



DICOM in Dart (DCMiD)

Project 13

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Seminar Presentation

Critical Review

- X. Lu and M. Zhang, **Research and Implementation of Medical Images Management System Based on DICOM Standard**. *Advances in Biomedical Engineering, Vol. 9, 2012*

Project Overview and Motivation

Determine the feasibility of using binary DICOM for building browser based medical imaging applications

- **Project Goal**

Develop a zero-footprint client that reads and writes binary DICOM and displays it using HTML5, CSS, and Dart.

- **Motivation**

Need an understanding of DICOM structure and what it means to parse a DICOM study.

Need to create a system architecture that allows us to quickly deliver requested materials to the endpoint user.

Introduction and Goal of Paper

- *“Discuss how to transmit and query the medical images within LAN, and present a novel medical images management system based on the DICOM standard.”*
- High level overview of algorithms and architecture of their system.
- Materials and Methods
 - Storage Method
 - Database structure
 - System architecture
 - Extracting image information from DICOM files
 - Transmission of DICOM file
 - Implementation of query and search functions

DICOM Structure

From high to low level structure.

1. Top level information model

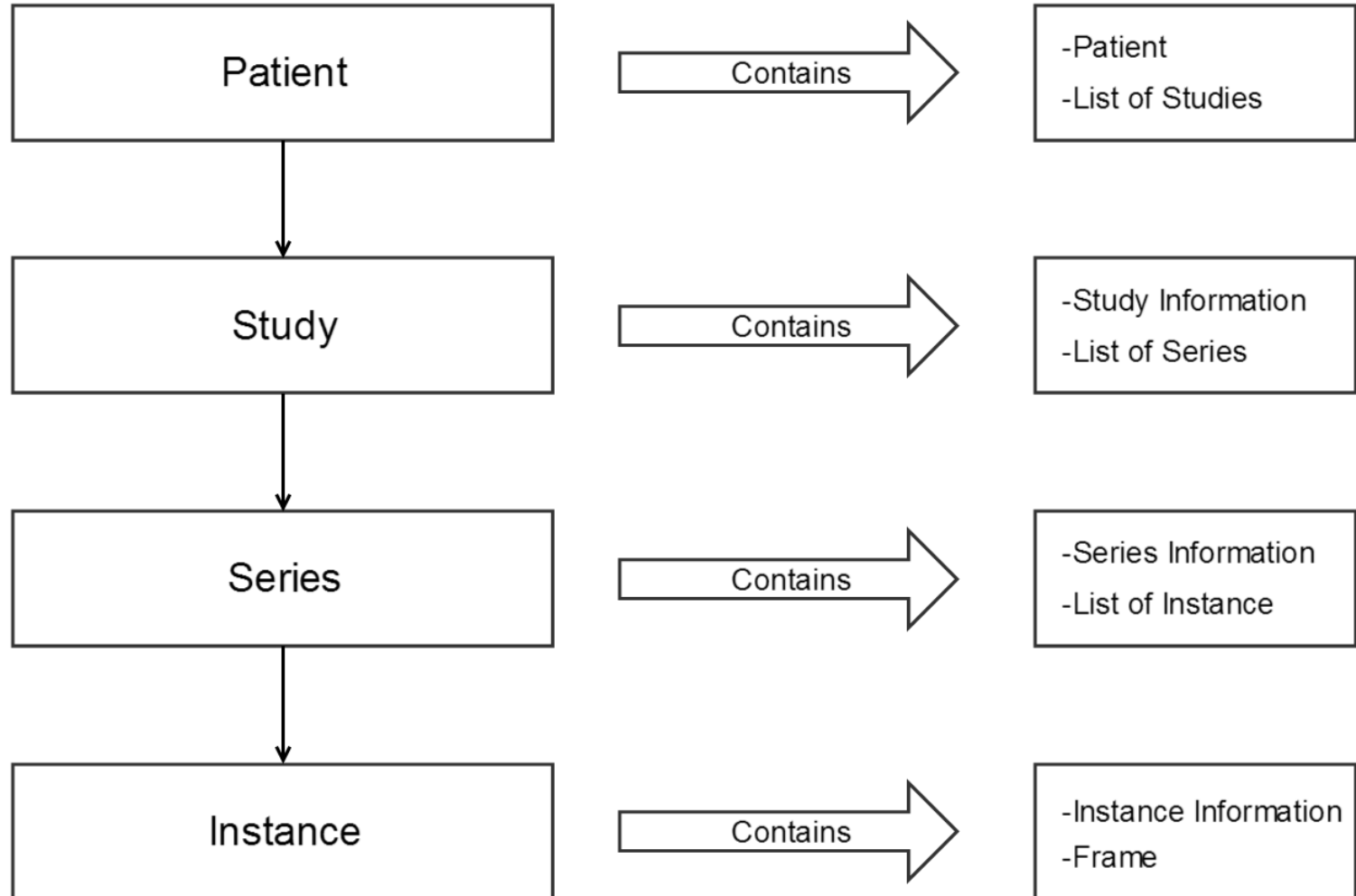
Patient -> Study -> Series -> Instance

2. Low level structures in which everything is stored.

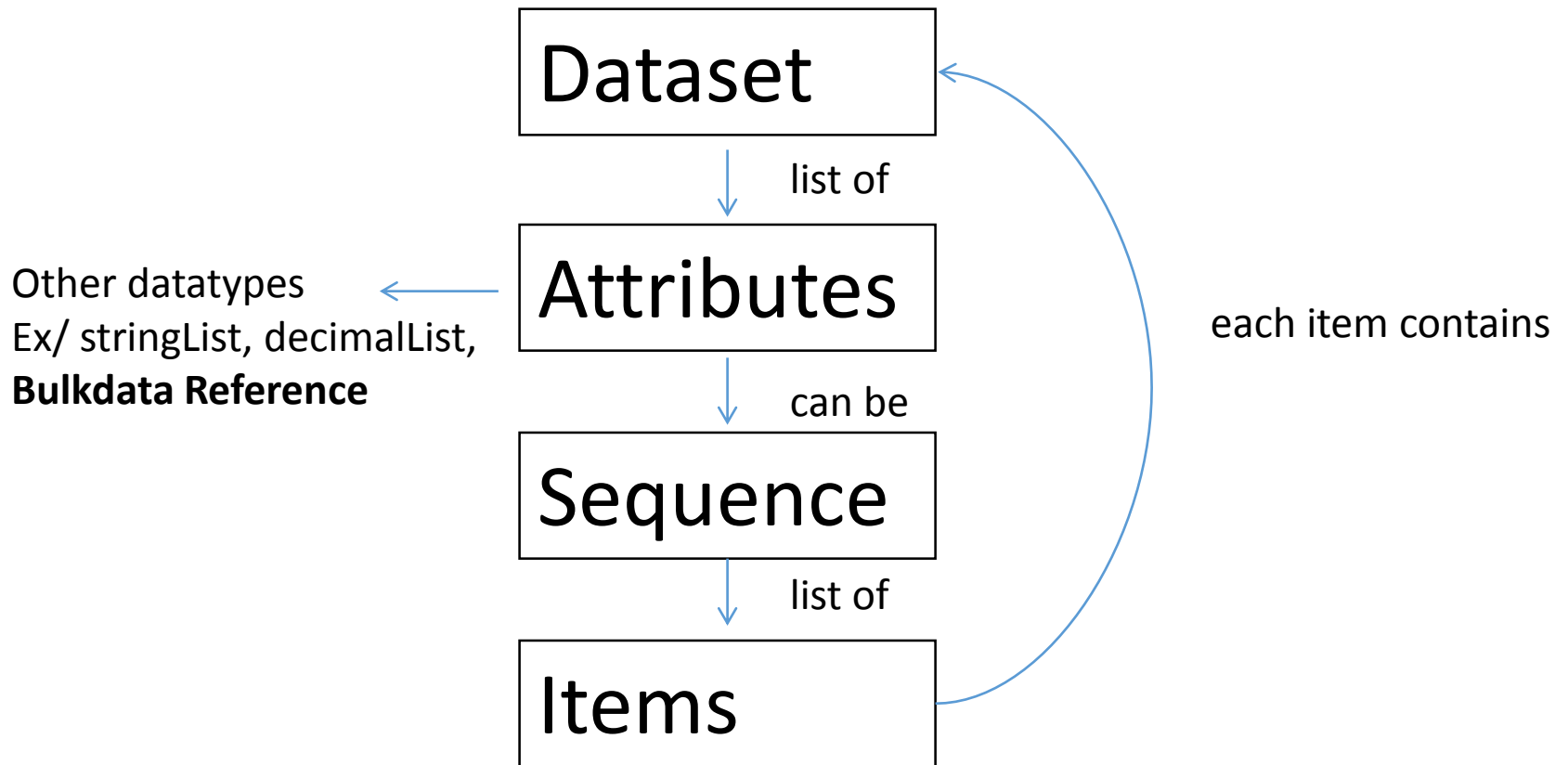
Dataset -> Attribute -> Sequence -> Item

3. What is an attribute?

Top Level Information Model



DICOM Internals



DICOM Internals: What is an attribute?

- An attribute is stored as follows:

Tag	VR	Length	Value Field
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- As an example:

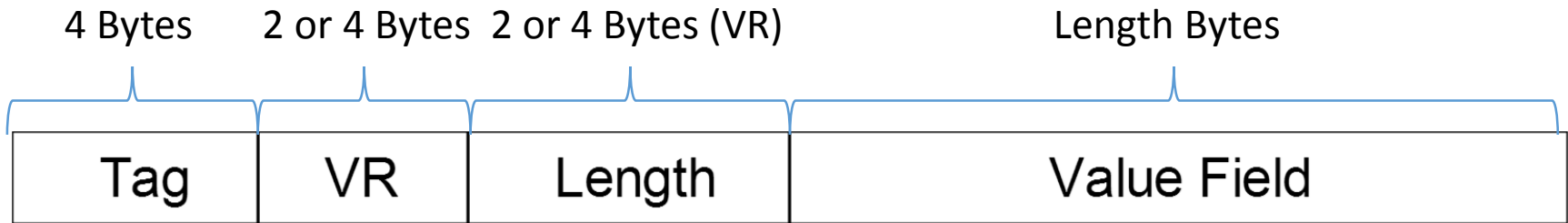
(0010,0010)	PN	5	"Adams^John Robert Quincy^Rev.^B.A. M.Div."
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What is parsing?

- **Definition**

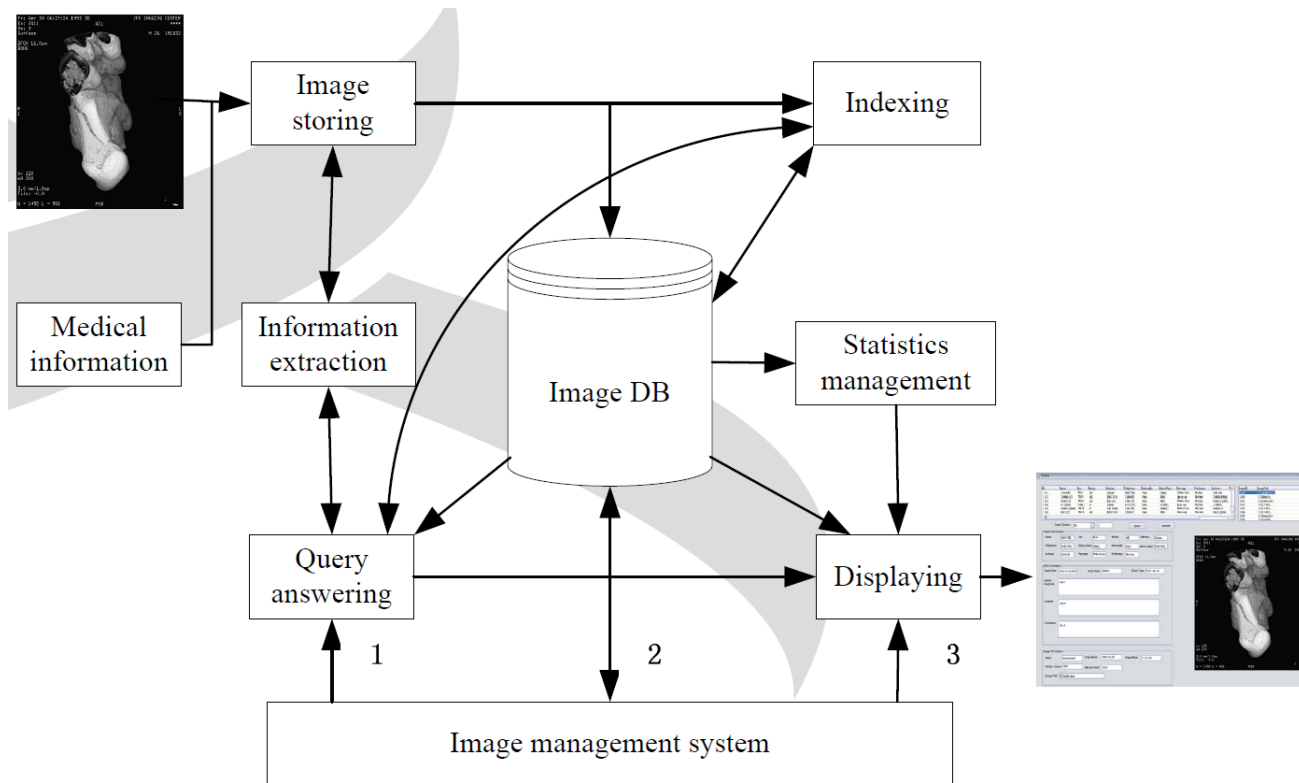
To analyze a string of characters in order to associate groups of characters with the syntactic units of the underlying grammar.

- How do we parse Binary DICOM?



Parsing Demo

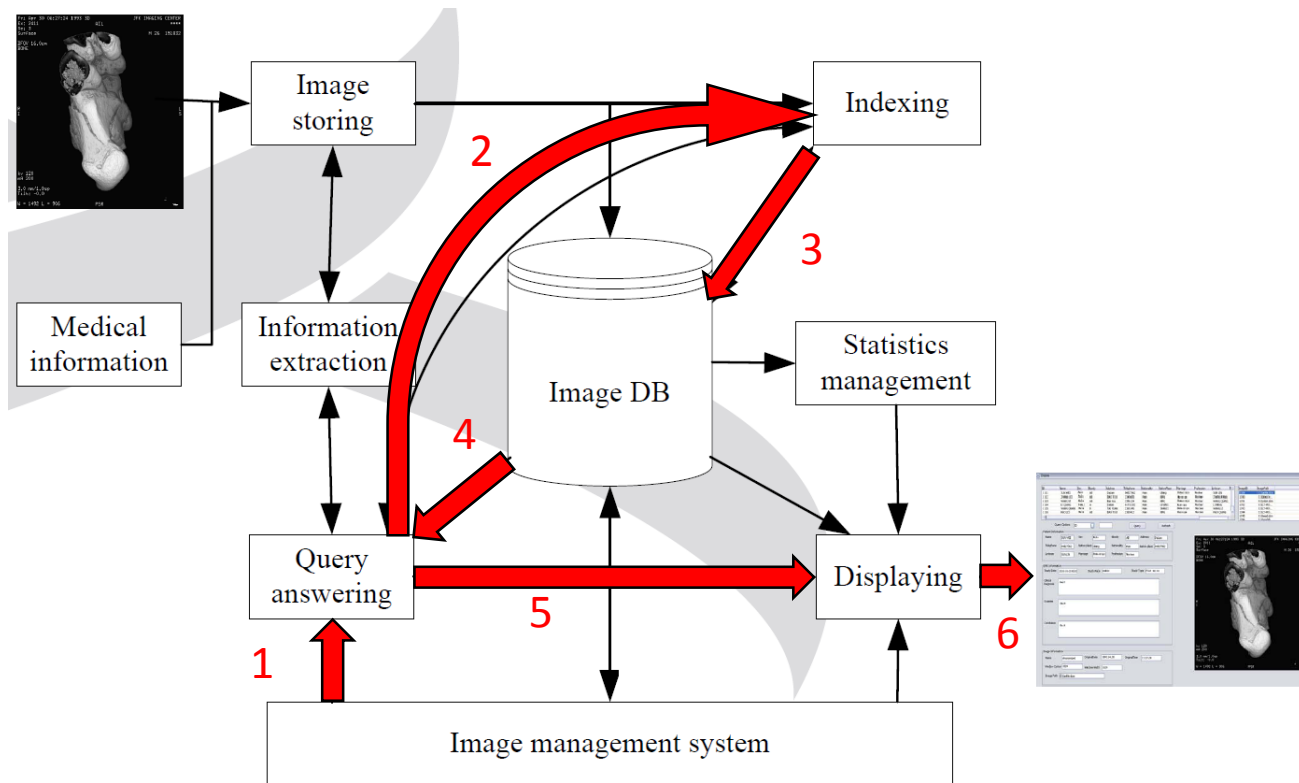
System Architecture



3 Main Points of Internal Interaction

- (1) through the application programming interface (API) of the query answering module
- (2) through the database, where every data in the system is maintained
- (3) through the API of the displaying module

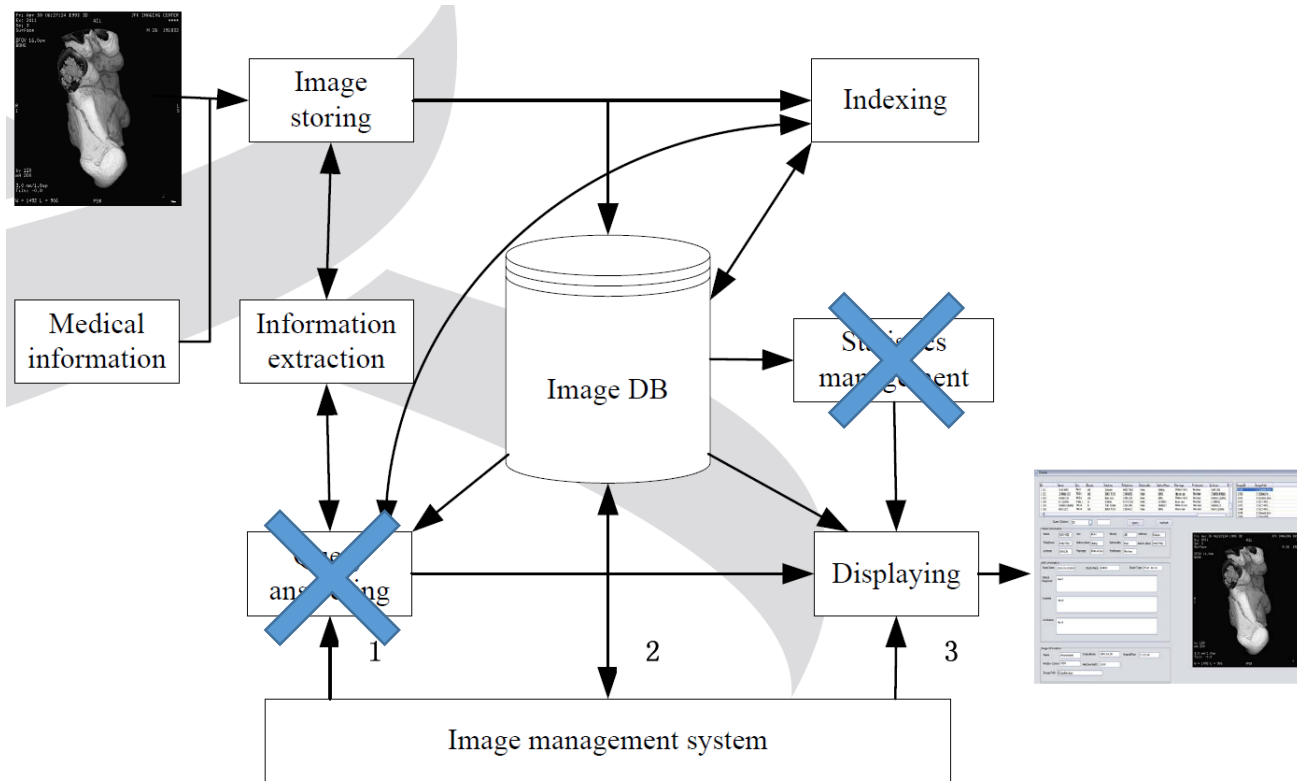
System Architecture



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Where do we differ?

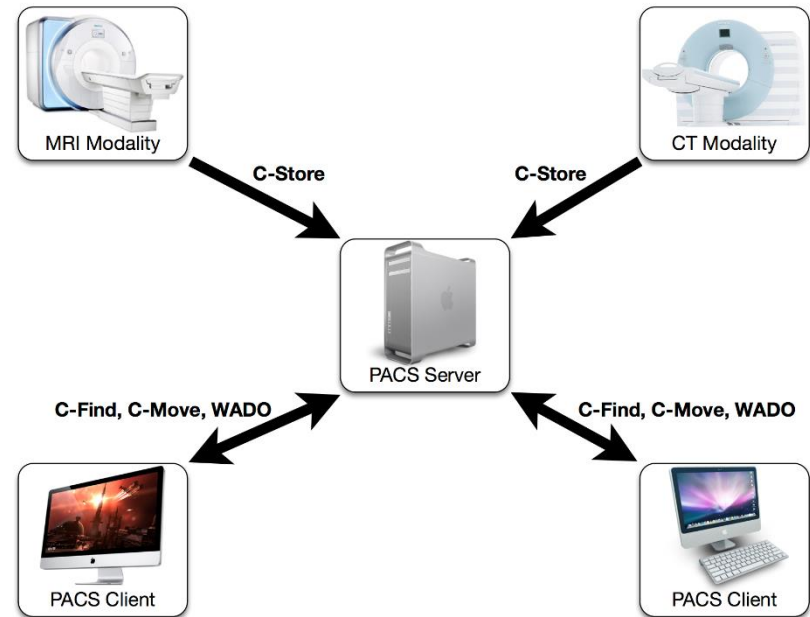


Transmission of DICOM files

- SCP (Service Class Provider) was used to provide image information and data storage, query, and conversion services.
- 3 main commands that strictly follow the DICOM standard:
 - STORE SCP
 - Used to receive and store medical images from the client.
 - FIND SCP – Patient ID or Patient Name
 - Used to find information which meets the clients query request in the database and return that information.
 - MOVE SCP
 - Receive C-MOVE's requests from the client and send the appropriate images to the specified customers.

Picture Archiving and Communication System (PACS)

- Different image modalities are sent to the PACS Server in DICOM format.
 - DICOM C-Store.
- Server and clients communicate using DICOM protocol.
 - DICOM C-Store
 - DICOM C-Find
 - DICOM C-Move
- The clients display the images through medical imaging software.
 - DICOM Viewer <-- US :D



Results

- System can parse all DICOM formats and store image files and corresponding patient medical records.
- System holds 25,000 images from the Department of Diagnostic Radiology and 12,500 electronic medical records.

Further Work

- Keep collaborating with physicians to improve the system
 - Collaboration with medical image, medical informatics, and radiology experts.
 - Implementation with the critical and service-oriented hospital information system.
- Plan to consider the security and privacy function of the system in the near future.

Project Applications

“This research work lays the foundation for the further comprehensive development of PACS system and also has a great significance for the construction of hospital information.”

- DICOM Parsing
- System Architecture
- Server Construction

Questions?