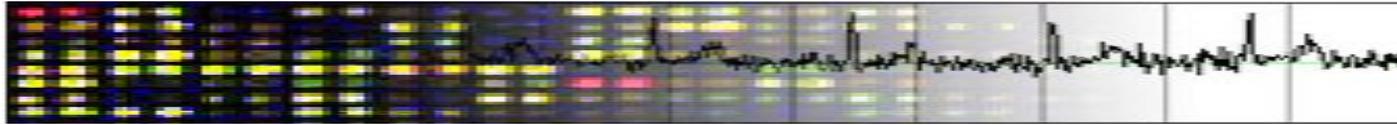


Biomedical Information Technology

2.771J BEH.453J HST.958J Spring 2005

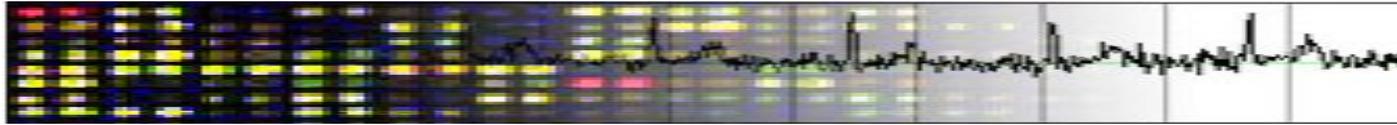
Lecture 26 April 2005

Data Integration and Analysis I: Medical Information Systems

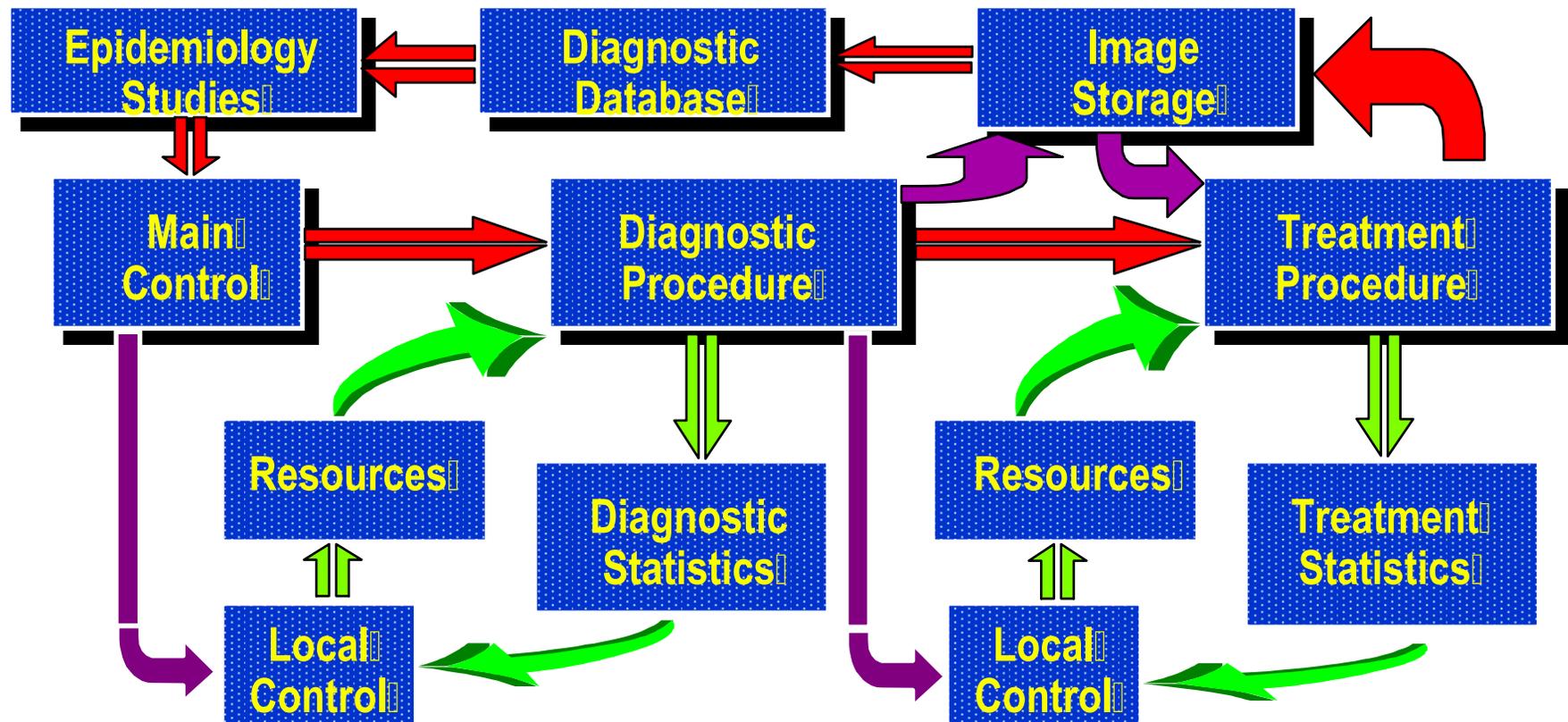


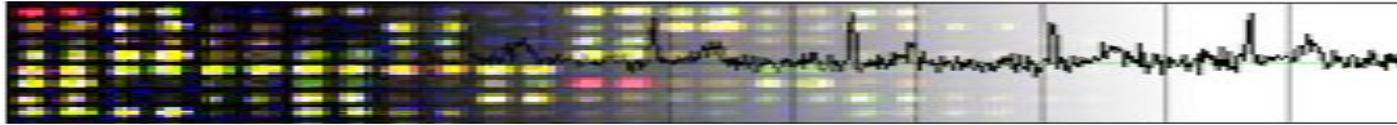
DATA INTEGRATION AND ANALYSIS I

- ❖ Integration in the hospital environment
 - Imaging and information flow
 - Use of DICOM standard
 - The personal healthcare record
 - HL-7: the hospital standard for data interchange
 - IHE: Integrated Healthcare Environment
- ❖ The importance of use cases: York Hospital
- ❖ Adding metadata to medical records
 - DICOM Structured Reporting (SR)
 - Snomed

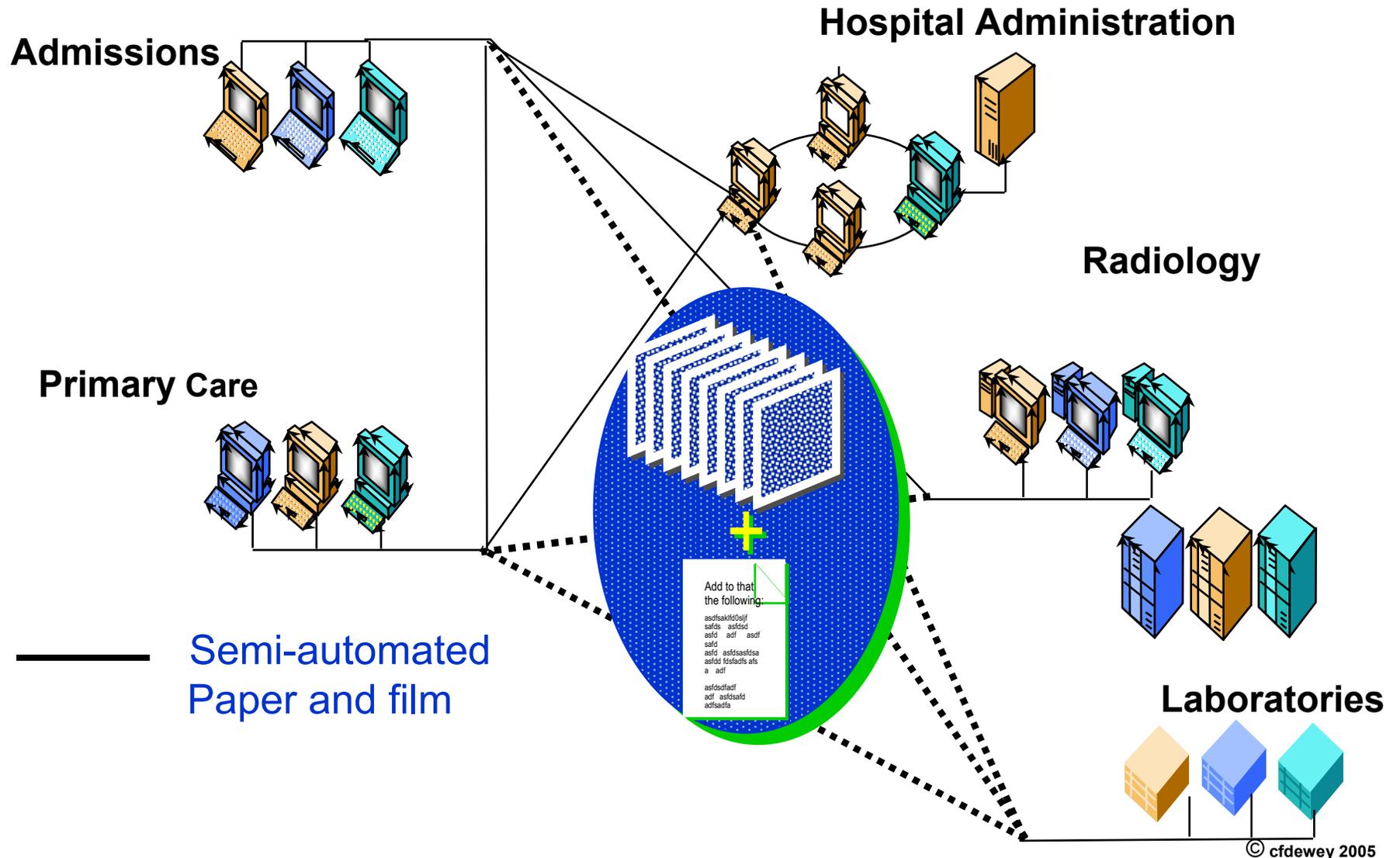


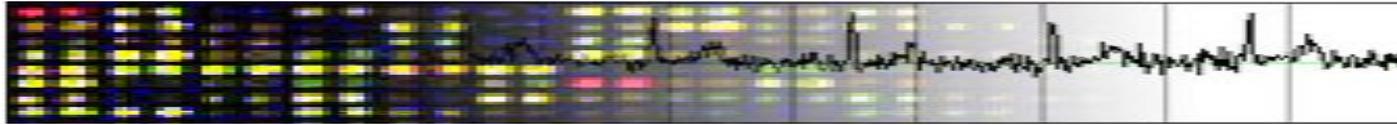
Information flow in health care delivery



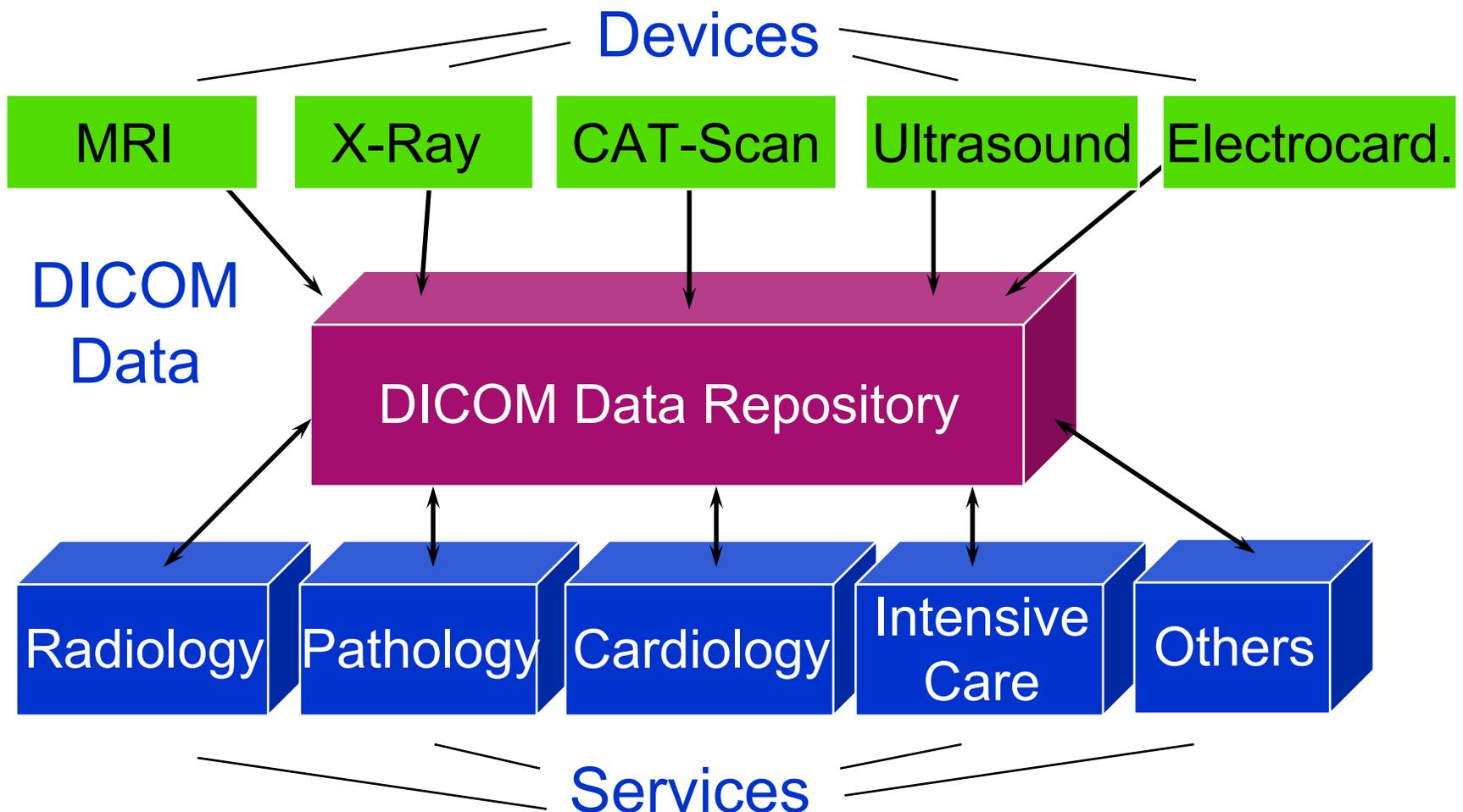


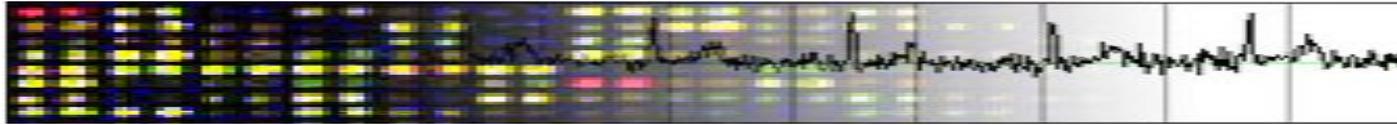
Here's a diagram of what is there today



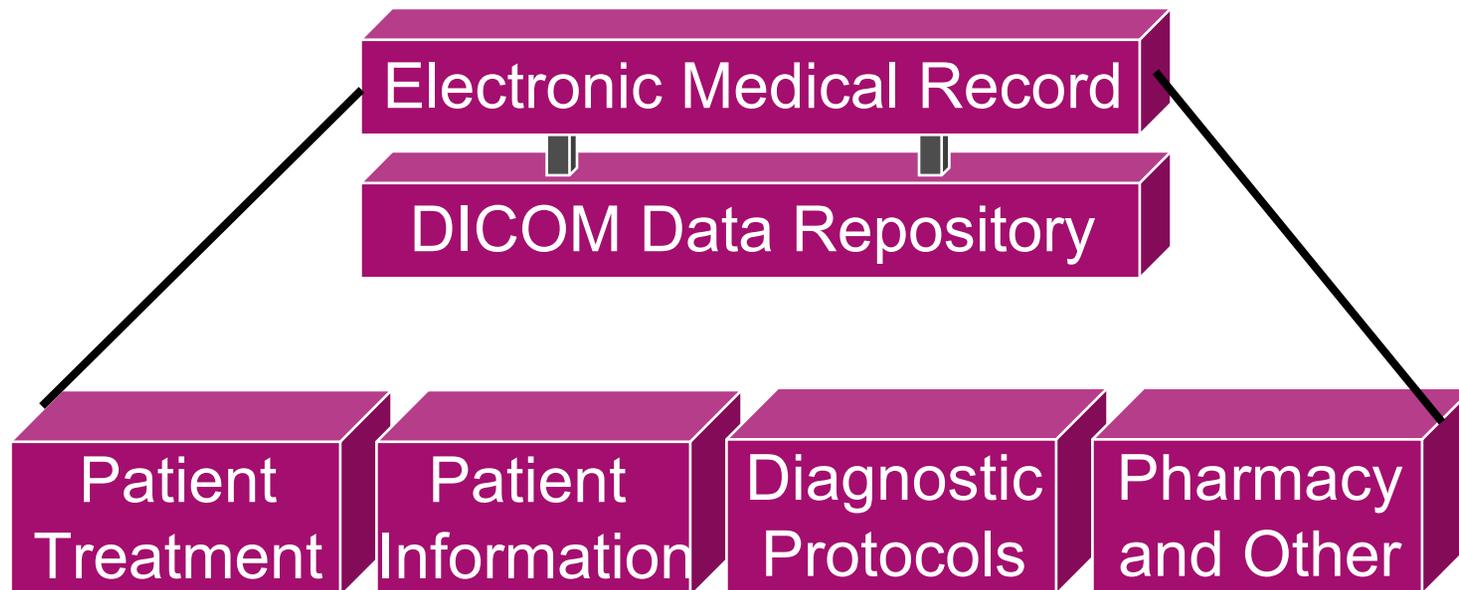


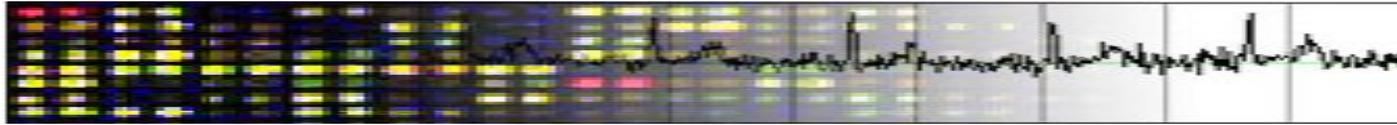
Integrating the hospital information entities



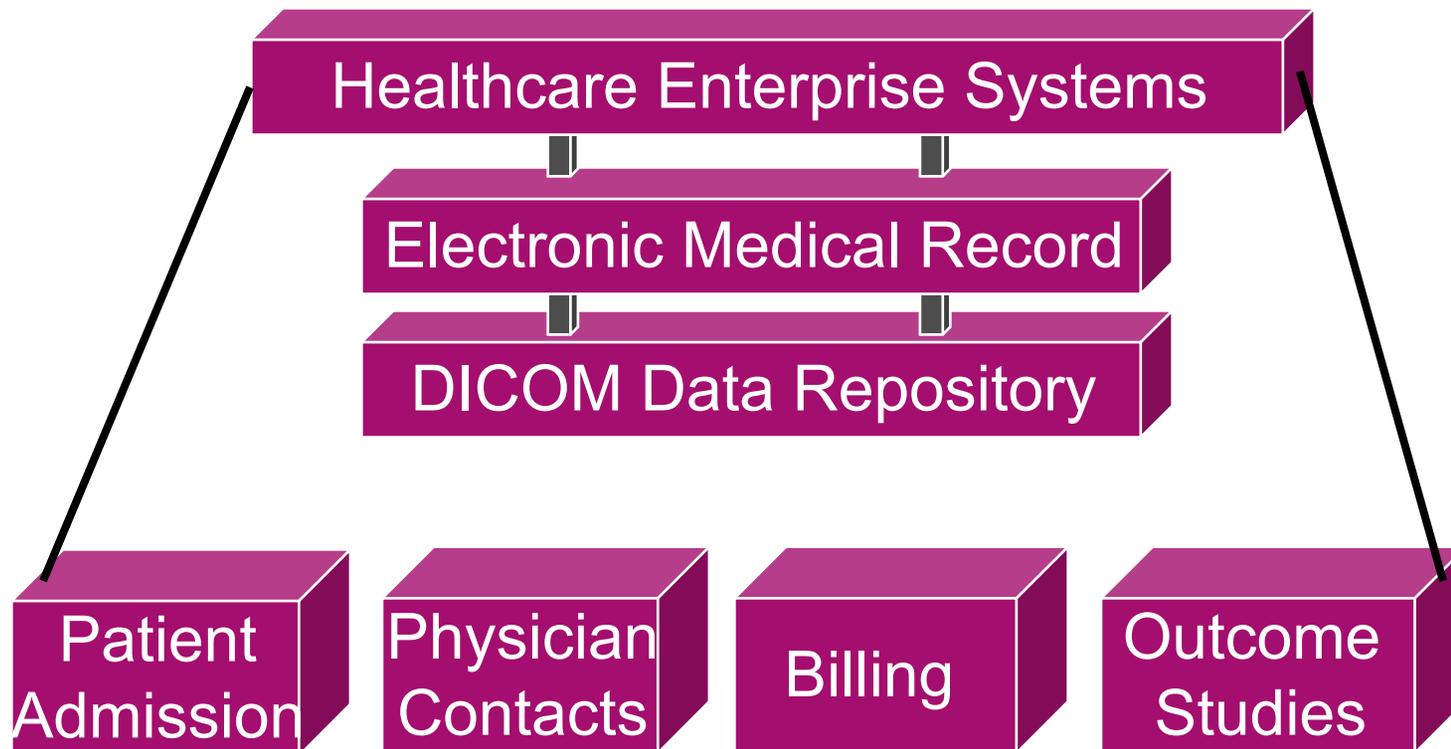


The personal Electronic Medical Record (EMR)





The enterprise healthcare system





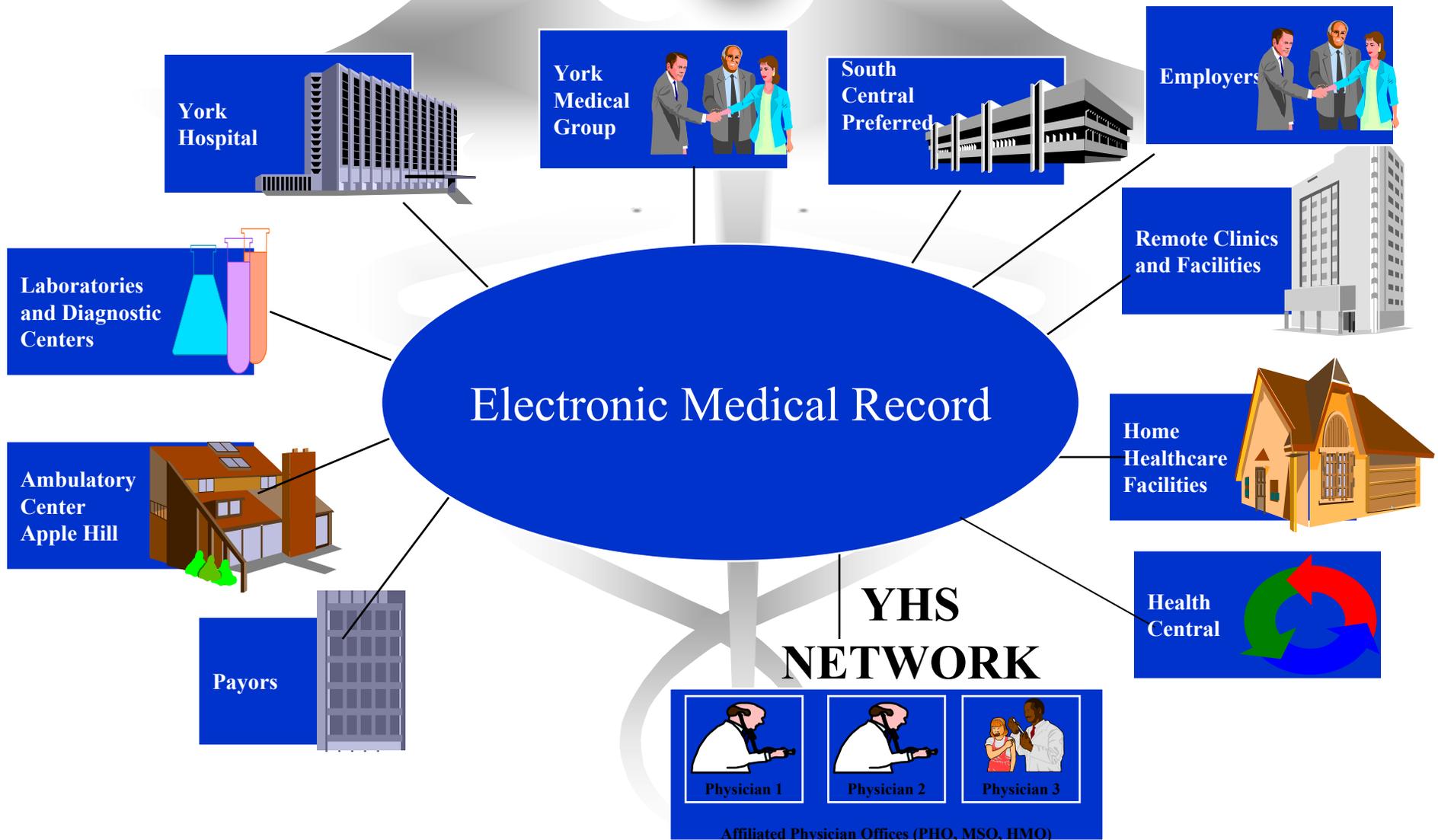
Integrating Medical Imaging with a Person-Centric EMR

*William “Buddy” Gillespie
Chief Information Officer*

www.yorkhealth.org
1998

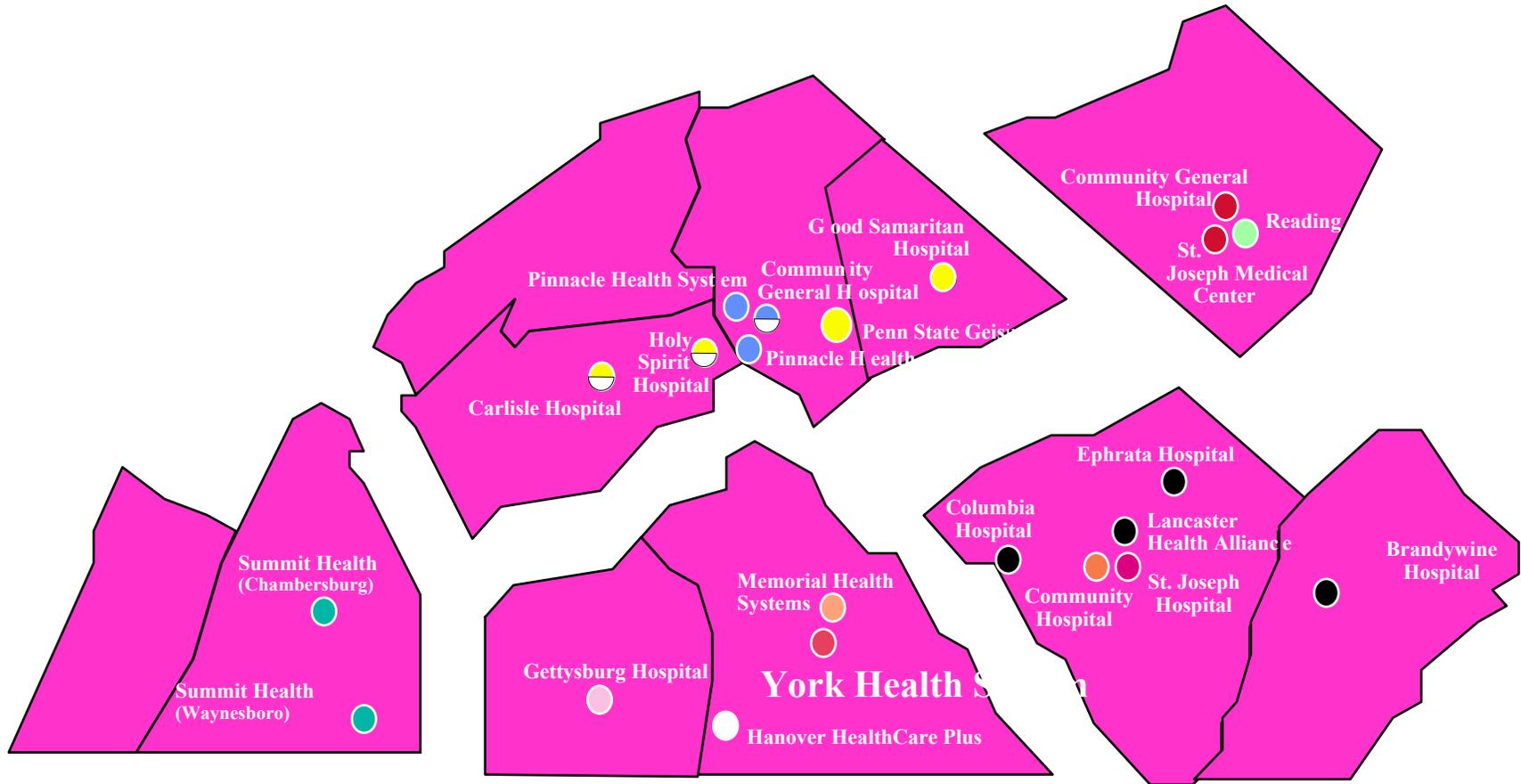
Courtesy of William Gillespie. Used with permission.

Integrated Delivery Network



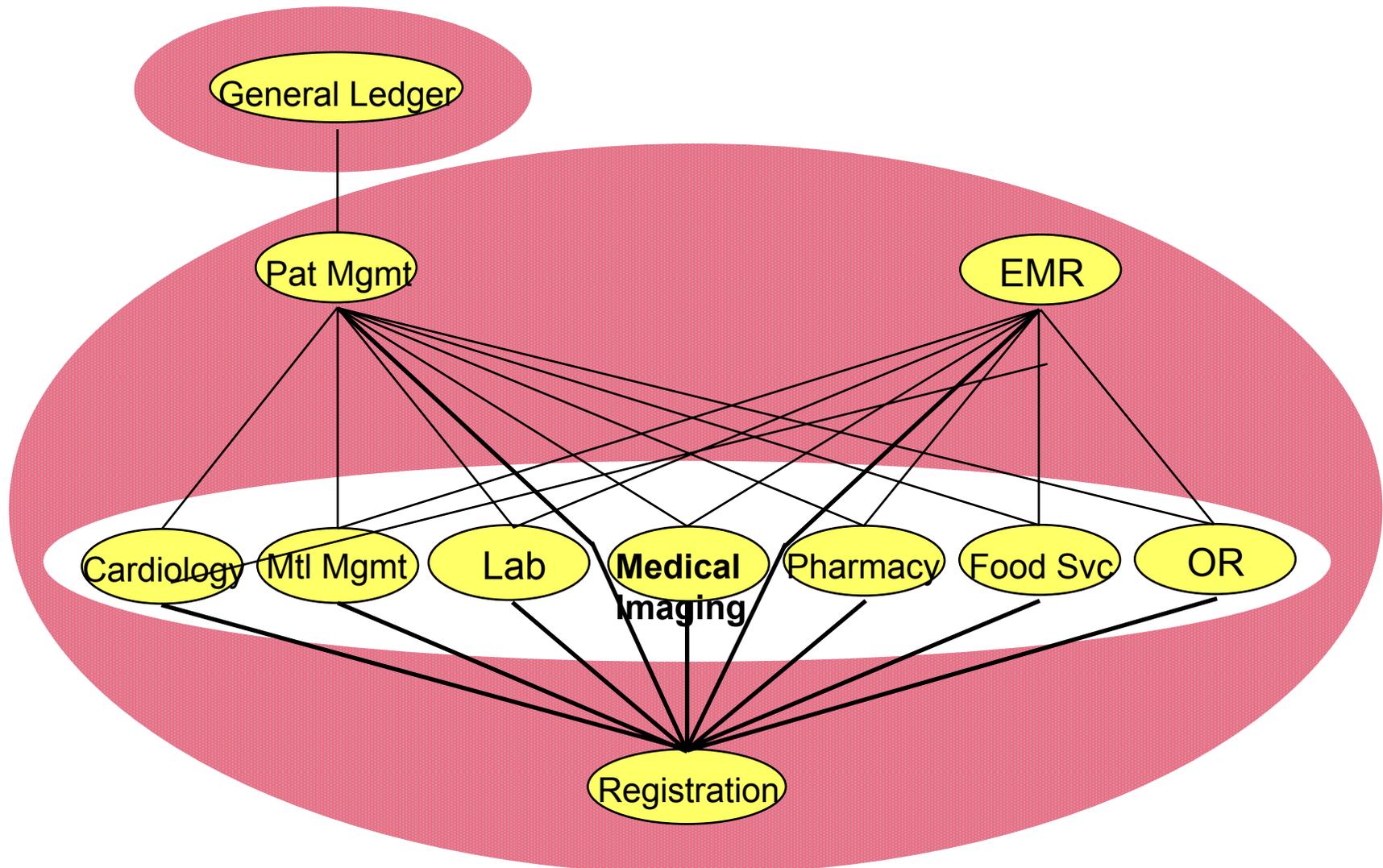


Regional Affiliations



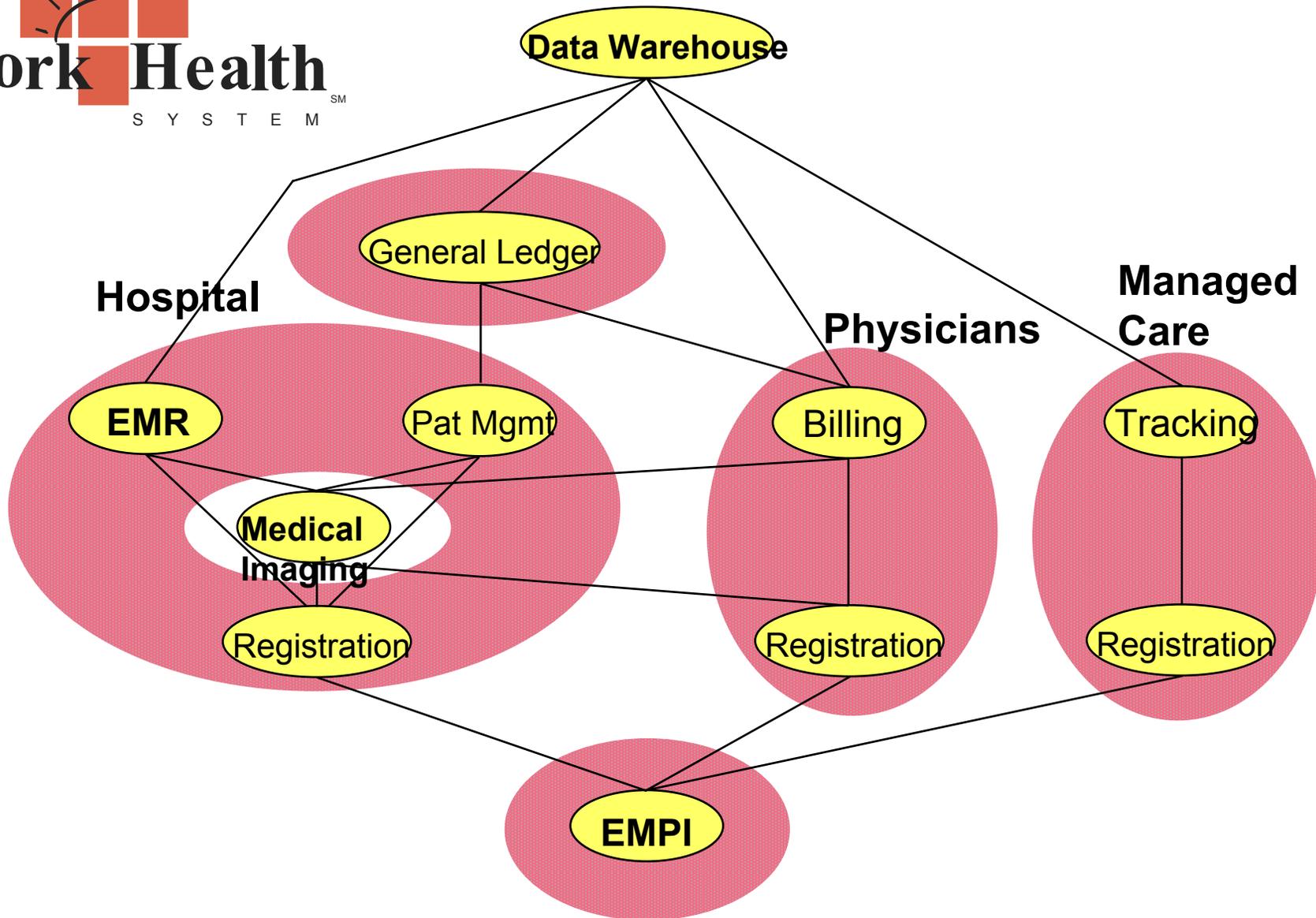
Courtesy of William Gillespie. Used with permission.

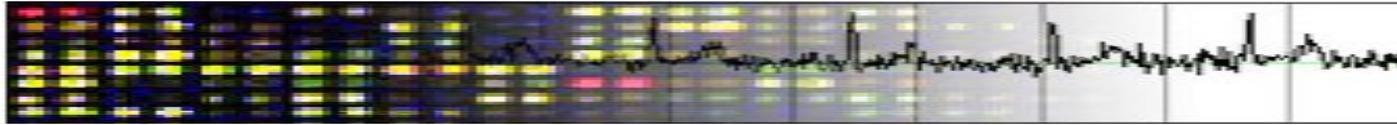
York Hospital Information Flows





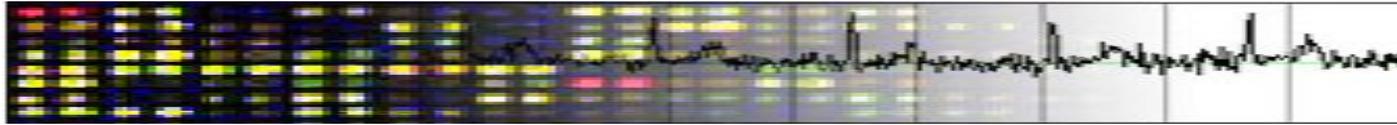
York Health System Information Flows





Generation and storage of metadata

- ❖ Diagnostic analysis
 - Track and record changes to the image
 - Store results (see MS image segmentation)
 - Coding systems
 - HL-7
 - Snomed
 - ICD 9/10
 - UMLS
- ❖ Structured Reporting
 - Originated with DICOM
 - Is broader than DICOM



Diagnostic coding systems

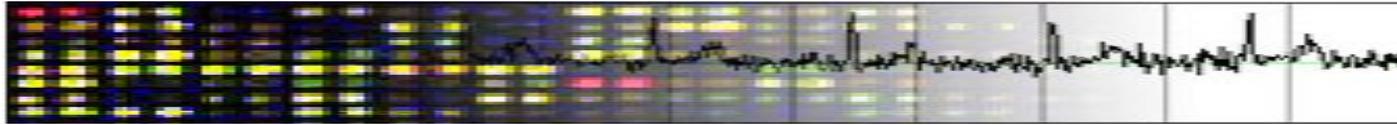
- ❖ Long history of nomenclature attempts

- ICD
- DRG
- Read Codes
- Unified Medical Language System (NLM)

- ❖ SNOMED is the current most accepted standard

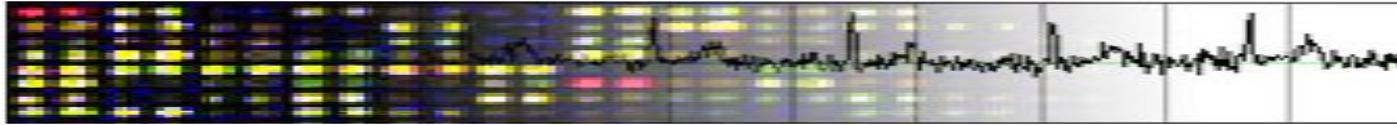
“SNOMED Clinical Terms provides a common language that makes health care information accessible and usable, whenever and wherever it is needed, to improve health care across primary and specialty medicine settings internationally. Government entities and healthcare organizations in 28 countries have adopted SNOMED CT since its release in January 2002.” www.snomed.org

Ref: J.J. Cimino, Meth. Info. In Medicine 35: 273-284 (1996)



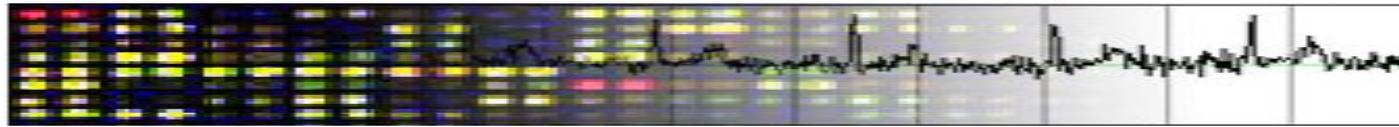
Hospital information coding systems

- ❖ HL-7
 - Started as simple set of transaction codes
 - Grew to some 3,000 tags with definitions
 - Current version 2.08, March 2005
 - Tags are a cumbersome way to enforce ontologies
- ❖ HL-7 Version 3 is an object model
 - Object model
 - Strangely silent since 2002
 - Had major effort and use cases; see handout



Metadata: viewing medical images

Diagram removed for copyright reasons.
Depiction of different views and functions on a given image:
magnifying glass, window/level, zoom, pan, flip
vertical/horizontal, invert, annotate.

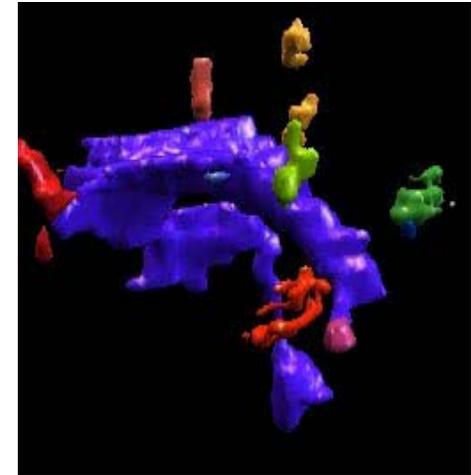


A complex case at BWH, Harvard Med. School

❖ Multiple sclerosis

❖ Design

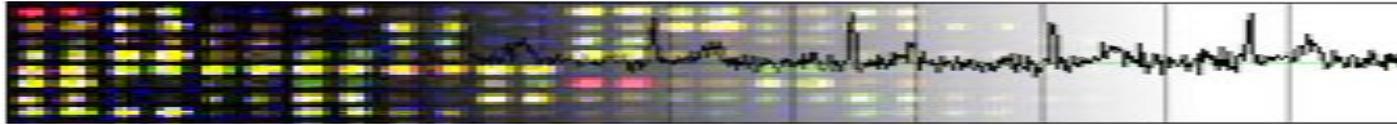
- 100 patients
- 20 time points/patient
- Four 3-D MR images/time point
- 60 GB raw data



❖ Analysis

- Segmentation of 3-D images for lesions
- Time course of lesions (another 40 GB)
- Associated patient genetic database

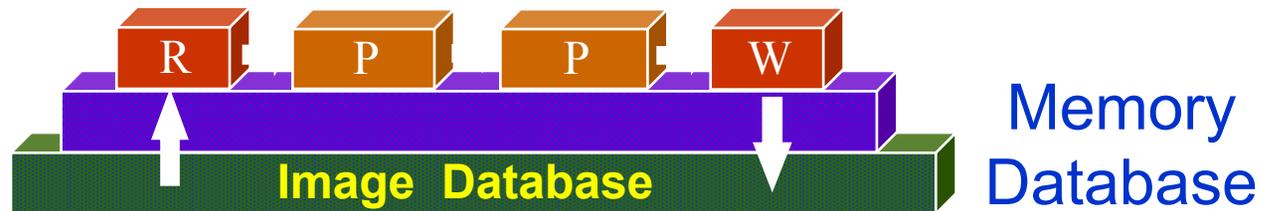
Courtesy of Dr. Charles Guttman. Used with permission.



Advanced image processing architecture

❖ Component Sharing & Interoperability

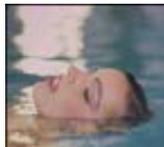
Efficient Architectural Model:



❖ Image Stream / Pipeline Processing

Efficient Execution Model:

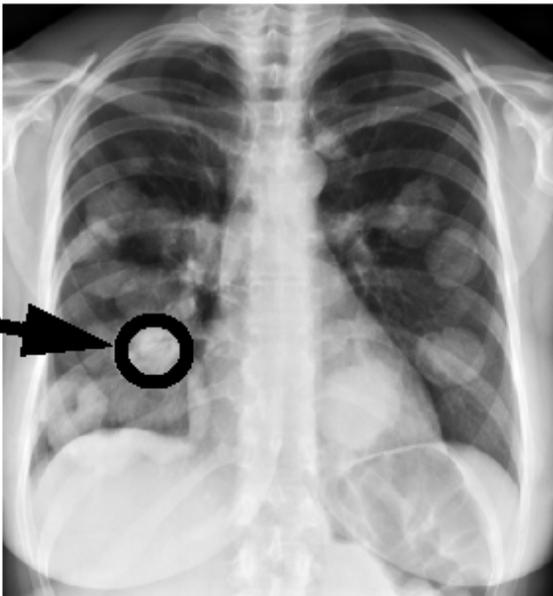


= Edge (Gray (Sharpen ()))



Integration of metadata: An example of a Structured Report (SR)

Chest X-ray Report:
Observer: Clunie^David^A^Dr.
History: malignant melanoma excised 1Y
Findings:
- finding: multiple masses in both lung fields
- best illustration of findings:
Conclusions:
- conclusion: cannon-ball metastases
- conclusion: recurrent malignant melanoma
Diagnosis Codes:
- diagnosis: 172.9/ICD9
- diagnosis: 197.0/ICD9



*Ref: David A. Clunie, DICOM Structured Reporting,
PixelMed Publishing, 2000, p 30*