Spatial Service Oriented GRID Architecture

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Web services

- Web services-
  - W3C (World Wide Web Consortium) defines as "a software system designed to support interoperable Machine to Machine interaction over a network."
  - Web services are frequently just Web APIs that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services.
Defining the Grid: A Roadmap for OGSA® Standards Version 1.1 2008.2.12

- “Grid” is concerned with the integration, virtualization, and management of services and resources in a distributed, heterogeneous environment. It is “service-oriented” because it delivers functionality as loosely coupled, interacting services aligned with industry-accepted Web services standards.
GRID-not only compute-intensive

- Early on, much of the available literature focused on the compute-intensive problems made tractable by grid, often associating it with cycle-scavenging or job scheduling technologies.
- The real “innovation” in grid comes from the combination of technology domains that include workload virtualization, information virtualization, system virtualization, storage virtualization, provisioning, and orchestration.
- From this statement, one may already conclude that no single technology constitutes a grid, but, instead, the method with which broad sets of resources are accessed and combined.
- Grid computing is not about a specific hardware platform, a database or a particular piece of job management software, but the way in which IT resources dynamically interact to address changing business requirements.
IBM views grid computing as critical to the ongoing development of a dynamic and flexible infrastructure that enables SOA:

- **Traditional SOA**
  - allows customers to separate applications from services

- **Grid**
  - allow customers to separate both applications and services from the infrastructure and systems resources

- **Grids provide an underlying foundation to support the dynamic nature of SOA**
SOA, Web 2.0, and mashup

• In technology, a **mashup** is a **web application** that combines data from more than one source into a single integrated tool; an example is the use of cartographic data from **Google Maps** to add location information to real-estate data from **Craigslist**, thereby creating a new and distinct web service that was not originally provided by either source
  • Ex: iGoogle
Mashup-iGoogle
Mashup-SOA
Machine to Machine

Service Oriented GRID (Broker, Coordinator)

Business process

Accelerate AP development speed

Integrates heterogeneous resources
Open Geospatial Consortium

- The Open Geospatial Consortium, Inc (OGC) is an international industry consortium of 348 companies, government agencies and universities participating in a consensus process to develop publicly available interface specifications. **OpenGIS® Specifications** support interoperable solutions that "geo-enable" the Web, wireless and location-based services, and mainstream IT. The specifications empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications.
OGC: Geo-services server with apps
An Geo-Spatial GRID Architecture

CSW-Catalog Service for Web
WFS-Web Feature Service
WCS-Web Coverage Service

SAS-Sensor Alert Service
SOS-Sensor Observation Service
SPS-Sensor Planning Service
The Development of OGC OWS

OWS: OGC Web Services
After the events of September 11, the OWS 1.1 sponsors agreed to align OWS 1.1 to address interoperability challenges defined by officials in New York City.

The OWS 1.1 demonstration scenario developed by the sponsors challenged participating technology developers and integrators to implement interoperability capabilities that address specific critical disaster management needs involving New York City data.

Focus on:
- OGC Common Architecture
- Web Mapping
- Imagery Exploitation and Sensor Web
OWS-1 achievement

- Stefan Falke, "The OWS-1 Initiative work," says Falke "means that analysts can not only get at sensor data, but can seamlessly integrate it with other data, including imagery, base maps and other resources."

OWS-2

- **Common Architecture:**
  - using the W3C's WSDL and SOAP standards for "publishing, finding and binding" geoprocessing services.

- **Technical Baseline Maturation:**
  - Developing compliance tests for and improving the OpenGIS Specifications for WMS, WFS, WCS, WOS, CS-W and GML 3.x. A Reference Implementation for Web Coverage Server and for an Integrated Client will be created under this initiative.

- **Image Handling and Decision Support Tools:**
  - Finding, binding, and chaining" individual Web accessible image archival and processing functions sequentially into complete workflows Information Interoperability:
OWS-3

- Common Architecture
- Sensor Web Enablement (SWE)
- Geo-Decision Support Services (GeoDSS)
- Geo-Digital Rights Management (GeoDRM)
- Open Location Services (OpenLS)
OWS-4

- Sensor Web Enablement (SWE)
- Geo Processing Workflow (GPW)
- Geo-Decision Support (GeoDSS)
- Geo-Digital Rights Management (GeoDRM)
- CAD / GIS / BIM (CGB)
- OGC Location Services (OpenLS)
- Compliance Testing (CITE)
OWS-5

- 1. Sensor Web Enablement (SWE)
- 2. Geo Processing Workflow (GPW)
- 3. Agile Geography
- 4. Compliance Testing (CITE)
- CAD / GIS / BIM
OWS-6

- 1. Sensor Web Enablement (SWE)
- 2....
- 3....

Will be announced on June, 2008.
Example of OWS-4 achievement

Scene 4- Weather and Environment Impact

- JPEG-2000 Hi-Res Imagery
- NOAA Doppler Radar
- NOAA GOES Imagery
- Lagrangian Plume Model
- WMS LizardTech
- SAS ORNL
- CSW Ionic
- Service Metadata
- NWS Weather Stations
- CSIRO Environ. Sensors
- SOS CSIRO-ICTC
- SOS IFGI
- SOS UAH
- SOS UAH
- Rad Sensor

OGC Data Specifications: O&M, SensorML, GML
ESRI ArcGIS Explorer

AVI
**Debris Flow Monitoring**

2004/07/02 12:01:56 1st 鋼索斷裂
2004/07/02 12:02:02 2nd 鋼索斷裂

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**Warning Announcement**

疏散避難情形
2004/07/02 12:00 疏散至郡坑國小及5鄰、7鄰活動中心，共計疏散1200人

**Construction Infrastructure**

自桃芝風災後進行相關防砂壩工程，共計經費125,634,000元。

**Rural Village**

南投縣水里鄉
平均高度 550m
平均坡度 25%

**Debris Flow Monitoring**

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Google Mashup

Rainfall, CWB

Debris Flow Monitoring, SWCB
Procedure of Heterogeneous information integration under SOA-Stockpiles distribution

1. Report stockpiles demand to Agency $X_o$
2. On-warehouse stockpiles demand to Agency $X_o$
3. Support real-time aerial photo/satellite photo to Agency $X_o$
4. Call Stackelberg Game Service and input demand/supply
5. Return the optimum distribution solution to Agency $X_o$

- Sensor Grid
- Application Grid
- Computing Grid
- Information Grid
- Stockpiles warehouse
- On-warehouse Stockpiles Service
- National Sd-Tech for Disaster Reduction Cooperation Agency
- Real-time Image Service
- Agency $X_o$
- Stockpiles Distributor
- Academia
- Stackelberg Game Service
- Local Government
- Stockpiles demander
Stockpiles distribution decision support

- Portable water: 450
- Rice: 220
- Water pump: 4
- Motor: 2

AVI
Composing services

STAGE 1

Service: disaster area point

Service: stockpiles located in the specific area of disaster area point

Service: stockpiles allocation

Service: allocation

Decision maker

Use 3 services

Compose those 3 services to another service
Implementation of Geo-Spatial GRID Architecture

Service from Soil/water conservation bureau (Stockpiles allocation)

Service from Water Resource Agency (Sensor data)

Service from Ministry of Interior (Shortest Path Service)
Conclusion

• The share of Geo spatial among government departments has evolved from data interchange to service composing.
• To enhance the performance of government administration, it’s urgent and necessary to connect traditional MIS and GIS data.
• To establish a common data/services interchange platform is essential to any country.
SOAG

- SOAG
  - Service Oriented GRID Architecture
  - Lead GRID technology into traditional SOA
  - With a virtualized infrastructure, customers can much more easily scale their support for SOAs

- We need to see cross organization collaboration to drive the innovation required for SOA. In simple terms, grid computing, based on open standards and supported by collaborative communities, delivers the underlying dynamic infrastructure that enables competitive advantage for customers implementing SOA-based solutions.
While they hate to see wealth lying about on the ground, they do not necessarily keep it for their own use. While they hate not to expert their own effort, they do not necessarily devote it for their own ends.