Building Taiwan Health Grid for Health Decision Making

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Agenda

- Taiwan Introduction
- Health Grid @ Taiwan
- Conclusion
Brief View of Taiwan

- Total population: 22.5 million
- The area approximately 36,000 sq. km
- About 394 km long and 144 km wide
- Temperatures ranging from 28 deg C in July to 14 deg C in January
Formosa, A Beautiful Island

Every autumn, endangered black-faced spoonbills migrate through Taiwan, stopping at Chi-ku near the Tsengwen River in Tainan County. (Courtesy of the Black-Faced Spoonbill Conservation Society, Tainan County)

The Taiwan Blue Magpie is endemic to Taiwan and currently under protection as an endangered species. (Photo by Teh Ming-yuan)

The Taroko Gorge, a spectacular marble-cored cliff-hanging near the east coast city of Hualien, is one of Taiwan’s most attractive

Tubia coral, a variety of soft-hard coral, forms individual clusters of bright orange coral on rocks or in crevices beneath the sea. (Photo by Jang Ming-shih)

The Lansang Plain, the largest plain in northeastern Taiwan, is home to many people. (Courtesy of Liu Taidi)
World’s highest building: Taipei 101

- 507 meters
- Offices, hotels and mall (now open)
National Health Insurance

- Department Of Health has Bureau of NHI.
- National Health Insurance for all people in Taiwan since 1995
- NHI IC Card are used all over Taiwan on Jan. 1, 2004.
NHI IC Card
NHI IC Card
Background

- Biomedical data
  - Scale, Complexity, Timeliness
  - Massive data and heavy computation
- Collaboration between hospitals and research/education institutes
- Grid for large data and computing power
Massive Data

- National Health Insurance DB: 4TB
- Interactive Clinical DataBank: 20GB
- CasImage: 3GB
- Visible Human Project: 40GB
- Dental Image Database
- Real Clinical Data:
  - Two teaching hospitals of TMU: over 300GB of clinical data
Interactive Clinical Image Databank
Welcome to the website of CASIMAGE at the Geneva University Hospital, Switzerland.

http://www.casimage.com

Welcome to our Casimage database!

You are located in Taiwan (IP Address: 211.22.19.73).

Our Casimage database actually stores 50 different collections with 2164 teaching files including 9501 images.

Click here to directly enter our database!
Estimate medical data of Taiwan

- Outpatient visits: 300 millions per year
- Inpatient stays: 2.8 millions per year.
- ~ 900TB image data per year
- ~ 30TB text data per year
- ~ laboratory data up to 1 billion records and size 1.2TB per year
- Grow exponentially in the next 5 years when electronic health record matures
Health Grid at Taiwan
Real connection between hospitals and researchers

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TMU & GIMI

- Taipei Medical University
- Graduated Institute of Medical Informatics (GIMI) is the first graduated school of medical informatics in Taiwan since 1998
  - Center for Biomedical Informatics
  - Bioinformatics Computer Center
  - Staff’s computers and computer rooms, about 300+ nodes
NTU

- National Taiwan University
- First University in Taiwan
- 200+ nodes testing Grid on Chemistry, Physics, Bioinformatics
- 8 Computer rooms in NTU Computer Center, 400+ computing nodes available
Academia Sinica

- Already collaborate with CERN on High Energy Physics Grids
- Academia Sinica Computing Centre
- Institute of Information Science
Networking Environment
Collaboration People

- WFH & TMU: Yu-Chuan Li, MD. PhD.
- TMUH: Li Liu, PhD.
- NTU & NTUH: Feipei Lai, PhD.
- Academia Sinica: Simon Lin PhD.
- IIS: Dai-Wei Wang, PhD.
- GIMI: All faculty
- University of Geneva: Dr. Henning Muller
Scenario: Carpal Tunnel Syndrome

- A physician of rehabilitation may want to know:
  - Percentage of different treatment on CTS in whole Taiwan:
    - Operation,
    - Rehabilitation,
    - Traditional Chinese medicine (e.g. acupuncture)
  - The outcome and return-to-hospital rate of each treatment options for a patient with specific age and occupation
  - The rate of CTS and other RSI
HealthGrid Can help on CTS

- For physicians
  - Choose optimal treatment for individual patient
- For patients
  - Get better medical care
- For health policy maker
  - Make future public health policies
Scenario: A 58 year-old female

- Lab Data: cholesterol 500mg/dl
- A doctor may want to know:
  - The percentage of people who eventually get Coronary Artery Disease
  - Their treatment options
  - Medication usage... etc.
- Provide physician to do better medical decision
SARS Damage in Taiwan

- Severe Acute Respirator Syndrome during March 2003
- 346 people affected by SARS
- 73 people were dead
  - Including 12 health professionals
HealthGrid for SARS

- For health care people
  - Patient’s History
  - SARS Chest X-ray Image
  - Lab Data / biopsy
  - Information from research labs
  - Share experience and knowledge to fight SARS!

- For researcher
  - Have enough clinical data to study SARS

- For government and the director of health
  - Prevent SARS epidemic
Possible Applications

- CBIR System for Medical Images
- Data Mining on Medical Data
- Health Insurance Database Research
- Aggregated EHR data for medical decision making and public health policy making
MIEC Project

- National Medical Information Exchange Center
- MIEC is not successful
- Hospitals treat health and medical data as their own property
- Not willing to share with other hospitals
- Concern about privacy, legal and business issues
To Share, or Not to Share

- Medical data are sensitive and “proprietary”
- No identifiable patient data will be shared
- Share the results of computation, not the patient data itself
- Privacy enhancing technologies
- Multiparty private computation
- IIS Cellsecu System
Privacy Enhancing Technology (PET)

- De-identification before shipping the dataset: manipulate data so that no individual information can be inferred
- Data-centered: to have data processing programs come to the data source and reply the results after finishing processing
CellSecu

- A gatekeeper to ensure datasets meet the privacy requirement before releasing
- Based on modal logic formalism
- Using generalization of attributes to enhance privacy protection
- Privacy measurements are based on information theory and benefit gained for dataset receiver
- Developed in Academia Sinica Taiwan
Cellsecu

- IIS of Academia Sinica
- Technology used:
  - Data de-identification
  - Encryption technology
  - Multiparty private computation
Dataset Linkage problem

- Linking several dataset can be very useful
- Linkage is prohibited by law in many places due to privacy concerns
- Private multiparty computation (MPC) protocols might remedy the situation
- We plan to study the feasibility and impact of applying MPC on Grids
Research of Health Grid
Conclusion

- Use Grid technology to collaborate hospitals and academic institute
- Build a testbed and demo site of a Taiwan Health Grid
- Devise PETs than can be used in this Health Grid
- Increase international collaboration
Q & A

Welcome to ISGC 2004 in Taiwan!

Thanks you!