Recent Developments of the National Grid Project in Thailand

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National E-Infrastructure

- Fast computer
  - massive computing power
  - Large and fast storage for data intensive applications

- Fast network
  - Information sharing
  - Collaboration

- Middleware
  - Security, connectivity, access

- Portal
  - Hiding the complexity of access, data movement, and execution from users
Introduction to ThaiGrid

- A National Project under Software Industry Promotion Agency (Public Organization), Ministry of Information and Communication Technology
- Started in 2005 from 14 member organizations
- Expanded to 22 organizations in 2008

Objective

- Driving better research and education using grid and HPC as an enabling technology
- Making Thailand more competitive by applying HPC and Grid Technology
Lesson Learned

• Clearly show the benefit of the national grid to top management in those organizations
• Find one or two champions in each organization work heavily with them
• Keep adding benefit to the projects
• Creating an open community behind the project
Thai Grid Infrastructure

[Map showing network connections with bandwidths such as 155 Mbps, 310 Mbps, and 2.5 Gbps to various locations across Thailand.]
**TERA Cluster**

- **1 Frontend** (HP ProLiant DL360 G5 Server) and 192 computer nodes
  - Intel Xeon 3.2 GHz (Dual core, Dual processor)
  - Memory 4 GB (8GB for Frontend & infiniband nodes)
  - 70x4 GB SCSI HDD (RAID1)
- **4 Storage Servers**
  - Lustre file system for TERA cluster's storage
  - Attached with Smart Array P400i Controller for 5TB space

**Diagram:**
- KU Fiber Backbone (1Gbps Fiber)
- 1 Gbps Ethernet/Fiber
- Edge Switch 1Gbps Ethernet
- Storage 48 TB
- 200 Ports Gigabit Ethernet switch
- Storage Tier 5TB Lustre FS
- 2.5Gbps to Uninet

**Details:**
- **FE Sunyata**: 4 nodes
- **FE Araya**: 4 nodes
- **WinHPC (FE)**: 64 nodes
- **TERA (FE)**: 96 nodes + 16 spare nodes
- **Anatta (FE)**: 15 nodes
- **SPARE1 (FE)**
- **SPARE2 (FE)**
- **FS 1**, **FS 2**, **FS 3**, **FS 4**

**Specifications:**
- **Frontend** (HP ProLiant DL360 G5 Server)
  - Intel Xeon 3.2 GHz (Dual core, Dual processor)
  - Memory 4 GB (8GB for Frontend & infiniband nodes)
  - 70x4 GB SCSI HDD (RAID1)
- **Computer Nodes**
  - Intel Xeon 3.2 GHz (Dual core, Dual processor)
  - Memory 4 GB
  - 70x4 GB SCSI HDD (RAID1)
- **Storage Server**
  - Lustre file system for TERA cluster's storage
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Utilization

<table>
<thead>
<tr>
<th>Name / Info</th>
<th>1-Min Load Avg</th>
<th>5-Min Load Avg</th>
<th>15-Min Load Avg</th>
<th>%CPU System</th>
<th>Users</th>
<th>Nice</th>
<th>Idle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root Grid: ThaiGrid Grid (16 Units)</td>
<td>0.005</td>
<td>0.006</td>
<td>0.002</td>
<td>0.041</td>
<td>0.040</td>
<td>0.000</td>
<td>6.574</td>
</tr>
</tbody>
</table>

Cluster: 14
Host: total 231
running: 149
down: 82
CPUs: 576

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**ThaiGrid Grid Load Average Last Year**

**ThaiGrid Grid Memory Last Year**

**Tera Cluster Load Average Last Year**

**Tera Cluster Running Processes Last Year**

**Utilization Percentage**

- January: 63.84%
- February: 68.27%
- March: 69.10%
- April: 69.98%
- May: 68.12%
- June: 56.99%
Grid as a Super Cluster

Grid Scheduling

Middleware

- Globus 4.x
- GridWay 5.2.3
- SGE, PBSpro, Condor
- SCMS

July 31, 2008

Grid 08, Leela Palace, Bagalore
Lesson Learned

• Multi-level grid/cloud
  – In the large Grid, it is hard to get all sites in Grid works at the same time.
  – Dividing Grid into multi-level of services with multi level of access can solve the issue
• Multi-level services and support
  – Core sites will also act as main service
• Network
  – quality limit capability for each site
• Middleware standard
  – Need to enforce a strong standard
• Find technical support people
  – Training program, web support, technical material
ThaiGrid Usage

- ThaiGrid provides about 290 years of computing time for members
  - 9 years on the grid
  - 280 years on tera
- 41 projects from 8 areas are being support on Teraflop machine
- More small projects on each machines
Medicinal Herb Research

Partner
- Cheminormetrics Center, Kasetsart University (Chak Sangma and team)

Objective
- Using 3D-molecular database and virtual screening to verify the traditional medicinal herb

Benefit
- Scientific proof of the ancient traditional drug
- Benefit poor people that still rely on the drug from medicinal herb
- Potential benefit for local pharmaceutical industry
NanoGrid

Objective
- Platform that support computational Nano science research

Technology used
- AccelRys Materials Studio
- Cluster Scheduler: Sun Grid Engine and Torque

ThaiGrid MS-Gateway

Computing Resources

AccelRys Materials Studio Gateway

Cluster Scheduler

Grid Infrastructure
Impact of blood flow heat transfer during cancer treatment with Hyperthermia method

- Influence of seed number and configuration on generated thermal field. Temperature in K.

V. Juntasaro et.al, Kasetsart University, Thailand
Collaboration
Peering using PBSPro

- **Goal**
  - Testing the use of PBS peering facility to build an industrial strength grid that can span internationally

- **Partners**
  - MIMOS, ThaiGrid, Altair Engineering

- **Status**
  - PBS pro installed at ThaiGrid and Mimos
  - Mimos test peering
  - ThaiGrid test local peering
SCMSWeb Grid Monitoring

- SCMS, a Grid monitoring tool, development is housed by TNGC
- Goal
  - Creating a Grid monitoring environment for ThaiGrid
- Current Status
  - Deployed and run in ThaiGrid (http://observer.thaigrid.or.th)
  - Also being used in PRAGMA (http://goc.pragma-grid.net/scmsweb)
PRAGMA Software Catalog

• Goal
  – Detecting software installation in PRAGMA is hard
  – A module in SCMS to catalog PRAGMA software usage in each cluster

• Collaborator
  – Thai National Grid Center, TH
  – SDSC (San Diego Supercomputer Center), US

• Current Status
  – Deployed and demo in last PRAGMA14 (Taiwan). Become an awarded demonstration of PRAGMA
  – Live status: http://goc.pragma-grid.net/cgi-bin/scmsweb/swcatalog.cgi?grid=PRAGMA
Condor+SCMSWeb collaboration for PRAGMA

• Goal
  – Making Condor-G able to submit Grid job by utilizing data from SCMSWeb
  – Deploying a Condor-G in PRAGMA Grid and run a job through all resources in PRAGMA

• Collaborator
  – Thai National Grid Center, TH
  – University of Wisconsin, US (Condor team)
  – San Diego Supercomputer Center (SDSC), US (PRAGMA team)
  – KISTI, KR (Job submission test)
Creating Grid Technology Awareness

• Seminar, talk, workshop
  – 9 events in 2006
  – 35 event in 2007 (about 3 events monthly)

• News
  – National newspaper, magazine
  – International

• 2006-2007
  – 2 National Conference on Grid computing (attendants 300-500)
  – 3 International workshops
  – 67 Publication papers from members
    • 29 papers in 2006
    • 38 papers in 2007

• Research Area
  – Scientific computing in CFD, life science, physics, chemistry, math, Geo science
  – Grid: middleware, application, algorithm, scheduling, tools
Benefit of ThaiGrid

Research and education

• Driving the rapid growth computational community
• Provide a world class environment for researchers to explore more complex and realistic computational research
• Reduce time to result and increase productivity
• Lower the infrastructure cost by sharing the infrastructure together

Industry

• Creating a platform for industry
  • Digital media, CAE, financial engineering
• Create an ecosystem that drive the adoption of HPC technology
Future Focus

**Sustainability**
- Creating sustainable model/project with high impact to Thailand economy

**Accessibility**
- Providing not only infrastructure but useful and easy to access services

**Collaboration**
- Driving sustainable collaboration among academics and industry

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Creating a Sustainable Grid Ecosystem

Grid Ecosystem
- Infrastructure
- People
- Technology
- Business

Creating Grid Community
Creating Grid Technology Awareness
Driving Grid Research and Adoption
Building the Grid Infrastructure
Potential Area

- Automotive Grid
- Animation Grid
- BioGrid
- Financial Grid
- Agricultural Grid
- Environmental Grid

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Cloud Computing

- Cloud computing is a platform composed of large number of servers linking together and provides a hosting services to large number of users and applications.
  - Web2.0, Web Services
  - Virtual Machine Hosting
Thai Computing Cloud

• Building a cloud that provides virtualized services for computation and data management

• Benefit
  – lower total cost of ownership
  – Ease of Management
  – Easy to access using WEB 2.0 technology
Summary

• Building a National Grid is a long term evolutionary process. A sustainable ecosystem must be built.
• Simplicity is a key to the success in building an infrastructure.
• A well define and focus application projects is very important in demonstrating the usefulness of the grid.
For more information please visit: http://www.thaigrid.or.th