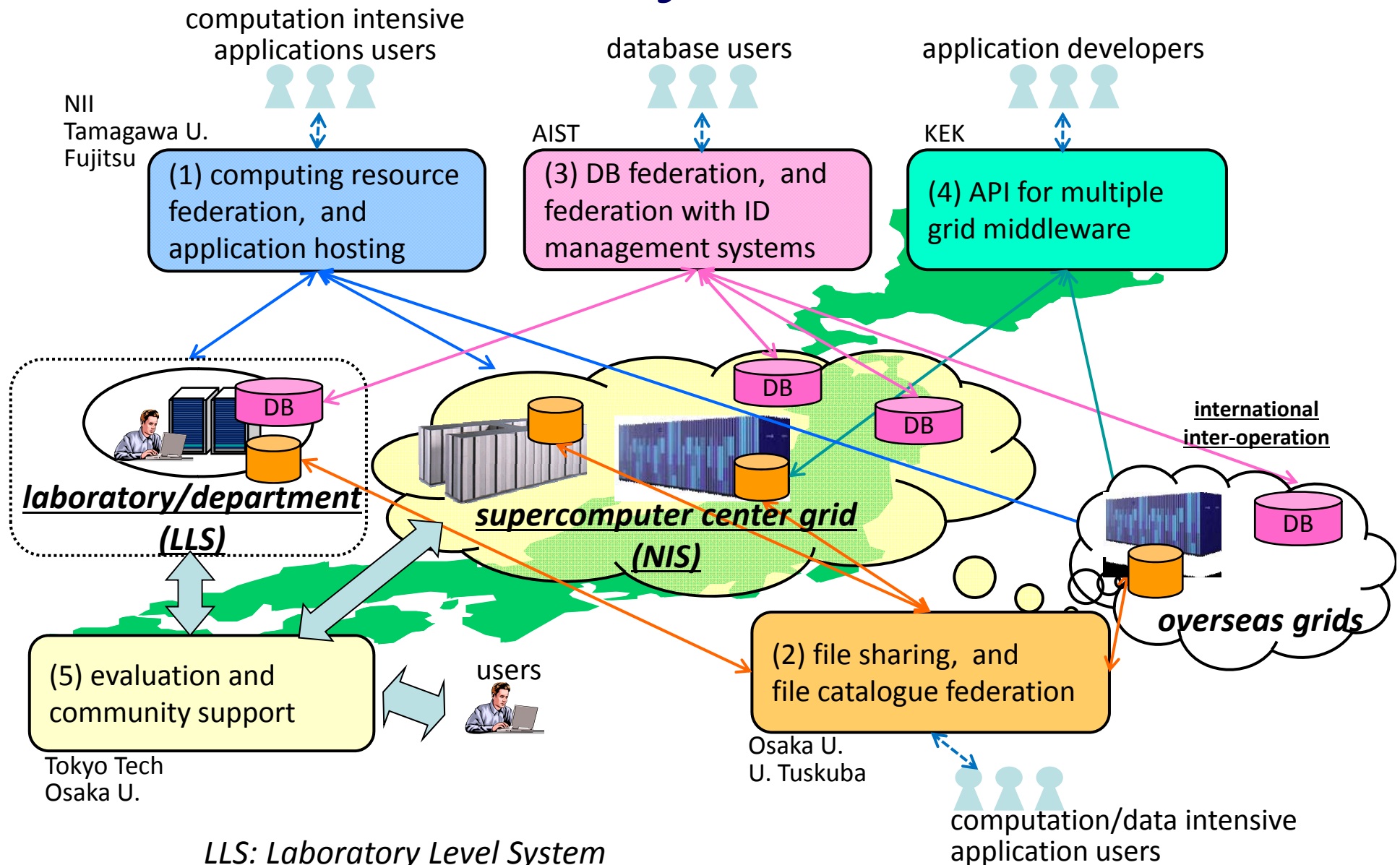
■ Goal

- research and development of middleware technology to utilize computing powers, files, DBs, ... on different operational environments, e.g. local machines and grids with different middleware.

■ Members

- AIST, Fujitsu, KEK, NII, Osaka Univ. Tamagawa Univ., Tokyo Tech. , Tsukuba Univ.

RENKEI Project Overview



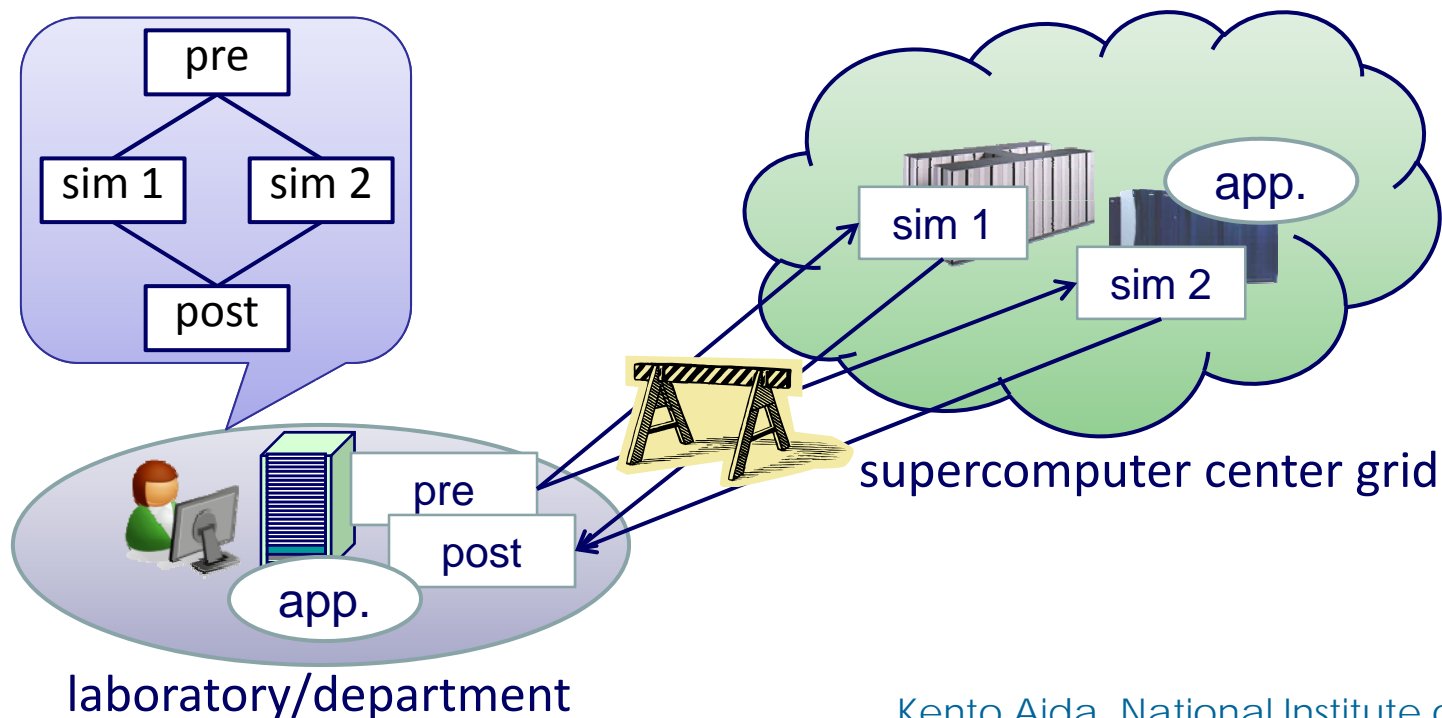
LLS: Laboratory Level System

NIS: National Infrastructure System



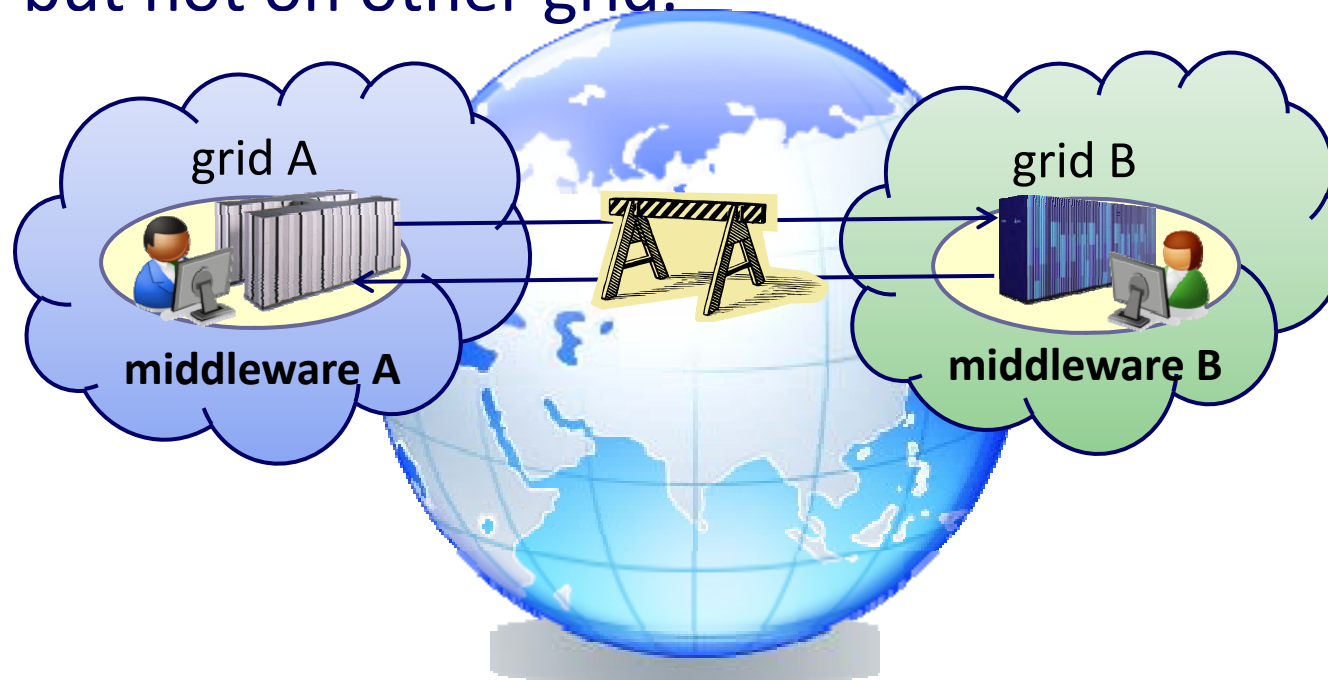
Difference of Compt. Env.

- We want to run an application on both local machines (in a laboratory or a department) and machines on a supercomputer center grid, but ...
 - The user needs to run jobs on the machines in different way. (no single sign-on)



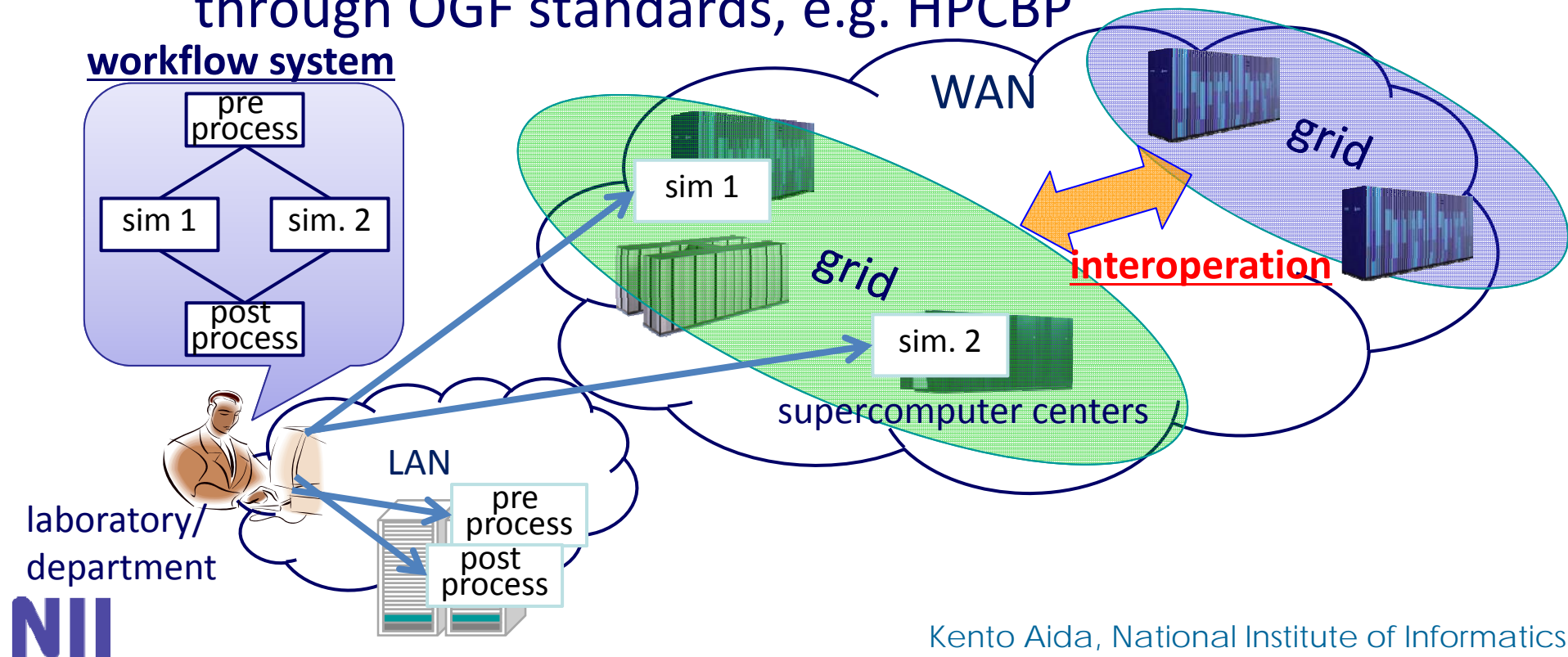
Difference on Compt. Env. (cont'd)

- We want to run an application on machines in multiple grids, but
 - grid environments with difference grid middleware
 - The user can run jobs on his/her grid environment but not on other grid.

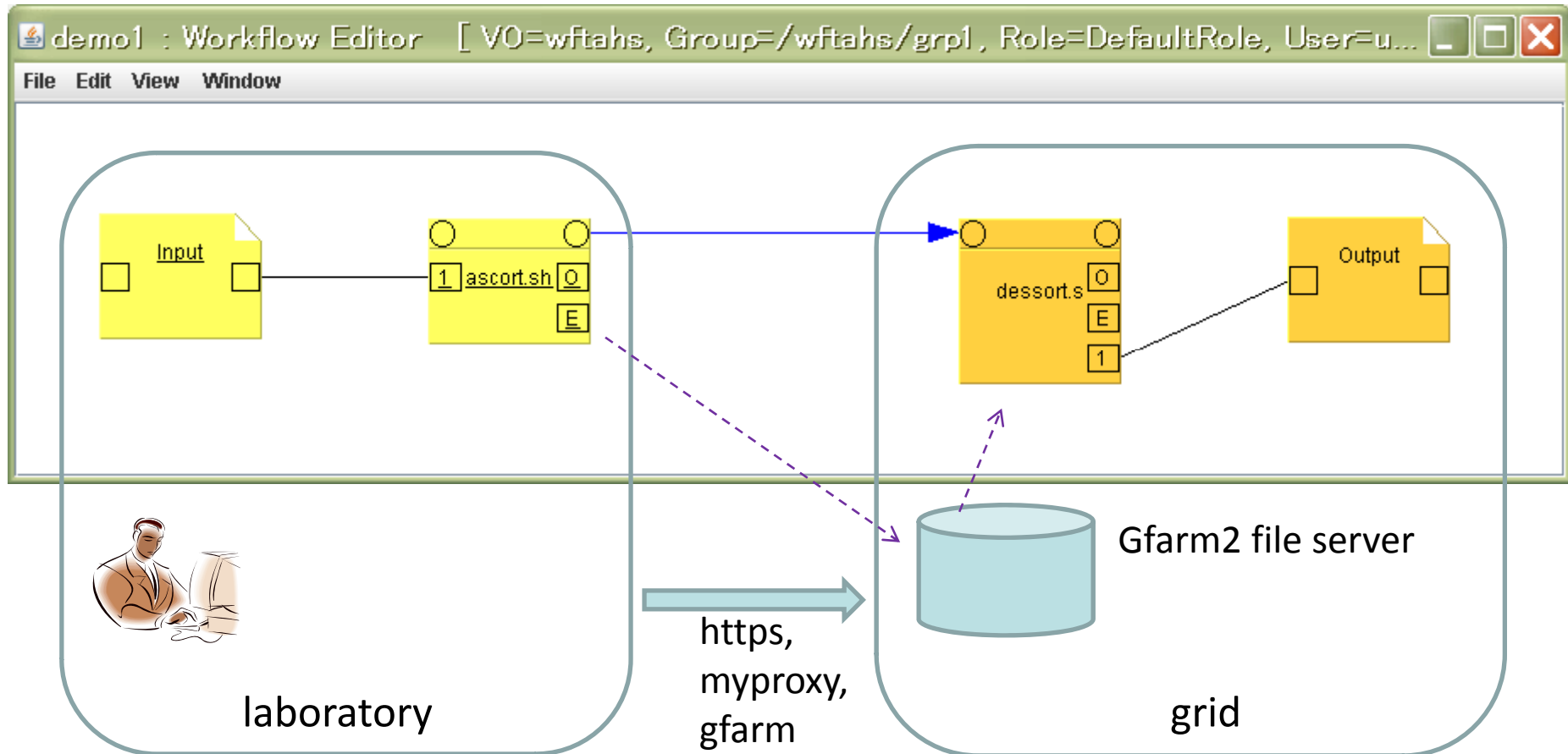


Computing Resource Federation

- workflow system
 - job submissions to LLS/NIS
- interfaces for grid interoperability
 - job submission and resource information sharing through OGF standards, e.g. HPCBP

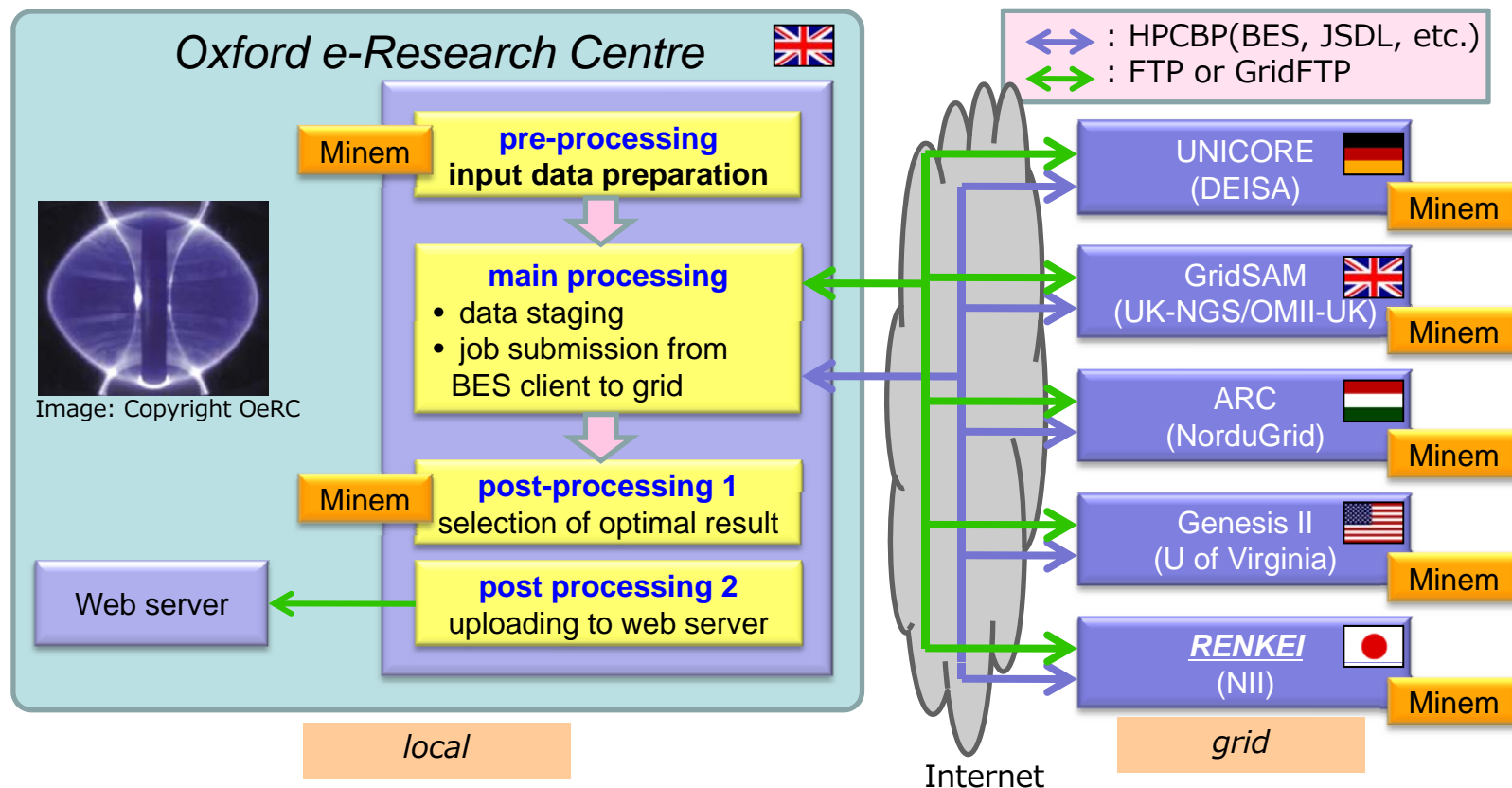


Demo of Workflow System (SC09)



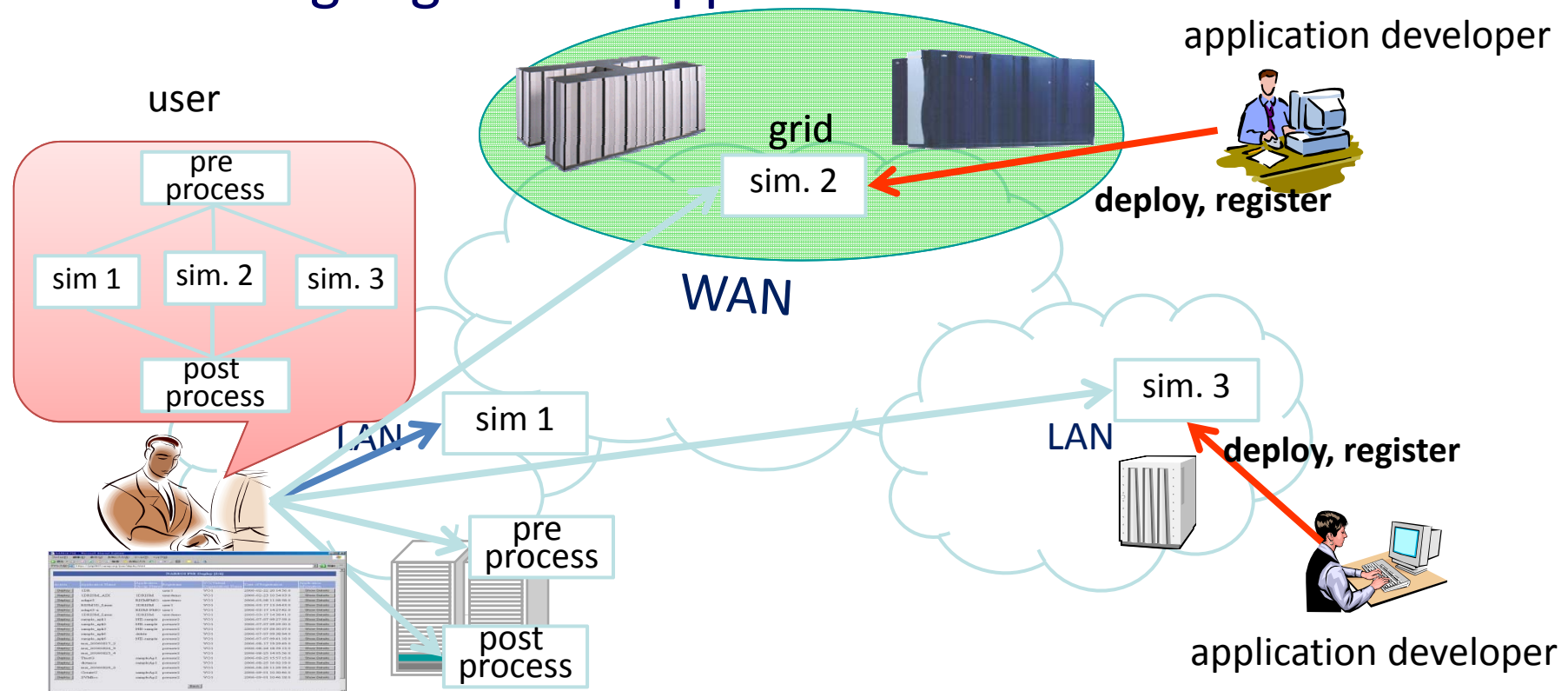
Interop Demo @ 5th IEEE eScience

- Plasma Charge Minimization: Minem
 - minimization of the total electric charges over the surface of a sphere
 - local environment for pre/post processing and grid environment for main processing
- job submission to multiple grids via HPCBP



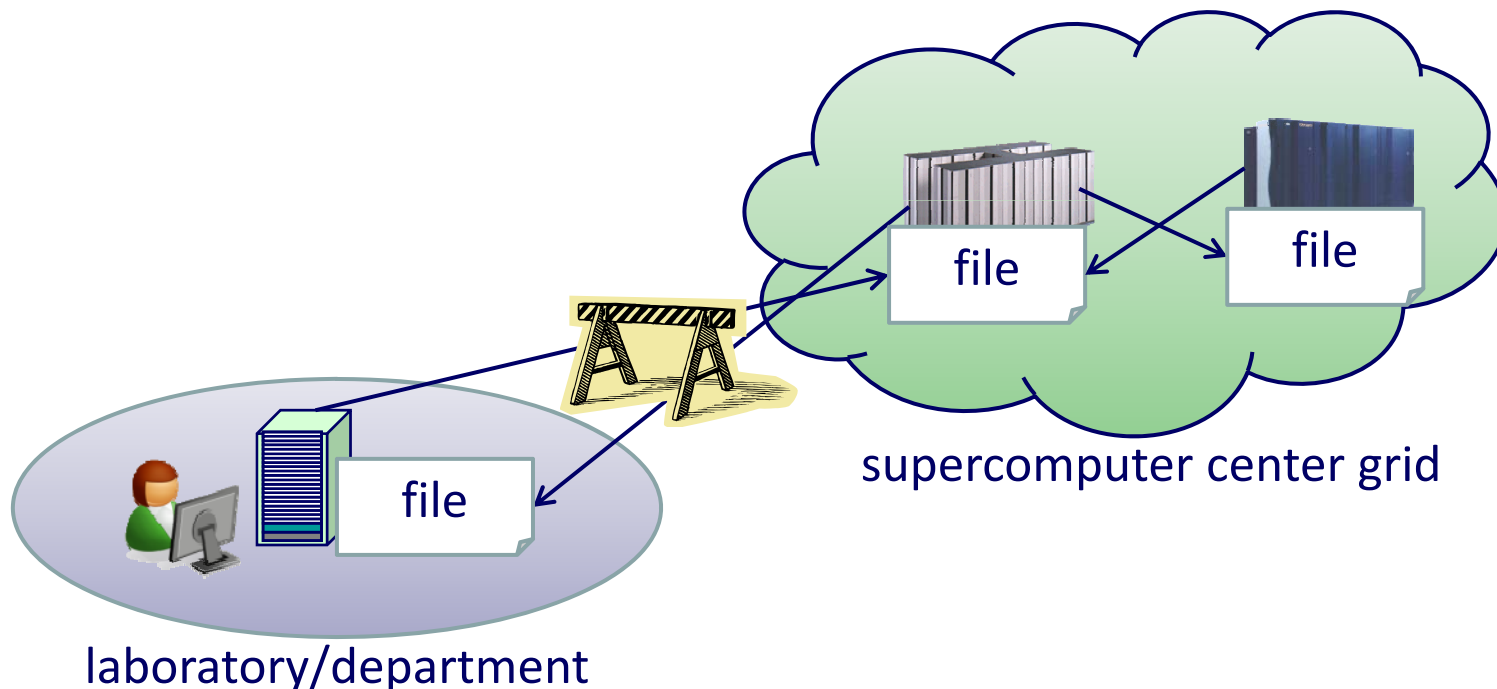
Application Hosting

- sharing applications in a research community
 - deployment and registration of applications by application developers
 - running registered application



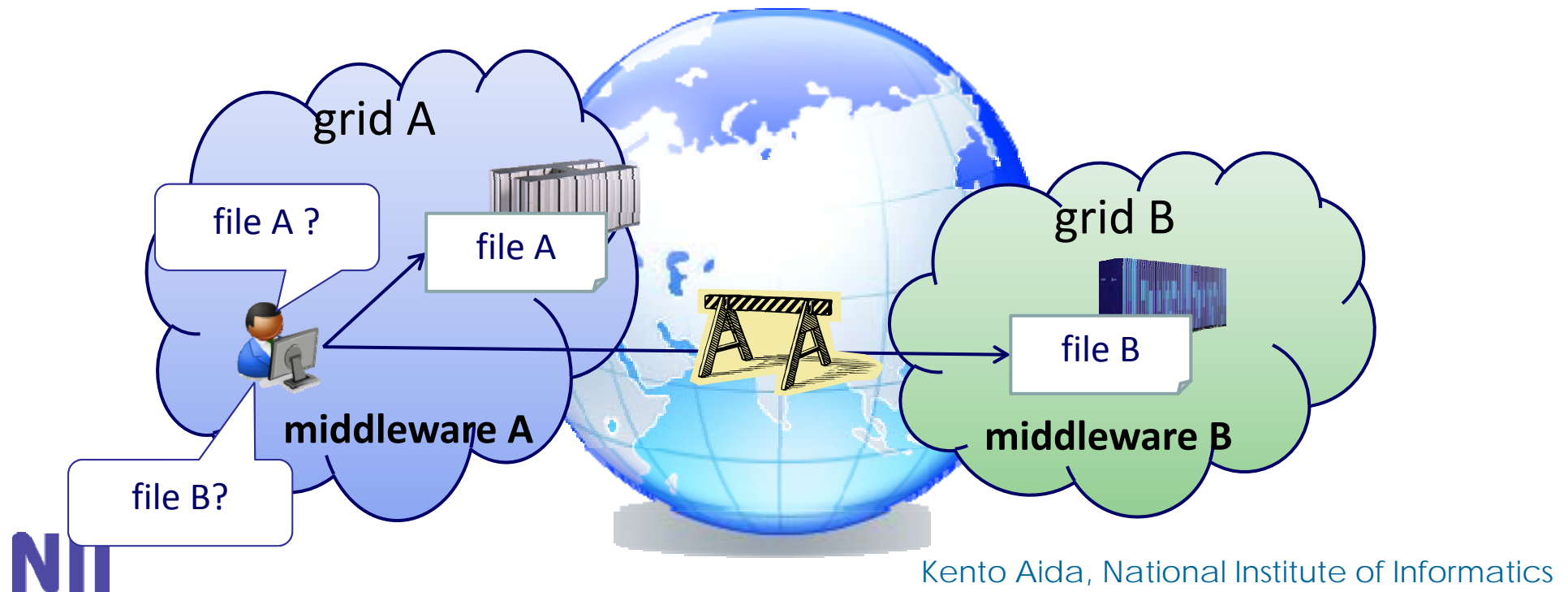
Difference of File Access Method

- We want to access files on a supercomputer center grid from local machines, but ...
 - The user needs to manually transfer/copy files between local machines and machines on the grid.



Difference of File Access Method (cont'd)

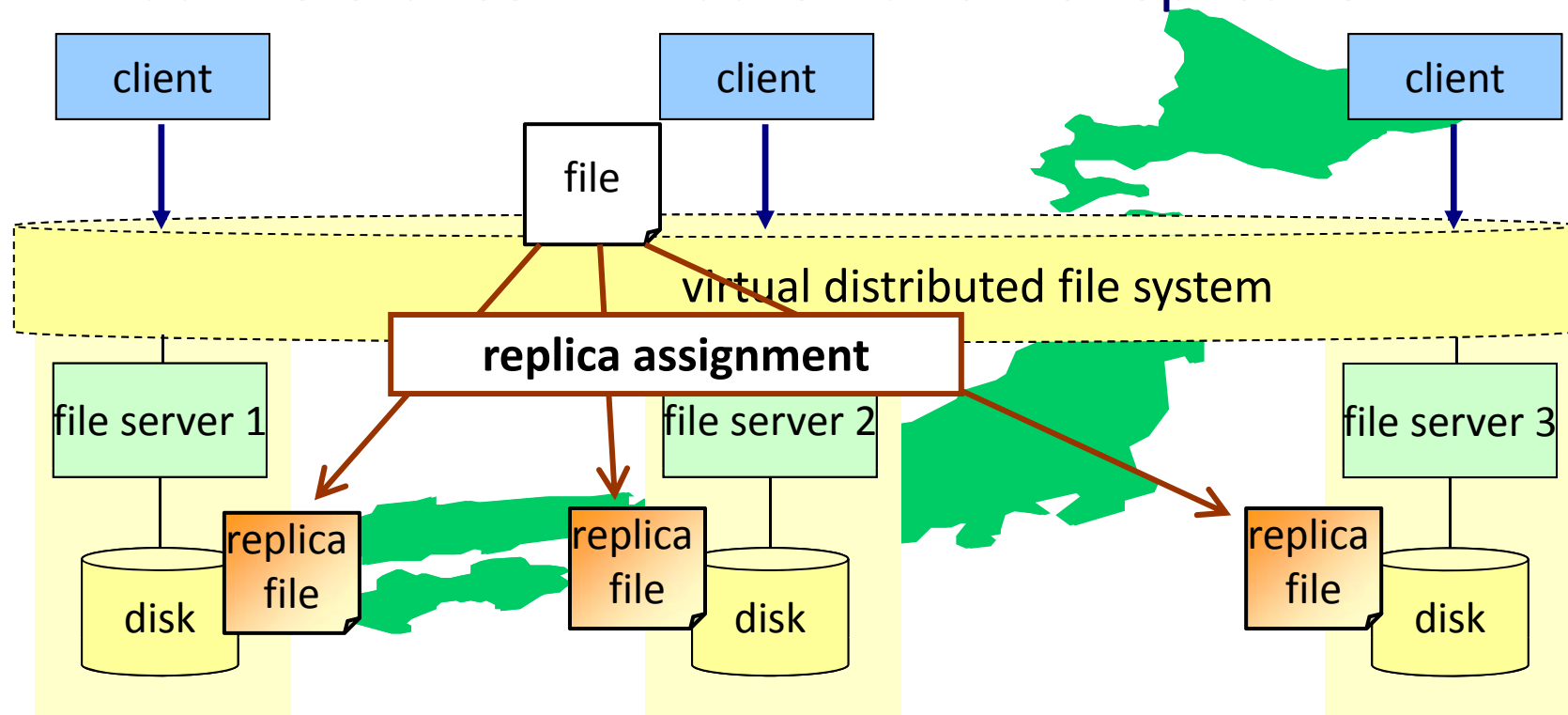
- We want to access files on multiple grids, but ...
 - multiple file catalog implementations
 - The user needs to learn multiple operations for the file catalog implementations.



File Sharing

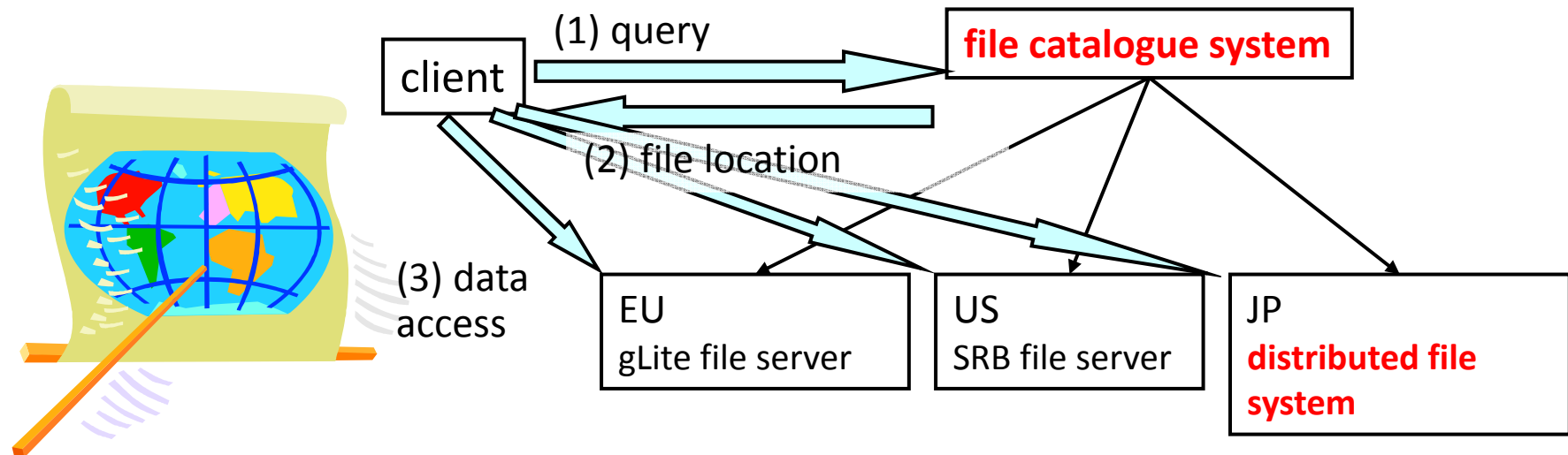
■ distributed file system

- high performance file access from LLS/NIS with automatic replica file allocation
- fault tolerance with automatic file replication



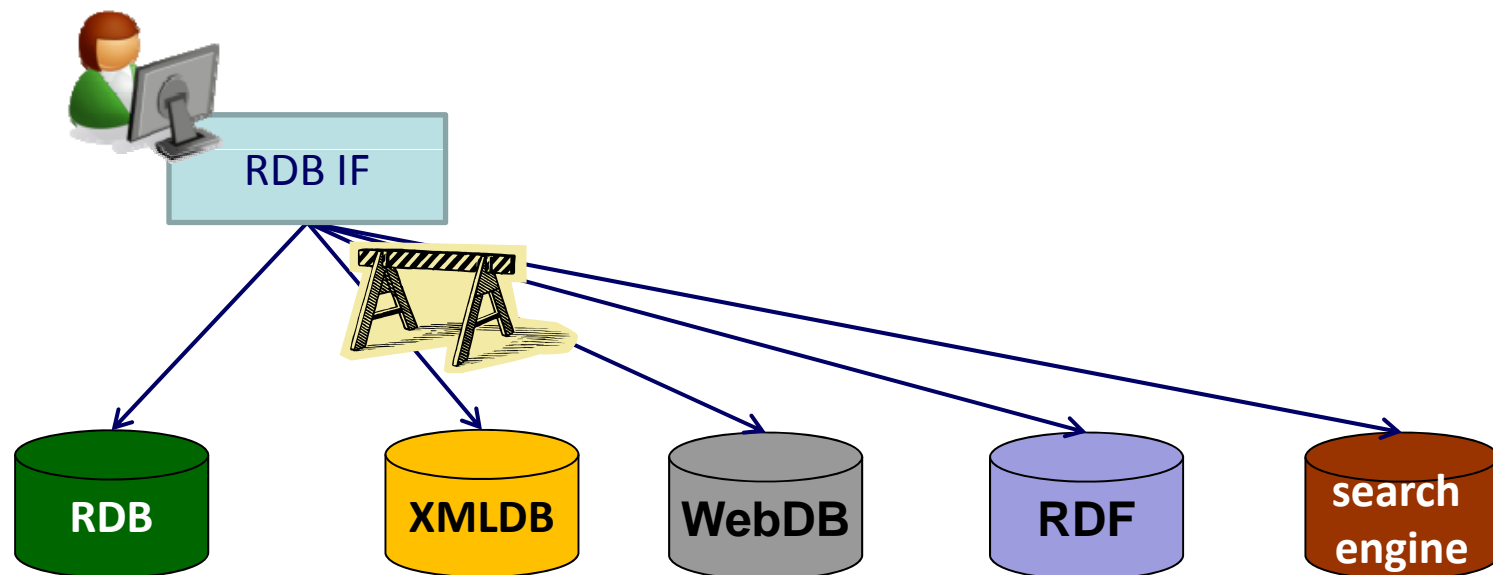
File Catalogue Federation

- federation of file catalogues running on different grid middleware (international interoperation)
 - development of the file catalogue system with RNS (OGF standard)
 - standardization of interfaces in OGF



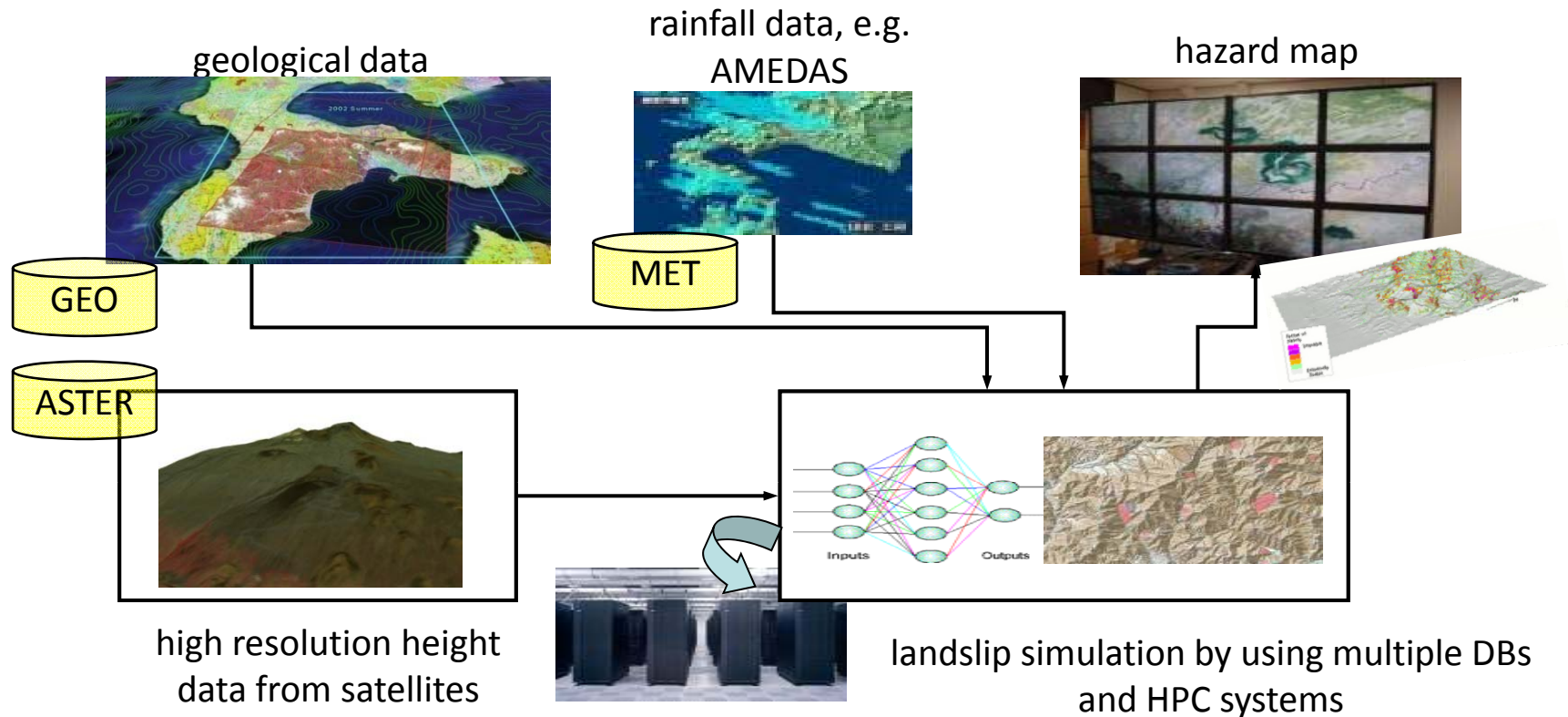
Difference of DB Access Methods

- We want to query data on multiple DBs in multiple research communities, but ...
 - multiple DB implementations
 - The user needs to learn multiple operations for the DB implementations.



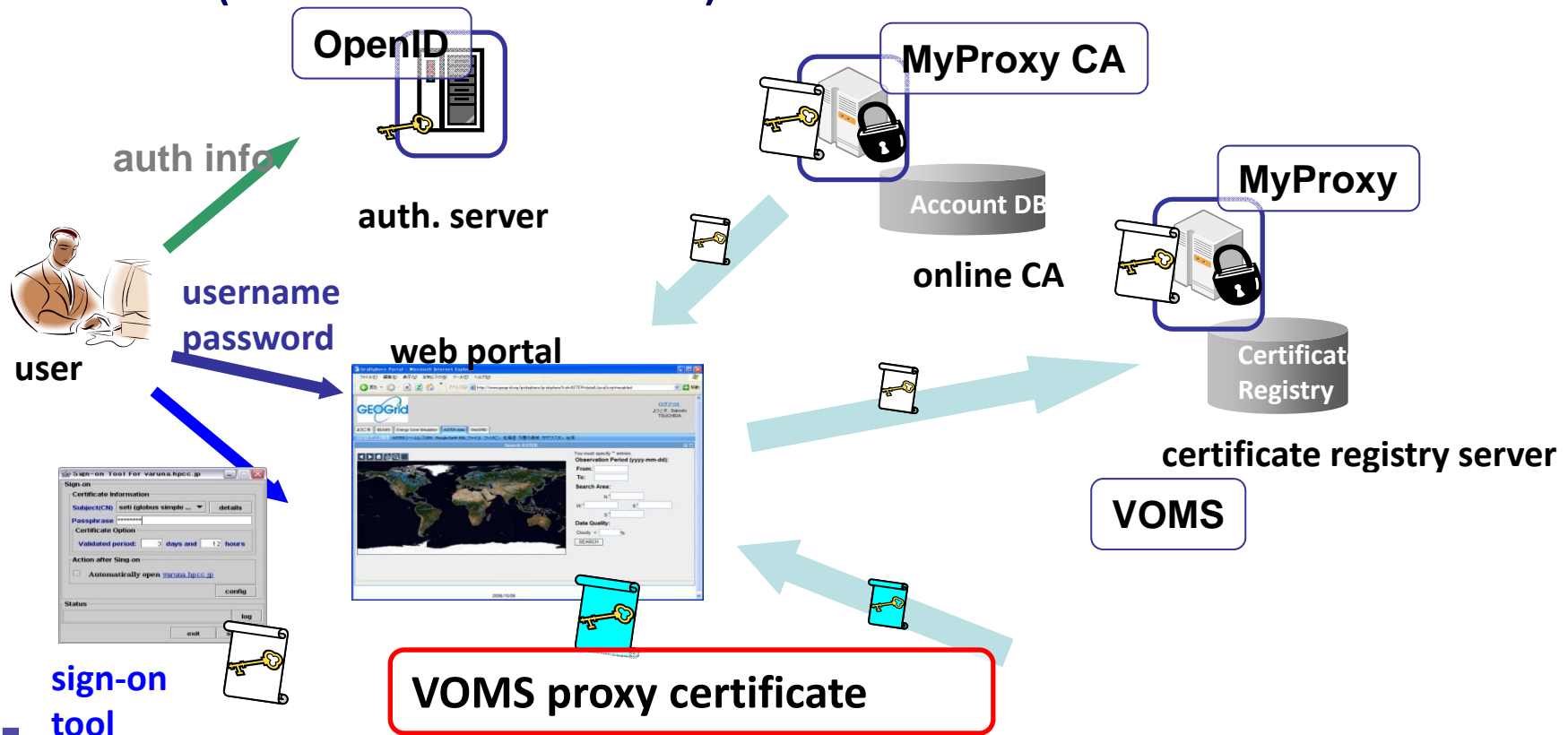
Database Federation

- unified and easy access to multiple DB with different implementation, e.g. RDB, XML, Web, RDF, search engine,...



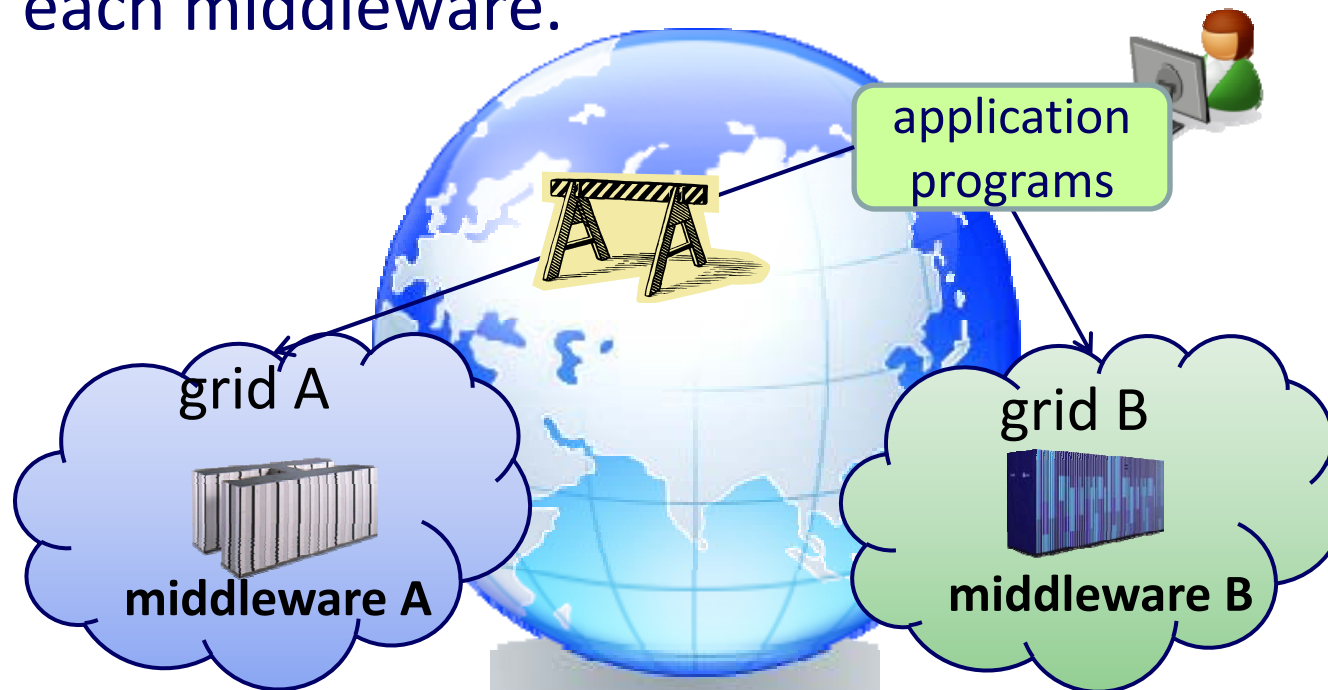
Federation with ID Management Systems

- generation of grid auth. information federating with various ID management system
 - Username/password, OpenID, Shibboleth, Kerberos, PKI (X.509 certificates)



Difference of App. Development Env.

- We want to develop an application running on multiple grid middleware, but ...
 - multiple API implementation
 - The user needs to modify application programs for each middleware.



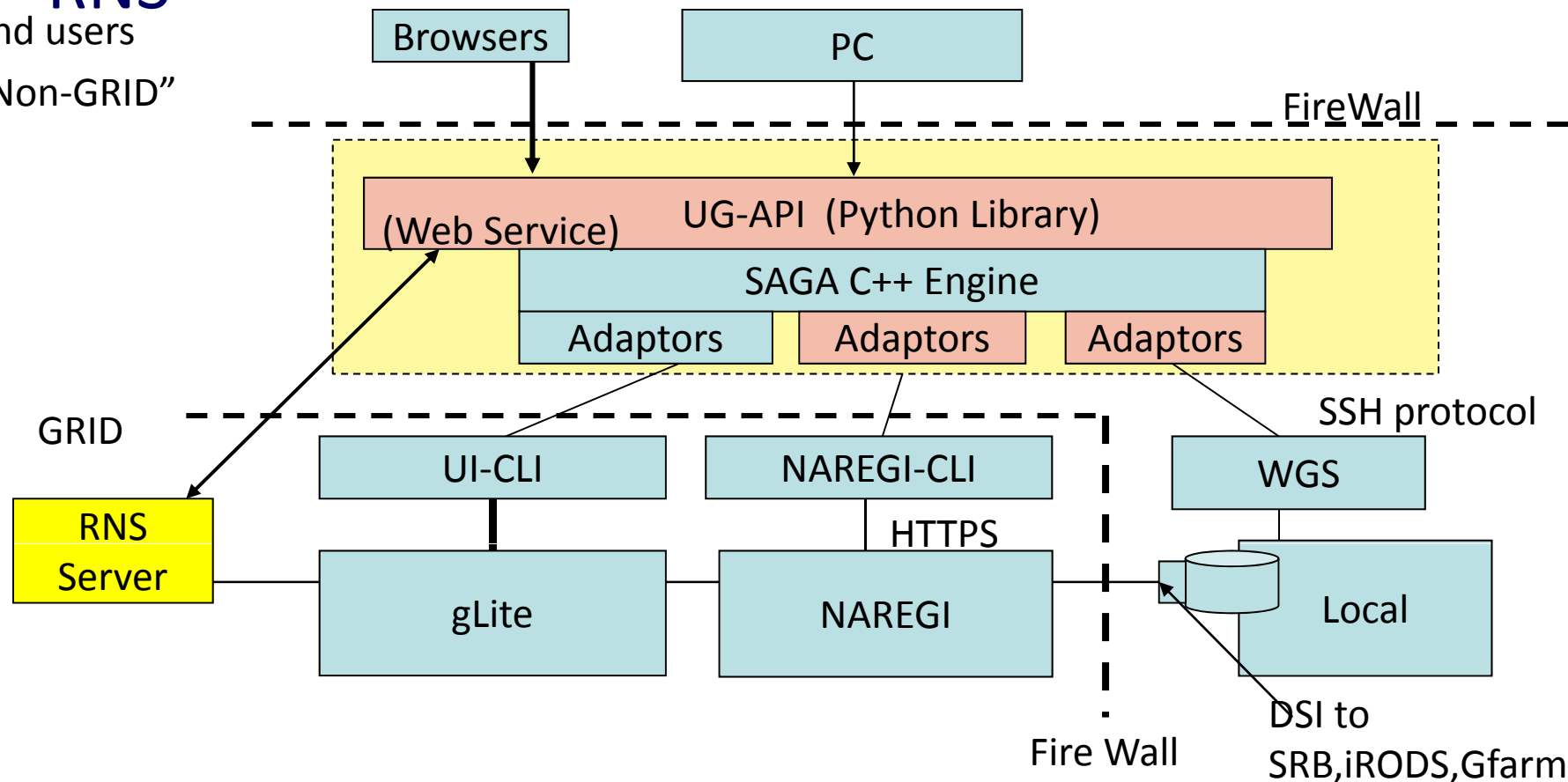
API for Multiple Grid Middleware

- API to develop/run applications on multiple grid middleware with OGF standards, e.g. SAGA and

RNS

End users

“Non-GRID”



source: Takashi Sasaki, KEK

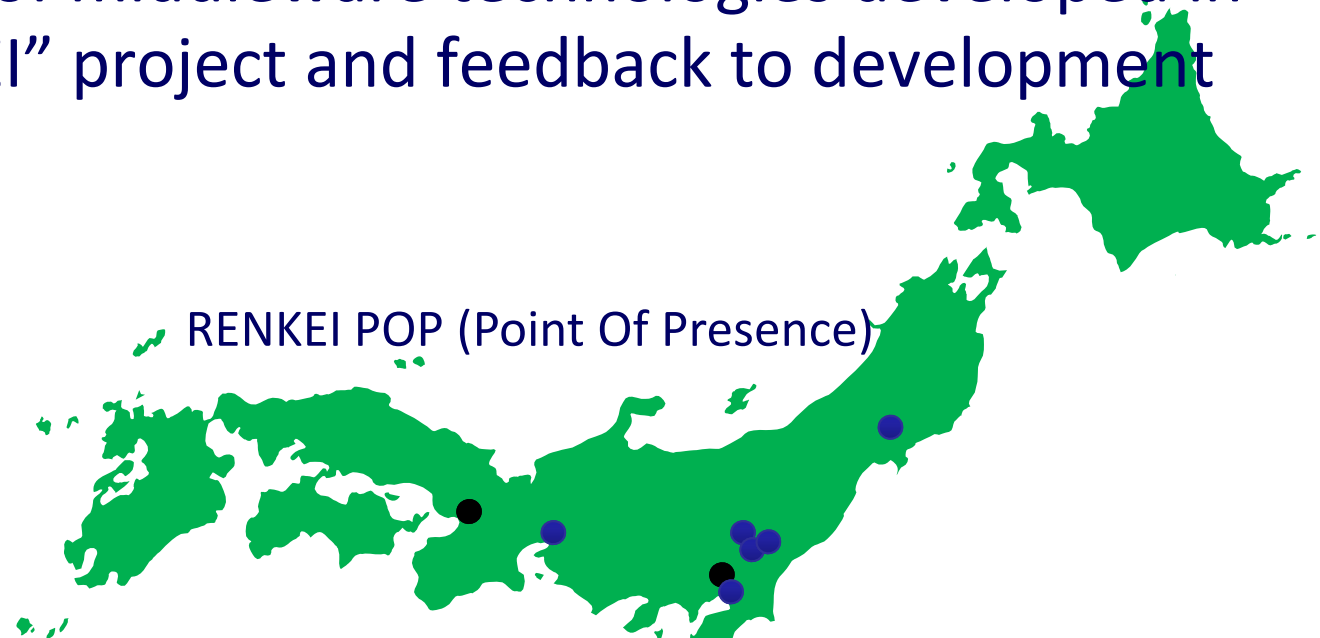
Evaluation and Community Support

■ testbed

- building testbeds with LLS/NIS

■ collaboration with user communities

- collecting needs from application users for e-science infrastructure
- evaluation of middleware technologies developed in the “RENKEI” project and feedback to development teams



Summary

- More resource federation is needed for enabling e-Science.

- Removing barriers for more resource federation.
 - local environment (laboratory/department) vs. supercomputer center grid
 - grids with different middleware

- The middleware development project, “RENKEI”, will remove the barriers.

<http://www.e-sciren.org/>