個人化健康醫療管理，醫療資訊應用新視野

發展健康照護雲端服務

徐建業

台北醫學大學醫學資訊研究所
Taipei Medical University
Graduate Institute of Medical Informatics

台灣醫學資訊學會
Taiwan Association for Medical Informatics TAMI

國內現況觀察
執行現況檢視

- ## 政府相關政策
  - 「全人健康照護」政策目標
  - 「從出生前到老去健康資訊ｅ化流通」發展策略
  - 網路健康服務推動計畫（民國91至94年）
  - 衛生局所網路便民服務計畫（民國92至95年）
  - 民國93年10月開始規劃「國民健康資訊建設計畫（National Health Informatics Project，NHIP）」
  - 由政府扮演推動角色，營造國家健康資訊發展環境，推動衛生醫療資訊的重要基礎建設

醫療照護的複雜及不連續性
Current Care

- **Shoot and Forget**: too complex and uncoordinated
- **Hit and Miss**: discontinuous (mostly miss)
- **Trial and Error**: not personalized
- **Up and Down**: quality is not consistent, 46% below required quality

The six health care performance dimensions

- 安全 safe
- 及時 timely
- 有效 effective
- 有效率 efficient
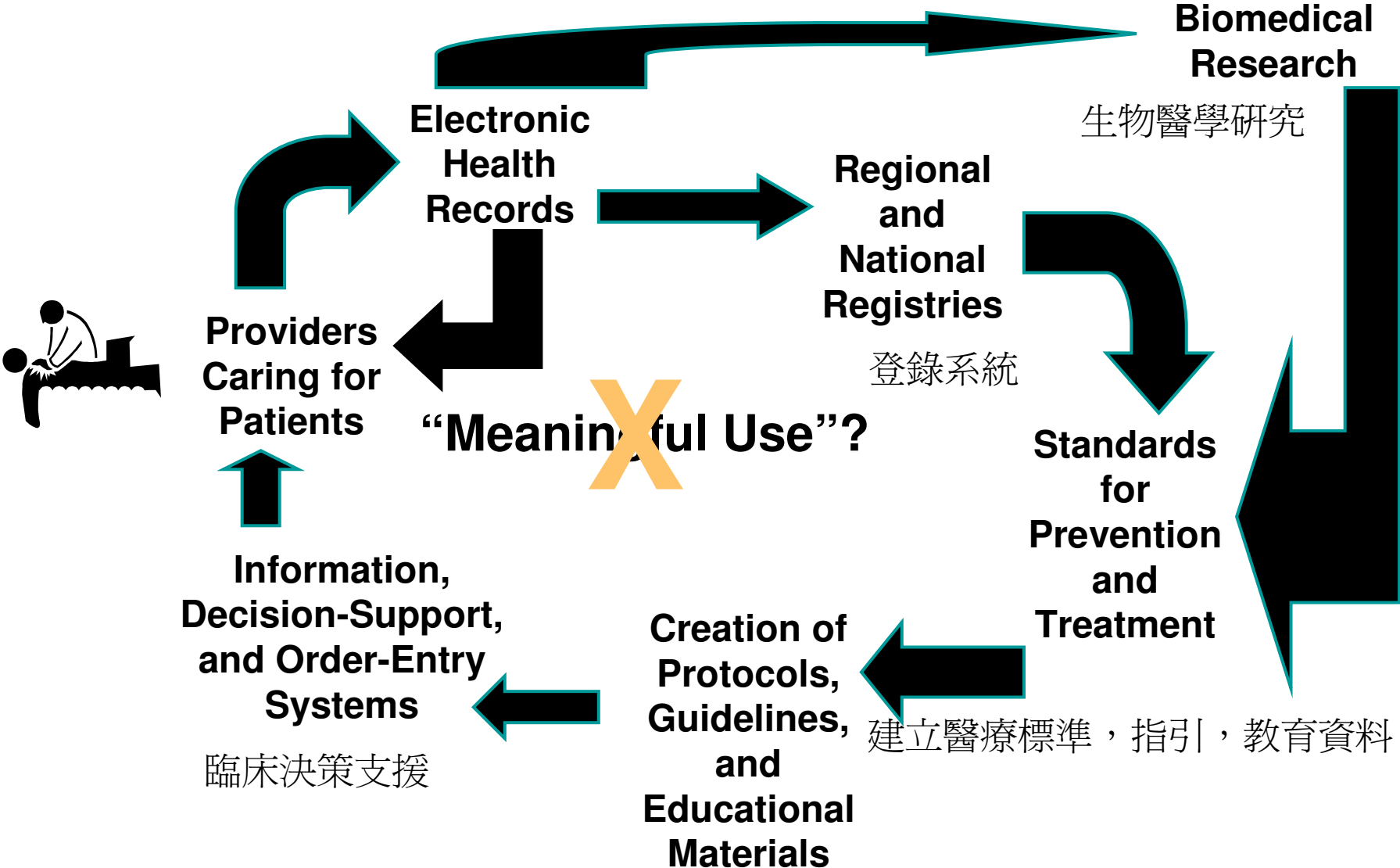- 公平 equitable
- 病人為中心patient-centered

IOM 2000

臺灣健康資訊基礎建設

- 臺灣生物資料庫
- 電子病歷內容基本格式制定
- 以病人為中心之電子病歷資訊環境
- 生醫暨臨床資訊整合資料中心
- 網路健康長期照護服務
- 健康生活智慧資訊平臺
- E-Health, M-Health, U-Health

電子病歷路線圖 USA
A Roadmap to the EMR

- 美國The 2009 American Recovery and Reinvestment Act (ARRA) or Stimulus bill committed an estimated $40 billion to reach "meaningful use" (有意義的使用)of EMRs in hospitals and physician practices.
- improving quality(品質), safety(安全), efficiency(效率), and reducing health disparities(不均等) and improving care coordination.
  - Electronic prescribing.(電子藥單)
  - Electronic exchange of quality measures, including process and outcome metrics.(測量質料的交換)
  - Coordination of care through the transmission of clinical summaries. (臨床記錄交換)
  - EMR must also be connected to a health information exchange to improve quality of care.(電子病歷交換)

整合電子病歷以改醫療照護，知識及安全

Biomedical Research

生物醫學研究

Electronic Health Records

Regional and National Registries

登錄系統

Providers Caring for Patients

"Meaningful Use"?

Standards for Prevention and Treatment

Information, Decision-Support, and Order-Entry Systems

臨床決策支援

Creation of Protocols, Guidelines, and Educational Materials

建立醫療標準，指引，教育資料

Edward H. Shortliffe, MD, PhD

Better Information

Better Decision

Better Healthcare

多元化個人電子健康紀錄
Personal Electronic Health Record
Portable Device

- Portable device for personal electronic health records
- Software and hardware architecture
- Personal records can be access at any time and any place
- EHR development
- Standard format of Medical information
- Privacy and security
- Applications
  - Health education, health management, drug safety, Exercise and Dietary Intake Analysis
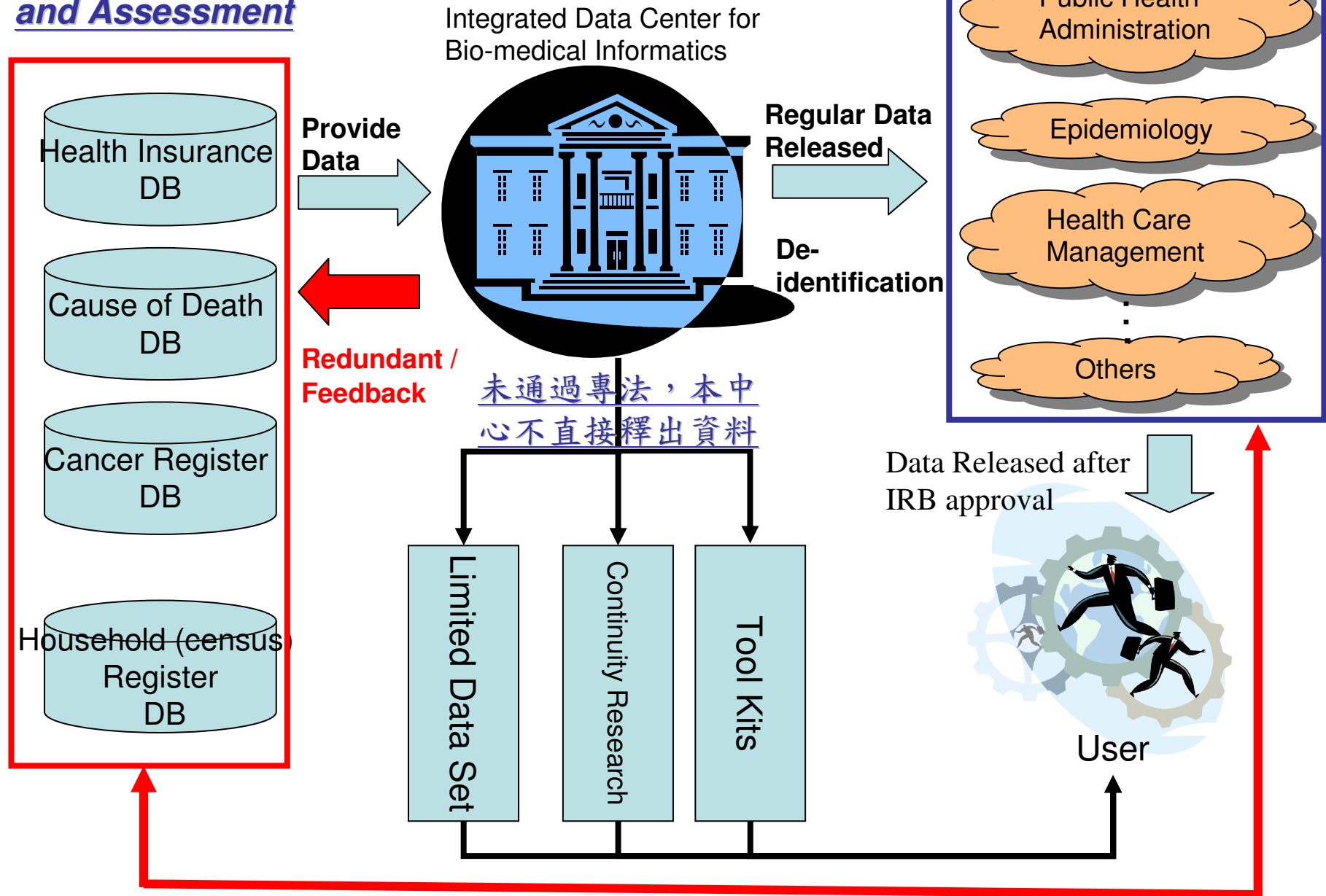
Integrated Data Center for Bio-medical Informatics
整合生物醫學資料庫—建立知識基礎

1. Integrated Data Center for Bio-medical Informatics with centralized and integrated existing bio-medical databases
2. Cross-database mapping and analysis
3. ELSI : Ethical, Legal, and Social Issues for personal privacy protection.
4. Feasibility of the system and emerging other bio-medical databases.

主動式具有分析評估能力的主題式資料架構

Data Architecture by Subjects with Active Analysis and Assessment

Integrated Data Center for Bio-medical Informatics

Health Insurance DB

Cause of Death DB

Cancer Register DB

Household (census) Register DB

Provide Data

Redundant / Feedback

未通過專法，本中心不直接釋出資料

Regular Data Released

De-identification

Public Health Administration

Epidemiology

Health Care Management

Others

Limited Data Set

Continuity Research
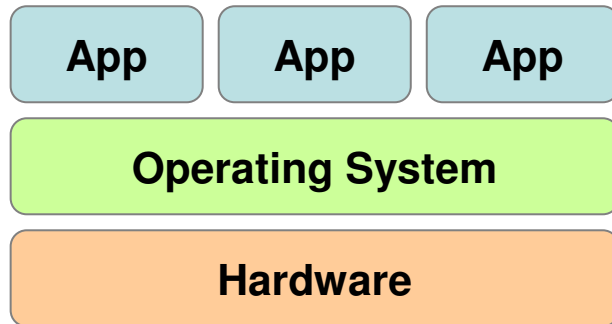
Tool Kits

Data Released after IRB approval

User

雲端運算的醫療資訊運用

- 醫療資訊雲端服務託管Cloud services of hosting healthcare information
- 基礎設施和服務 National level infrastructure and services
  - 電子病歷的資料資源分享平臺EHR Data Platform for resource sharing
  - 電子病歷資訊整合與交換 EHR Information Integration and Exchange
  - 醫療政策控制 Healthcare Policy Control
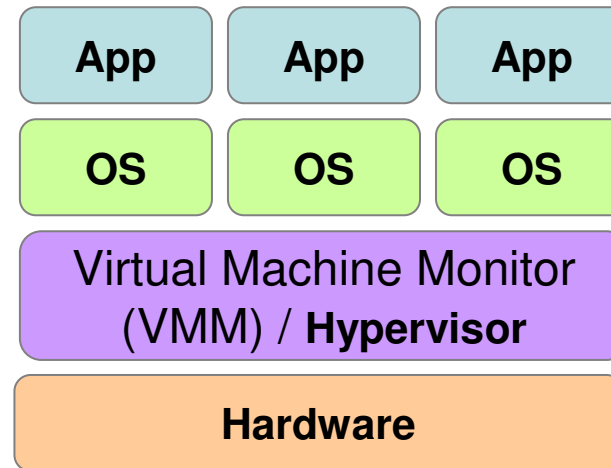 - 建立資料中心以進行各種資料管理及分析，提供各項服務，例如醫療機構KPI，多元化個人電子健康紀錄與健康管理

EMR Cloud Computing的關鍵問題

- 必須有各領域專家的合作**Project team of subject matter experts**
- 項目範圍和期限必須明確**Project scope and duration**
- 專案預算的支援**Project funding**
- 政府的期望和成功的定義**Government expectation and success definition**
- 法規的制定與現實脫節**Regulations**
- 電子病歷與電子健康紀錄之標準整合與交換

Key Technology: Virtualization

App | App | App

Operating System

Hardware

Traditional Stack

App | App | App

OS | OS | OS

Virtual Machine Monitor (VMM) / **Hypervisor**

Hardware

Virtualized Stack

SaaS
Software as a Service

PaaS
Platform as a Service

IaaS
Infrastructure as a Service

SaaS

PaaS

IaaS

Common Factors

- Pay per use
- Instant Scalability
- Security
- Reliability
- APIs

Advantages

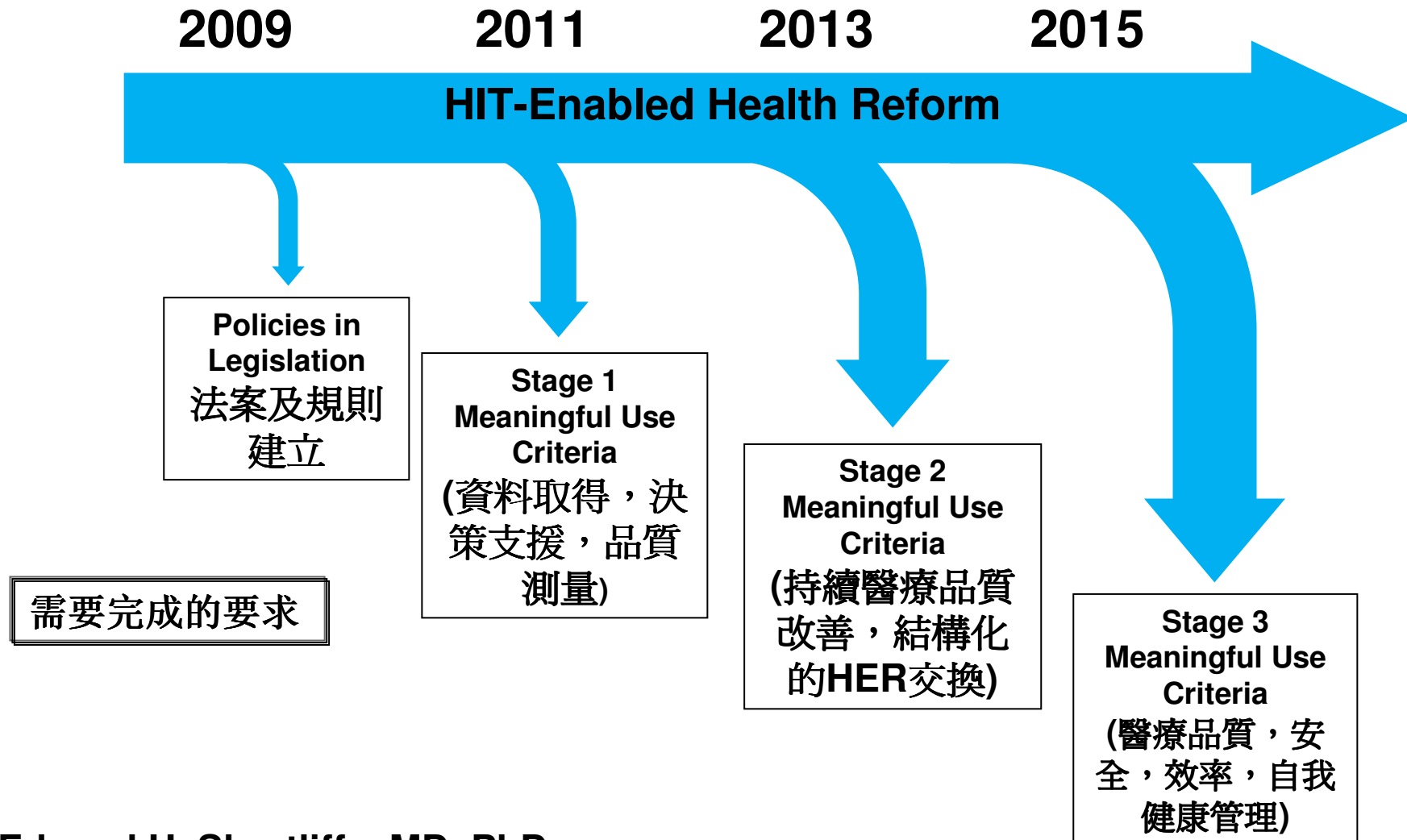SaaS

PaaS

IaaS

- Lower cost of ownership(擁有且低成本)
- Reduce infrastructure management responsibility(降低基礎建設管理)
- Allow for unexpected resource loads(分散資源負載)
- Faster application rollout(快速應用展示)

利用**HIT** 改進健康照護
達到有意義的使用**(Meaningful Use) EMR**

2009　　　　**2011**　　　　**2013**　　　　**2015**

HIT-Enabled Health Reform

Policies in Legislation
法案及規則建立

需要完成的要求

Stage 1 Meaningful Use Criteria
(資料取得，決策支援，品質測量**)**

Stage 2 Meaningful Use Criteria
(持續醫療品質改善，結構化的HER交換**)**

Stage 3 Meaningful Use Criteria
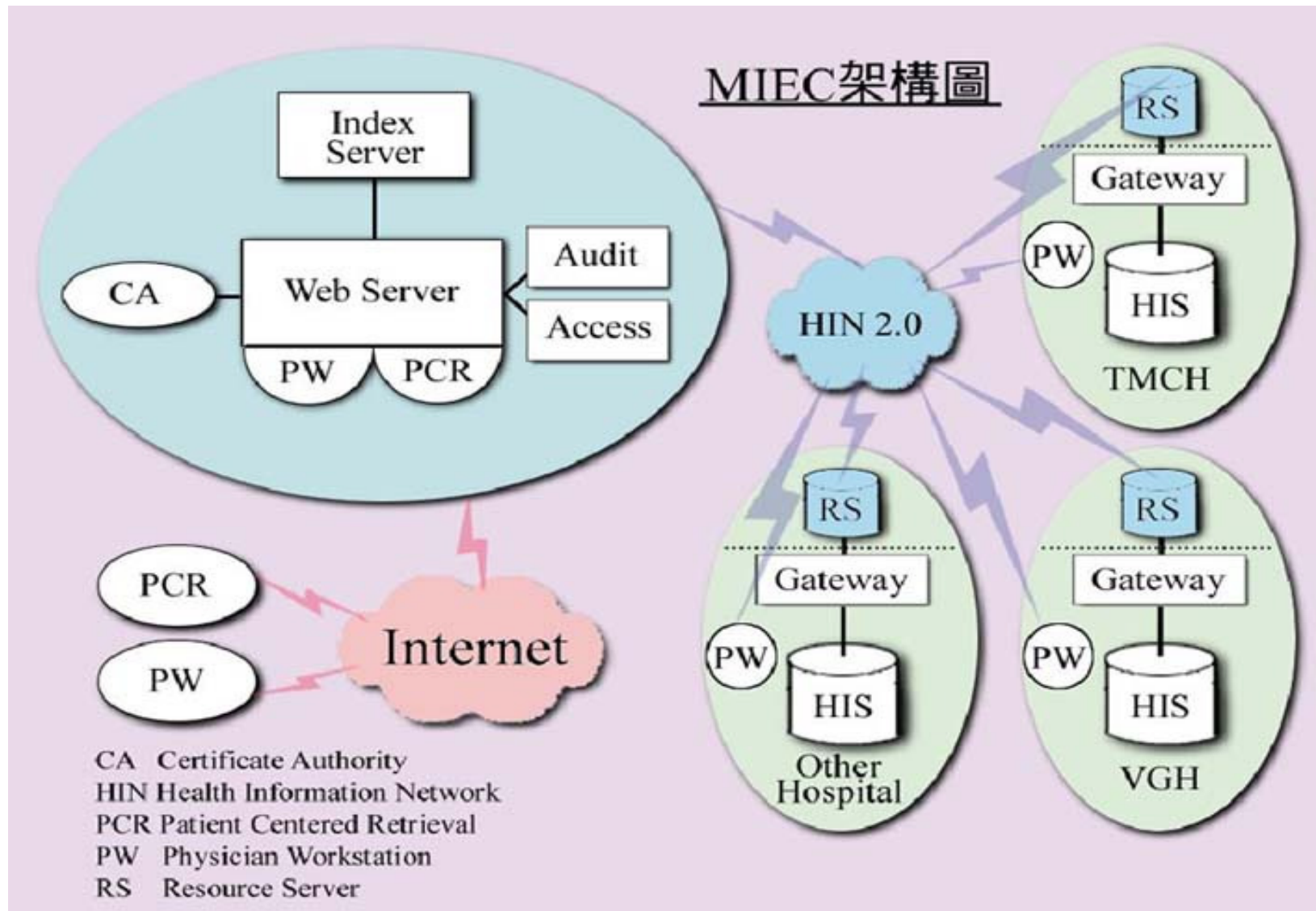**(**醫療品質，安全，效率，自我健康管理**)**

Edward H. Shortliffe, MD, PhD

Multifunctional Personal Electronic Health Record個人化健康資訊整合架構

- Cloud services for personal electronic health records
- Design Software and hardware architecture
- Personal records can be access at any time and any place
- EHR Integration and Exchange
- Standard format of Medical information
- Privacy and Security
- Applications
  - Health education, health management, drug safety, Exercise and Dietary Intake Analysis
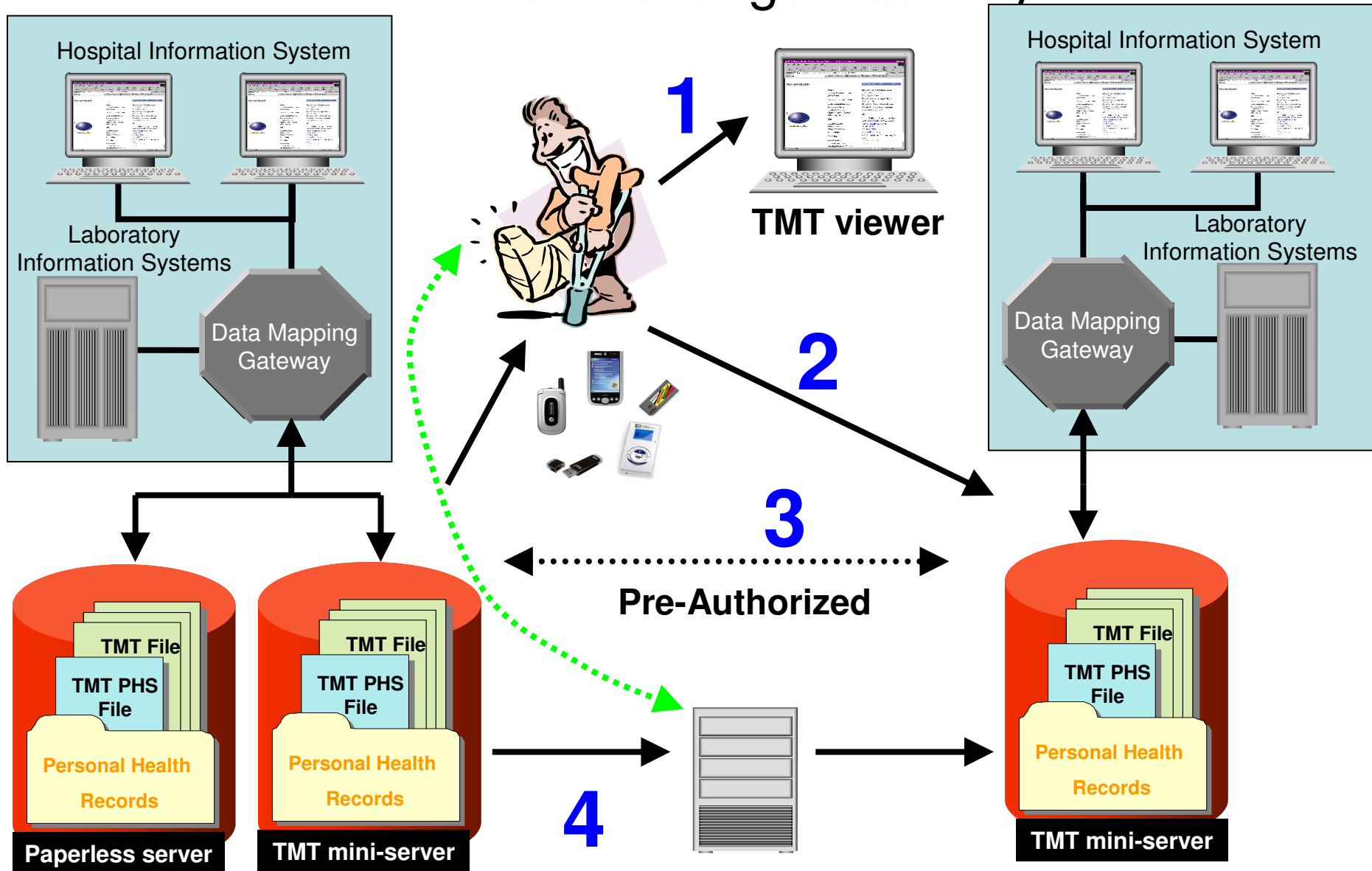
個人醫療資訊交換中心　　2000
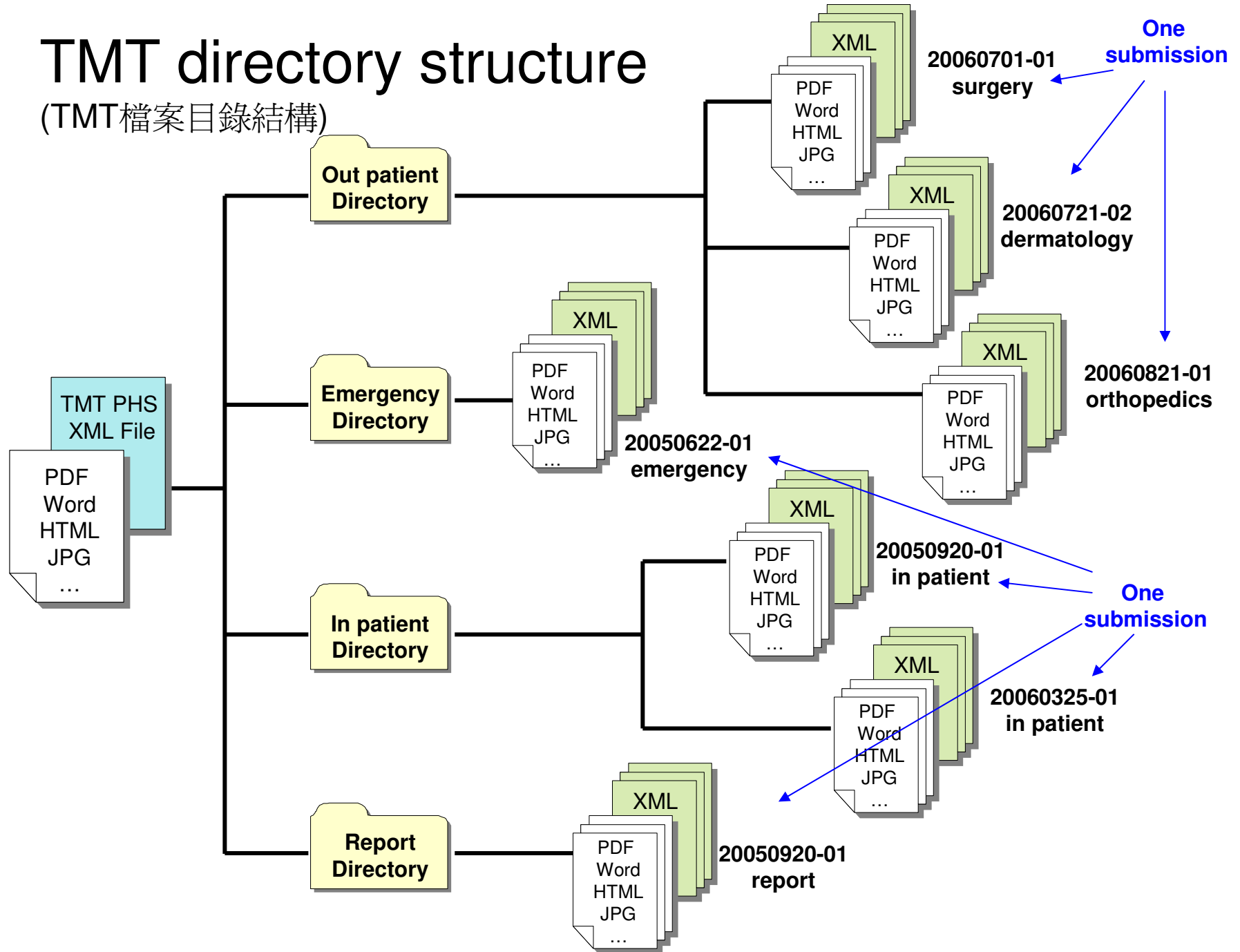# Medical Information Exchange Center - MIEC

個人化健康資訊整合架構
TMT File Exchange Pathway

TMT viewer

1

2

3
Pre-Authorized

4

Hospital Information System

Laboratory Information Systems

Data Mapping Gateway

TMT File

TMT PHS File

Personal Health Records

Paperless server

TMT mini-server

Internet Health and Life Supporting Data Bank

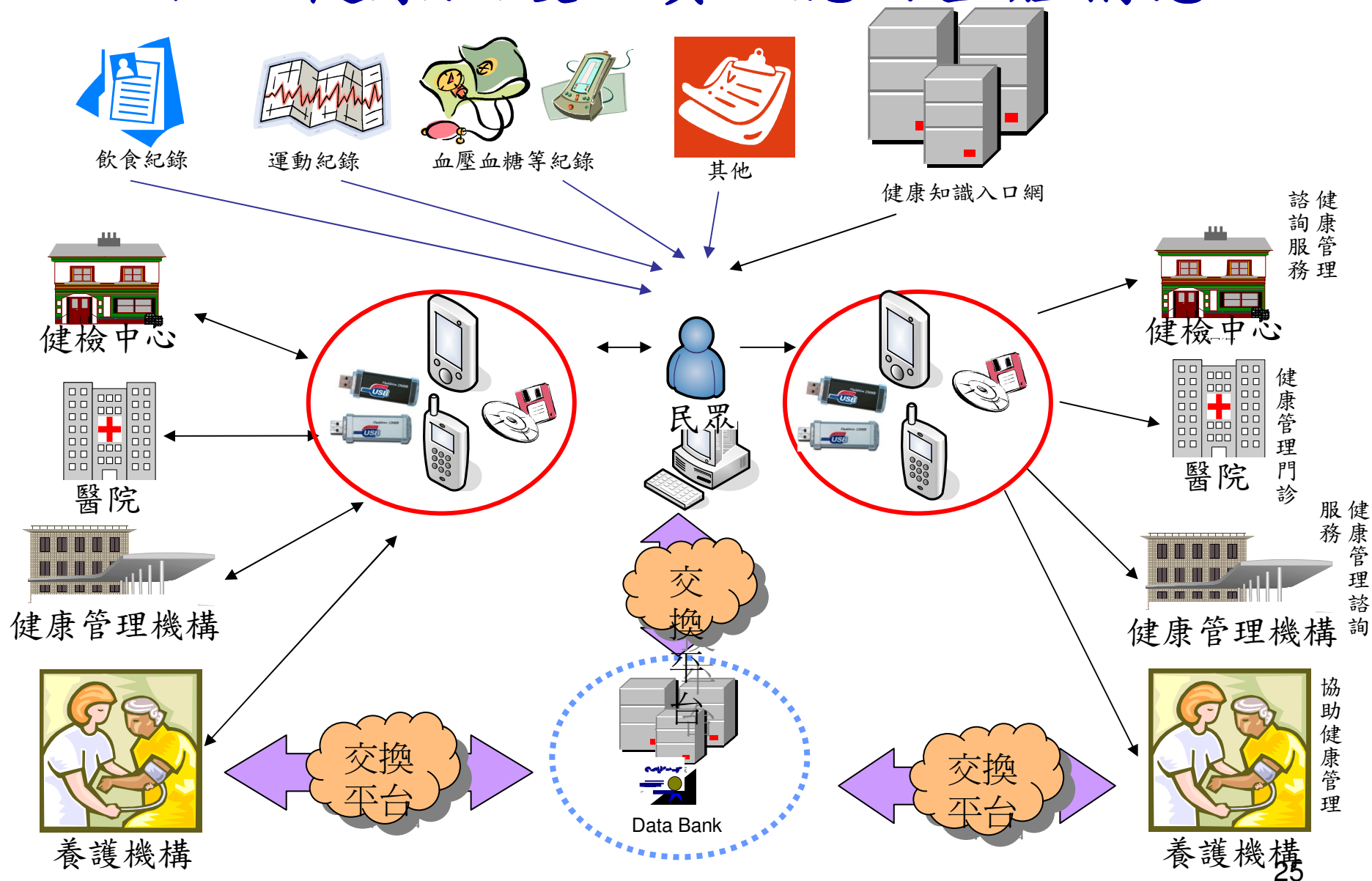# TMT directory structure

(TMT檔案目錄結構)

潛在效益

- 減少和防止藥品不良事件，減少住院費用
- 建置以病患為中心(Patient-centered)的共通電子病歷整合平臺Inter-institutional EMR
- 降低重複用藥及檢查，節省健保支出，增加用藥安全
- 提高效率，增加醫療資訊產業收益，節約資源(綠色醫療，無紙化病歷)
- 持續健康照護, Knowledge and evidence-based System, 轉譯醫學(translational research), 健康保險，公共衛生資訊

Benefits of Cloud Computing for Biomedical Applications

- Reduced Cost
- Increased Storage
- Highly Automated
- Flexibility
- Mobility
- Elimination of barriers to EHR adoption

個人健康照護之資訊應用整體構想

飲食紀錄　　運動紀錄　　血壓血糖等紀錄　　其他　　　健康知識入口網

健檢中心

醫院

健康管理機構

養護機構

民眾

交換平台

交換平台

交換平台

Data Bank

健康管理諮詢服務

健檢中心

健康管理門診

醫院

健康管理諮詢服務

健康管理機構

協助健康管理

養護機構

雲端運算將快速改變醫療資訊的運用

- The fact that Google and Microsoft are heavily invested "in the cloud" extends to their new offerings for medical records services, such as Microsoft's HealthVault and Google Health.
- SWOT analysis — strengths, weaknesses, opportunities, and threats

可能需要討論的議題

- Privacy and Security
- Scalability
- Reliability(可靠程度)
- Maintenance(維護)
- Multi-tenancy (租用)
- Device and location independence(設備場所獨立性)

Q&A

Prof. Chien-Yeh Hsu

e-mail:cyhsu@tmu.edu.tw

Tel：02-27361661#3349

Taipei Medical University

Graduate Institute of Medical Informatics

Taiwan Association for Medical Informatics, TAMI

250 Wu-Hsing Street, Taipei, Taiwanhttp://gimi.tmu.edu.tw/

Q&A

徐建業教授
e-mail:cyhsu@tmu.edu.tw
電話：02-27361661#3349
通訊位址：臺北醫學大學，醫學資訊研究所
臺灣醫學資訊學會
臺北市信義區吳興街250號
傳真號碼：02-27392914
http://gimi.tmu.edu.tw/