

PRAGMA 2013  
Kasetsart University, Bangkok



# e-Science and Data Infrastructure Development

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President  
National Science and Technology Development Agency (NSTDA), Thailand

March 22, 2013

# Outline

- Thailand at a glance
- NSTDA at a glance
- National e-Science Infrastructure Consortium
  - Introduction
  - Some projects
- Thailand Data Infrastructure
- Collaborations with PRAGMA's members

# Thailand at a glance

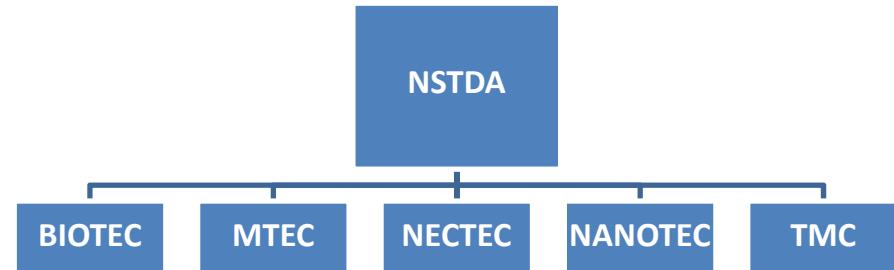
- An upper middle income and 2<sup>nd</sup> largest economy in ASEAN after Indonesia
- Total population of 69.5 million in 2012
- Competitiveness
  - 18<sup>th</sup> (from 185) in Ease of Doing Business 2013
  - 38<sup>th</sup> (from 144) in Global Competitiveness Report 2012 - 2013 by World Economic Forum
  - 30<sup>th</sup> (from 59) in IMD World Competitiveness Rankings 2012
- 2011 GDP: US\$ 345.65 billion
  - 8% Agriculture
  - 47% Services
  - 45% Manufacturing
- Top 3 **rice** exporter and 2<sup>nd</sup> largest **sugar** exporter
- World's largest natural **rubber** producer and exporter
- World's 2<sup>nd</sup> largest **hard-disk drive** exporter after China
- **Auto manufacturing** hub in Southeast Asia
- World's top **chicken** meat exporter

# Thailand's Economy

- After recovering from the **Asian Crisis** of 1997-1998, the Thai economy took off again with growth averaging about 5% per year in the period 2002-2007.
- In the decade that ended in 1995, the Thai economy was one of the world's fastest growing at an average rate of 8-9% per year.
- Over the last decade (2001-2010), poverty has been reduced from its recent peak of 21% (a result of the 1997 crisis) to about 8% in 2009.

Source: World Bank

# NSTDA at a glance



**Established:** December 1991

by the National Science and Technology Development Act, 1991

**Governance:** A quasi-government agency with  
Minister of Science and Technology as chairman of the board

**Location:** Thailand Science Park (30 kilometers north of Bangkok)

**Vision:** Key S&T partner towards knowledge based society/economy

**Missions:** R&D, Technology Transfer, HRD, and Infrastructure

**Org chart :** **Four national R&D centers** (total 98 laboratories):

BIOTEC      **National Center for Genetic Engineering and  
Biotechnology**

MTEC      **National Metal and Materials Technology Center**

NECTEC      **National Electronics and Computer Technology Center**

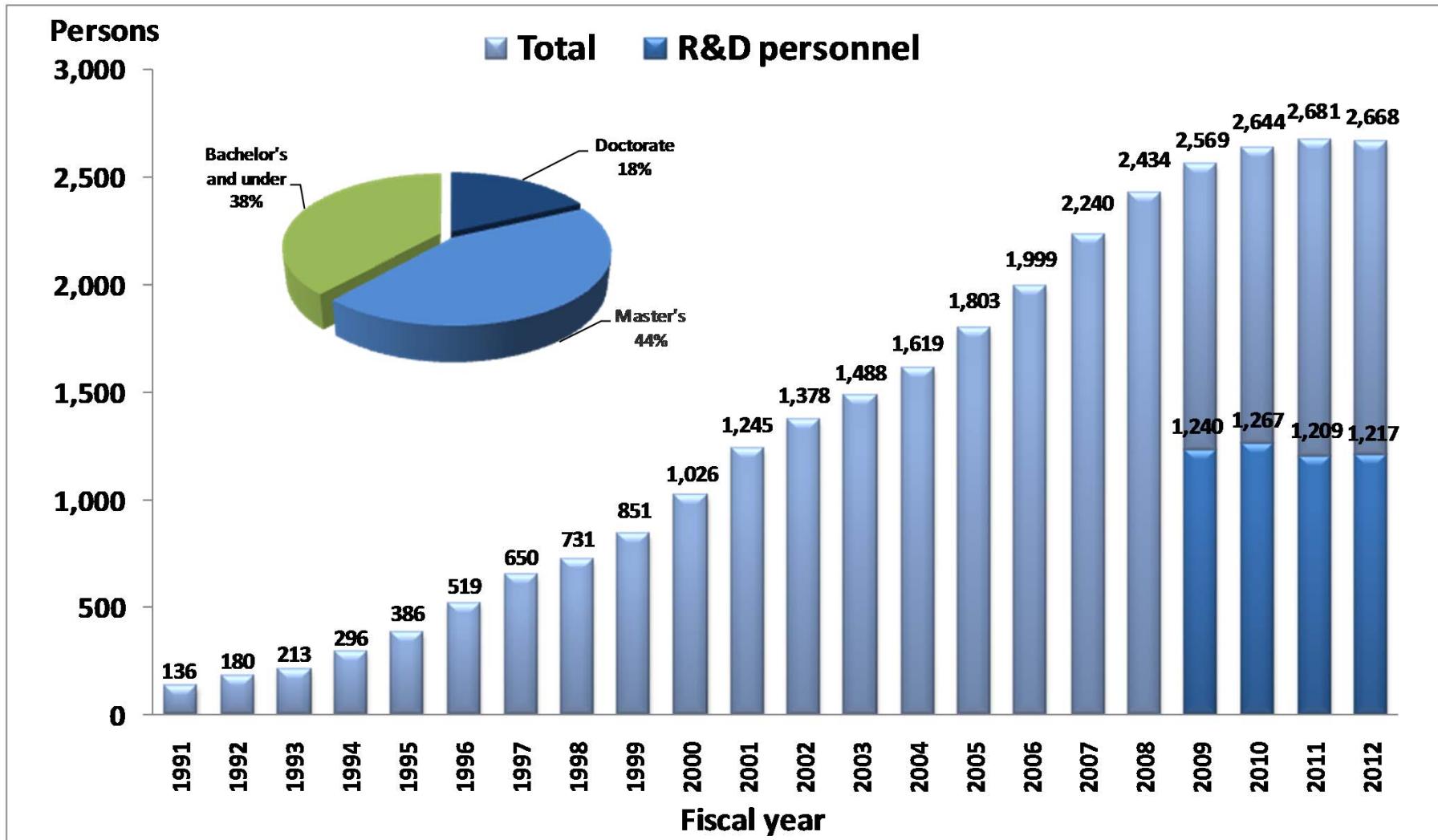
NANOTEC      **National Nanotechnology Center**

**One technology management center**

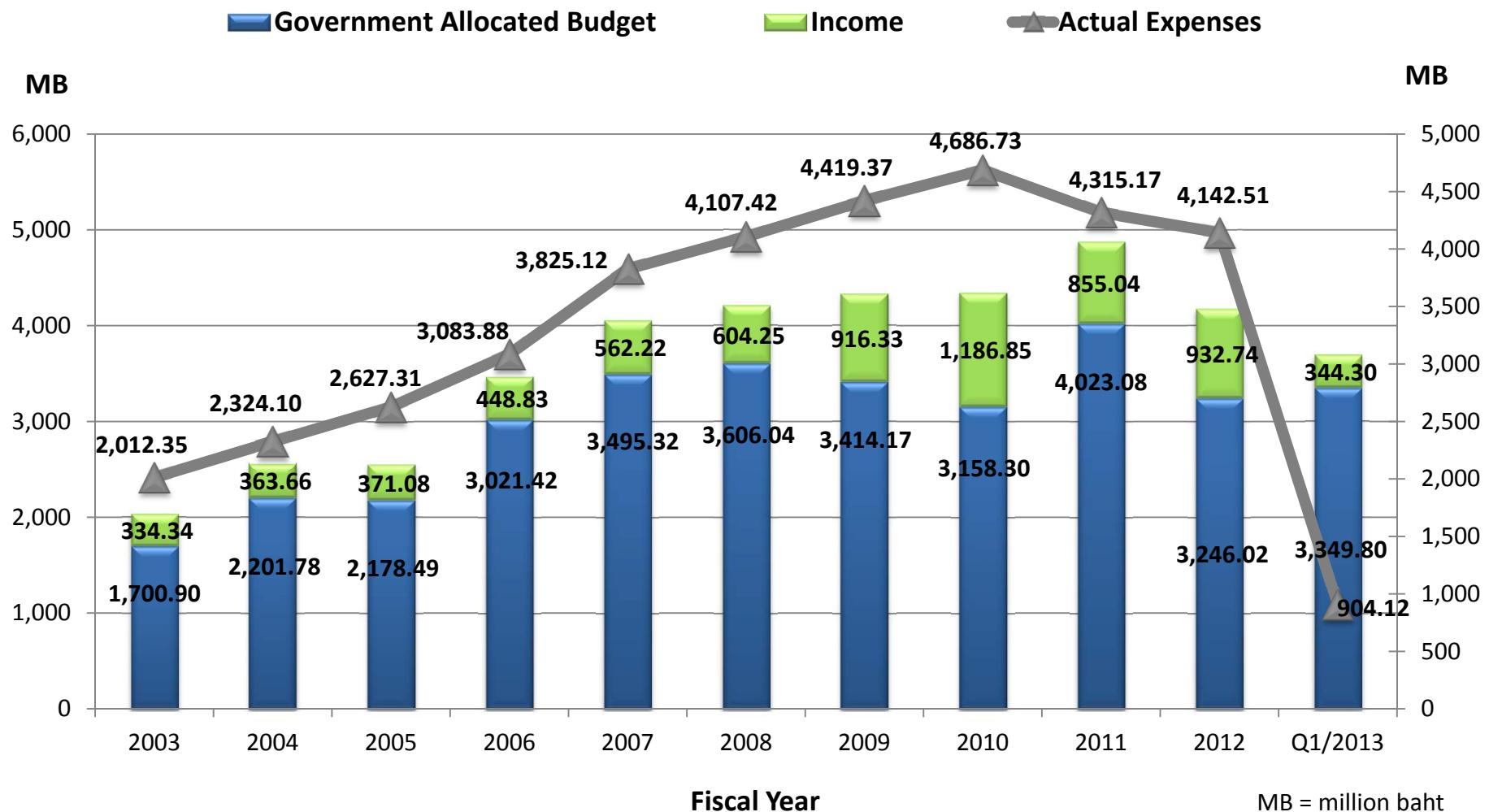
TMC      **Technology Management Center**

**Focal point:** NSTDA is national focal point for EU's Framework Program

# Personnel Distribution



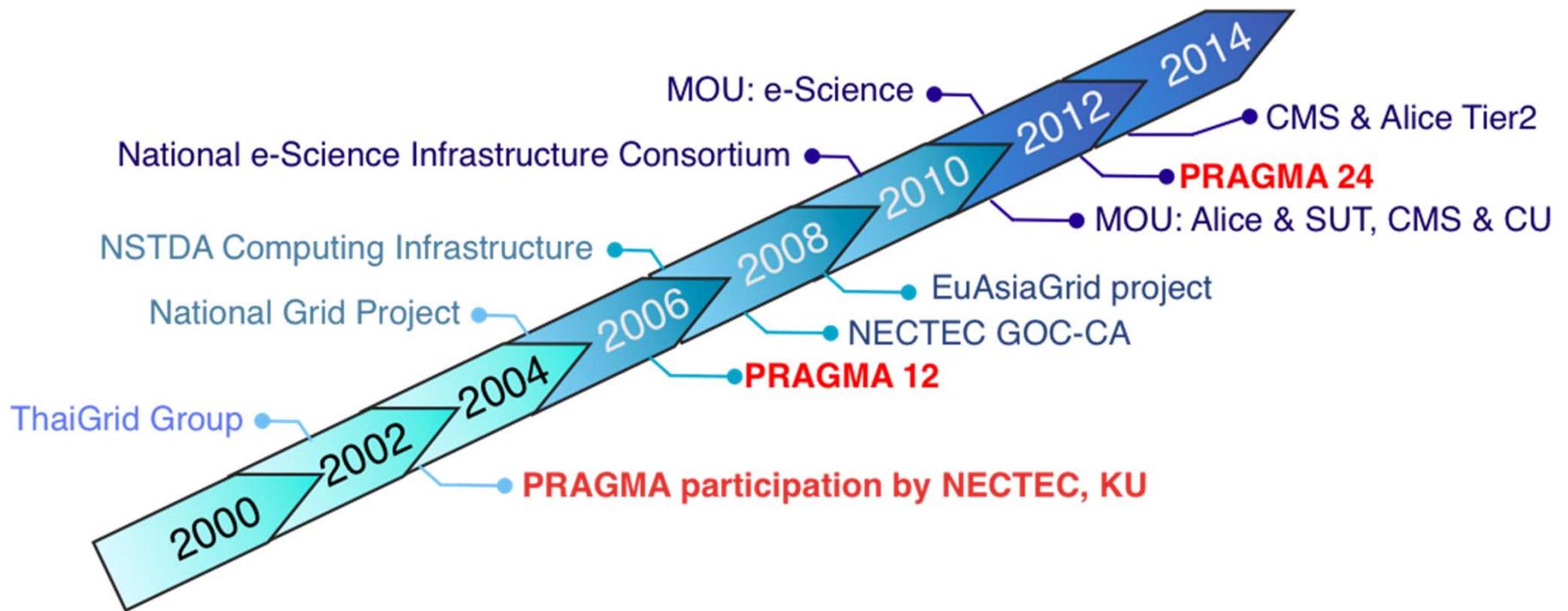
# Budget, Income and Expenses



# R&D Strategy (2011-2016)

Target Industry	Agriculture and Foods	Energy and Environment	Health and Medicine	Bioresources, Communities and the Underprivileged	Manufacturing and Service Industries
Cross-cutting Programs	Functional Materials and Processing				
Platform Technologies	Digital Engineering (Design, Engineering and Automation)				
	Sensor and Intelligent System				
	SRI (Service Research and Innovation)				
	<b>Biotechnology</b> <ul style="list-style-type: none"><li>▪ Functional Genomics Technology</li><li>▪ Microbial Biotechnology</li><li>▪ Agrobiotechnology</li></ul>	<b>Materials Technology</b> <ul style="list-style-type: none"><li>▪ Computer-aided Design, Engineering and Manufacturing</li><li>▪ Materials Design and Production</li></ul>	<b>Information and Computer Technology</b> <ul style="list-style-type: none"><li>▪ Devices and Systems</li><li>▪ Service Informatics</li></ul>	<b>Nanotechnology</b> <ul style="list-style-type: none"><li>▪ Nano-coating</li><li>▪ Nano-encapsulation</li><li>▪ Functional Nanostructure</li></ul>	

# Thai Computing Development: 2000-Present



# National e-Science Infrastructure Consortium

- Initiative to collaboratively develop national infrastructure for e-Science in Thailand
- Run as a consortium
  - All members manage with their own budget
  - Heads of all institutes are Steering Committee members
- Providing high performance computing resources for Grid and Cluster applications
- Will include data resources
- Founding members: HAI, NSTDA CU, SUT, KMUTT,



# Organization

## Steering Committee

- Head of Regular Member Institutes
- Advisories & Experts

## Working Groups

- Usage Management
- Resource
- Tools
- Network

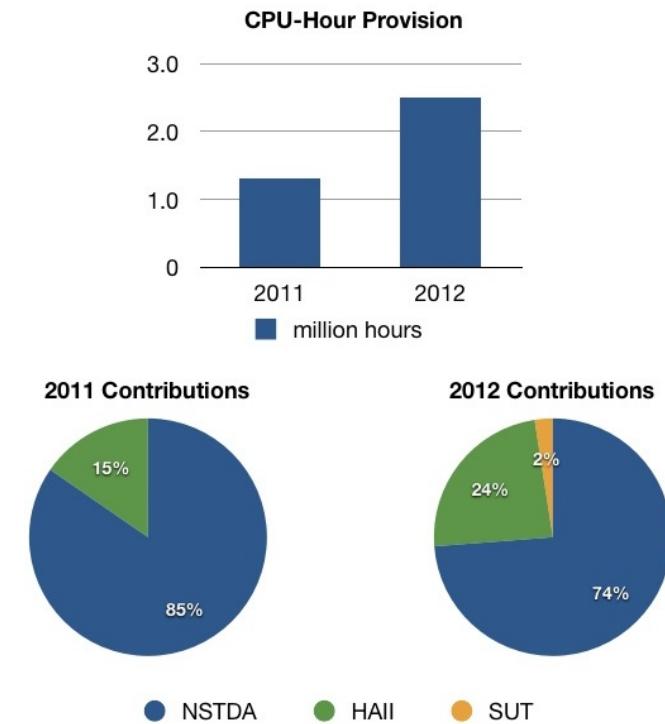
# Application Areas

- High energy physics
- Climate change
- Water and energy resources, and, environment
- Computational science and engineering
- Computer science and engineering

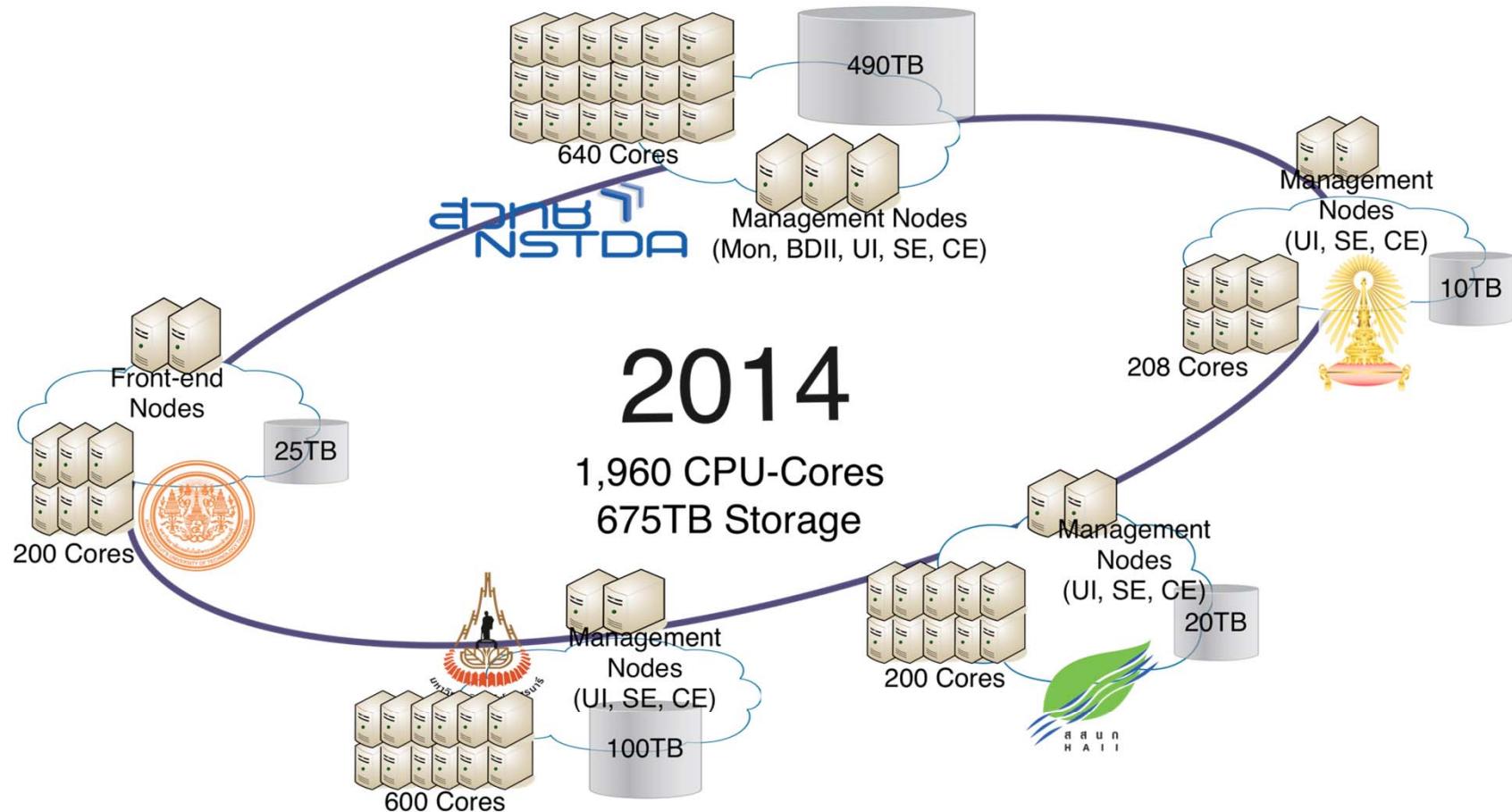
# Computing Resources

- 2012: 360 cores, 350 TB
- 2013: 1,660 cores, 465 TB
- 2014: 1,960 cores, 675 TB

# Resource Provisions



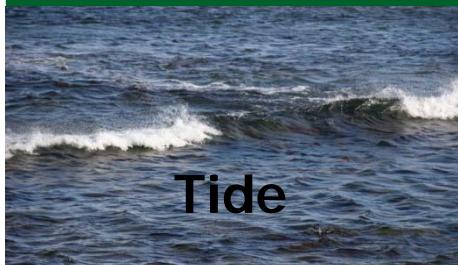
# Consortium: Roadmap



# SOME PROJECTS

# Coastal Ocean Modeling

Done

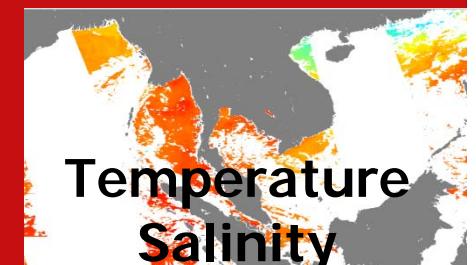


On-going



River  
Discharge

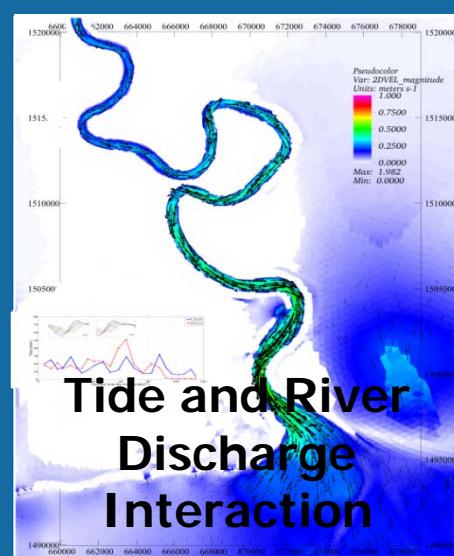
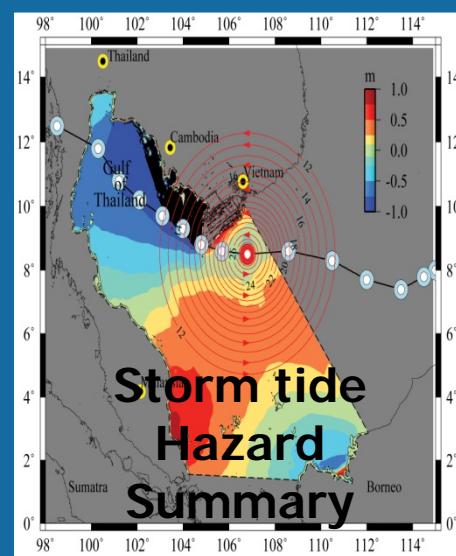
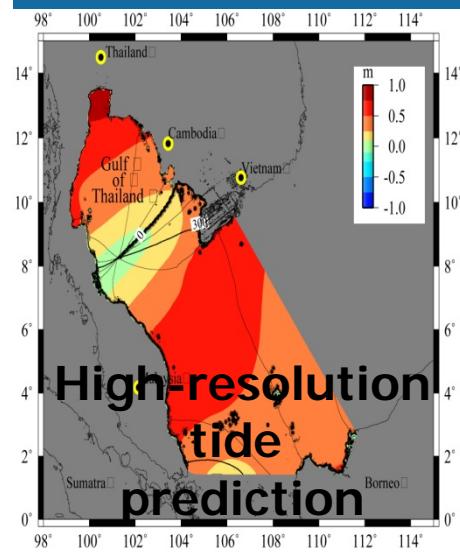
Plan on



Ocean Model  
(FVCOM)

Data  
Assimilation

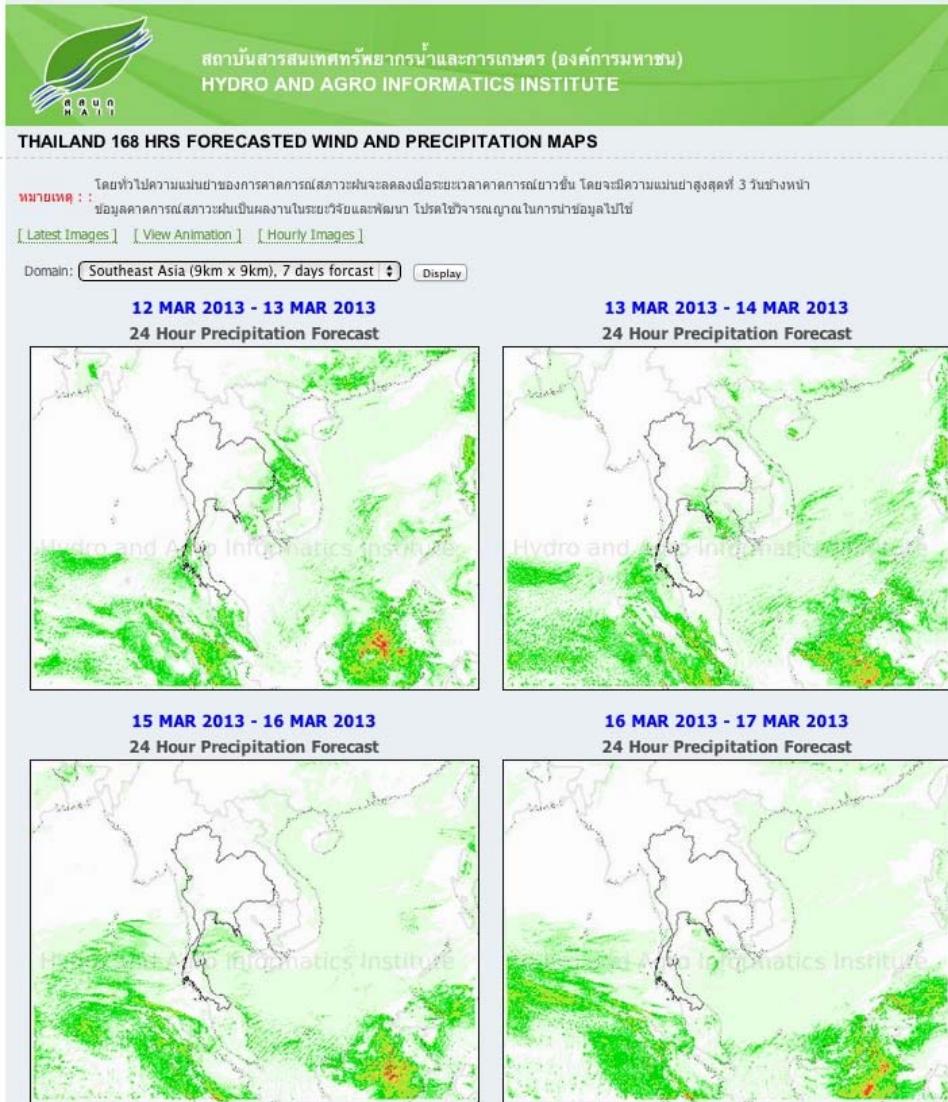
Observations



## Potential applications

- Fishery and Ecology
- Pollution monitoring and management
- Disaster mitigation and rescue response
- Tourism and recreation

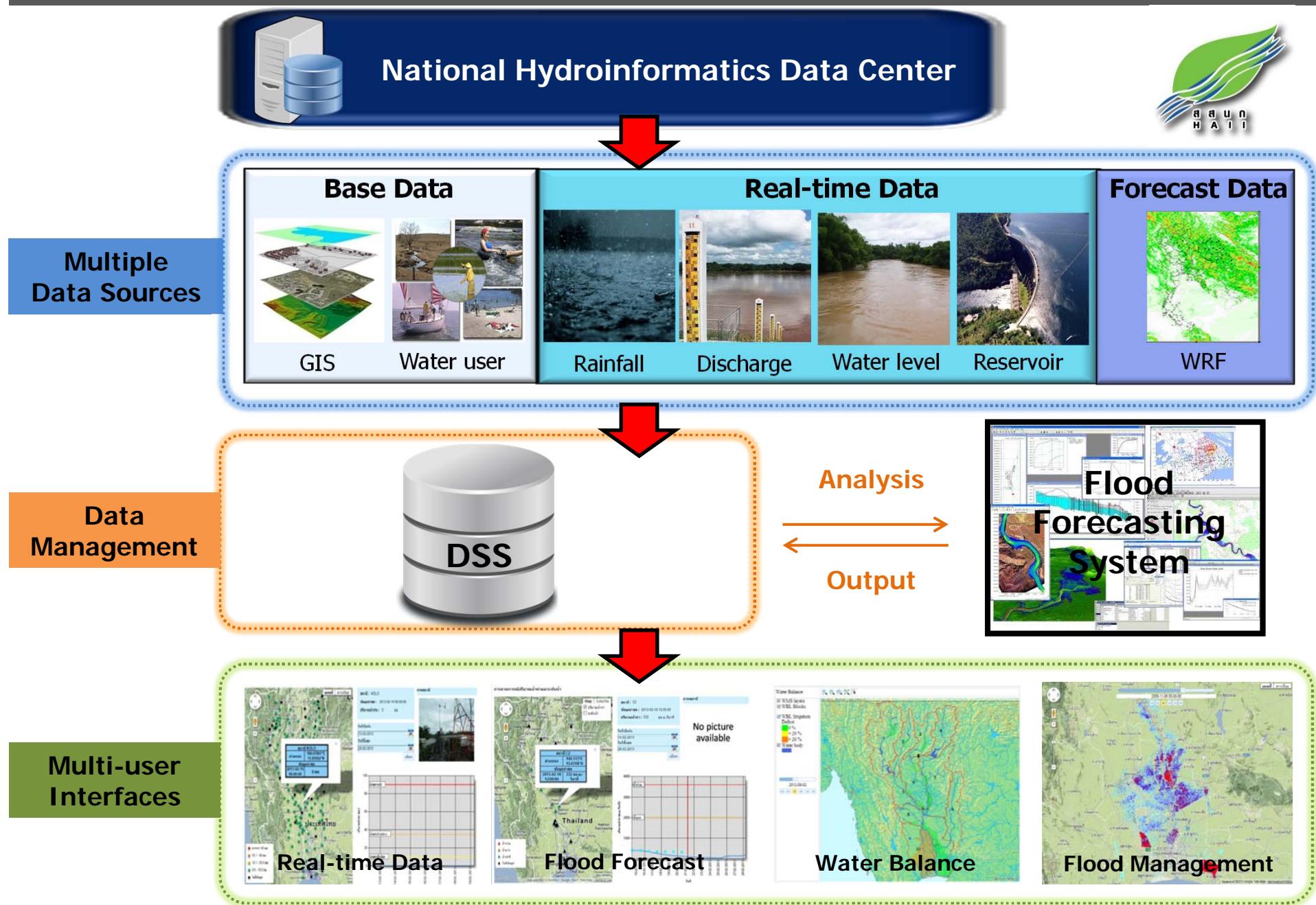
# Weather Modeling



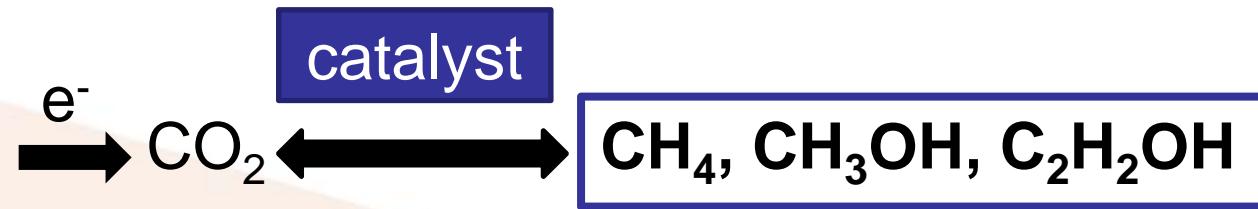
- Using WRF & RAMS
- Inputs: NCEP GFS (0.5x0.5 degrees)
- Three nested domains (27, 9, 3 km resolutions)
- Two forecasts per day
- Run-time: 4.5 hrs on 144 cores



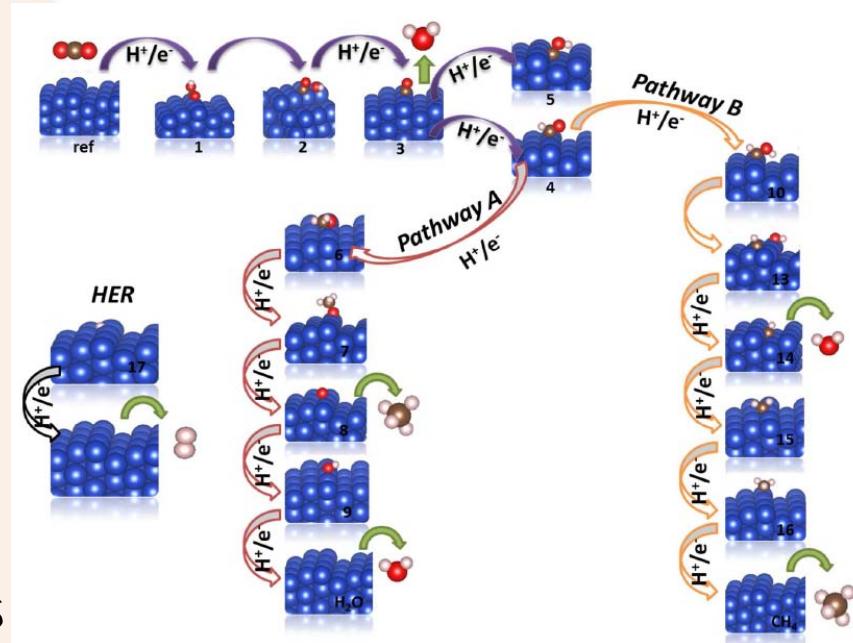
# HAI! Mathematical Model for Flood Forecast



# Catalysts for CO<sub>2</sub> Electro-reduction to Hydrocarbons



- Recycle CO<sub>2</sub> waste gas to be valuable fuels.
- The process requires low energy.
- The reaction can occur at room temperature.
- The activity and selectivity strongly depend on catalyst.
- Using molecular modeling approach
  - Provide cheap and fast catalysts screening
  - Allow a throughout reaction mechanisms investigation.



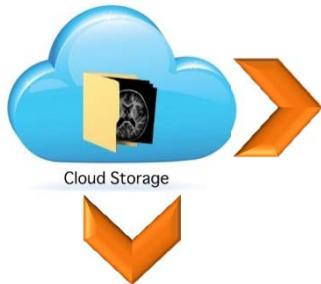
Nanoscale Simulation group  
NANOTEC

A Driving Force for National Science and Technology Capability

# SkyPACS: Software Solution for Radiologist



KMUTT

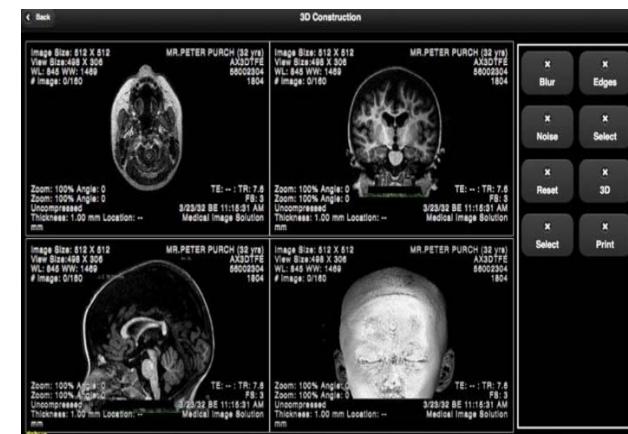


Radiologists can rapidly diagnose their patients by using 2D/3D images

Scanner produces 2D Image size ~ 1 megapixels

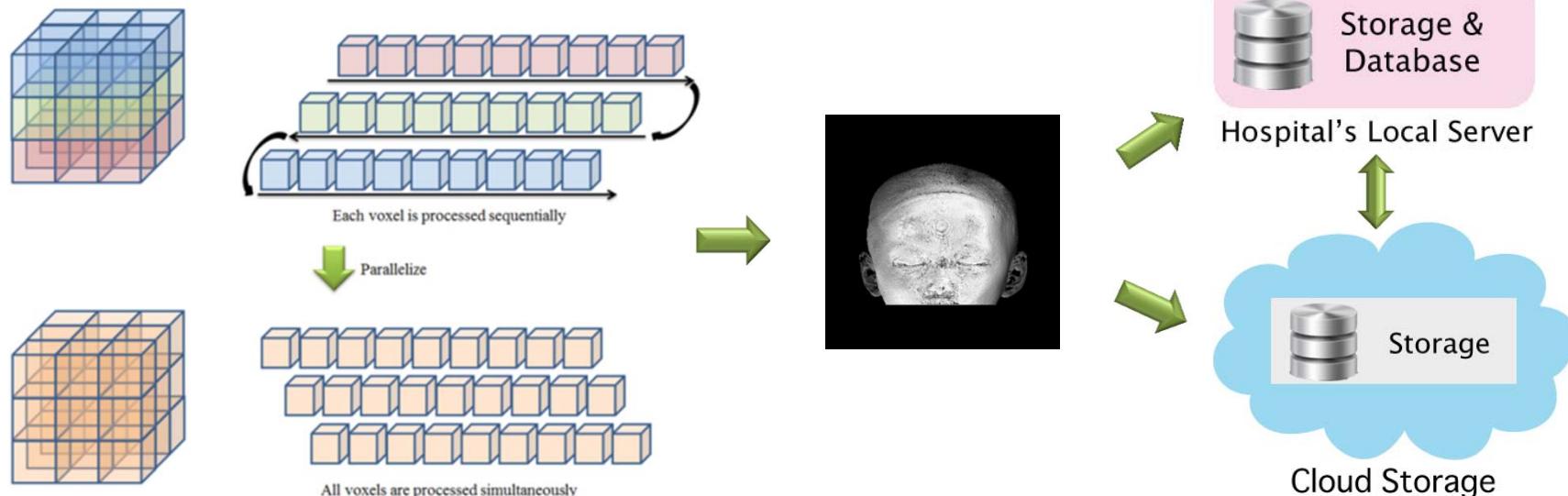
Image transfer with no compression

Display of client device must be qualified for medical application



# 3D Reconstruction of medical images

- Problems
  - Require high processing time for high resolution of 3D object
  - Interactive, real- time display is a challenge
  - Require large memory to store the images
- Solutions
  - Modify current sequential algorithms to achieve higher performance
  - Parallelization with GPU as computational platform
  - Use Cloud-based storage and explore the storage virtualization concept



# DATA INFRASTRUCTURE

# Annotated & Multimedia Corpus

<http://www.nectec.or.th/corpus/>



- Annotated text, speech, images, and multimedia
- Open and free corpus for researchers
- To promote top-up R&D in Thai Natural Language Processing and Knowledge Discovery
- Text: 5 million words; Tagged sentences; Dictionary 130k words
- Speech: Phone-Speech; Prosody-tagged Speech; Thai Command Speech (*order of thousands*)
- Character Recognition: Character and Document Images (books, news papers, magazines); (*order of 100k*)
- Other data: Thai People Body Shape Data; Traffic Camera Data

## The Consolidation of BIOTEC Genome Databases



FRONTPAGE  
return home

UNIFIED  
database viewer

DOWNLOAD  
resources

cassava

rice

shrimp

spirulina

thaisnp2

### About

The National Center for Genetic Engineering and Biotechnology (BIOTEC) has sponsored several genome-scale database of different organisms since 2000. The databases include the rice genome database at Kasetsart Kampangsan campus (riceDB), the Thailand SNP database at BIOTEC (thaisnpDB), the black tiger shrimp EST database at Chulalongkorn University (shrimpDB), the cassava EST database at BIOTEC (cassavaDB), and the latest spirulina genome database at King Mongkut University of Technology (spirulinaDB). Although, sponsored by BIOTEC, these databases are not stored locally and the principle investigators of

### Other databases

- ThaiMut: Human mutation data that Thai researchers submitted to Pubmed
- PASNP Database: Collaboration with PASNP Consortium, collection of SNPs from Asian population
- Thalassemia Database: SNP data from Thalassemia patients
- Rubber Genome Database

## Bioinformatic Tools at Genome Institute

### Bioinformatic tools and web-applications developed at the Genome Institute, BIOTEC

iLOCi: a SNP interaction prioritization technique for detecting epistasis in genome-wide association studies

Link: <http://www4a.biotech.or.th/GI/tools/iloci>



RExPrimer: an integrated web-based application for primer design

Link: <http://www4a.biotech.or.th/rexprimer/>

**ขอต้อนรับสู่**  
**สำนักงานข้อมูลสมุนไพร**

Fast search database by Thai/English name :

เข้าชมเว็บไซต์ ...  
 • การพัฒนาเว็บไซต์ใหม่ในการบริการทุกทางด้าน  
 ประจำเดือนในผู้อ้างอิง (11/03/13)  
 • สารคุณภาพของเพลี้ยกับกระบวนการในหมู่ (11/03/13)

[... Login ...](#) [... ประชุมวิชาการ เรื่อง "แผนกวัดและสุขาภิบาล"](#)

โภคภัณฑ์ กับ ชื่อกิจกรรมในไทย

สำนักงานเรียกเก็บกับสมุนไพร  
ฐานข้อมูลสมุนไพรสาธารณะชุมชน  
การคุณภาพเมือง  
การคุณภาพเมือง (2)

ฐานข้อมูลสรพศคนที่สำนักงานคณะกรรมการอาหารและยา  
อนุญาตให้ใช้เป็นยาแผนโบราณ

ฐานข้อมูลพืชสมุนไพรที่มีการไว้ในผู้ติดเชื้อและผู้ป่วยเออส์

ฐานข้อมูลความปลอดภัยของสมุนไพรที่มีการขันทะเบียนยาแผนโบราณ

เข้าชมความเคลื่อนไหวเกี่ยวกับสมุนไพร (เข้าชมทั้งหมด)

พิชิตยิ่ง, รายงานการเก็บพิชิตในคน [\[UPDAT\]](#)

การคุณ เป็นยาสมุนไพร  
การคุณแห่งชาติ

Weblinks

การคุณสมุนไพร

สำนักงานข้อมูลสมุนไพร 447 ถนนศรีอยุธยา เขตราชเทวี กรุงเทพฯ 10400  
โทรศัพท์ 0-2354-4327, 0-2644-8677-91 ต่อ 5305, 5316 โทรสาร 0-2354-4327  
E-mail: [headpypi@mahidol.ac.th](mailto:headpypi@mahidol.ac.th)

**PHARM Database**

สำนักงานข้อมูลสมุนไพร คณศ.ดร. มนารี หยาลัยหินดี

หน่วยบริการฐานข้อมูลสมุนไพร ศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพแห่งชาติ

Thai / English Name  Genus  Biological Activity

**BCC**  
BIOTEC Culture Collection

[SEARCH](#) [QUICK ORDER](#) [CART](#)

[About BCC](#)

[About BCC](#)

**BIOTEC Culture Collection**

Recognizing the importance of microorganisms, especially those isolated from natural environments in Thailand, National Center for Genetic Engineering and Biotechnology (BIOTEC) founded BIOTEC Culture Collection (BCC) in 1996. The primary objective of BCC is to collect and maintain microorganisms and their relevant data for BIOTEC's in-house research. Microorganisms in BCC are routinely tested by BIOTEC researchers to find valuable products such as secondary metabolites, enzymes and bioactive short peptides. Besides the maintenance and distribution of microorganisms for in-house research, BCC provides such services as well as training, identification, and lyophilization services to public.

**Links**

- [On-line catalogue for BIOTEC's in-house research \(Intranet\)](#)
- [Thailand Network on Culture Collections \(TNCC\)](#)
- [Bioresources Technology Unit \(BTU\)](#)

  
ศูนย์รวม ข้อมูลสิ่งมีชีวิต

**BIOTEC Bangkok Herbarium (BBH)**

Address:  
BIOTEC Bangkok Herbarium,  
113 Thailand Science Park,  
Paholyothin Road,  
Klong 1, Klong Luang,  
Pathumthani 12120, Thailand

Tel: 662-5646666-94 ext. 3700  
Fax: 662-5646707  
E-mail: [herbarium@biotec.or.th](mailto:herbarium@biotec.or.th)

This program is supported by research grant BRT D\_547001 and BT-B-02-XG-BC-4702.

© 2004 The National Center for Genetic Engineering and Biotechnology, National Science and Technology Development Agency, Thailand  
Best view with 800 x 600 Resolution and above. Microsoft Internet Explorer 5.0 and above, and Netscape 4.5 and above. Firefox 1 and above.  
Since July 1, 2002

[Privacy Policy BIOTEC](#) Last updated: September 4, 2008 1:58 PM

Thailand Web Rank  
bbh.biotech.or.th  
RANK5847 10116  
Dated by: TRUENOTS

WEBMASTER

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004631

BIOTEC

Google

Google Search

WWW BIOTEC Bangkok Herbarium

  
Mycology Laboratory BIOTEC



# National LCI-Master Plan

## Energy, Utilities and Transportation

Natural Gas  
Petroleum  
Biofuel  
Electricity grid mix  
Transportation  
(Truck, Ship, Train)  
Water supply

Recycle  
Landfill  
Wastewater treatment  
Incineration

## Industrial Materials

Plastics (PS, PE, PP, etc.)  
Non-ferrous metals  
Ferrous metals  
Aluminum, Copper  
Fibers  
Pulp & Paper  
Petrochemicals

## Commodity Chemicals

NaOH  
 $\text{H}_2\text{SO}_4$   
HCl  
 $\text{Cl}_2$   
Lime  
Sulfur  
Fertilizer mixing

## Agriculture

Cassava  
Rice  
Corn  
Natural rubber  
Vegetables  
Livestock  
Animal feeds  
Fishery

## Building and Construction Materials

Steel  
Fiber glass  
Glass  
Wood and Parawood  
Sawdust  
Tiles

# Amount of LCI



WG1 : NATURAL GAS	6
WG2 : REFINERY	7
WG3 : PETROCHEMICAL PRODUCTS	19
WG4 : FERROUS and NON-FERROUS	
Ferrous	9
Non-Ferrous	5
WG5 : INFRASTRUCTURE & TRANSPORTATION	
Electric Grid Mix	1
Transportation	
By Truck	188
By Ship	21
By Rail	22
Water	6
WG6 : CONSTRUCTION MATERIALS	
Ceramics & Tiles	7
Glass & Mirror	7
Alternative Materials for Wood	3
Other	8
WG7 : AGRICULTURE and AGRO-PRODUCTS	
Feedmill	15
Livestocks and Products	19
Rubber	9
Pulp & Paper	9
Wood (Para-wood)	9
Cassava	2
Cassava Products	9
Longan	4
Pineapple	1
Plantation of Plants (literature)	80
Frozen fruit and vegetable	10
Palm	24
Curry Soup	3

WG8 : BASIC CHEMICALS	
Paint	6
Basic Chemical	14
Chemical Products	2
Industrial Gases	3
Fertilizers and Herbicides	47
WG9 : WASTE MANAGEMENT	
Incinerator	8
Landfills	7
Recycle	13
Wastewater Treatment	7
WG10 : OTHERS	
Textile	30
Electric&Electronic Parts	80
Automotive Parts	3
Varnish	3

## Gate to Gate

-done = 726

-on going = 73

## Cradle to Gate

- done & pass CR = 360

- on going = 168

# Example of cassava LCI

## Input

Fertilizers ....kg

Water ....L

Land occu. ....rai-y

Chemicals ....kg →

Fuel ....L



## Output

**Products** ....kg

**Emissions to air**

N<sub>2</sub>O ....kg

CO<sub>2</sub> ....kg

CH<sub>4</sub> ....kg

SO<sub>2</sub> ....kg

NO<sub>x</sub> ....kg

**Emissions to Water**

NO<sub>3</sub> ....kg

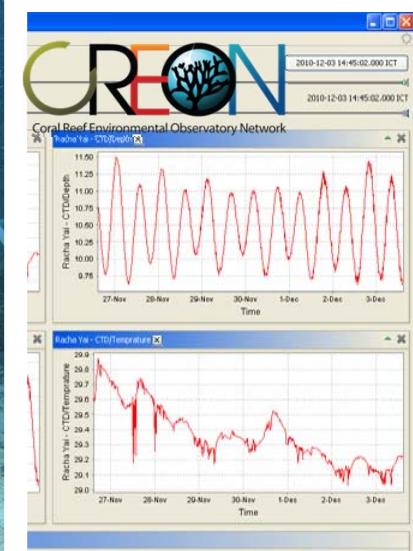
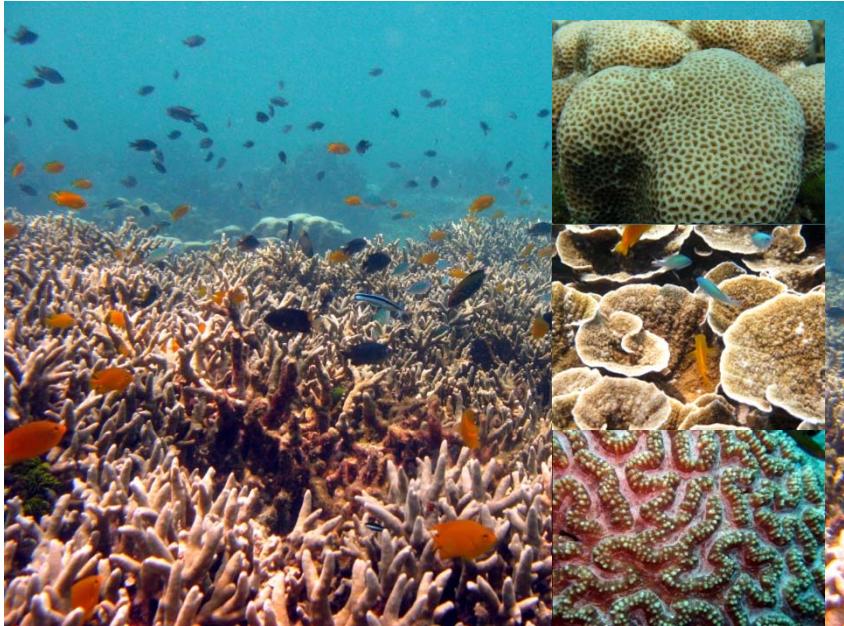
PO<sub>4</sub> ....kg

**Emissions to soil** ....kg

**Solid wastes** ....kg

# COLLABORATION WITH PRAGMA

# Coral Reef Monitoring



# Asia Geo Grid Initiative

1. Project management
2. Development and management of Asia GEO Grid Infrastructure
3. Development of model cases at Flux observation sites.
4. PRAGMA/CREON Joint WS (2011)
5. OGC TC Meeting (2012)



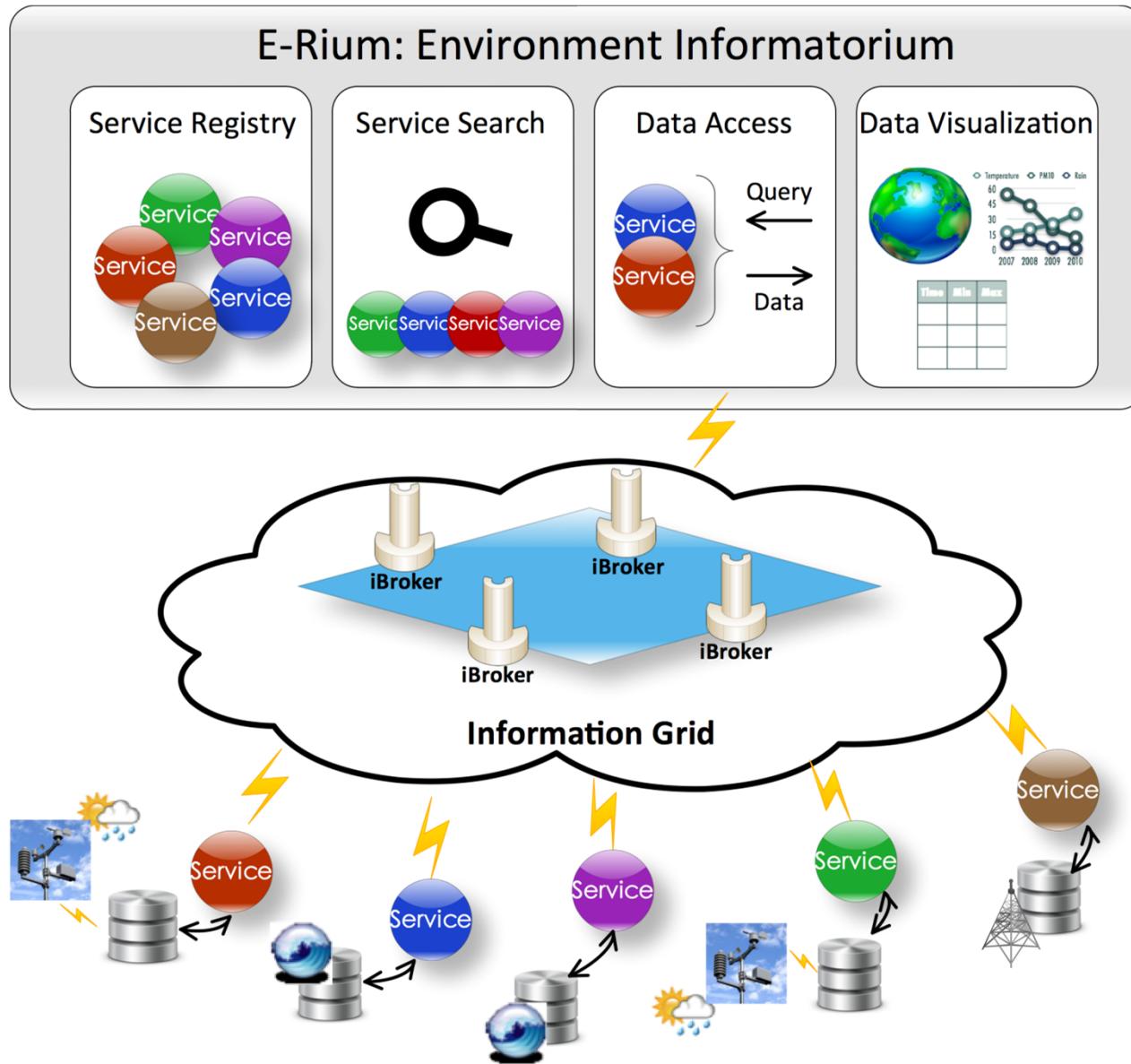
1. Promotion of collaboration with ThaiFlux
2. Development of “Information Grid” and “Environment Informatorium”.
3. Evaluation of Asia GEO Grid Infrastructure.

1. Development of near-real-time pipeline for processing satellite images to support in-situ image data to disaster prevention center.
2. Support TaiwanFlux to provide Flux data by GEO Grid middleware.

1. Development of model cases at Flux observation sites.
2. Leading collaborations with AsiaFlux Network

1. Development of GEO Grid Infrastructure in Vietnam
2. Understanding Physics, Mathematics used in weather research and forecasting model.
3. Evaluation of Asia GEO Grid Infrastructure.

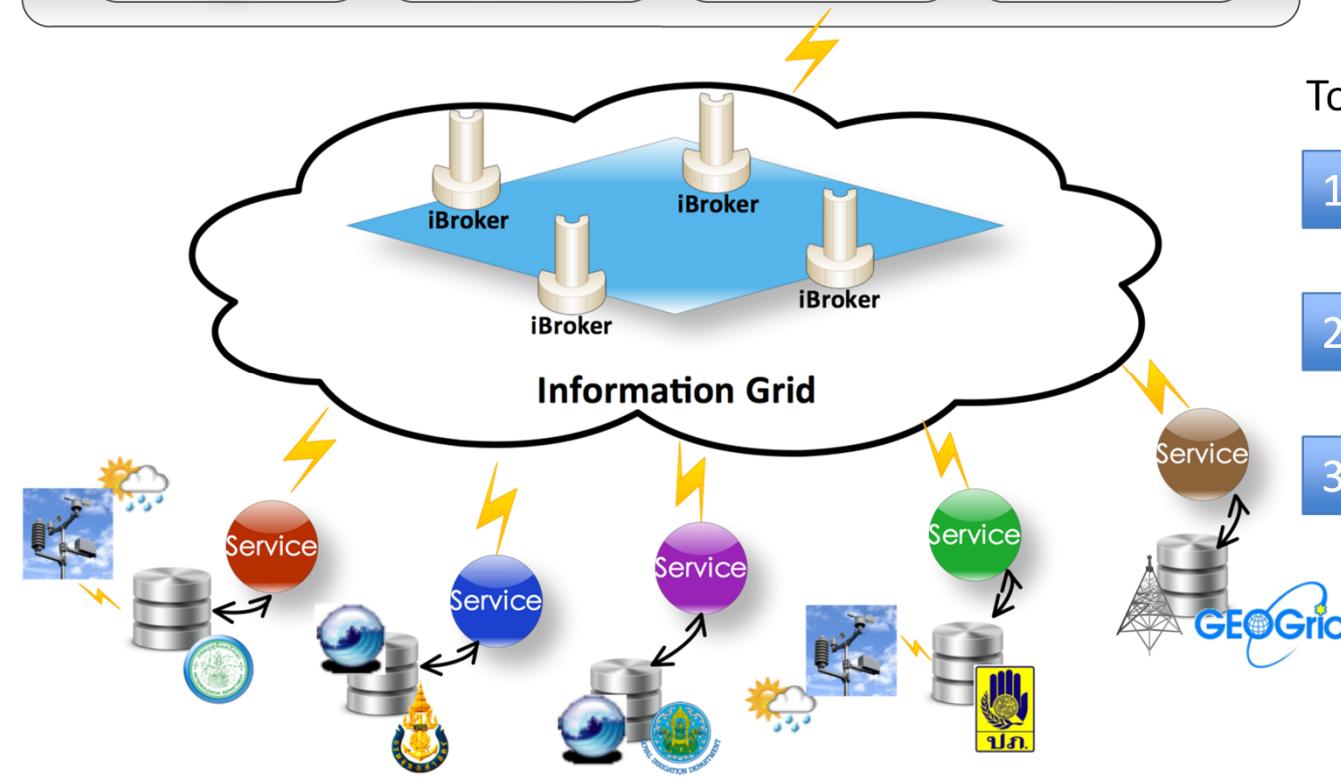
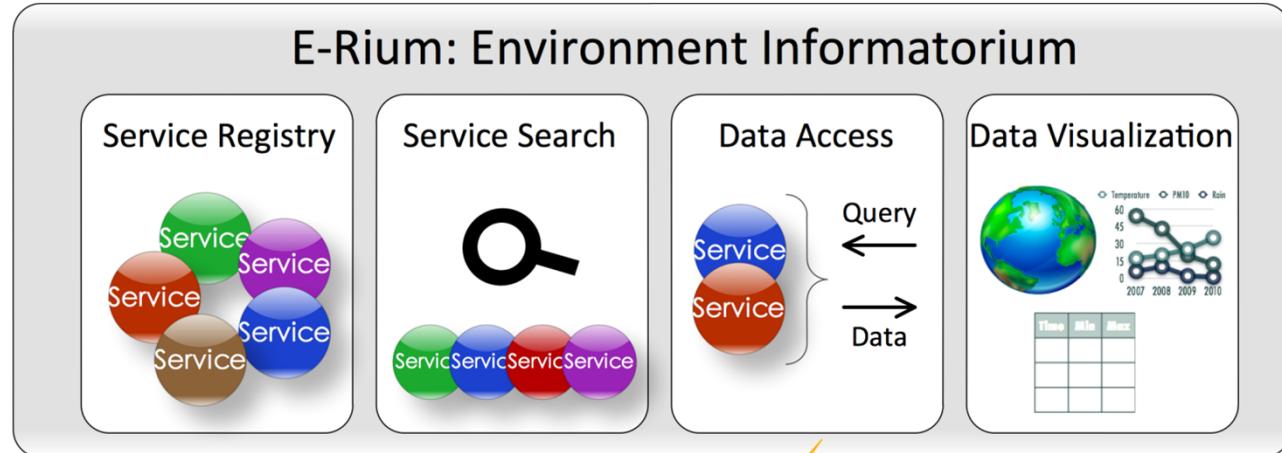
# NECTEC Activities



## Overall Capabilities:

- 1 Catalog for two kinds of heterogeneous services:  
OGC-SOS & LSR-SDS
- 2 Simple data access across  
geographically distributed  
and heterogeneous services
- 3 Basic visualization of  
different data types via  
map, graph and table

# Collaborations



## Current Collaborators:

- 1** GeoGrid:  
Sun Photometer Data
- 2** Disaster Department:  
Temperature Data  
Rain Data  
Humidity Data

## To-be Collaborators (hopefully):

- 1** Royal Irrigation Department:  
Tidal Data and etc.
- 2** Navy Department:  
Tidal Data and etc.
- 3** Thai Meteorological  
Department:  
Weather Data and etc.

# Thank you!

A Driving Force for National  
Science and Technology Capability



## National Science and Technology Development Agency

111 Thailand Science Park

Phahonyothin Road,  
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Pathumthani 12120

Thailand

<http://www.nstda.or.th/eng/>

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Fax. +66(0)2-564-7004

Email: [ic@nstda.or.th](mailto:ic@nstda.or.th)