



System Software Overview of China National Grid

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VEGA R&D Team,

Research Centre for Grid and Service Computing,

ICT, CAS



Outline

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 - Grid applications
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Background

- **Grid related research at ICT since 1999**
 - **PoC of Grid System Software**
 - LDAP + batch system + CGI + Web server
- **CNGrid System Software is supported by the China Ministry of Science and Technology 863 program (2002~2005)**
- **Other grid related research includes:**
 - Information Grid
 - GSML Workshop
 - Web Service Based Workflow
 - Semantic Grid
 - ...



Motivation

- **Need for Internet based grid system software**
 - **Manage large scaled distributed resource effectively**
 - **Provide uniform approach accessing the heterogeneous resources in grid**
 - **Support Internet based resource sharing and collaborating**
- **Need for Easy-to-used grid**
 - **Low cost**
 - **Hiding interior details for programming and management user**
 - **Convenient for end user**
 - **Multiple access mode**
 - **Client/Server, Browser/Server and other modes**
 - **Batch mode and interactive mode**



Goals

- Develop a virtualized resource sharing mechanism and framework on computing, data, software and combined resources
- Provide secured, uniformed and friendly interfaces accessing the scientific computing and information services
- Support multiple domain specific applications running on above



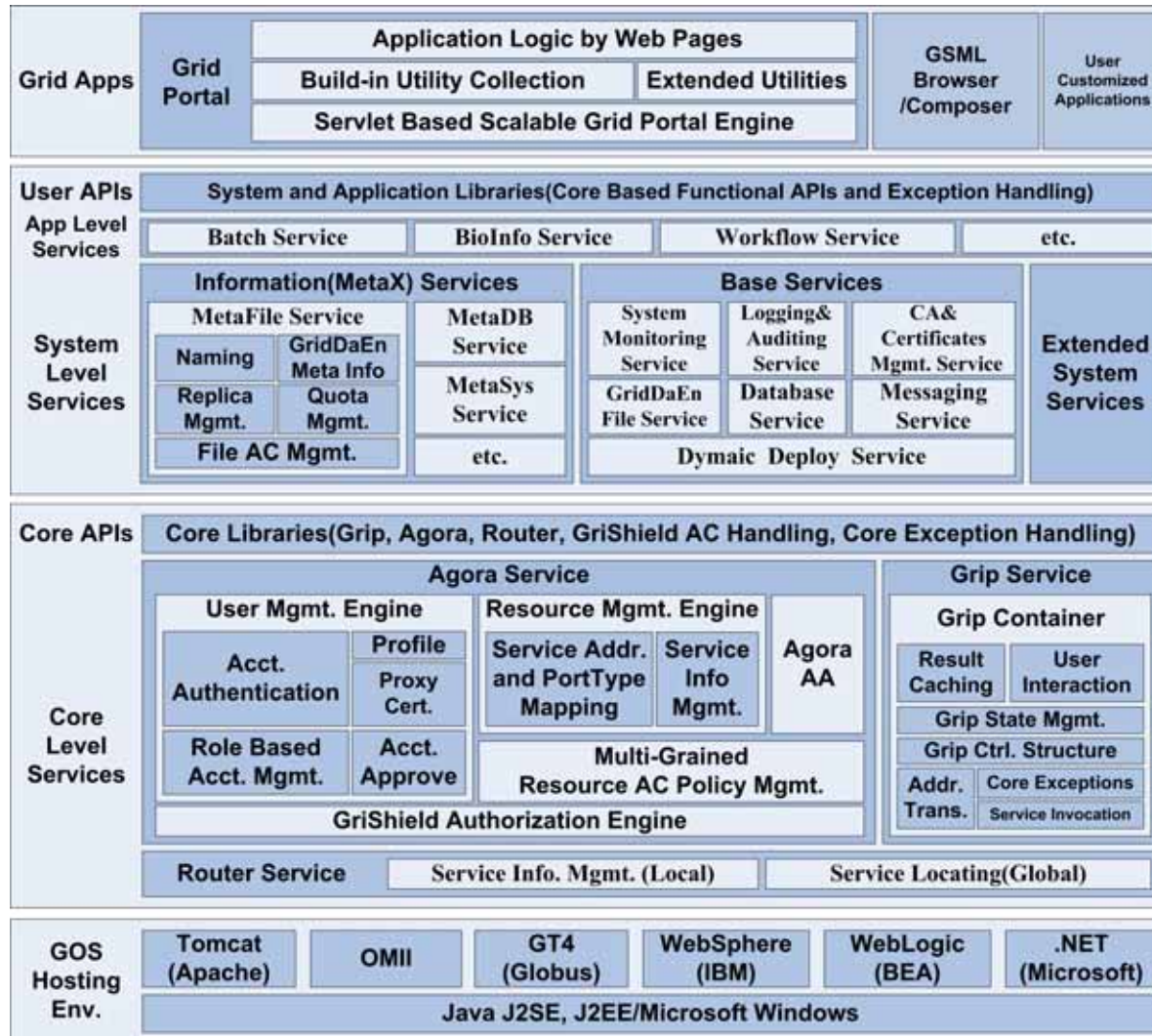
CNGrid System Software

--Design Principles

- **Only focusing on functions that meet common requirement of grid application**
 - Resource and user management
 - Policy management
 - Security mechanism
 - User interface to resources
 - File, metainfo, batch service and so on
- **Using computer system architecture that combined with SOA**
 - Logically divided into 3 layers
 - Core, System and Application layers
 - Taking system abstractions in traditional OS for reference
 - Address space
 - Process
 - Each individual module encapsulated by plain Web service
- **Adopting matured standards and technologies**
 - Hosting environment. Tomcat+axis, GT4, OMII...
 - WS- related standards and implementations, such as WS-I, WS-security...
 - File transfer. RFT, GridFTP
 - Job submission and management. GRAM, GridSAM

CNGrid System Software

--Architecture



Grid Portal, GSML suite and Grid Applications

Core, System and App Level Services

Axis Handlers for Message Level Security

Tomcat(5.0.28) + Axis(1.2 rc2)

J2SE(1.4.2_07), J2EE

OS (Linux/Unix/Windows)

Intel or AMD based PC Server (Grid Server)



CNGrid System Software

--Components

■ Core layer

- **Agora service**
 - Functions: service, user and policy management locally
 - Interface: *add, remove, search, update*
- **Grip service**
 - Functions: create or delete a grip, manage a existing grip, use a grip accessing services in grid
 - Interface: *create, bind, invoke, control, close*
- **Router service**
 - Functions: Maintain mappings between real service and virtual service; provide global service locating by unique service id and provide SSled service view based on linked router services
 - Interface: *start, stop, dump, locate, link, unlink, ping*

■ System layer

- **Batch service**
 - Accept batch job submission, status and cancel request; Forward batch job commands to backend batch system and get back results.
- **File service**
 - Based on local file system, organize plain files for user; Provide HTTP based file transfer.
- **Dynamic deploy service**
 - Dynamically deploy a service implementation (.jar) into its hosted service container as well as update and remove a existing service.
- **Messaging service**
 - Provide reliable messaging between peers by message queue, message subscribe and notification.
- **General metainfo service, CA service, Database service and others are in developing**

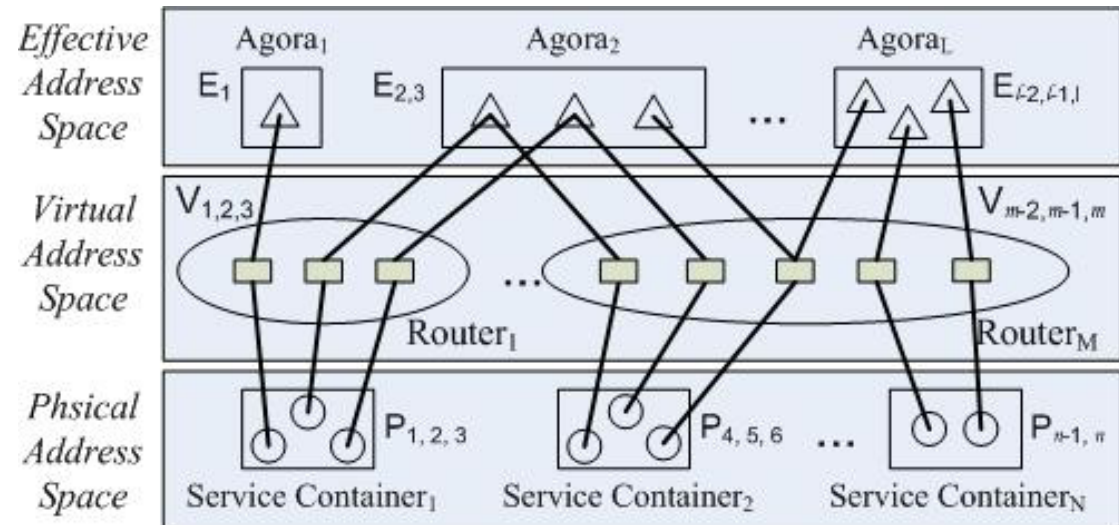
■ Application layer

- **Grid Portal for management**
- **GSML workshop for end user programming**
- **Other domain specific applications**

CNGrid System Software

--Features

- **CNGrid system software and resource are encapsulated by service**
 - Can provide uniformed interface and hide underlying resource heterogeneity
 - Easy for integration and expansion (WS stack, SOA, loosely/de coupled)
- **Layered resource spaces for virtualization**
 - Construct by Physical, virtual and effective resource layers (every upper layer is built on lower layer)
 - Separate resource and application so that application can keep still while resource changing
 - Functions such as resource selection, tolerance, authorization and access control can be made transparent to user



Service address naming schemes in CNGrid software 2.0 are as follow:

Physical: `http://host_name_or_ip:port_number/suffix`

Virtual: `vres://router_id:service_id`

Effective: `eres://agora_name:effective_service_name`

Effective-Virtual-Physical
Service Addressing Model



CNGrid System Software

--Features(cont.)

- **Proposed several abstractions in grid system software**
 - “grip” is something like “grid process”
 - Maintaining the conversation between user and service at runtime
 - Holding necessary information of user and service, such as user proxy, resource binding address and so on
 - Providing a set of uniformed interface for accessing different services
 - “agora” is kind of concrete implementation of “VO”
 - Aggregating and organizing user and resource locally
 - Establishing corresponding relationship across them, such as roles, service category, service selection and authorization policy
- **Grid security mechanism that support Web service**
 - PKI based authentication which is WS-Security compliant
 - Separate authorization decision and implementation using SAML token
 - Support multiple access control approaches by axis handler-chain mechanism

Programming interface

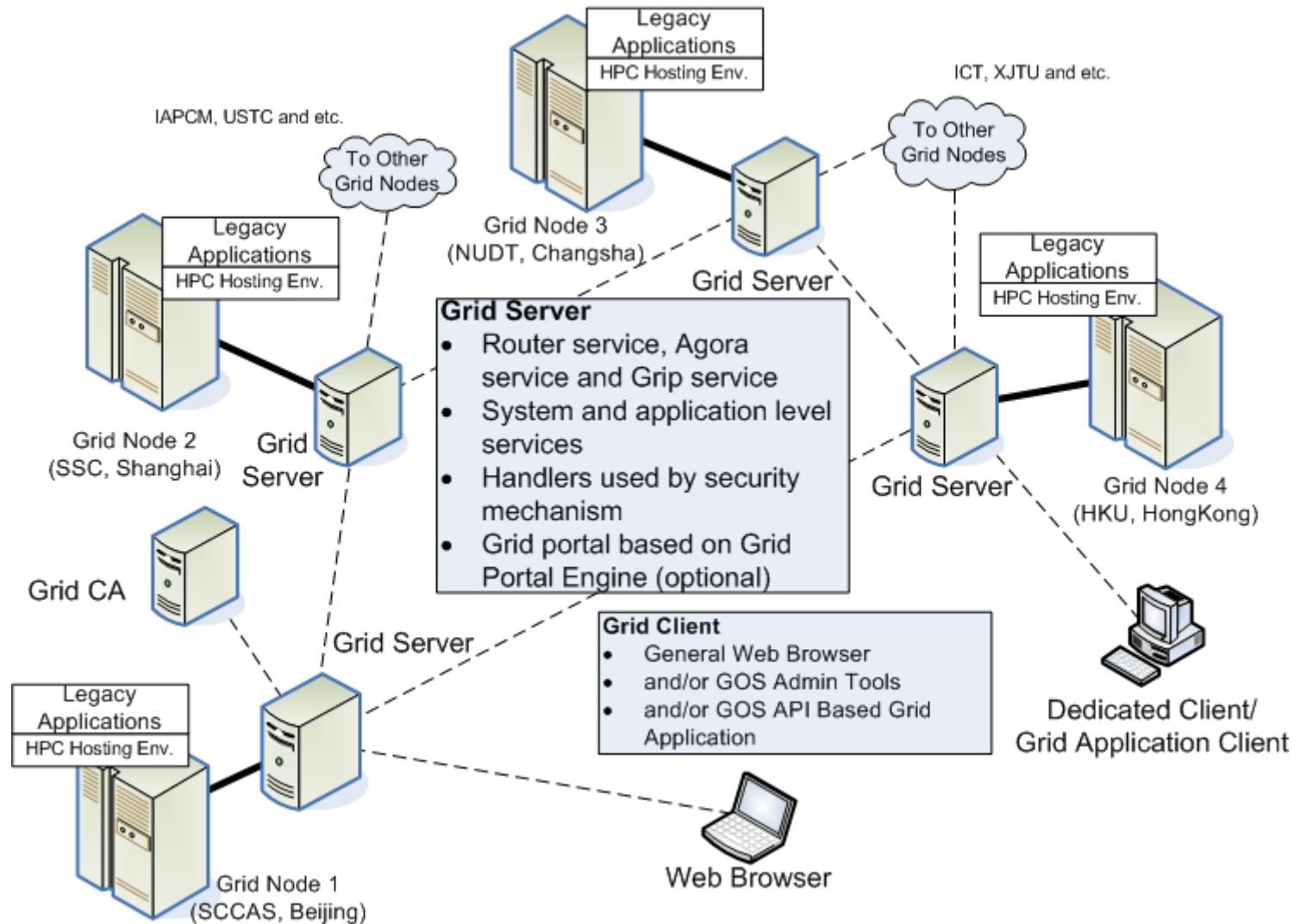
--Sample Code Using Grip

```
...
//define effective resource name
String effective = "eres://agoral:MService";
//new a gripclient object
GripClient testgripclient = new GripClient( );
//create a grip with user id, passwd and
//agora name want to login
UserHandle griphandle = testgripclient.create("usr1", "usr1",
    "agoral");
//bind the effective resource
int index = testgripclient.bind(effective, griphandle);
//invoke the bound service by resource index and
//pass the parameters required
Object retvalue = testgripclient.invoke(index, "list",
    new Object[] {"/"},
    GripContainer.M_SYNCHRONIZED, griphandle);
...
//process the return value here
...
//close it, reclaim the resources used by grip
testgripclient.close(griphandle);
...
```

synchronization flag

Application Scope

-- China National Grid



WMS Community Model



Introduction:

The PSU/NCAR mesoscale model (known as WMS) is a limited-area, nonhydrostatic, terrain-following sigma-coordinate and simulate or predict mesoscale atmospheric circulation. The model is supported by several pre- and post-processing pre-referred to collectively as the WMS modeling system.

简介:

WMS是由美国国家气象局和宾夕法尼亚大学联合开发的中小尺度非静力动力气象模式。主要是FORTRAN、C编程。是一个应用广泛的并行化开源软件。模式、大气化学、生态环境、气象等方面的研究和预报。它由若干个子模块组成。主计算程序和后处理模块组成。我们在深算4800上移植并优化了WMS,目前上提供计算服务。

Do WMS

Job name

Load [job_001.t00](#) file

Load [job_002.t00](#) file

Load [job_003.t00](#) file

Load [job_004.t00](#) file

Load [job_005.t00](#) file

Load [job_006.t00](#) file

or



Introduction:

Starting from the basic laws of quantum mechanics, Gaussian predicts the energies, molecular structures, and vibrational frequencies of molecular systems, along with numerous molecular properties derived from these basic computation types. It can be used to study molecular and reactions under a wide range of conditions, including both stable species and complexes which are difficult or impossible to observe experimentally such as short-lived intermediates and transition structures.

更多介绍:

[Download the software](#)

WMS GAUSSIAN

Job name Example:

InputFile(*.com) [download jobname_file.t00](#)

Upload .chk file? yes no

Output Files

download .chk? Yes No

(If .chk is required, choose yes, then input the file without postfile--chk)output

Parallel Parameters:

CPU:

Queue:

Copyright 2009-10 by Gaussian, Inc. All rights reserved. 090421 090421

Satellite Remote Sensing Image Processing 卫星图像处理

[\[old job list\]](#) [\[back\]](#) [\[forward\]](#) [\[specification说明\]](#) [\[example\]](#)



介绍:

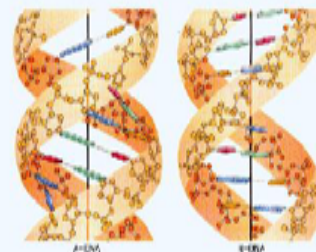
卫星遥感图像处理服务主要包括: 卫星遥感图像辐射和系统几何校正; 图像变换、滤波增强、边缘检测、直方图运算; 遥感图像自动配准、分割、目标识别、定位。

Introduction:

Remote sensing image processing service include the following: radicalization and system geometry proofread; image transform, filter enhance, edge detect and computing; a auto-adjust and division, object identify, position parallel arithmetic etc.

| | |
|---------------|-----------------|
| 灰度变换 | GrayTrans |
| 直方图变换 | HistogramTrans |
| 时域滤波变换 | FilterTrans |
| 形态学基本变换 | MorphologyTrans |
| 形态学类体变换 | SkeletonTrans |
| 正交变换--快速付立叶变换 | FFTTrans |
| 正交变换--离散余弦变换 | DCTTrans |

[\[old job list\]](#)



BLAST是"Basic Local Alignment Search Tool"的缩写。它是一个用来比对生物序列的一级结构(如不同蛋白质的氨基酸序列或不同基因的DNA序列)的算法。已知一个包含若干序列的数据库, BLAST搜索可以让研究者在其中寻找与其感兴趣的序列相同或类似的序列。例如如果某种非人动物的一个以前未知的基因被发现, 研究者一般会在人类基因组中做一个BLAST搜索来确认人类是否包含类似的基因(通过序列的相似性)。BLAST算法以及实现它的程序由美国国家生物技术信息中心(NCBI)研制。

研究者利用BLAST来解决的其他问题有:

- 哪个细菌物种包含与氨基酸序列已知的某蛋白质有亲缘关系的蛋白质?
- 被测序的一段DNA来自哪里?
- 何种基因编码的蛋白质表现出刚刚被确定的某种结构或结构模体? 等等。

BLAST MANUAL

Indispensable parameters:

Job Name

Program Name[-p](Help)

Database [-d](Help)

Load Query File [-i]

测试文件下载:

[aa_seq.csi](#) 文件用于测试blast和test_aa_db组合 [fasta017.csi](#) 文件用于测试blast和fasta_run_trainedates 017组合

Application Scope

-- other apps in CNGrid

- File management aim to individual user
 - Upload, download files that stored in multiple grid nodes
- System monitoring aim to grid nodes in CNGrid
 - Record the running information of grid nodes, such as “uptime”, “loadavg”, utilization of “cpu”, “mem” and “hd”



Application Scope

-- service, user and policy administration

The image displays three overlapping screenshots of the GOS2 Portal web application interface, demonstrating its administrative capabilities:

- Top Screenshot (User Management):** Shows the "User Management" page in Mozilla Firefox. The browser address bar indicates the URL `http://159.226.40.23:8080/portal/ums/manage.html`. The page header shows the user is logged in as `whoami: usermanager` with the current grip `login(0)`. The main content area displays a tree view of the application structure under "Root[reload]".
- Bottom-Left Screenshot (Resource Management):** Shows the "Resource Management" page. It displays a tree view of resources under "Root[reload]". The "Effective Address" is `eres://a` and the "Properties" are `data_p`. The "Virtual Resources" section lists several vres with their respective URIs and HTTP endpoints.
- Bottom-Right Screenshot (Manage Policy):** Shows the "Manage Policy" page in Mozilla Firefox. The browser address bar indicates the URL `http://159.226.40.23:8080/portal/app/pcpolicy_3ip`. The page header shows the user is logged in as `whoami: policymanager` with the current grip `login(0)`. The main content area displays a "policy list" table with columns for "update", "delete", "subjectName", and "objectName".

The "policy list" table contains the following data:

| update | delete | subjectName | objectName |
|------------------------|------------------------|--------------|--|
| update | delete | defaultrole1 | AgoraService |
| update | delete | defaultrole1 | vres://4b4ba0b69abfa2077f8612af5b27769d-d5949fd2528766a0 |
| update | delete | defaultrole1 | vres://c9ad64ca5539d2ec3721dc6a417c580d-b902ba159d8f6b1: |
| update | delete | defaultrole1 | AgoraService |
| update | delete | defaultrole1 | AgoraService |
| update | delete | defaultrole1 | vres://c9ad64ca5539d2ec3721dc6a417c580d-fd14c92dd91a778 |
| update | delete | defaultrole1 | AgoraService |
| update | delete | defaultrole1 | vres://c9ad64ca5539d2ec3721dc6a417c580d:08683d1f5aa5aff5 |
| update | delete | defaultrole1 | AgoraService |
| update | delete | defaultrole1 | AgoraService |
| update | delete | defaultrole1 | vres://c9ad64ca5539d2ec3721dc6a417c580d:a49ecc406bdb3: |
| update | delete | defaultrole1 | AgoraService |
| update | delete | defaultrole1 | AgoraService |

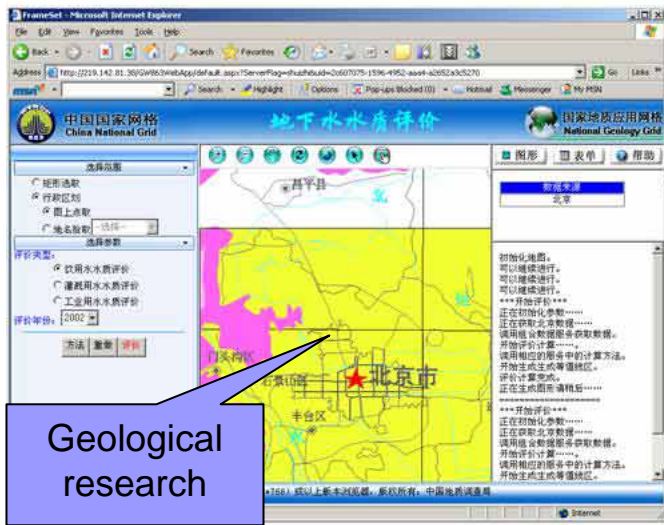
Application Scope

Biological research

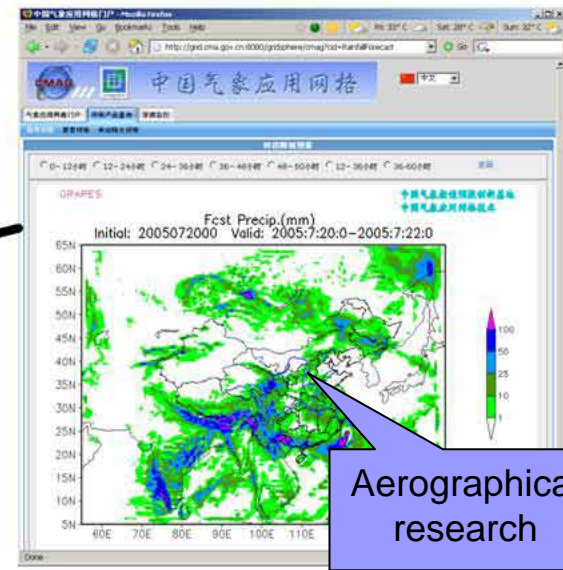


-- Grid Applications

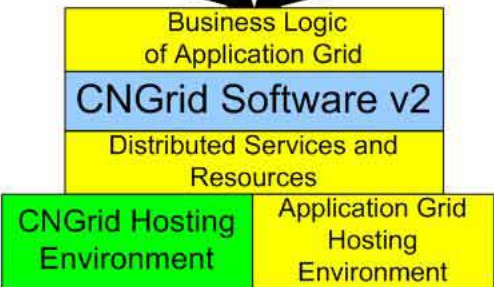
Simulation on manufacturing



Geological research



Aerographical research





Conclusion and Future Works

- CNGrid System Software can be summarized as follow
 - CNGrid system software is based on WS-I and OGSA standards
 - Utilizing computer system approach combined with loosely coupled SOA concept
 - Proposed several key abstractions, “address space”, “grip”, “agora”
 - Providing SSled resource sharing via address space virtualization
 - WS-Security compliant authentication and SAML token based authorization which is separated from WS implementation
- The next version of CNGrid system software will focus but not only on:
 - Key abstraction and core level service refinement, “address space”, “grip”, “agora”
 - System level service and functionality expanding, database, CA, metainfo service, grid data management and workflow
 - Application scope enlarging, from scientific area to general service computing area



Thanks!