

# **A Grid-based Medical Decision Support System**

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# Outline

- Introduction
- Data Mining
- System Architecture
- System Design
- Research Result
- Discussion
- Conclusion

# Introduction (1/2)

- With the widespread popularity of the Internet, it becomes a trend to get as many thing done as possible on computer networks.
- In addition to data content, the resource sharing is a major issue in the Internet era. Taking Taiwan's medical industry as an example, it lacks a platform for sharing, processing and analyzing huge amounts of medical data.

# Introduction (2/2)

- We develop an experimental Medicare Grid System
  - Grid technology
    - Medical data sharing mechanism
  - Data mining technology
    - Medical data format
    - Data analysis
    - Association rule 、 Clustering 、 Classification
  - Medical decision support system
    - Support medical faculty
    - Disease prevention
    - Improve medical quality
    - Reduce health insurance cost

# Medicare Grid: A Grid Based E-health System

## National Tsing Hua University

### Decision Support System

- Data Warehouse
- Data Mining

Feng Chia University

### Intelligent Mobile System

- RFID Mobile System
- RFID Exchange System

National Chiao Tung University  
Chung Hwa University

### Personal Health Protection System

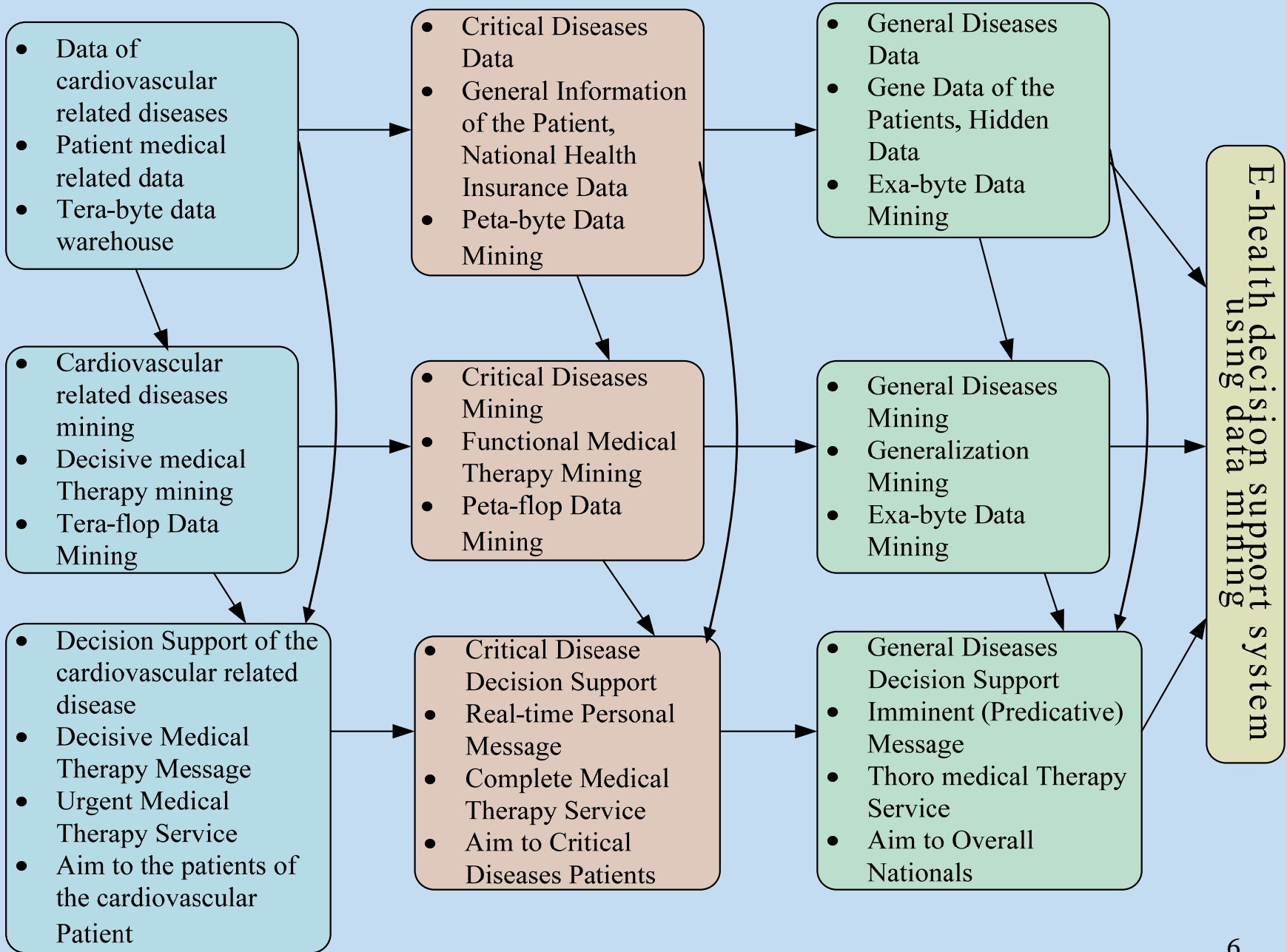
- Physiological Signal Sensor System
- Physiological Signal Transmission System

Feng Chia University

### E-health Medical Grid Platform

- Medical Grid management System
- Medical Computation Grid Platform
- Medical Data Grid Platform

Providence University  
Tunghai University

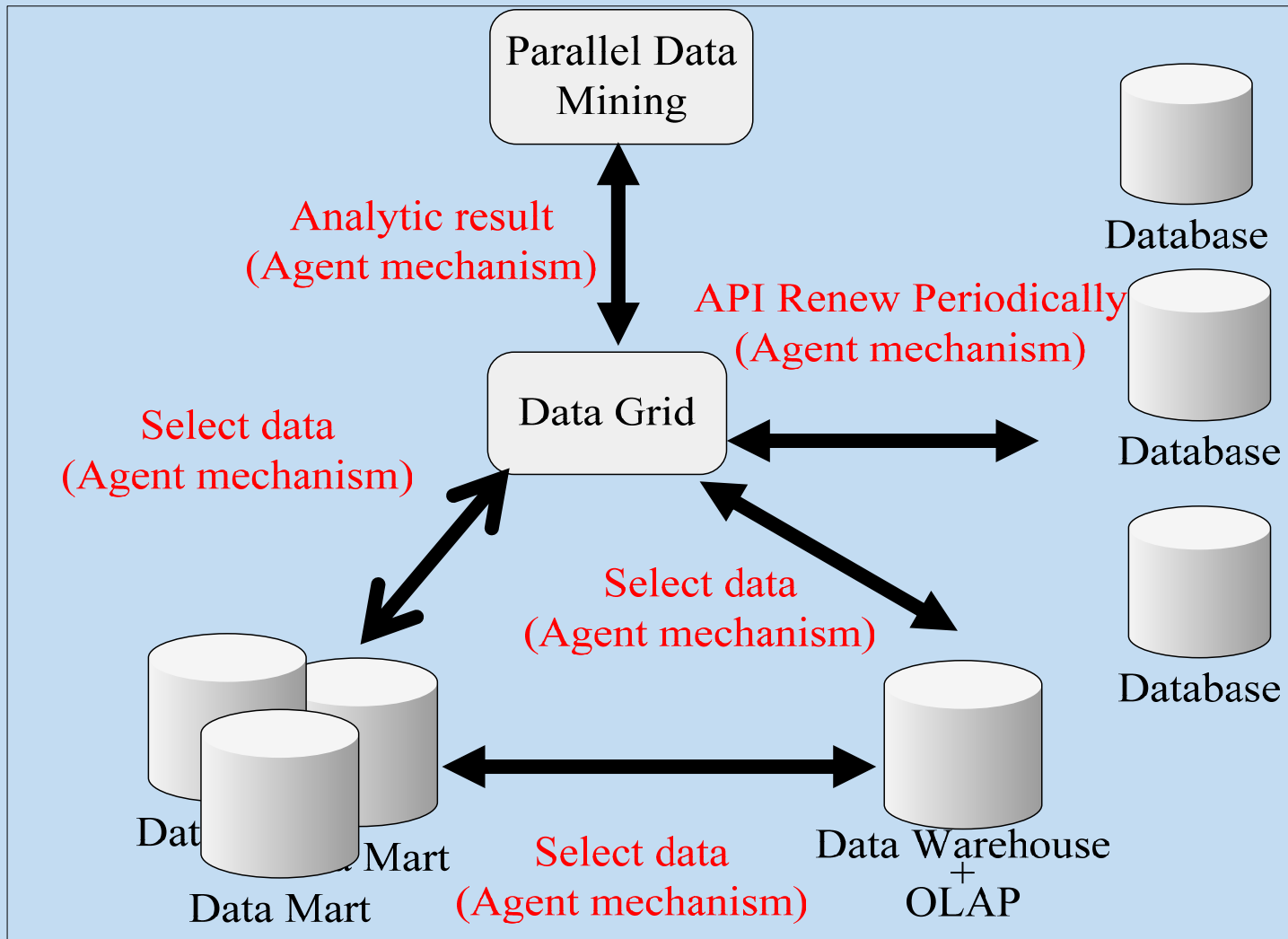


# Data Mining

What functions does data mining have

- To discover hidden, but useful information
- To describe the features and associations of data
  - Support for decision making
  - Trend prediction

# System Architecture





# System Design (1/3)

- Using data mining methods and techniques in medical grid to build models for the prevention and medical care of cardiovascular disease. It also provides cost information for medical decision making.
  - Patient's profile and health condition records
  - Patient's medical history records
  - Clinical data and health insurance cost data

# System Design (2/3)

- Medical data collection and analysis
  - The diagnosis and medical treatment process of patients with cardiovascular disease
  - The drugs used for cardiovascular disease
  - Study the performances of medical behavior
- Data mining and model generation
  - To build a risk prediction model
  - Medical cost procedure analysis
  - Chronic cardiovascular disease analysis

# System Design (3/3)

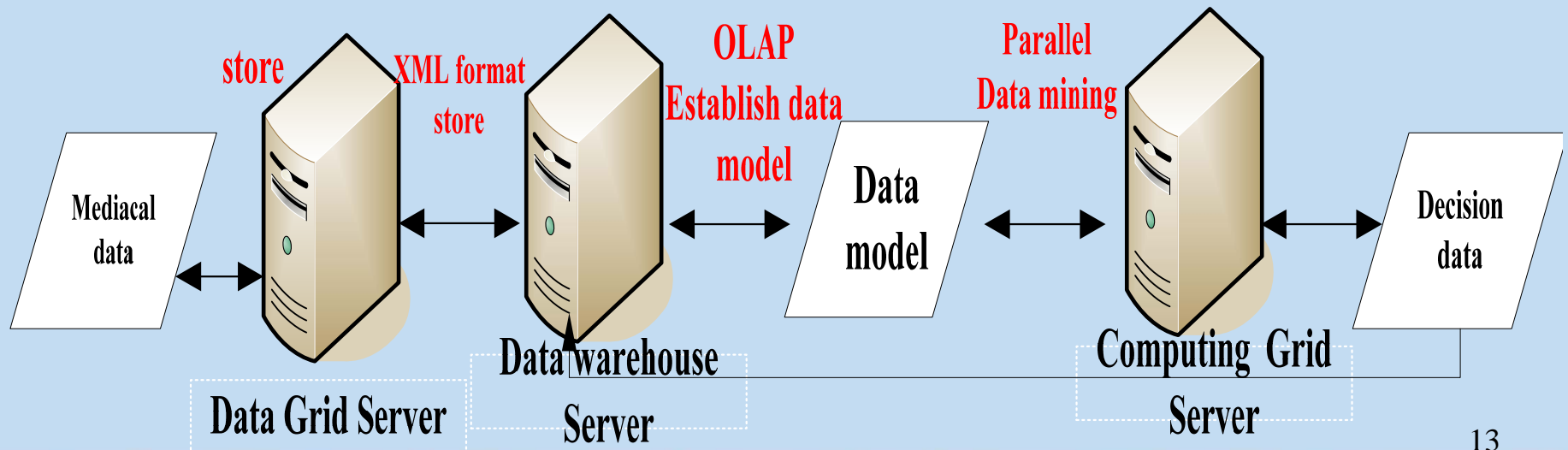
- Provide a prototype of decision support system
  - With the built data warehouse and results of data mining system, we start to track and analyze the collected data for preventing and taking care of the patients with cardiovascular disease.
  - Based on the data analysis from different hospitals, we try to provide medical decision-support information for the doctors, hospitals, insurance companies.

# Parallel data mining

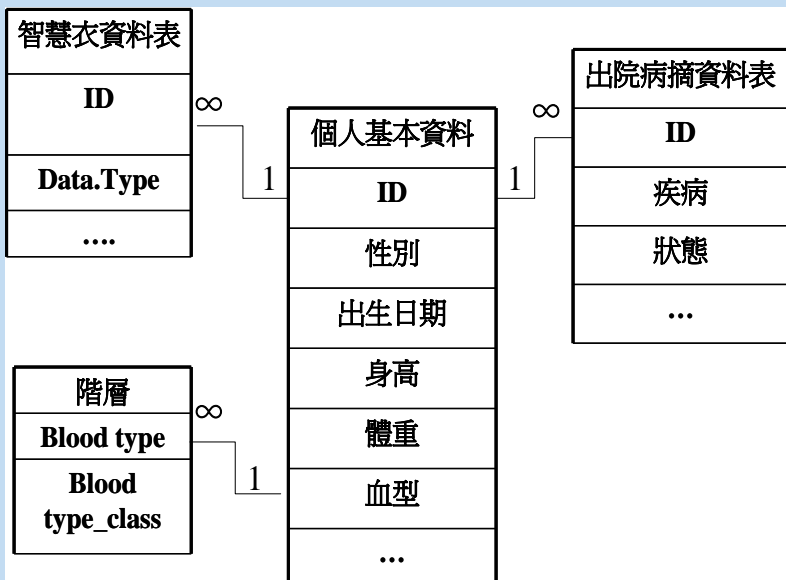
- We have developed some parallel DM algorithms
  - Association rule mining
    - Parallel Apriori algorithm for association rule mining
    - Parallel FP-tree (frequent pattern tree) algorithm
    - Parallel TM (transaction mapping) algorithm
  - Clustering
    - Parallel k-means algorithm

# Research Result (1/2)

- System environment
  - 1 data warehouse server (Windows Server 2003)
  - 6 Grid servers for computation
- Experimental result



# Research Result (2/2)



支援	大小	項目集
2	3	Height >= 163, Blood Type = O, Gender = M
2	3	Weight >= 61, Blood Type = O, Gender = M
2	3	Blood Type = A, Height >= 163, Gender = M
1	3	Height = 162 - 163, Blood Type = AB, Weight = 58 - 61
1	3	Blood Type = AB, Weight = 58 - 61, Gender = M
1	3	Height = 162 - 163, Blood Type = AB, Gender = M
1	3	Gender = F, Height = 158 - 162, Weight = 58 - 61
1	3	Height < 156, Weight >= 61, Blood Type = A
1	3	Height = 156 - 158, Blood Type = B, Weight < 54
1	3	Gender = F, Blood Type = B, Weight = 58 - 61
1	3	Height = 156 - 158, Weight < 54, Gender = M
1	3	Height < 156, Weight >= 61, Gender = M
3	3	Height < 156, Blood Type = A, Gender = M
3	3	Height = 158 - 162, Weight < 54, Blood Type = O
3	3	Height = 158 - 162, Blood Type = O, Gender = M
3	3	Weight = 58 - 61, Height >= 163, Gender = M
3	3	Gender = F, Height = 158 - 162, Blood Type = B
3	3	Weight = 54 - 58, Height >= 163, Blood Type = O
3	3	Height = 158 - 162, Weight < 54, Gender = M
3	3	Height = 156 - 158, Blood Type = B, Gender = M
3	3	Height = 156 - 158, Weight >= 61, Blood Type = O
3	3	Height = 156 - 158, Weight >= 61, Gender = M
3	3	Height = 162 - 163, Weight = 58 - 61, Gender = M

		Height Range	Height	Status											
		☐ 150 to 160					☐ 160 to 170								
		☐ 155		☐ 156		☐ 157		☐ 158		總和		☐ 162		☐ 163	
		OPD follow up		總和		expire		總和				OPD follow up		總和	
Blood Type Class	Blood Type	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數	XML 1 計數
type 1	A	1	1						1					1	1
	AB										1	1			
	總和	1	1						1	1	1	1		1	1
type 2	B					1	1	2							
	O			1	1			1	2					1	
	總和			1	1	1	2	4						1	
總計		1	1	1	1	1	2	5	1	1	1	2	1	1	

# Discussion

- Medical data
  - Heterogeneous data
  - Database integration
- Data mining
  - Medical domain knowledge
  - Effective rules
- Medical applications
  - Correct and useful rules
  - Need more help from the doctor and hospital

# Conclusion

- Now
  - Prototype for cardiovascular disease
    - Data format conversion
    - Online analysis
    - Parallel data mining
- Future
  - Medical Grid
  - Medical decision support system



Thanks for your attention!