MIMOS and Malaysia National Grid Computing and Bioinformatics Initiatives

An Overview
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Agenda

• A Brief History of MIMOS
• MIMOS Grid Computing and Bioinformatics Lab
• Malaysia National Technology Roadmap: Initiative Taken and Status
  – Grid Computing
  – Bioinformatics
• Status and Plans
  – MIMOS
  – National Grid
A Brief History
MIMOS R&D started back in October 1984, when the GoM endorsed a key national initiative…

To orchestrate the various players into playing their respective roles in the National Microelectronics Program:

- To map out a 5-10 year strategy for the structured growth of the microelectronics industry
- To identify niche product areas for penetration by Malaysian companies in local and foreign markets
- To investigate and propose the proper incentives for start-up companies
- To seek out and encourage established foreign companies for JV on new ventures
- To prepare appropriate policies to convert the labour-intensive industry to a more technology-, knowledge-, and capital-intensive industry

… which led to the formation of MIMOS to focus on R&D and to participate in these and other programs
MIMOS interests were in R&D and Business

Applied R&D in ICT and Microelectronics

- Develop indigenous technologies that meet the socio-economic needs of Malaysia

Business Ventures in ICT and Microelectronics

- Bring new technologies to the market to enhance Malaysia's economic competitiveness
With the experience, MIMOS is now strengthening and refocusing the ICT and Microelectronics research to include more advanced research ...

Applied R&D in ICT and Microelectronics

Develop indigenous technologies that meet the socio-economic needs of Malaysia

Business Ventures in ICT and Microelectronics

Bring new technologies to the market to enhance Malaysia’s economic competitiveness

Grid Computing and Bioinformatics  Learning Technologies  Microelectronics  Cyberspace Security  Nanoelectronics
MIMOS R&D in Grid Computing and Bioinformatics

Our Mission and Objectives
Answering the Whys
Our Mission and Objectives

• Mission:
  – Spearheading R&D in Grid Computing and Bioinformatics to accelerate agricultural and industrial scientific advancement for value creation.

• Objectives:
  – To become one of the nation's computation and data hub.
  – To share the HPC platform though the use of Grid Computing technologies among other research institutes (RIs) both locally and globally for:
    • Supporting research in genomics, proteomics, etc.
    • R&D in bioinformatics applications
    • R&D in HPC and Grid Computing
  – To research and develop cost effective high performance computing platform using open source solutions and COTS.
  – Development of a National Technology Roadmap for Grid Computing and Bioinformatics.
  – Enhance research collaboration between MIMOS, local RIs and with premier institutions globally.
  – To become Centre of Competency for High Performance Computing, Grid Computing and Bioinformatics R&D.
"...that biotechnology had great potential in Malaysia and it could be a catalyst for new growth areas in the country's economy as well as a source of new wealth and income for the people. Biotechnology is useful in many areas - agriculture, livestock farming, herbal industry and traditional and modern medicine."

Prime Minister of Malaysia, Datuk Seri Abdullah Ahmad Badawi
More Recently: The 9th Malaysian Plan

- The National Mission comprises five thrusts…
  - The first thrust is to move the economy up the value chain. The Government aims to *increase the value add of existing economic sectors* as well as *generate new knowledge-intensive activities and employment in ICT, biotechnology and services*… (source: Speech by Prime Minister)

- Initiatives recommended for *the advancement of bioinformatics and grid computing* will be with a view to undertaking research to support product and process development of the agriculture, healthcare and industrial sectors… (source: Chapter 5, Mainstream Information and Communication Technology, 5.67)

- Strategic initiatives will be rolled out for bioinformatics and grid computing to support the county’s biotechnology development. (source: Chapter 6, Biotechnology for Wealth Creation, 6.27)

- Grid Computing will be adopted as a means to reduce the cost of investment in R&D through sharing of facilities. (source: Chapter 6, Biotechnology for Wealth Creation, 6.28)

- Similarly, Grid Computing is mentioned again in Chapter 12, Harnessing Science, Technology and Innovation.

Source: http://www.epu.jpm.my/rm9/RMKe9.htm
National Technology Roadmaps

Initiatives Taken and Status
National Grid Computing Technology
Roadmap: Initiatives Taken and Status

• One-day workshop to strategize the formation of a research cluster for Grid Computing involving all relevant players (RIs, universities, and industry), 3 February 2005 (38 participants)
  – Outcome: unanimous agreement for a formal technology roadmapping exercise for Grid Computing

• Follow-up two-day workshop on the development of National Technology Roadmap for Grid Computing, 30 – 31 March 2005 (40 participants)
  – Outcome: drafted technology roadmap framework for Grid Computing

• One-day workshop to form 4 domain groups under each of the topic (Grid Computing Info/Infrastructure, Grid Middleware and Tools, Grid Applications, Policy and Governance) to discuss research projects and budgeting, 9 August 2005 (40 participants)
  – Outcome: 4 domain groups were formed with appropriate projects and estimated budget.

• Currently finalizing and to be presented to Ministry of Science, Technology and Innovation for endorsement soon.
Key Domain Areas in National Technology Roadmap for Grid Computing

1. National Grid Facility, Infrastructure and Security
   - Domain (1)

2. Grid Middleware and Tool Enablers
   - Domain (2)

3. Grid Applications
   - Domain (3)
   - Grid Service Package Domain (2)
   - Tools and Enablers
     - Service Management
     - Resource Allocation
     - Resource Monitoring
     - Globus Toolkits (GT4)

4. Policy & Governance
   - Domain (4)

Key Applications:
- Scientific & Engineering Apps
- Humanities/Social Science/Fine Arts Apps
- E-Learning Apps
- Life Sciences (BioMedical)
- All the national projects in BioInformatics, Semiconductor, Language Engineering and Security
National Bioinformatics Technology Roadmap: Initiatives Taken and Status

• One-day workshop to strategize the formation of a research cluster for Bioinformatics involving all relevant players (RIs, universities, and industry), 22 April 2005 (69 participants)
  – Outcome: unanimous agreement for a formal technology roadmapping exercise for Bioinformatics

• Follow-up two-day workshop on the development of National Technology Roadmap for Bioinformatics, 17 – 18 May 2005 (90 participants)
  – Outcome: drafted technology roadmap framework for Bioinformatics

• To prioritize the key areas in Bioinformatics, to form working groups to further identify the sub-key areas, and determine the work plan for each niche area, 27-28 September 2005 (66 participants)
  – Outcome: 6 domain groups were formed with appropriate projects and estimated budget.

• Currently finalizing and to be presented to Ministry of Science, Technology and Innovation for endorsement soon.
Key Domain Areas in National Technology Roadmap for Bioinformatics

Priority Focus Areas*

(WP 6) Policies & Governances

(WP 5) Common Enabling Tools

(WP 1) Molecular Bioinformatics

(WP 2) Structural Bioinformatics

(WP 3) Systems Biology

(WP 4) Bioinformatics Applications

Molecular

Structural

Cellular

Organismic & Ecosystem

* from national consultations through technology roadmapping workshops
Challenges

• Bottom-up approach as compared to Top-down approach in other countries.

• Getting the consensus from all participating members in regards to:
  – Governance and Policies
  – Common framework all members to work on
  – Security
  – IPs
  – Resource sharing
  – Funding
  – Etc.

• Identifying the right technologies and focus areas as well as the time and duration for R&D.

• Hopefully we’ll able to learn from others experiences.
Status and Plans

For MIMOS
For National Grid
Status and Plans for MIMOS

• Completed 1st phase prototype 68 CPUs Opteron based Linux cluster.
  – Estimated at roughly 200-240GFLOPS
  – Based on that experience a smaller cluster was setup for the PRAGMA testbed.
• Identifying new specifications and requirements for 2nd phase expansion.
  – Expand capacity in terms of computation power and storage
  – Using heterogeneous nature of the GRID, the new systems will be based on different CPU architectures, OS, schedulers, etc.
• Also looking into human capital development programme by:
  – Forming research partnerships and exchange programmes.
  – To invite researchers from around the world to join our fellowships programme to help strengthen the capacity and capability of our research staff.
  – To exchange ideas and knowledge in various areas including.
• Several in-house on-going projects:
  – Middleware and metascheduler
  – Grid Portals
  – Grid enabling several open source applications
  – Online Microarray Workbench
Status and Plans for MIMOS (cont’d)

• Joining regional projects/organizations such as South East Asia Grid Forum (SEAGF), Pacific Rim Applications and Grid Middleware Assembly (PRAGMA), Alliance of Advanced Science and Technology Research and Education Networks of ASEAN (ASTRENA), etc.
  – To actively participate in regional and global R&D activities and hopefully can give us and Malaysia a platform to be part of the region’s Grid Computing R&D efforts by:
    • Sharing experiences
    • Sharing of our computing resources
    • Joint research collaborations
    • Organize/Co-organize Trainings/Events, etc.
  – Just accepted as the new institutional member of PRAGMA.
  – Working Group leader for Bioinformatics and Grid Middleware in SEAGF.

• Further improve our current connectivity:
  – Looking towards joining MYREN (Malaysian Research and Education Network).
  – Looking into possibly of getting better dedicated Internet link.
Status and Plans for National Grid

• Formalizing the National Policies in Grid Computing and Bioinformatics.
  – To adopt a common understanding on the governance and policy for the National Grid.

• Formation of a National Grid Facility (NGF):
  – NGF is a National Grid Testbed and it’s one of the output of the National Technology Roadmap workshops.
  – The idea is to showcase to decision makers, industries and public alike on the potential of Grid Computing technologies.
  – It will leverage on the existing Malaysian Research & Education Network (MYREN) whenever possible.
  – Currently in process of linking up with local universities and research institutes:
    • Linked up: UM, USM
    • On-going: UPM, UKM, MINT, UTM, UTAR, MMU
  – Weekly AccessGrid test sessions
About MYREN

- MYREN or Malaysian Research and Education Network is a project under the Ministry of Energy, Water and Communications.
- It links up 12 local universities throughout Malaysia.
- Its project manager is the Multimedia Development Corporation (MDC) with its NOC in Cyberjaya (part of Multimedia Super Corridor).
- All local universities are connected with a 155Mbps backbone with various last mile bandwidth to respective universities.
- MYREN will provide connectivity to various other NRENs and is also currently focusing on connectivity to TEIN2.
- MIMOS is yet to be a full member of MYREN but currently already running several grid related tests with universities from MYREN.
  - Certain technical issues need to be solved before MIMOS is part of the MYREN.
MYREN Network

MYREII Production Network is based on MPLS Layer-2 Technology. The Virtual Circuits connecting the 12 sites varies from 1Mbps to 8Mbps.

The MYREII Experimental Network is based on Point-to-Point Connectivity with 2Mbps access for all 4 locations.
Quick View of Current Status

11:57:45 +0800

ROCKS

Last | day | Sorted | descending | Choose a Source

Malaysia National Grid Facilities Grid

CPU Total: 80
Hosts up: 28
Hosts down: 4
Avg Load (15, 5, 1m): 14%, 16%, 17%
Local time: 2006-05-03 11:57

Aurora (global view)
CPU Total: 32
Hosts up: 16
Hosts down: 1
Avg Load (15, 5, 1m): 722%, 722%, 722%
Local time: 2006-04-13 09:35

Mybiogrid (global view)
CPU Total: 68
Hosts up: 17
Hosts down: 0
Avg Load (15, 5, 1m): 17%, 18%, 20%
Local time: 2006-05-03 11:57

Grid009 (global view)
CPU Total: 5
Hosts up: 5
Hosts down: 0
Avg Load (15, 5, 1m): 2.0

Load/1000
Bytes

Memory Used
Memory Shared
Memory Cached
Memory Buffed
Memory Stopped
Total In-Cores Memory

Load/1000
Bytes

Memory Used
Memory Shared
Memory Cached
Memory Buffed
Memory Stopped
Total In-Cores Memory

Load/1000
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Memory Used
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Memory Cached
Memory Buffed
Memory Stopped
Total In-Cores Memory

Load/1000
Bytes

Memory Used
Memory Shared
Memory Cached
Memory Buffed
Memory Stopped
Total In-Cores Memory
General View of Malaysian National Grid Facility
Hopefully in a Very Near Future…
South East Asia Grid Forum (SEAGF)

- Newly established forum of National Grid Projects in South East Asia Region.
- Goals:
  - Act as a forum to define a common direction and policy for grid computing in the region
  - Creating research synergy among grid practitioners in the region.
- Partners:
  - National Grid Office, Singapore
  - Thai National Grid Center, Thailand
  - MIMOS, Malaysia
- 6 working groups:
  - Middleware
  - AccessGrid
  - Cheminformatics
  - Bioinformatics
  - Digital Archives & Libraries
  - Interactive Digital Media
- Next meeting will be held during GridAsia 2006 in Singapore, 19th May 2006.
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Thank You