# NAREGI-PSE: Problem Solving Environment with ACS based on Grid Services

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NAREGI-PSE Group

National Institute of Informatics
Fujitsu Limited
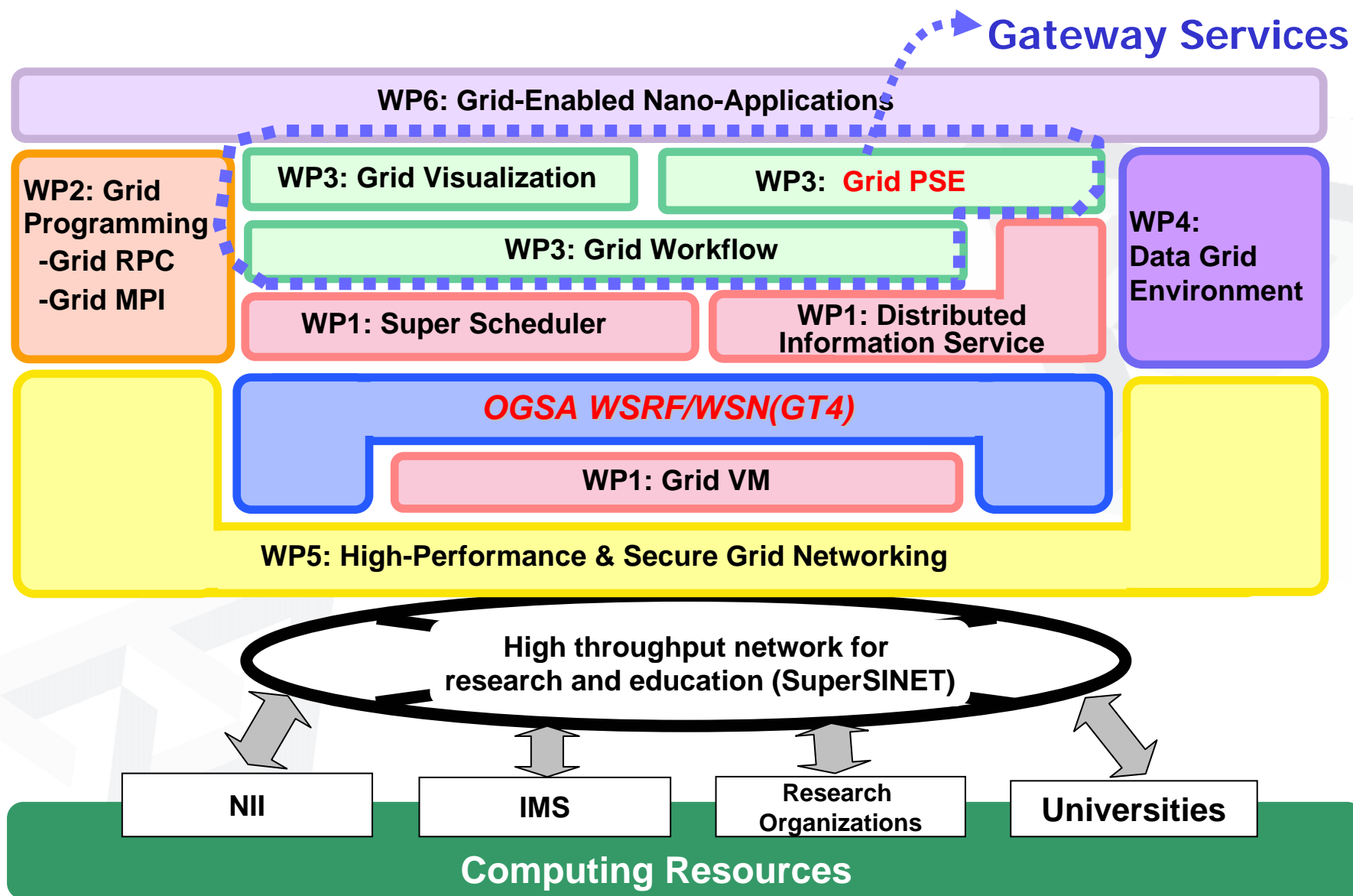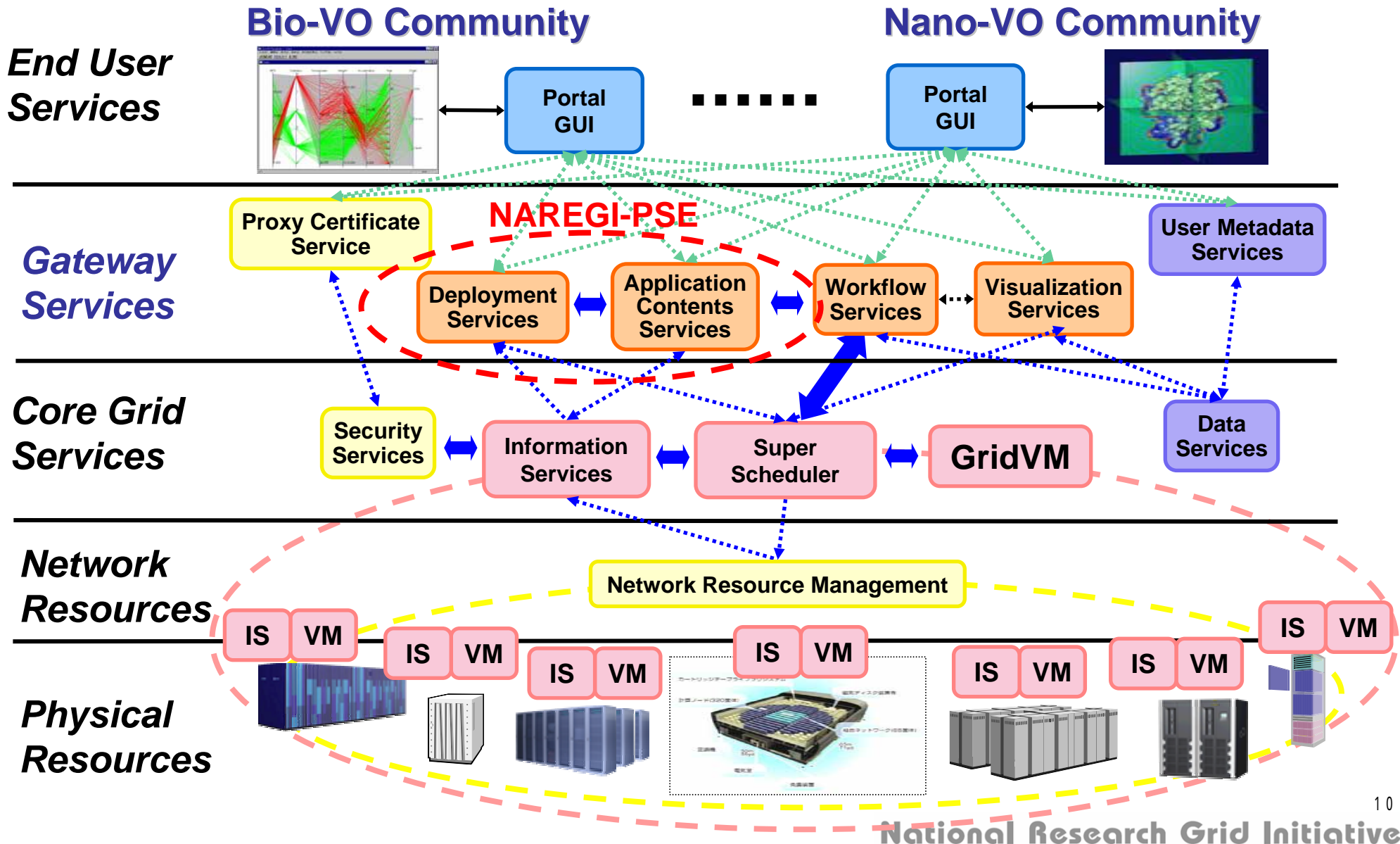Utsunomiya University

# National Research Grid Initiative (NAREGI)

■ **What is NAREGI?**     *http://www.naregi.org/*

■ **Research Themes in NAREGI**

- ■ **WP1: Resource Management in the Grid Environment**
  ( Scheduler, Broker, Auditing, Accounting, Grid VM )
- ■ **WP2: Grid Programming Environment**
  ( Grid RPC, Grid MPI )
- ■ **WP3: Grid Application Environment (User-Level Grid Tools)**
  ( Workflow GUI, Visualization Tools, *Grid PSE* )
- ■ **WP4: Data Grid Environment**
- ■ **WP5: High-performance & Secure Grid Networking**
  (Traffic Measurement, Optimal Routing Algorithms, Robust TCP/IP Protocols )
- ■ **WP6: Grid-Enabled Nano Applications**
  ( Parallel Structure, Granularity, Resource Requirement, Coupled Simulation )
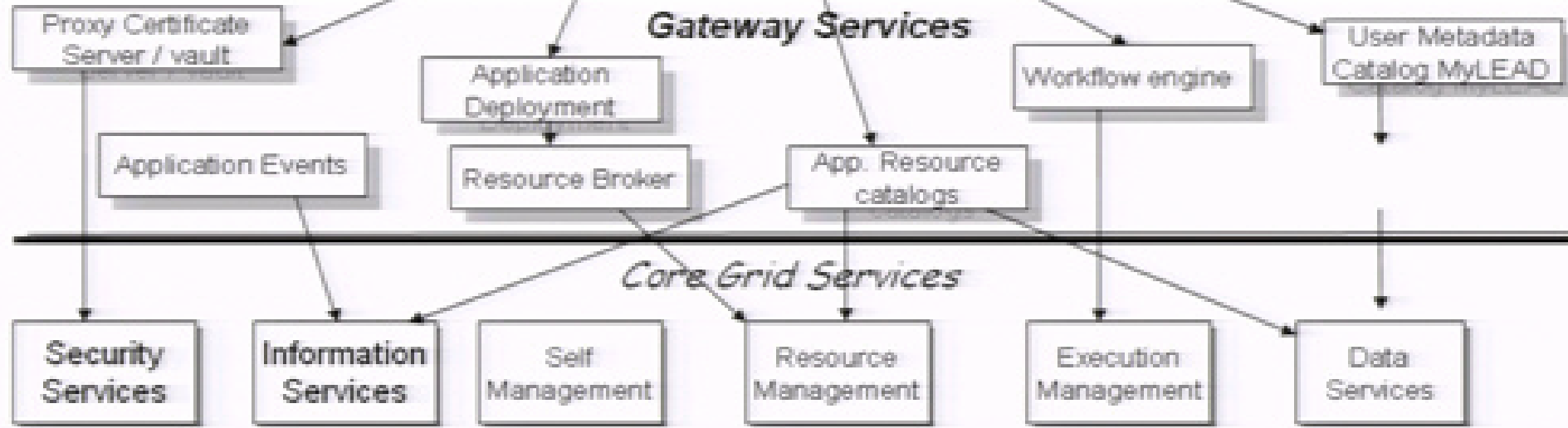
# NAREGI Software Stack

Gateway Services

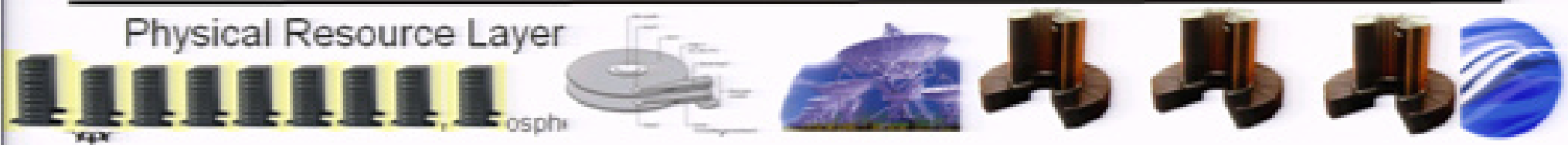**WP6: Grid-Enabled Nano-Applications**

**WP2: Grid Programming**
-Grid RPC
-Grid MPI

**WP3: Grid Visualization**

**WP3: Grid PSE**

**WP3: Grid Workflow**

**WP1: Super Scheduler**

**WP1: Distributed Information Service**

**WP4: Data Grid Environment**

*OGSA WSRF/WSN(GT4)*

**WP1: Grid VM**

**WP5: High-Performance & Secure Grid Networking**

High throughput network for research and education (SuperSINET)

NII

IMS

Research Organizations

Universities

**Computing Resources**

# NAREGI Middleware Services Architecture



**Bio-VO Community**

**Nano-VO Community**

**End User Services**

Portal GUI

Portal GUI

**Gateway Services**

Proxy Certificate Service

**NAREGI-PSE**

Deployment Services

Application Contents Services

Workflow Services

Visualization Services

User Metadata Services

**Core Grid Services**

Security Services

Information Services

Super Scheduler

GridVM

Data Services

**Network Resources**

Network Resource Management

**Physical Resources**

IS VM

IS VM

IS VM

IS VM

IS VM

IS VM

IS VM

National Research Grid Initiative

# The Architecture

LEAD Grid Portal Server

**Gateway Services**

Proxy Certificate Server / vault

Application Deployment

Workflow engine

User Metadata Catalog MyLEAD

Application Events

Resource Broker

App. Resource catalogs

*Core Grid Services*

Security Services

Information Services

Self Management

Resource Management

Execution Management

Data Services

OGSA-like Layer

Physical Resource Layer

# NAREGI-PSE Concept

- **Provide a framework to distributed users' applications on grid**
  - Users can register, deploy and retrieve applications by using NAREGI-PSE for real-time collaborations.
  - Application developers distribute and share his/her applications by research community members.
  - Application users easy to use the latest research applications without compile and test run.
- **Focus on a legacy application**
  - Deploy application binaries for specific targets machine.
  - Compile source programs, if needed

# Usage I (Compile, Deploy and Register)

**Application Developer**

Enter Application Info.

Upload files
- Source programs
- Compile script etc.

**NAREGI-PSE**

Application Pool = Application Information +ACS

Compile

Application files

Deployment Info.

Application Files(binaries)

**Resource Info.**
**Info. Service**

**Server#1**

Compile → OK!

**Server#2**

Post process → NG!

**Server#3**

Post process → OK!
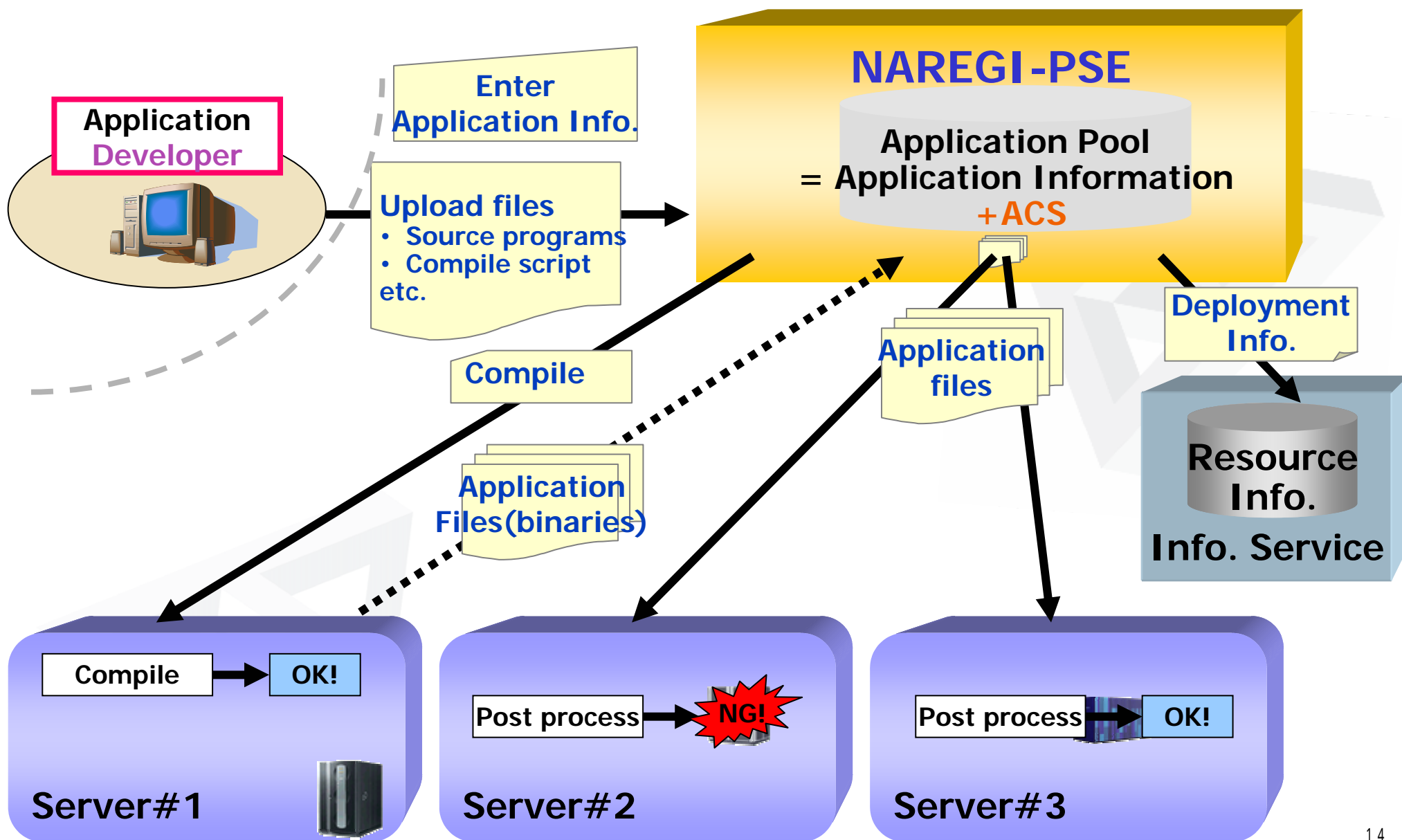
# Structure of Application Pool

**NAREGI-PSE**
**Application Pool**

**=**

**Application Information Including Resource Requirements (JSDL)**

**+**

**ACS (Application Repository +Application Archive )**

**ACS**

AR ⇄ AA

**Application Producer**

Create, Read, Update, Delete

**Contents**

**Application Consumer**

**Application Pool Interface**

**Application Repository Interface**

**Application Repository**

**Signature**

**AA Descriptor  AAD)**

**Application contents**

**Application Archive**

**Source + shell script, Binaries, Post script, WF(WorkFlow), & etc.**

# NAREGI-PSE and ACS
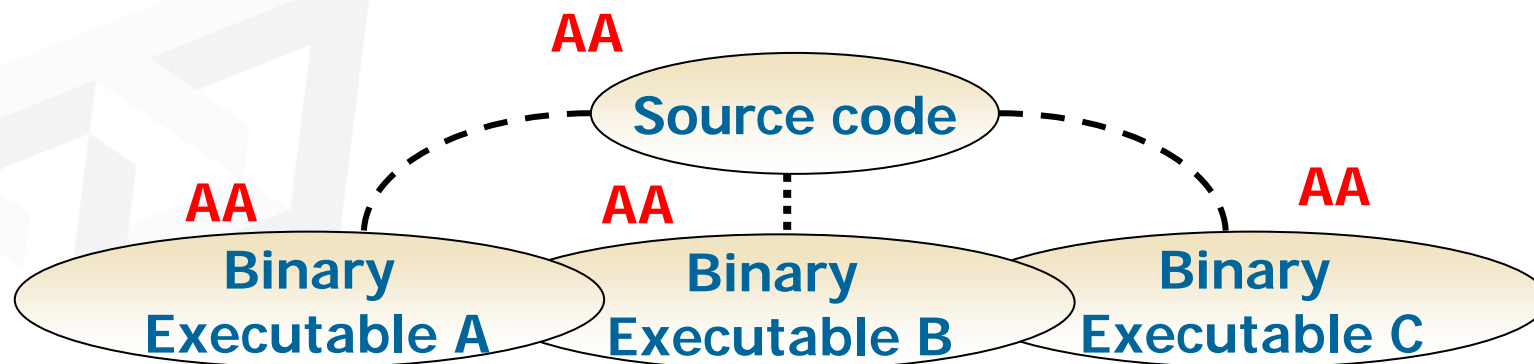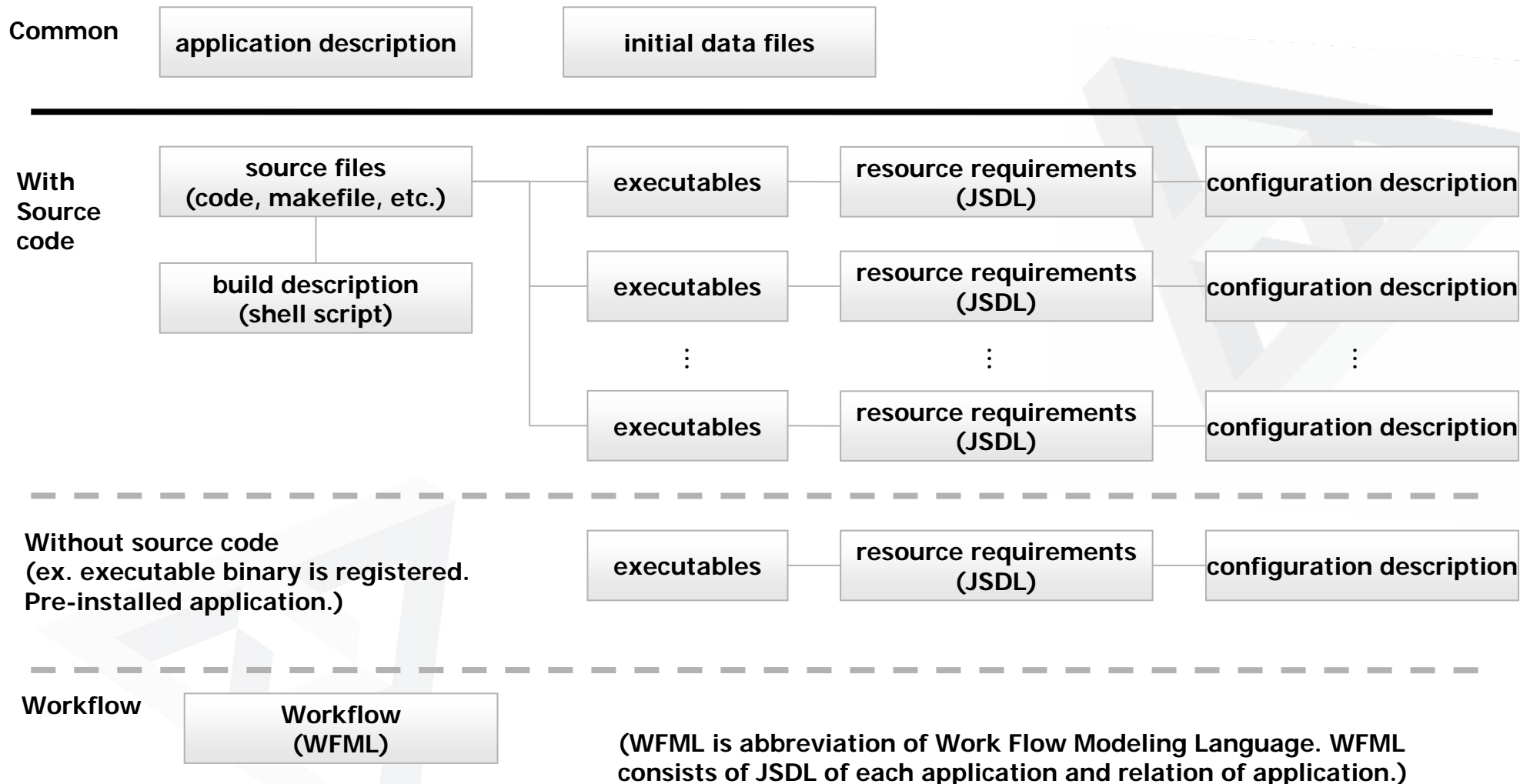
- **ACS**
  - NAREGI-PSE stores application files into Application Repository (ACS-AA) standardized by OGF.
  - ACS-AA can access from other OGSA-EMS standard Grid systems for Application Archives.
  - The application with a different resource requirement is stored as another application archive.
  - AA relation may be important to describe a relation between a source code and binaries.

# Application Model of NAREGI-PSE

**Common**

| application description | | initial data files |
|---|---|---|

**With Source code**

| source files (code, makefile, etc.) | executables | resource requirements (JSDL) | configuration description |
|---|---|---|---|
| build description (shell script) | executables | resource requirements (JSDL) | configuration description |
| | ⋮ | ⋮ | ⋮ |
| | executables | resource requirements (JSDL) | configuration description |

**Without source code (ex. executable binary is registered. Pre-installed application.)**

| executables | resource requirements (JSDL) | configuration description |
|---|---|---|

**Workflow**

| Workflow (WFML) |
|---|

**(WFML is abbreviation of Work Flow Modeling Language. WFML consists of JSDL of each application and relation of application.)**

# Resource Requirements

- **Resource requirements of applications in NAREGI-PSE are:**
  - Described based on Job Submission Description Language (JSDL).

- **PSE refers to resource requirements of the applications:**
  - to determine what nodes/systems are used for compilation/deployment.
  - Application user can copy JSDL from other application in PSE. They can modify JSDL to match their specific purposes in the Grid Workflow.

# Job Submission Description Languages (JSDL)

**Application element is extended:**
POSIXApplication
MPIApplicationSpecific
ApplicationResource
CheckPointableApplication

JSDL Overview in GGF drafts:

```
<JobDefinition>
    <JobDescription>
        <JobIdentification ... />
        <Application ... />
        <Resources... />
        <DataStaging ... />
    </JobDescription>
</JobDefinition>
```

**DataStaging element is not used. Described in Workflow.**

| | | | | | no use |
|---|---|---|---|---|---|
| JobDefinition | JobDescription | JobIdentification | JobName | | |
| | | | Description | | |
| | | | JobAnnotation | | |
| | | | JobProject | | |
| | | Application | ApplicationName | | |
| | | | ApplicationVersion | | |
| | | | Description | | |
| | | | POSIXApplication | Executable | |
| | | | | Argument | |
| | | | | Input | x |
| | | | | Output | |
| | | | | Error | |
| | | | | WorkingDirectory | |
| | | | | Environment | |
| | | | | WallTimeLimit | |
| | | | | FileSizeLimit | |
| | | | | CoreDumpLimit | x |
| | | | | DataSegmentLimit | x |
| | | | | LockedMemoryLimit | x |
| | | | | MemoryLimit | |
| | | | | OpenDescriptorsLimit | x |
| | | | | PipeSizeLimit | x |
| | | | | StackSizeLimit | x |
| | | | | CPUTimeLimit | |
| | | | | ProcessCountLimit | x |
| | | | | VirtualMemoryLimit | |
| | | | | ThreadCountLimit | x |
| | | | | UserName | x |
| | | | | GroupName | x |
| | | | MPIApplicationSpecific | MPIType | |
| | | | | TotalTasks | |
| | | | | TasksPerHost | |
| | | | | HelperCommand | |
| | | | | HelperCommnadArg | |
| | | | ApplicationResource | SoftwareName | |
| | | | | SoftwareType | |
| | | | | SoftwareVersion | |
| | | | CheckPointableApplication | CheckPointInterval | |
| | | Resources | CandidateHosts | HostName | |
| | | | FileSystem | FileSystemType | x |
| | | | | Description | x |
| | | | | MountPoint | x |
| | | | | DiskSpace | x |
| | | | ExclusiveExecution | | x |
| | | | OperatingSystem | OperationSystemName | |
| | | | | OperatingSystemType | |
| | | | | OperatingSystemVersion | |
| | | | | Description | |
| | | | CPUArchitecture | CPUArchitectureName | |
| | | | IndividualCPUSpeed | | |
| | | | IndividualCPUTime | | x |
| | | | IndividualCPUCount | | |
| | | | IndividualNetworkBandwidth | | x |
| | | | IndividualPhysicalMemory | | |
| | | | IndividualVirtualMemory | | |
| | | | IndividualDiskSpace | | x |
| | | | TotalCPUTime | | x |
| | | | TotalCPUCount | | |
| | | | TotalPhysicalMemory | | x |
| | | | TotalVirtualMemory | | x |
| | | | TotalDiskSpace | | x |
| | | | TotalResourceCount | | |
| | | DataStaging | FileName | | x |
| | | | FilesystemName | | x |
| | | | CreationFlag | | x |
| | | | DeleteOnTermination | | x |
| | | | Source | URI | x |
| | | | Target | URI | x |

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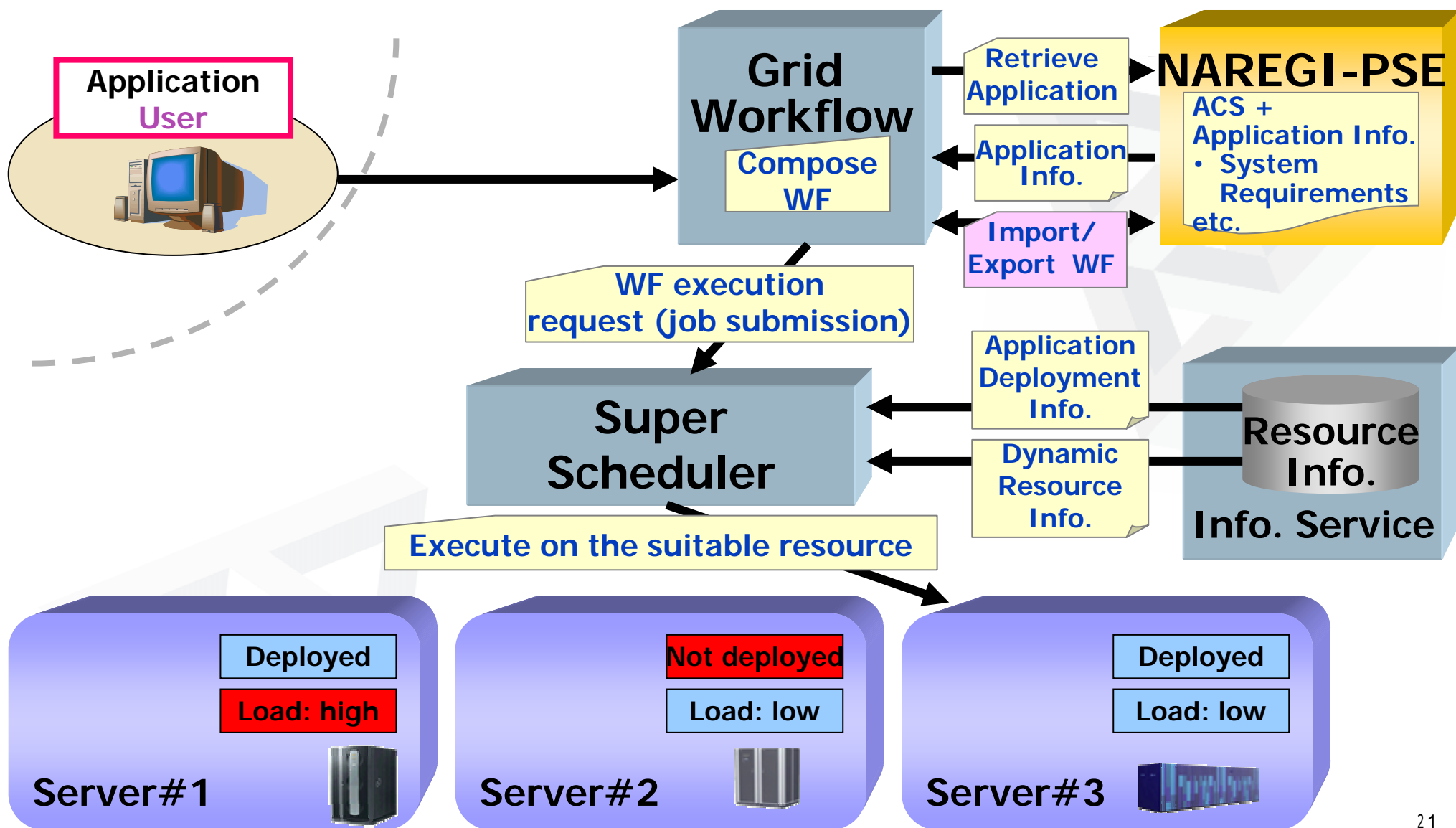
**NAREGI**

## ApplicationRepository

| No | Category | Name | ACS1.0 Reference Implementation in NAREGI-PSE | | | Comments |
|----|----------|------|------|------|------|----------|
| | | | Specification Version | Support | Reason | |
| 1 | Resource Properties | Version | ACS1.0 (2006-05-08) | ✓ | | |
| 2 | | TransportType | | ✓ | | |
| 3 | | TransportMethod | | ✓ | | |
| 4 | | QueryExpressionDialect | | ✓ | | |
| 5 | Operations | Create | ACS1.0 (2006-05-08) | ✓ | | |
| 6 | | LookupArchives | | × | EPR is managed on the PSE side | 1)Returning the message as "OperationNotSupportedFault" |
| 7 | PortTypes | GetResourceProperty 1(GetRPProvider) | http://docs.oasis-open.org/wsrf/2004/06/wsrf-WS-ResourceProperties-1.2-draft-01.wsdl | ✓ | | 1)Utilizes operation provided by GT4.0.1. (older schema 1.2-draft-01) |
| 8 | | GetResourceProperty 1(GetRPProvider) | | ✓ | | 1)Utilizes operation provided by GT4.0.1. (older schema 1.2-draft-01) |
| 9 | | ImmediateResourceTermination(Destroy) 1(DestroyProvider) | http://docs.oasis-open.org/wsrf/2004/06/wsrf-WS-ResourceLifetime-1.2-draft-01.wsdl | ✓ | | 1)Utilizes operation provided by GT4.0.1. (older schema 1.2-draft-01) |
| 10 | | NotificationProducer 1(SubscribeProvider) | http://docs.oasis-open.org/wsn/2004/06/wsn-WS-BaseNotification-1.2-draft-01.wsdl | ✓ | | 1)Utilizes operation provided by GT4.0.1. (older schema 1.2-draft-01) |

## ApplicationArchive

| No | Category | Name | ACS1.0 Reference Implementation in NAREGI-PSE | | | Comments |
|---|---|---|---|---|---|---|
| | | | Specification Version | Support | Reason | |
| 1 | Resource Properties | State | ACS1.0 (2006-05-08) | ✓ | | |
| 2 | | AAD | | ✓ | | |
| 3 | | DifferentialAAD | | ✓ | | |
| 4 | | CreationDateTime | | ✓ | | |
| 5 | | BaseAA | | ✓ | | |
| 6 | | NewerAA | | ✓ | | |
| 7 | | Repository | | ✓ | | |
| 8 | | QueryExpressionDialect | | ✓ | | |
| 9 | Operations | Update | ACS1.0 (2006-05-08) | ✓ | | |
| 10 | | GetContents | | ✓ | | |
| 11 | | GetArchive | | ✓ | | |
| 12 | PortTypes | GetResourceProperty 1(GetRPProvider) | http://docs.oasis-open.org/wsrf/2004/06/wsrf-WS-ResourceProperties-1.2-draft-01.wsdl | ✓ | | 1)Utilizes operation provided by GT4.0.1. (older schema 1.2-draft-01) |
| 13 | | GetResourceProperty 1(GetRPProvider) | | ✓ | | 1)Utilizes operation provided by GT4.0.1. (older schema 1.2-draft-01) |
| 14 | | ImmediateResourceTermination(Destroy) 2(ImmediateResourceTermination) | http://docs.oasis-open.org/wsrf/rlw-2 | ✓ | | 2)Implements originally to delete not only WS-Resource but also physical assets of AA (complies ACS1.0 schema) |
| 15 | | NotificationProducer 1(SubscribeProvider) | http://docs.oasis-open.org/wsn/2004/06/wsn-WS-BaseNotification-1.2-draft-01.wsdl | ✓ | | 1)Utilizes operation provided by GT4.0.1. (older schema 1.2-draft-01) |

# Conforming status to ACS V1.0  (3)

## ApplicationArchiveCreatedMessageType

| No | Category | Name | ACS1.0 Reference Implementation in NAREGI-PSE | | | Comments |
| | | | Specification Version | Support | Reason | |
|---|---|---|---|---|---|---|
| 1 | Properties | DateTime | | ✓ | | |
| 2 | | AAID | ACS1.0 (2006-05-08) | ✓ | | |
| 3 | | ArchiveEPR | | ✓ | | |

## ApplicationArchiveUpdatedMessageType

| No | Category | Name | ACS1.0 Reference Implementation in NAREGI-PSE | | | Comments |
| | | | Specification Version | Support | Reason | |
|---|---|---|---|---|---|---|
| 1 | Properties | DateTime | | ✓ | | |
| 2 | | AAIDNew | | ✓ | | |
| 3 | | AAIDOld | | ✓ | | |
| 4 | | ArchiveEPRNew | ACS1.0 (2006-05-08) | ✓ | | |
| 5 | | ArchiveEPROld | | ✓ | | |
| 6 | | DifferentialAAD | | ✓ | | |

# Conclusions

- **NAREGI Beta version** released at May,2006.
  - Download Site ; http://www.naregi.org/download/
- **Beta version of NAREGI-PSE enables users**
  - register their own applications,
  - compile and deploy the applications on the grid,
  - retrieve the application information,
  - and export the application information to Grid Workflow for execution.
  - import and export the workflow from Grid Workflow as a complicated application scenario.
- **NAREGI-PSE is implemented with ACS for real-time collaborations in research communities on VOs.**

National Research Grid Initiative

# Thank you!

## Questions?



# http://www.naregi.org