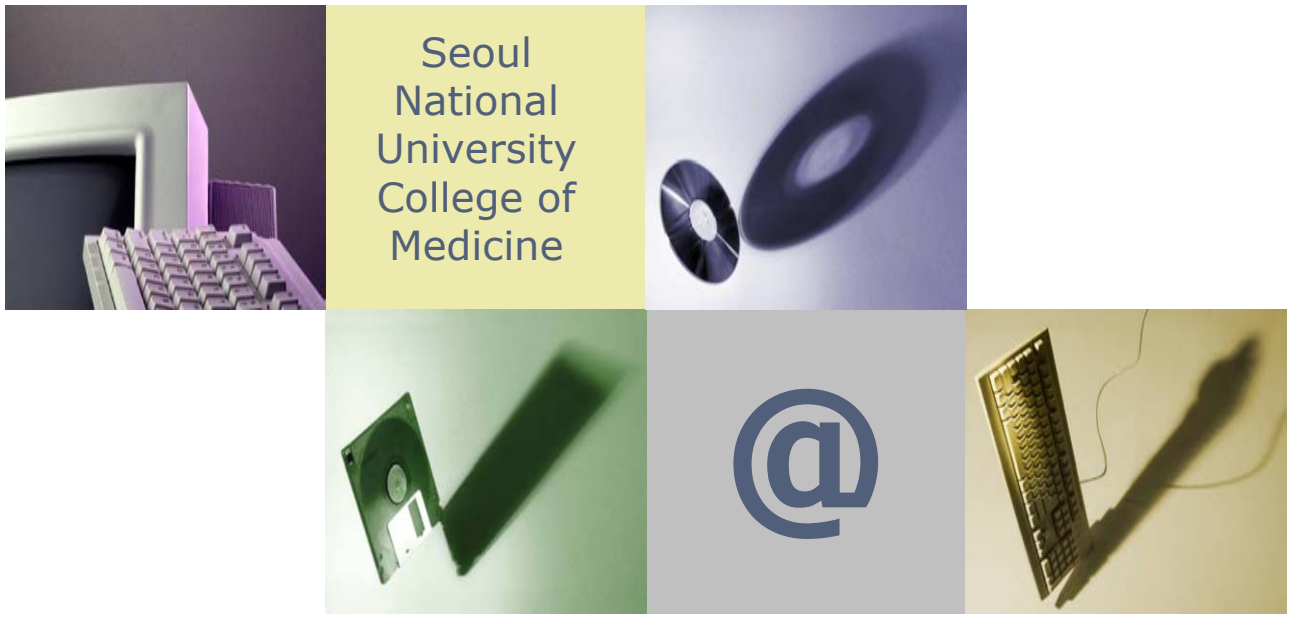
CDA and Virtual EMR



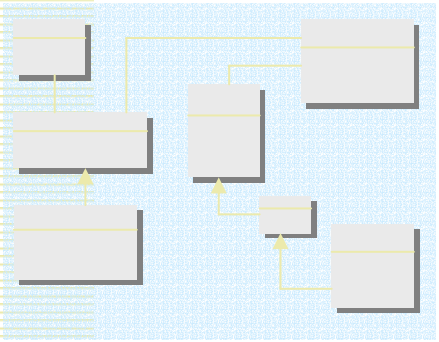
Jinwook Choi

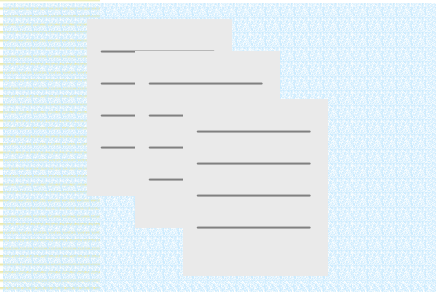
Seoul National University

Overall System Objectives

- **To share clinical data across heterogeneous institutions**

RIM

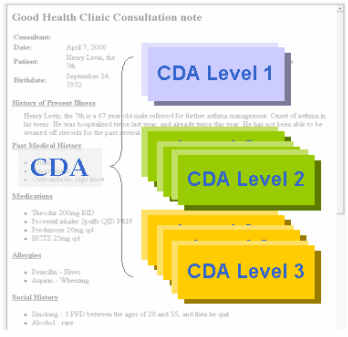




Arden Syntax

Development of CDA Based Clinical Data Exchange System

CDA

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  <value V="4.5" U="mg/dl"/>
</observation>
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HL7 V3 Message

Background

- **Pioneering Pilot Project of HL7 V3 in Korea**
  - Reference Information Model (RIM)
    - Shared information model and terminology
  - Clinical Document Architecture (CDA)
    - Common structure for persistent documents
  - Arden Syntax for Medical Logic
    - Formalism for expressing medical logic rules
  - Version 3 Messaging
    - Focus on data interchange for data bases
    - Enhanced for compound structures such as EHR elements

Overall System Architecture

CDSS Server

MLM in Arden Syntax

MLM

Vocabulary

ECA Engine

CDA Server

CDA Documents

CDR

CDA Documents

CDR Interface

CDA Builder

CDA Retriever

CDA Local Repository

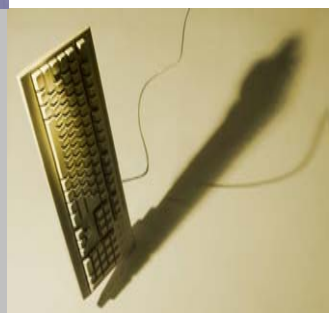
Echo-Cardiology System

HL7 messages

HIS

CDA Server

Seoul National University College of Medicine



Main Components of CDA Server

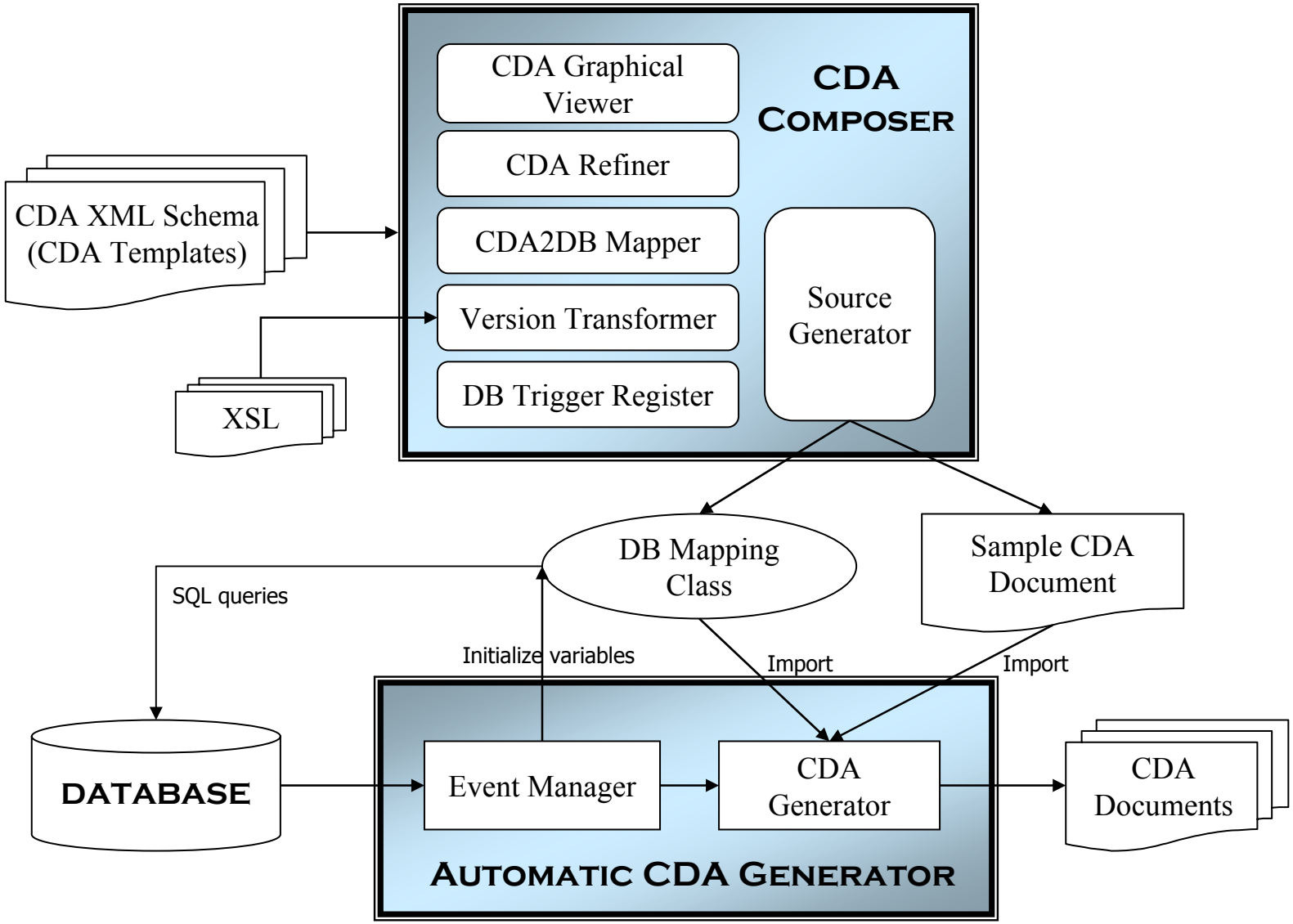
- **CDA Builder**
  - Toolkits for creating, viewing and transforming CDA templates and documents
- **CDA Retriever**
  - Web-based CDA document processing engine
- **CDR Interface**
  - HL7 messaging-based gateway for exchanging CDA documents with CDR

Design Objectives of CDA Builder

- **Compatible with a wide range of clinical information system**
- **Impose minimal overhead on the existing clinical information system**
- **Automatically create CDA documents by extracting data from the existing database**
- **Independent of the underlying storage mechanism**
- **Achieve software reuse through Component Based Development (CBD) methodology**
- **Use open standards**

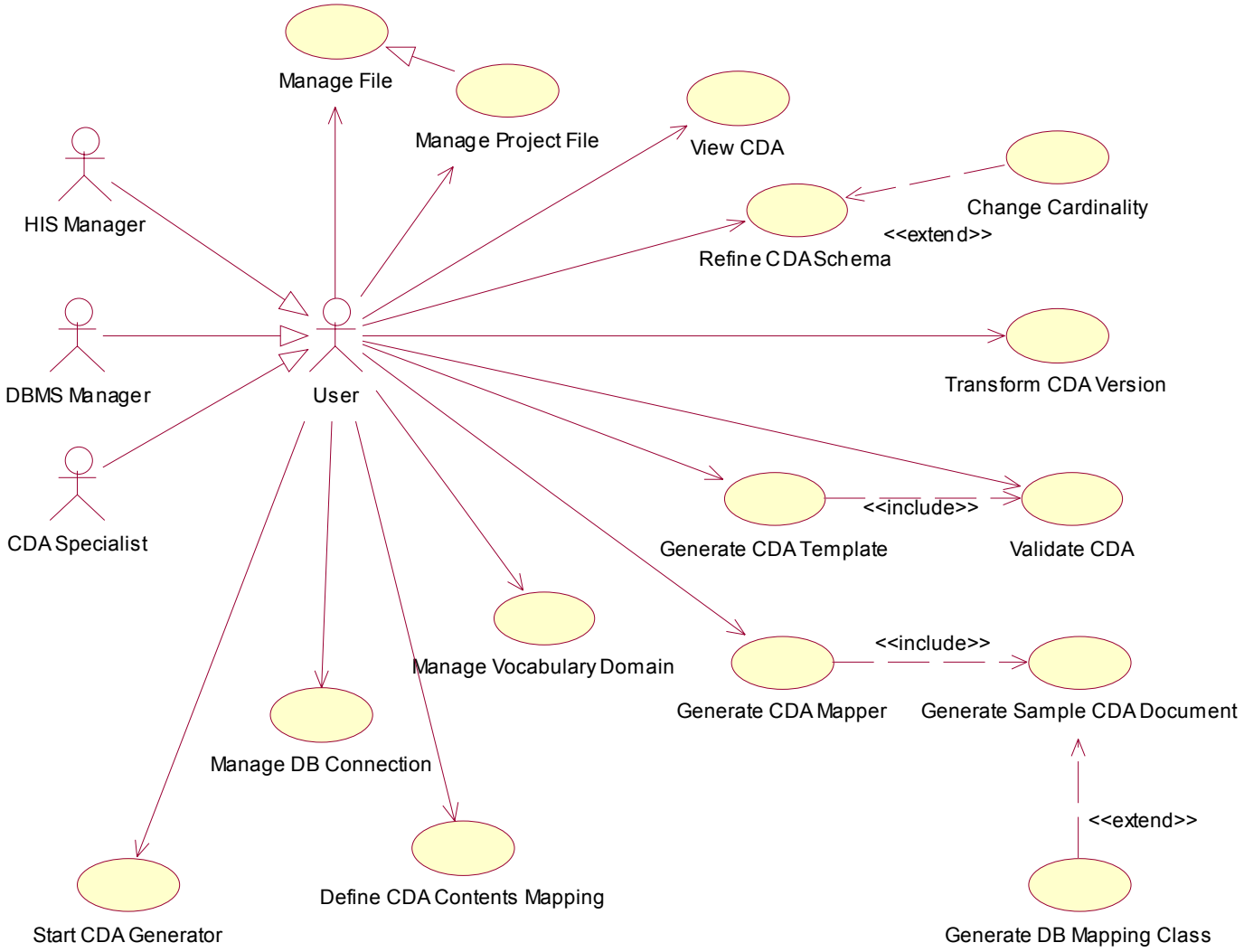
Architecture of CDA Builder

CDA SERVER

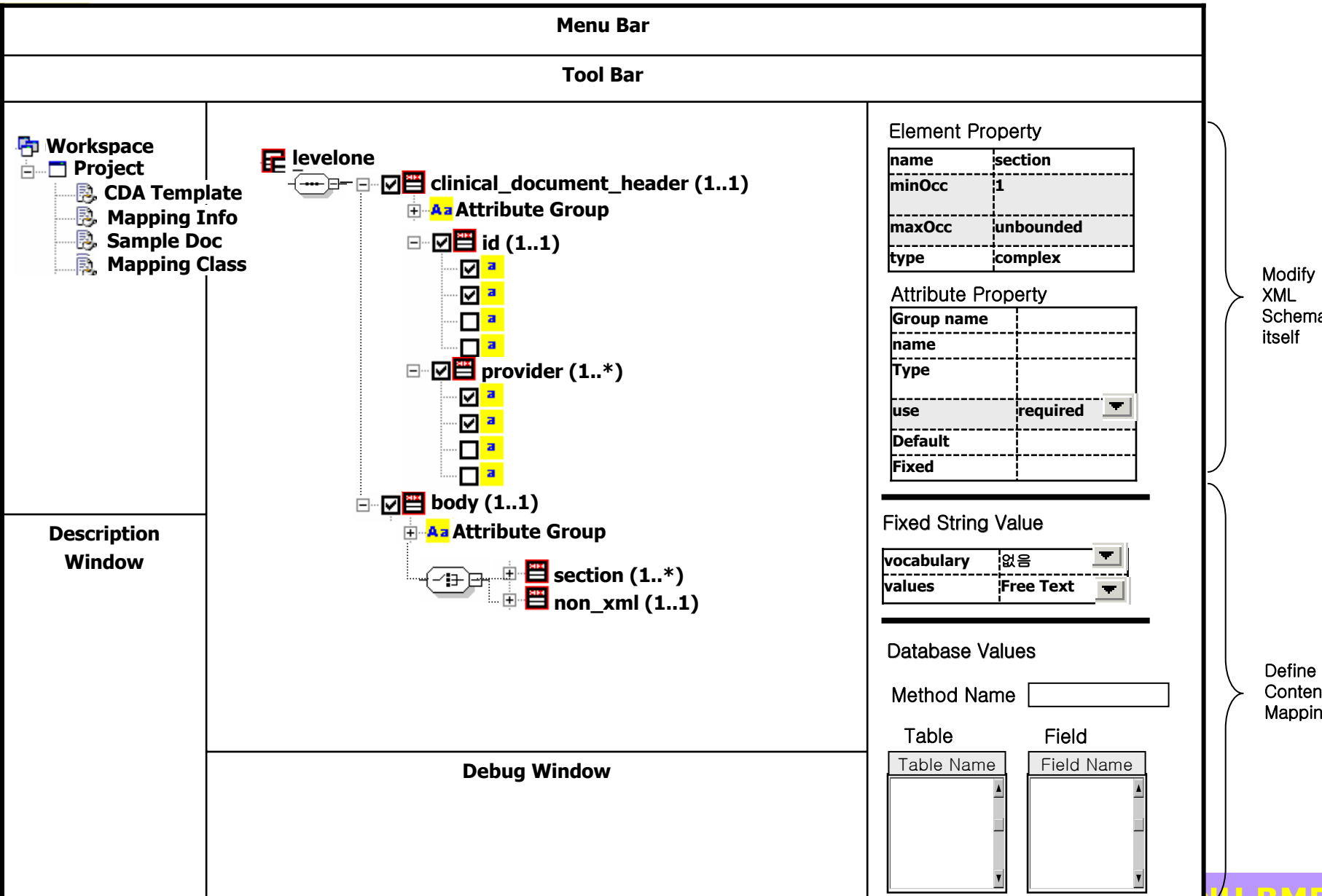


Use Case Diagram of CDA Composer

CDA SERVER



UI Design of CDA Composer

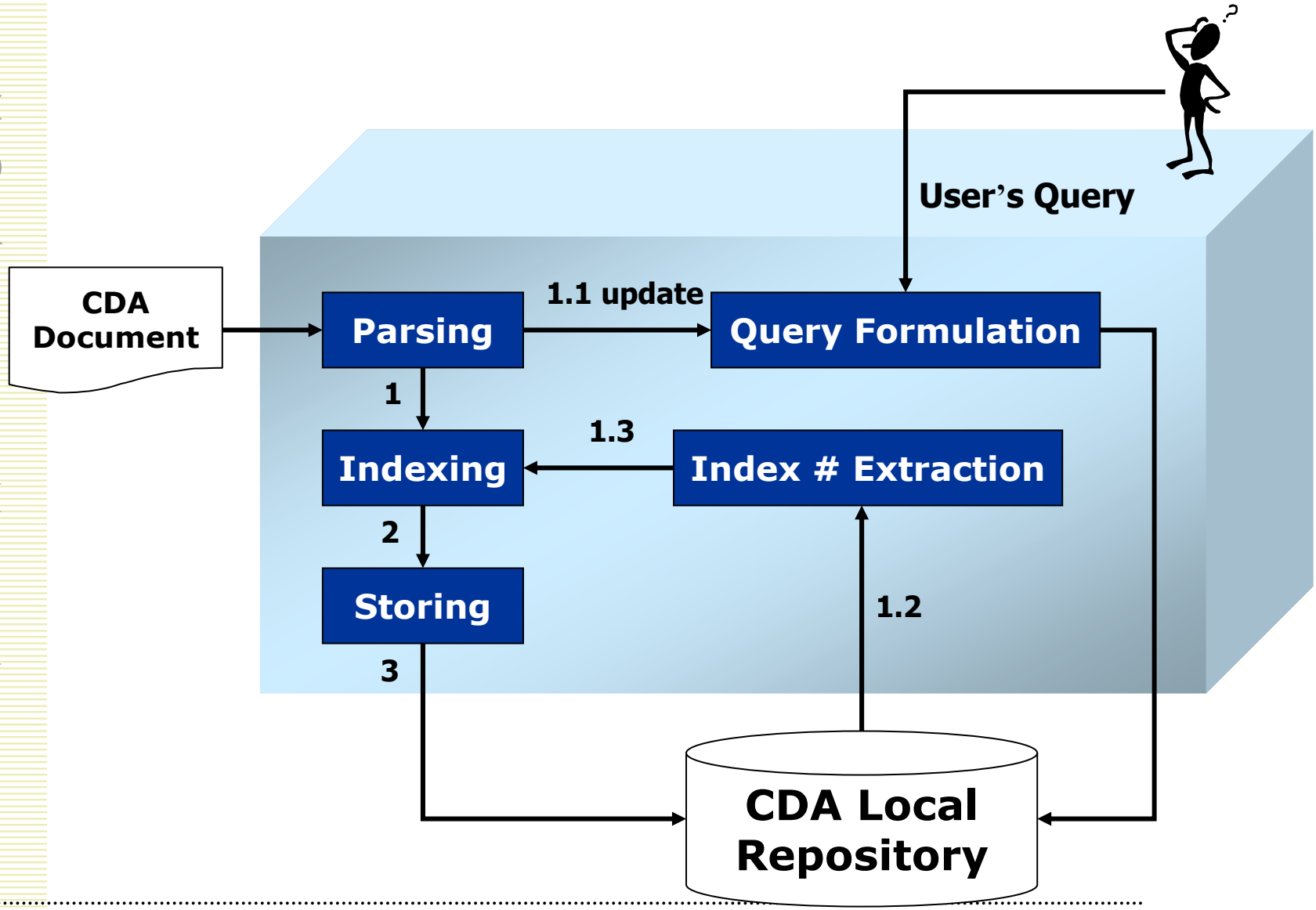


Design Objectives of CDA Retriever

- **Should be scalable to accommodate continuously increasing CDA documents**
- **Can accommodate any clinical documents that conform CDA specification**
- **Display CDA documents in a user preferred view using XML-aware browsers**
- **Support keyword search for CDA documents**
- **Use open standards**

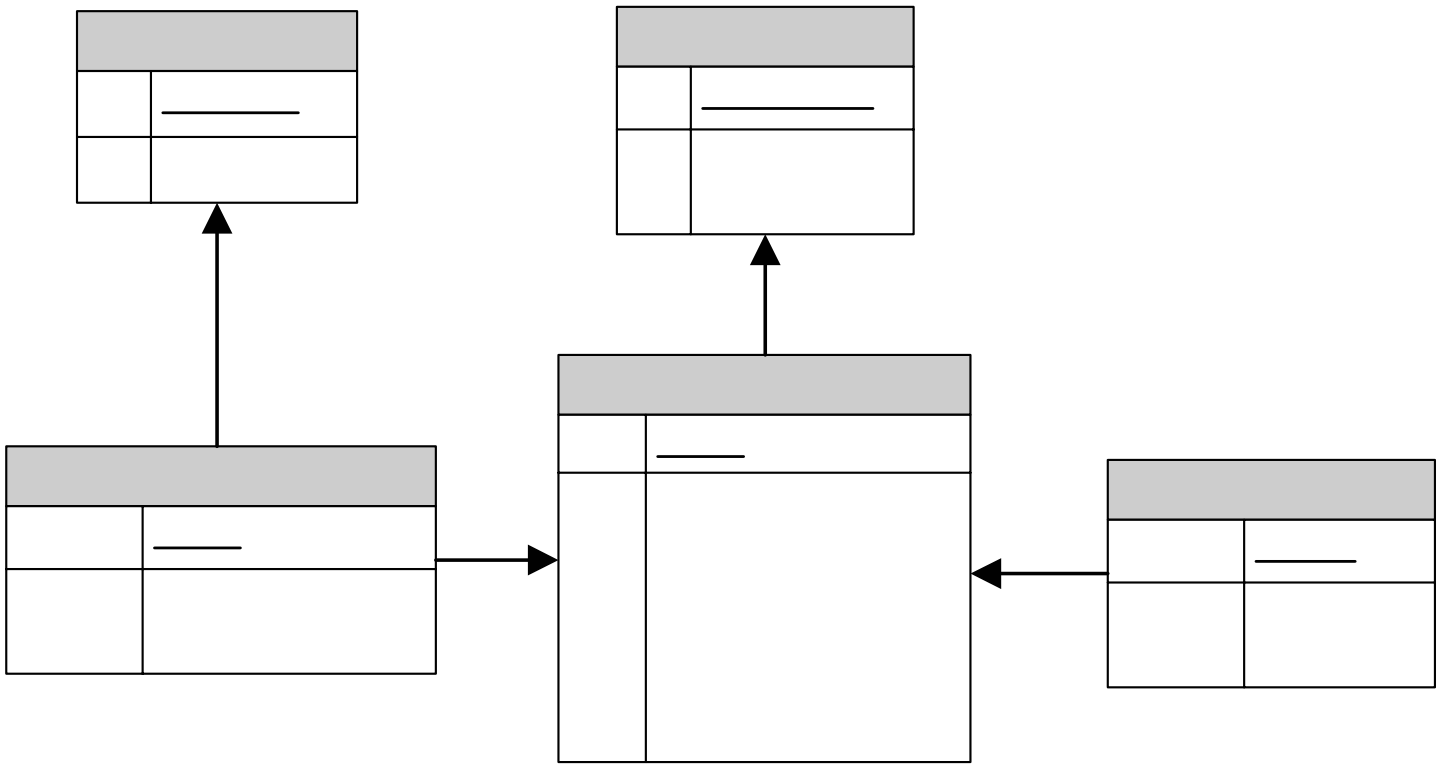
Architecture of CDA Retriever

CDA SERVER

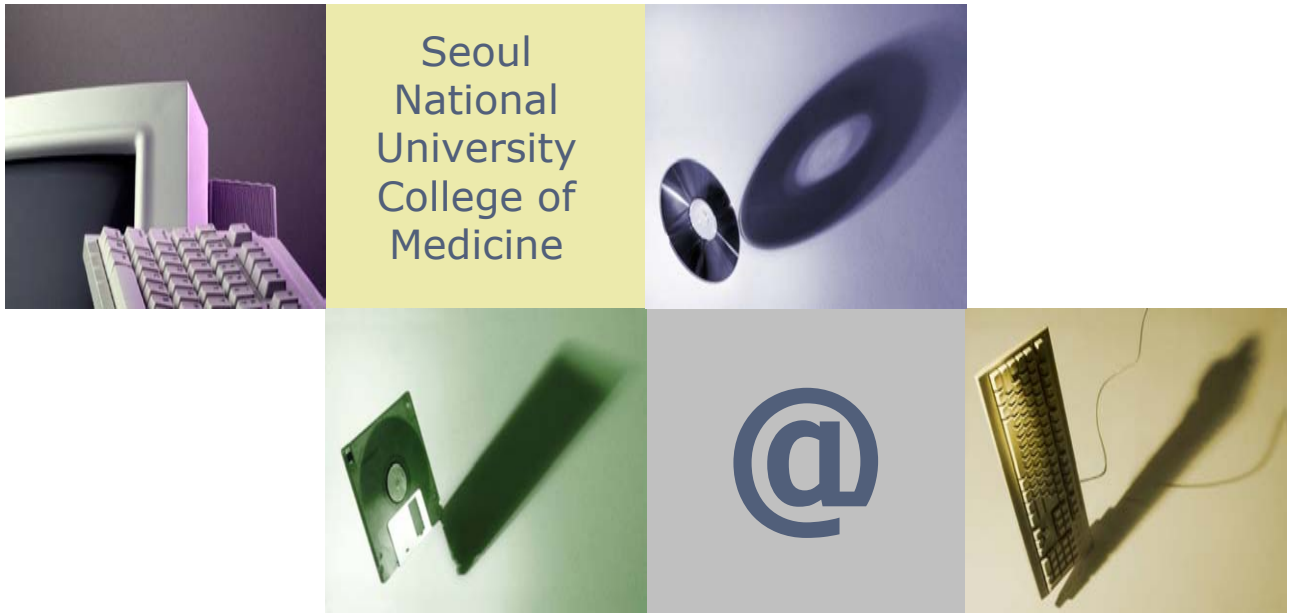


CDA Local Repository Schema

CDA SERVER



CDSS Server based on Arden Syntax



Background

CDSS SERVER

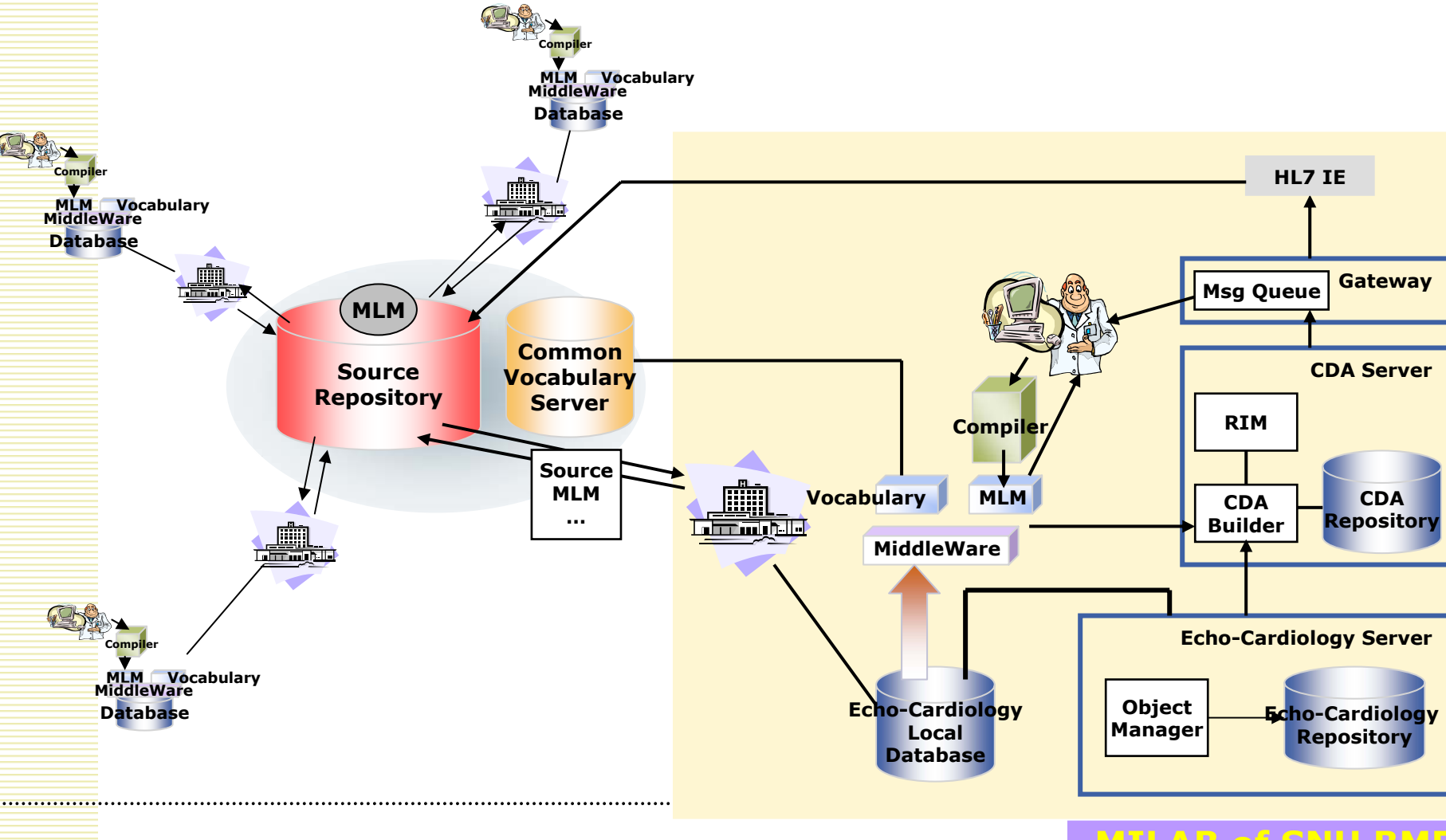
- **Using intelligent medical logic modules has lots of profits**
  - Prevent significant medical errors
  - Reduce hospital costs
- **Medical knowledge is highly specialized knowledge**
  - A medical expert cannot cover all the medical field
- **Sharing of MLM will enrich the CDSS environment**

Design Objectives

CDSS SERVER

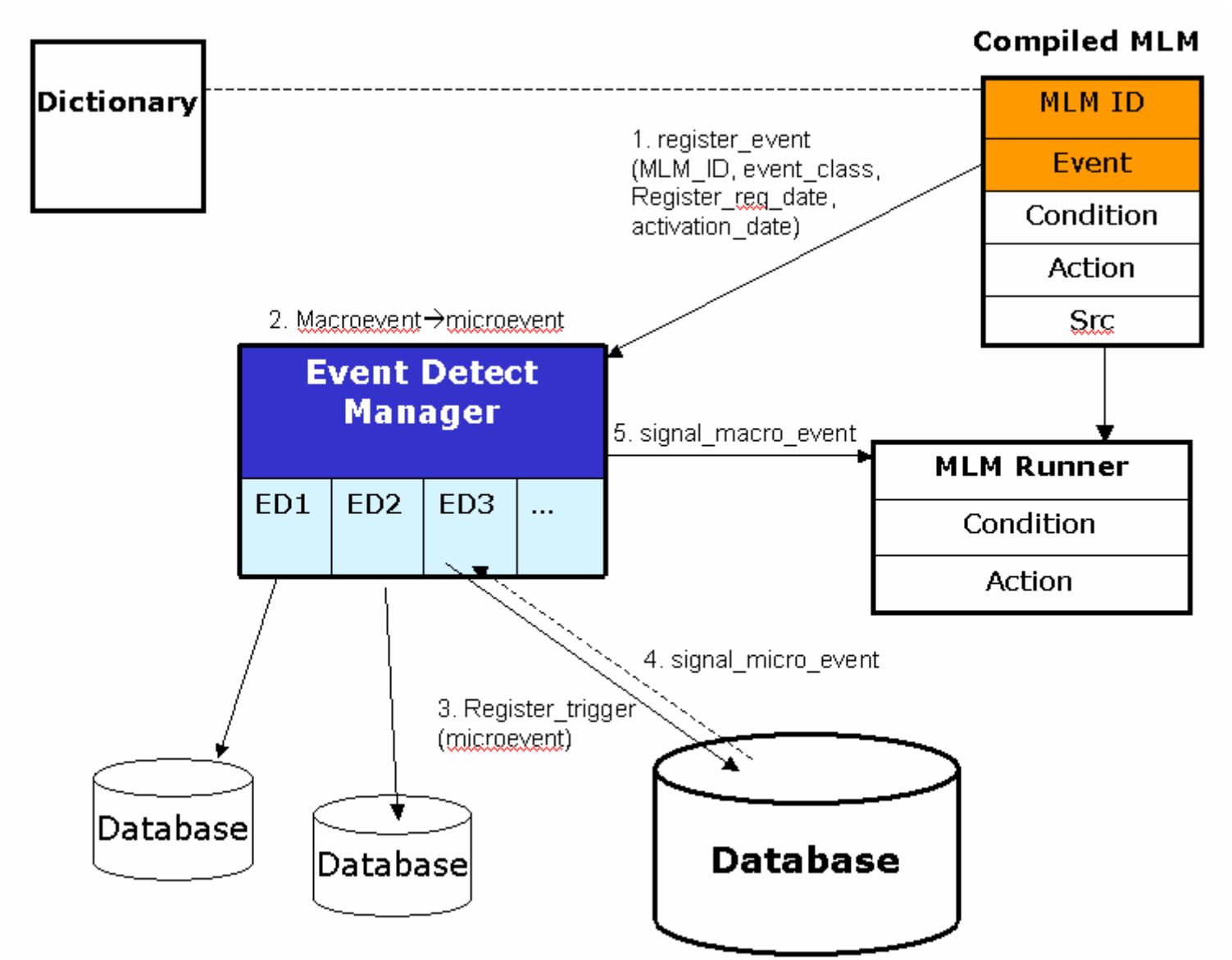
- **Establish MLM sharable environment among institutions**
- **Make an easy-to-use interface to write and register an MLM**
  - Arden Syntax editor
  - MLM register
- **Implement an MLM running environment**
  - Compiler
  - Vocabulary
  - ECA engine(Monitor Events)
  - Runner

MLM in Overall System Architecture

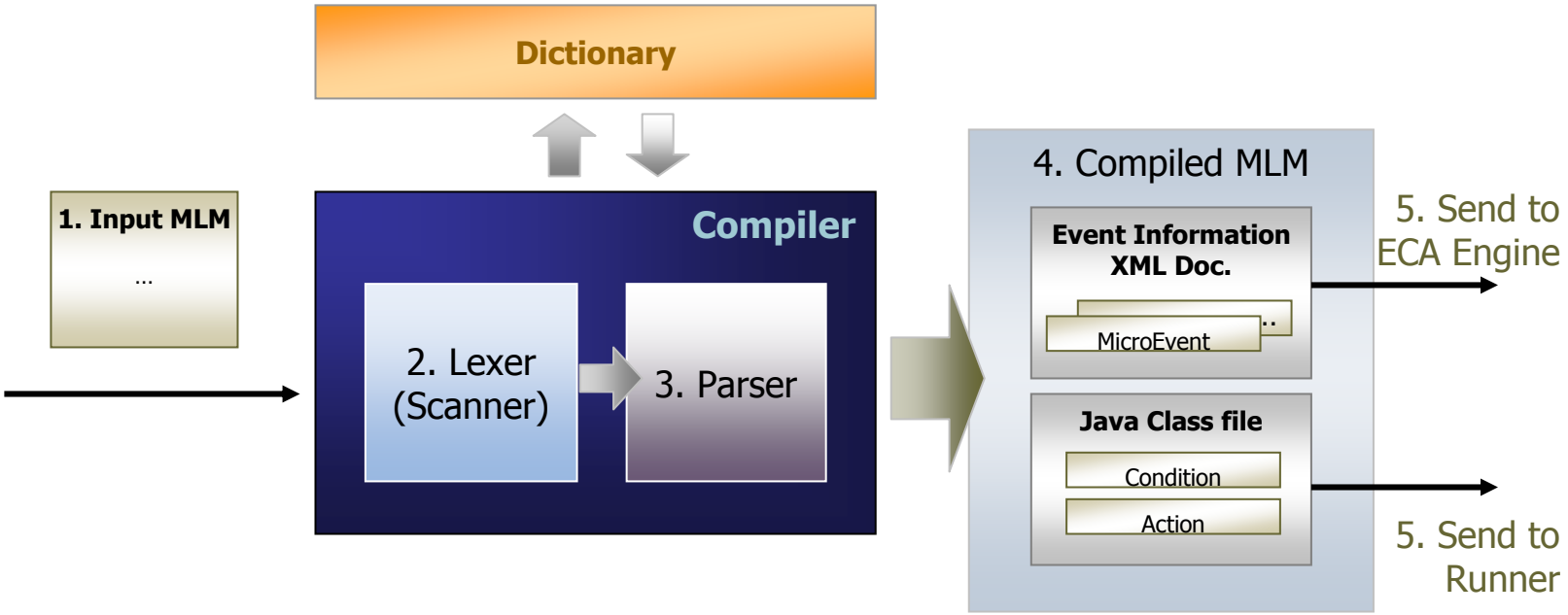


MLM Running Environment

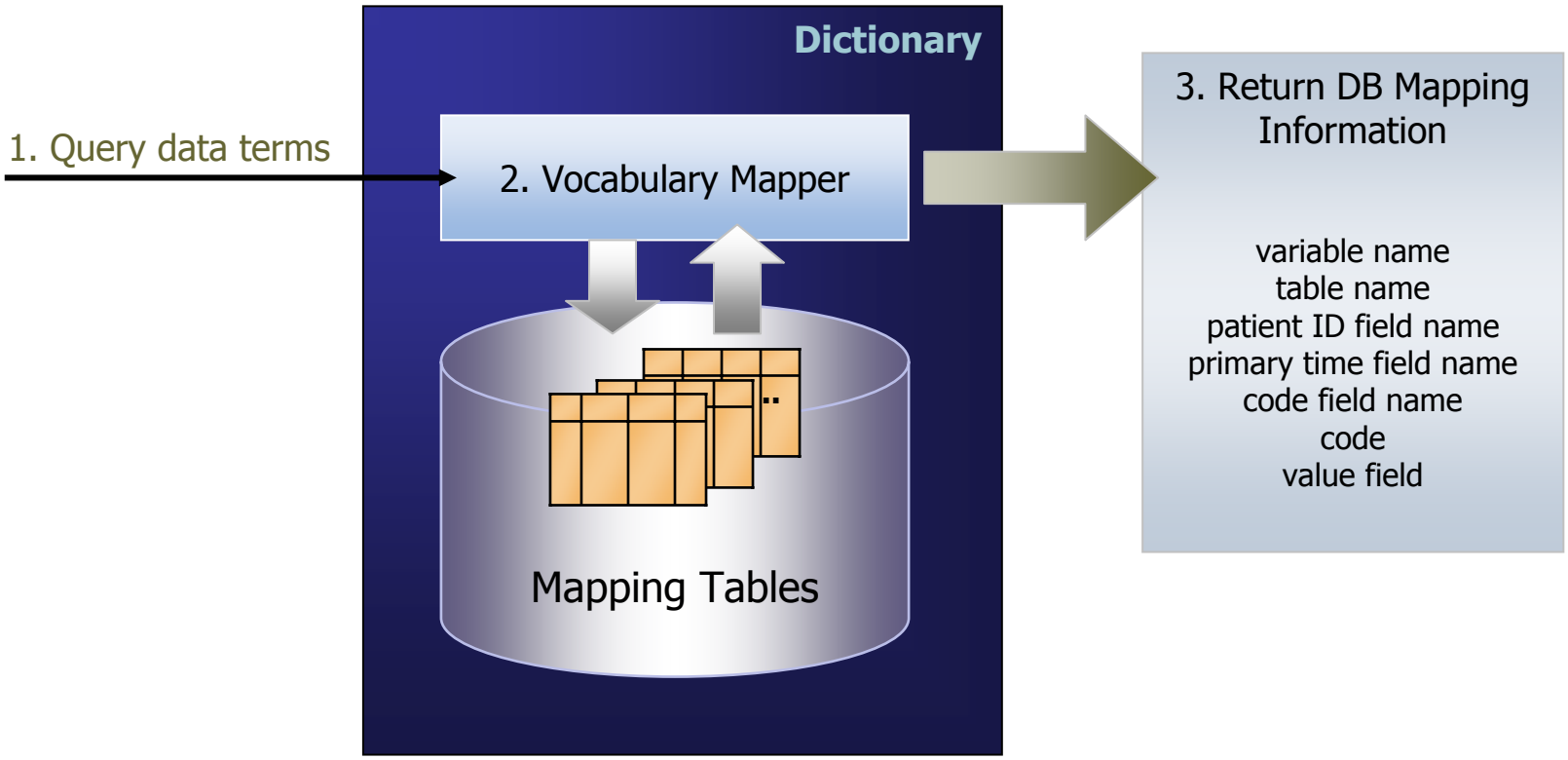
CDSS SERVER



MLM Compiler

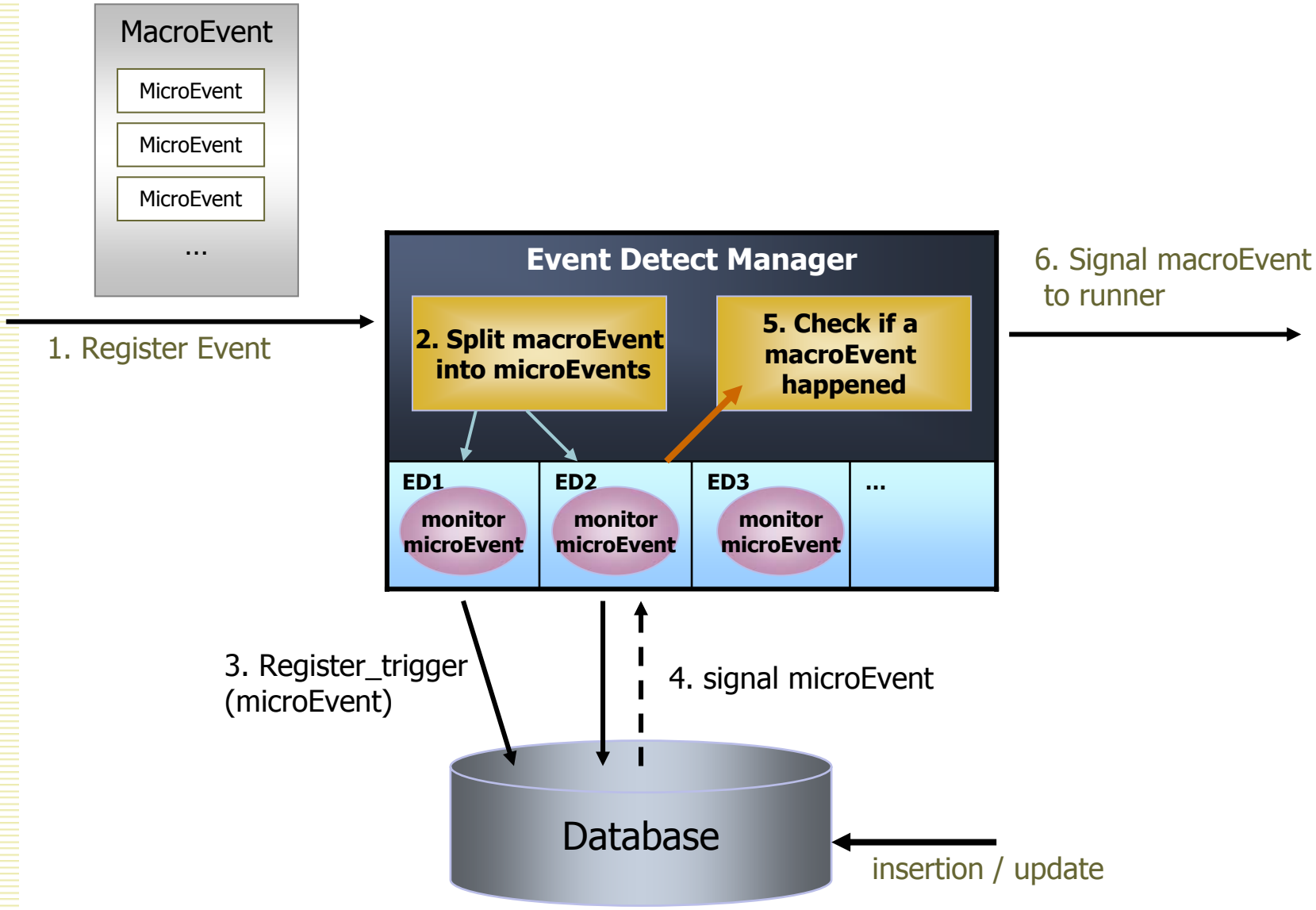


Dictionary for MLM Compiler

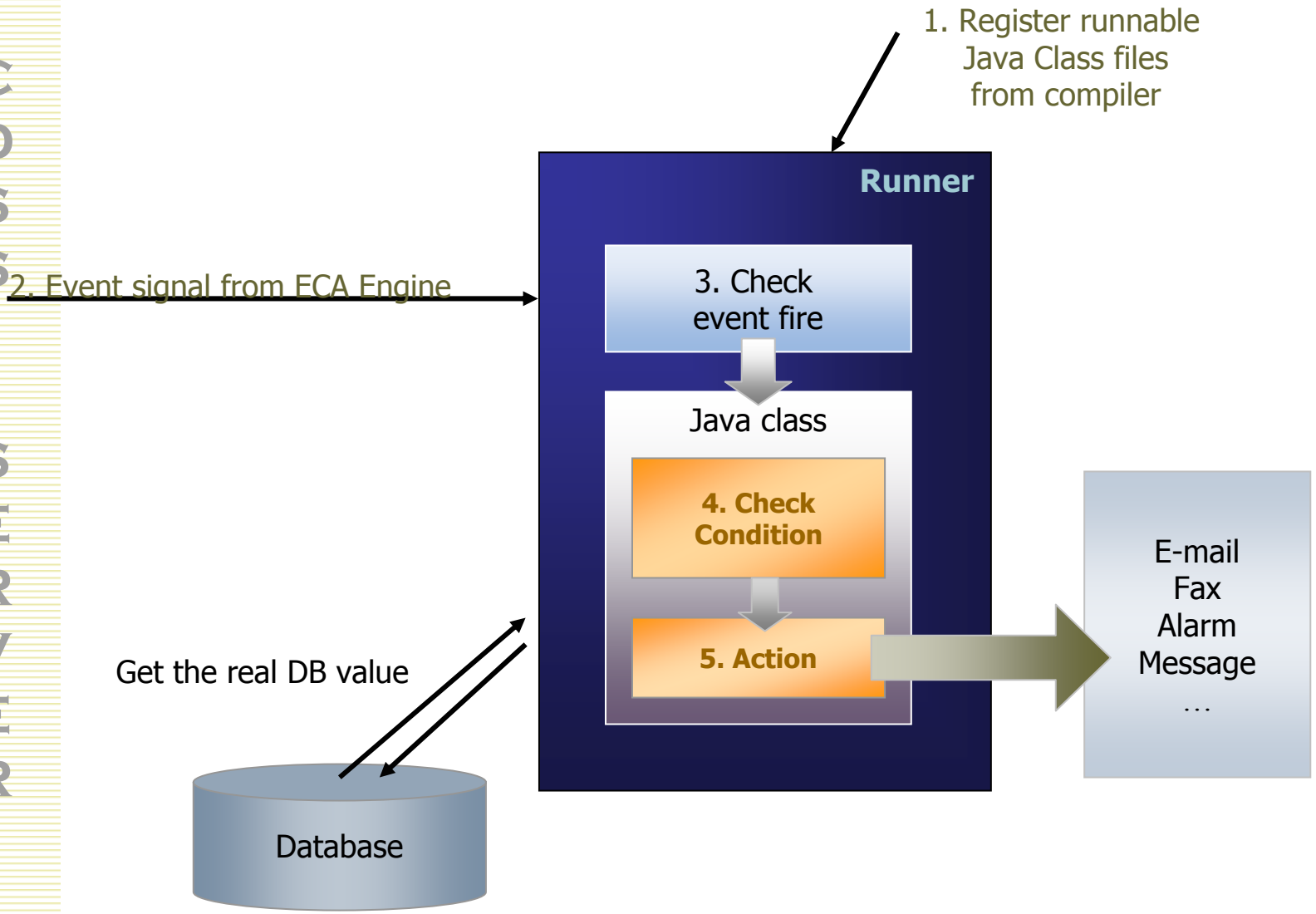


ECA Engine

CDSS SERVER

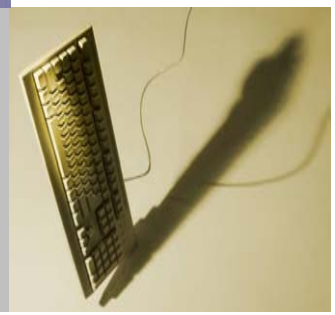


RUNNER

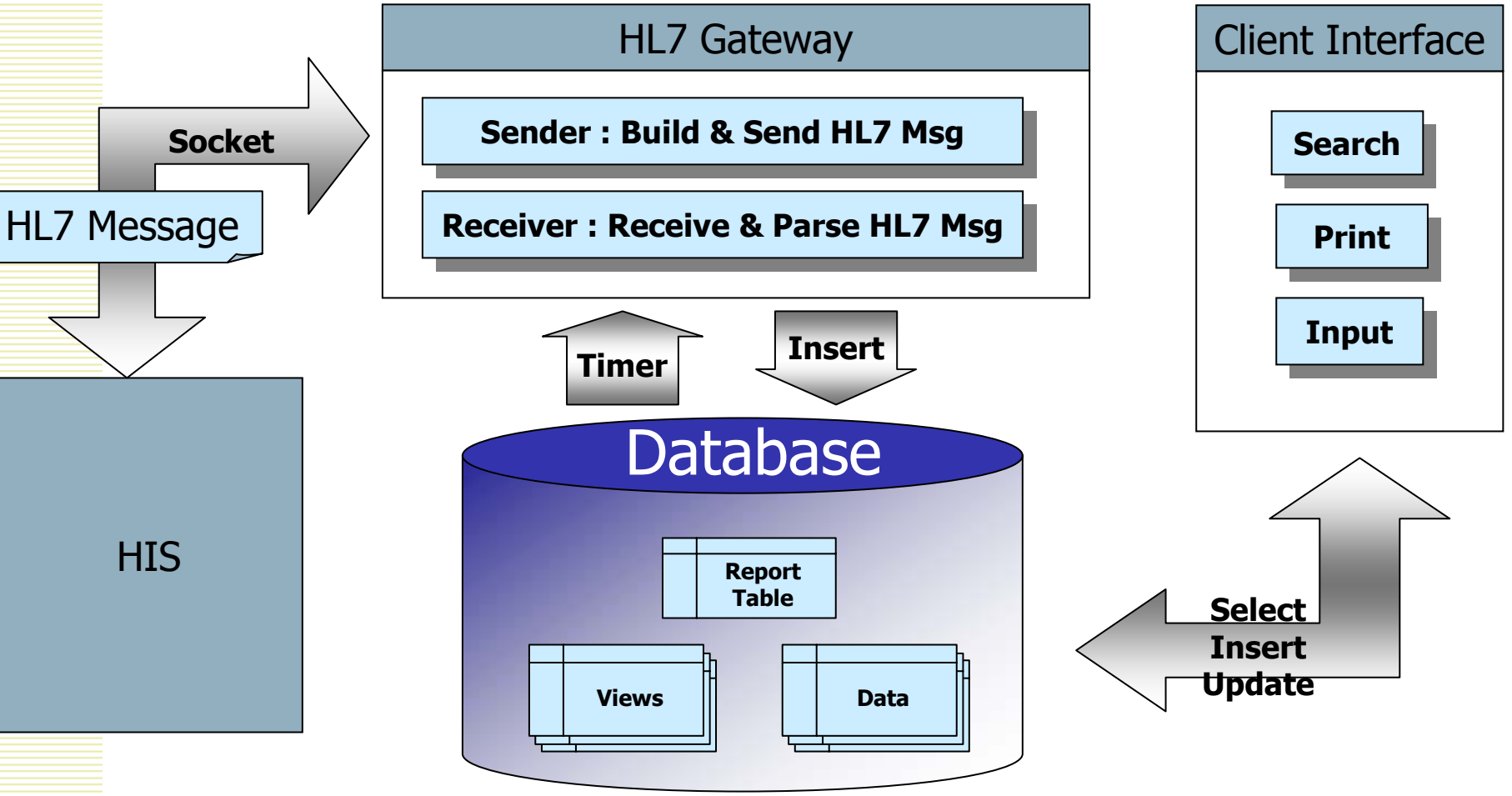

1. Register runnable
Java Class files
from compiler
Runner
2. Event signal from ECA Engine
3. Check
event fire
Java class
4. Check
Condition
5. Action
E-mail
Fax
Alarm
Message
…
Get the real DB value
Database

Echo-Cardiology Information System

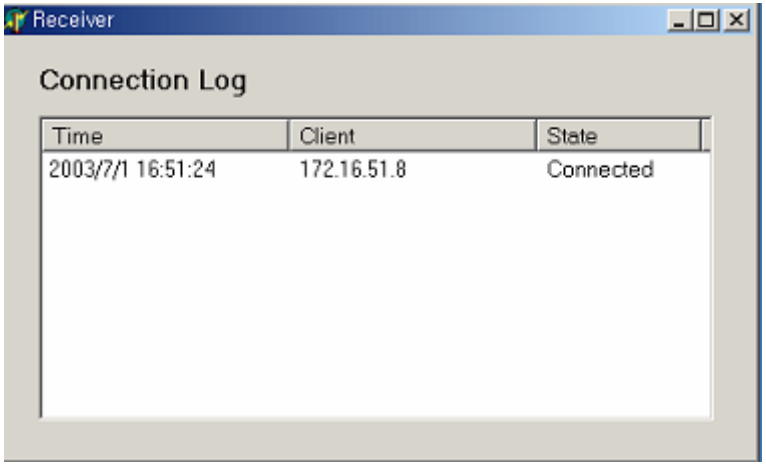
Seoul National University College of Medicine



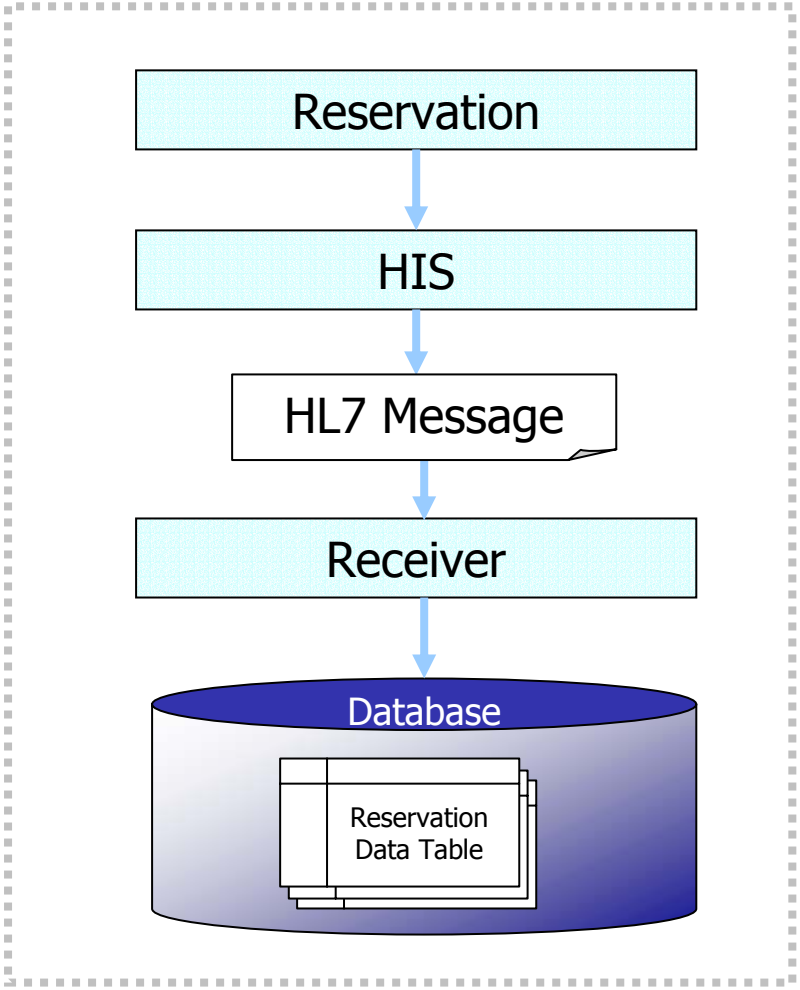
Architecture of Echo-Cardiology System



Receiver in HL7 Gateway



- Receive Msg
- Parse Data
- Insert to DB
- Write to Log



Reservation Message Log

ECHOCARDIOLOGY SYSTEM

Microsoft Access - [RLog : 테이블]

파일(F) 편집(E) 보기(V) 삽입(I) 서식(O) 레코드(R) 도구(T) 창(W) 도움말(H)

ID	Message	OrderType	OrderID	Rcv_Time	State
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34	MSH|^~₩&|^OCS|^SNUH|^ECHO|^SNUH|||ORM^O01|RS20030715286112990002|P|2.3||||AL|PID	XXXXXX	NW	20030715286112990002	2003-07-22 오후 2:48:47	Normal

MSH|^~₩&|^OCS|^SNUH|^ECHO|^SNUH|||ORM^O01|RS20030718321653840001|P|2.3||||AL
PID|||3XXXXXXX||0|XX||1XXXXXXX|F♪PV1||/IMC♪ORC|NW|20030718321653840001^OE
OBR||||KL14022^신환 Echocardiography(Routine ;2D +Doppler)|||||||||palpiation
with chest discomfort|||^XXX^^^^^^^&IMC|||||||SBA46/신환 심에코검사실
(Routine ;2D +Doppler)||||||||||||20030722101625♪

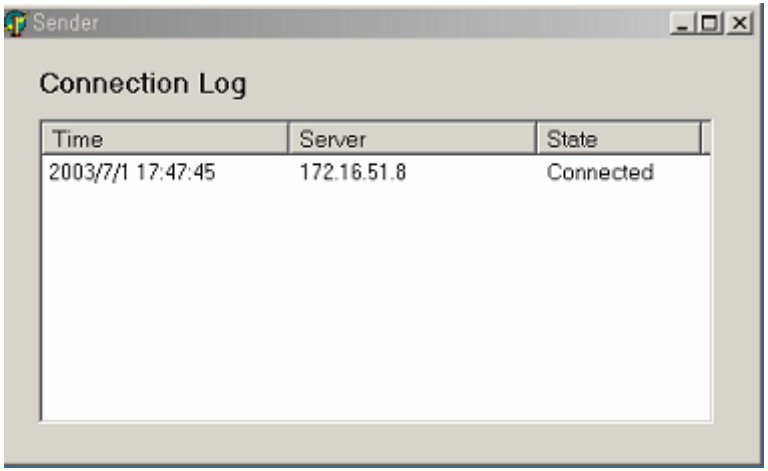
현재 레코드: 1 전체: 3489

데이터시트 보기

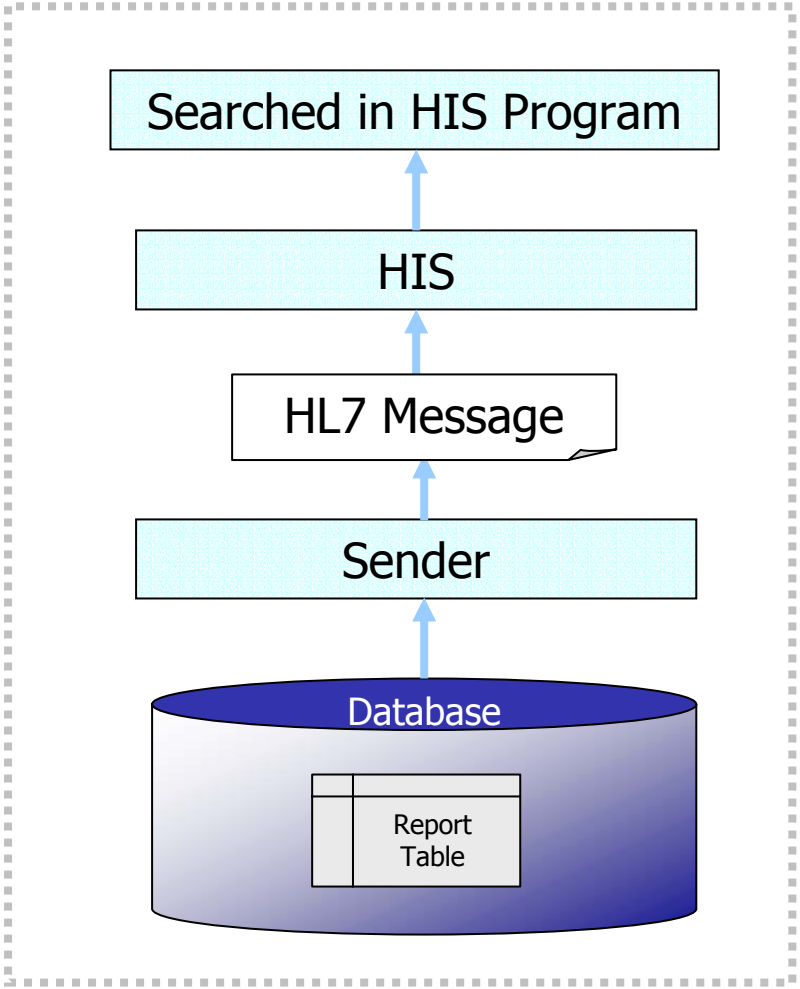
NUM

A漢

Sender in HL7 Gateway



- Make Msg
- Send Msg to HIS
- Write to Log



Observation Result Message Log

ECHOCARDIOLOGY SYSTEM

Microsoft Access - [OLog : 테이블]

파일(F) 편집(E) 보기(V) 삽입(I) 서식(O) 레코드(R) 도구(T) 창(W) 도움말(H)

ID	Message	OrderID	Edit_Num	Snd_Time	State
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2	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003052922004280000 1|P|2.3||||AL||PID|||xxxxxx|| xxxxxx	20030529220042800001	1	2003-09-01 오후 1:24:10	Sended
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15	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082130				
16	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2002061220308272				
17	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082032274574				
18	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003080432111510				
19	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082526113193				
20	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082232291238				
21	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082623881264				
22	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003090129758704				
23	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082827804012				
24	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082932299838				
25	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082132278886				
26	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082832252668				
27	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003090132301407				
28	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003081922154217				
29	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082630025031				
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32	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003083072846225				
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34	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082830461086				
35	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003052716189807				
36	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003090125758269				
37	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003090132277270				
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39	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003082918476165				
40	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003081932195532				
41	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003083021739670				
42	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003083021193086				
43	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003081915750509				
44	MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH||ORU^R01|RT2003080421193086				

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MSH|^~₩&|^ECHO|^SNUH|^OCS|^SNUH|||ORU^R01|RT200308213XXXXXXX0004|P|2.3||||AL
PID|||3XXXXXXX||김XX
ORC|NW|200308213XXXXXXX0004^OE♪OBR||||KL1402^Echocardiography(Routine ;2D +Doppler)|||||||||||||||79XXX|윤XX
OBX|1|ST|KL1402^Echocardiography(Routine ;2D +Doppler)||Final Impression__1. Normal LV cavity size and systolic
function; Calculated EF : 56%__2. No regional wall motion abnormality__3. Normal LV wall thickness__4. Normal
valves____Comment__좌심실의 크기는 정상이며 systolic function은 정상으로 calculated EF는 56%임. 좌심방,
우심실 및 우심방의 크기는 정상이고, 좌심실벽의 두께는 정상이며 regional wall motion abnormality는 관찰되지 않음.
__승모판 및 대동맥판막은 정상기능을 가지고 있으며 trivial TR이 동반되어 있음. TR velocity로 부터 추정한
폐동맥수축기압은  27mmHg로 정상임.____Mesurement__LVID syst : 31 [ 38 - 23 mm ] __LVID diast : 47 [ 52 - 34 mm ]
__EF(calculated) : 56 [ 70 - 55 % ] __IVS diast : 8 [ 11.5 - 8.1 mm ] __LVPW diast : 8 [ 11.5 - 8.7 mm ]
__LA size : 25 [ 38 - 23 mm ] __AV dia : 25 [ 33 - 22 mm ] __MV E Vel : 0.48 [ 1.2 - 0.5 m/s ]
__MV A Vel : 0.78 [ 0.8 - 0.3 m/s ] __MV DT : 178 [ 240 - 150 mSec ] ____Wall Motion__||||||N|||20030901114333♪
```

현재 레코드: 1 전체: 3056

데이터시트 보기

NUM

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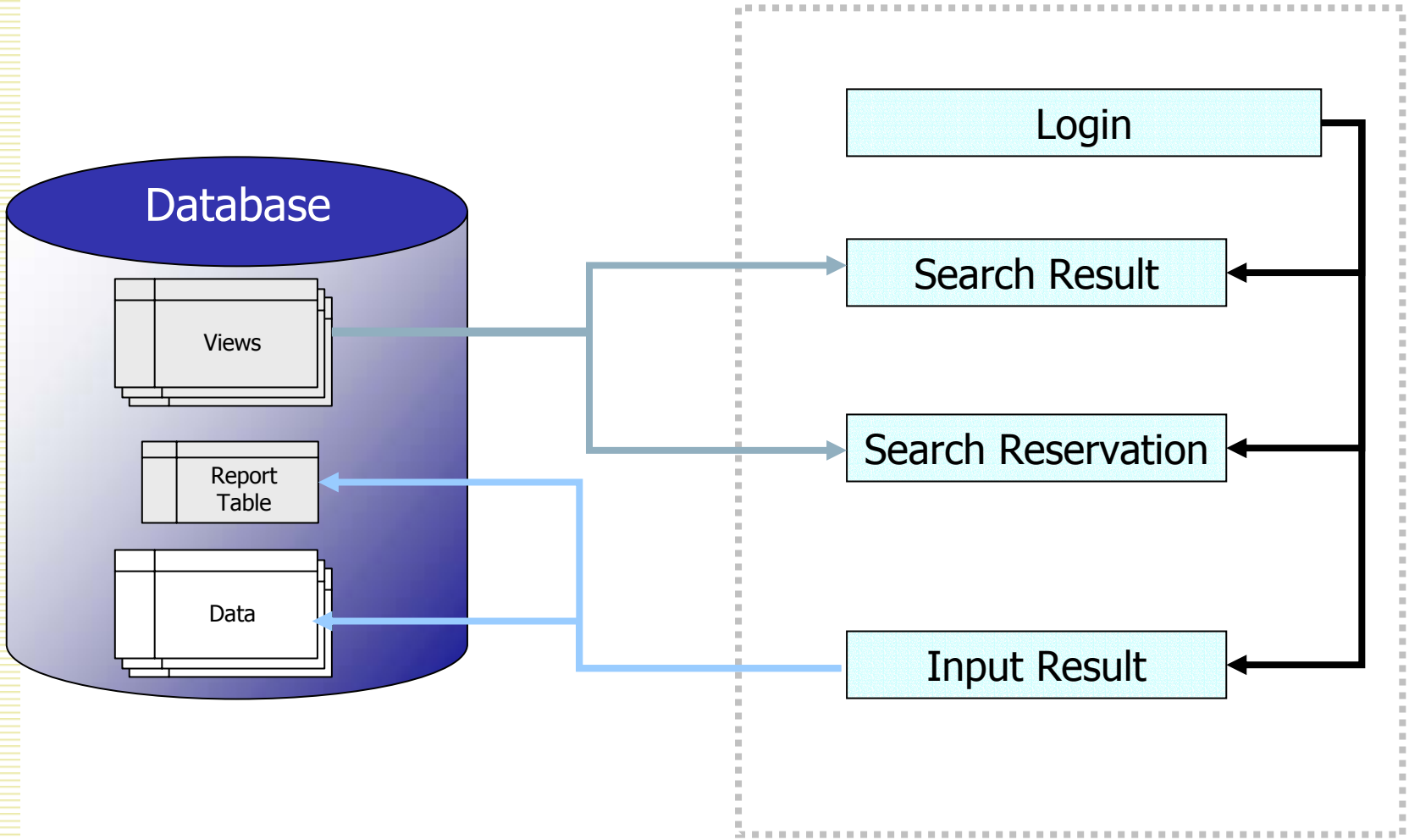
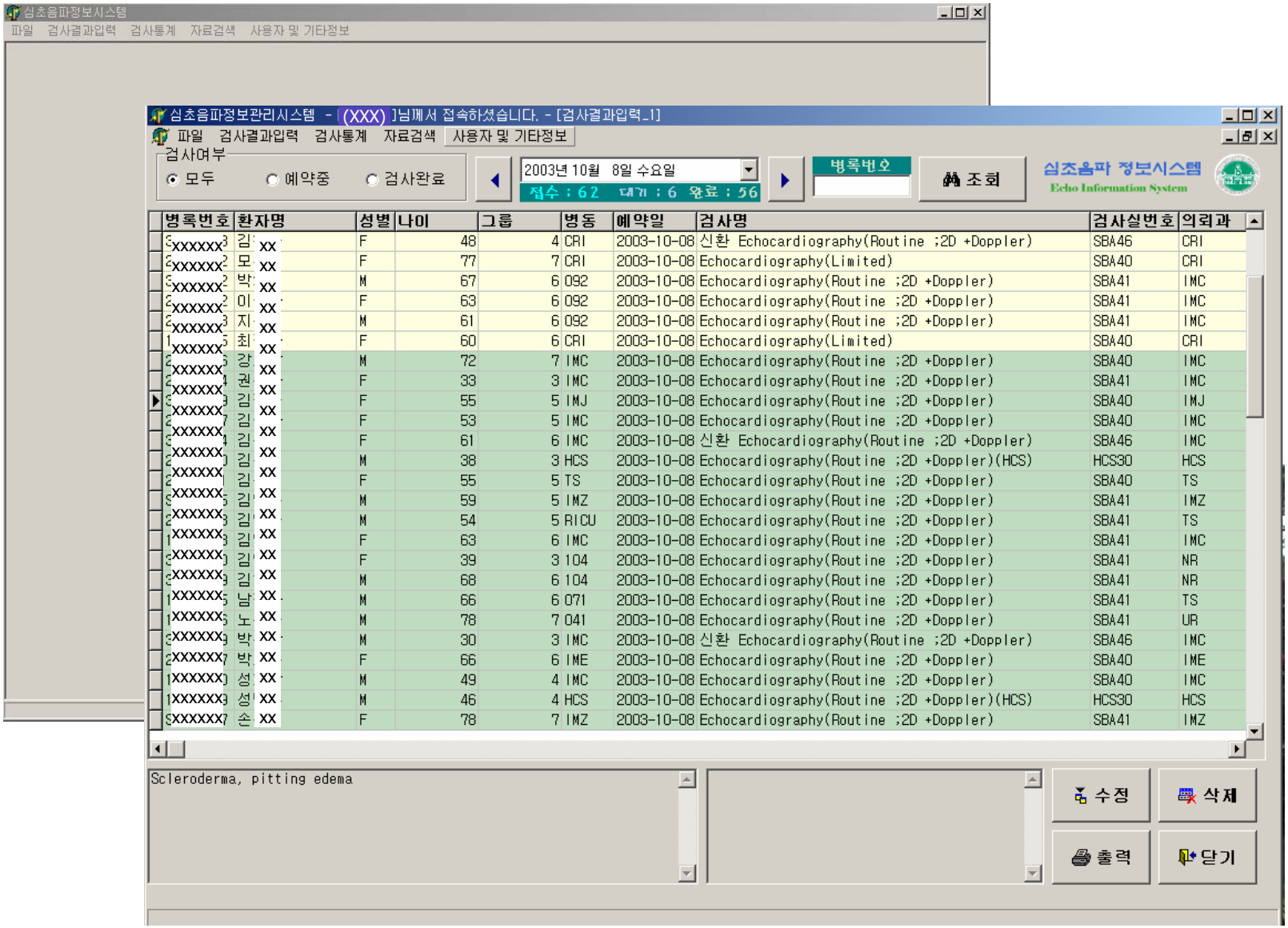
Client Interface for Retrieval



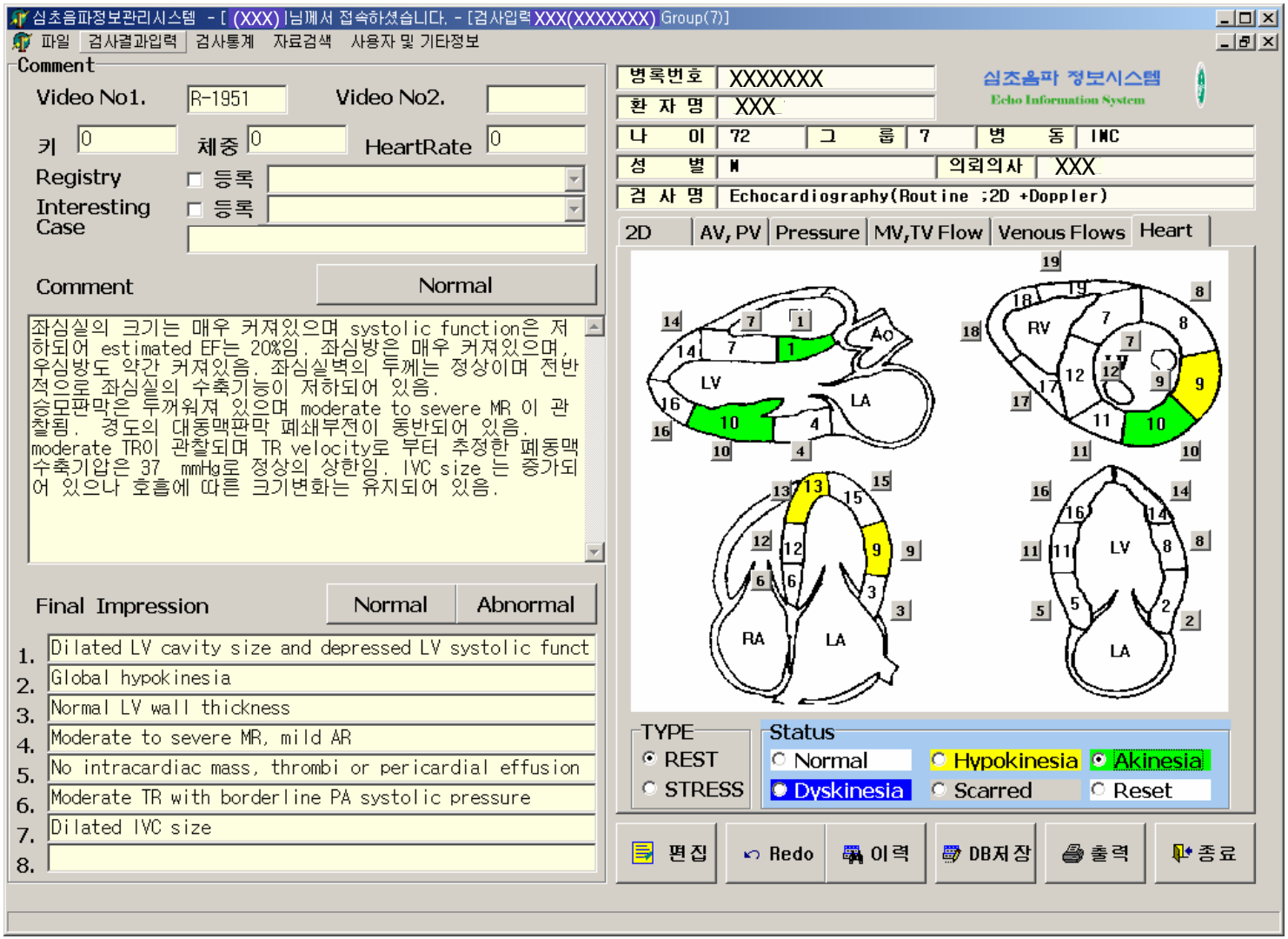
Interface for Patient Search

ECHOCARDIOLOGY SYSTEM



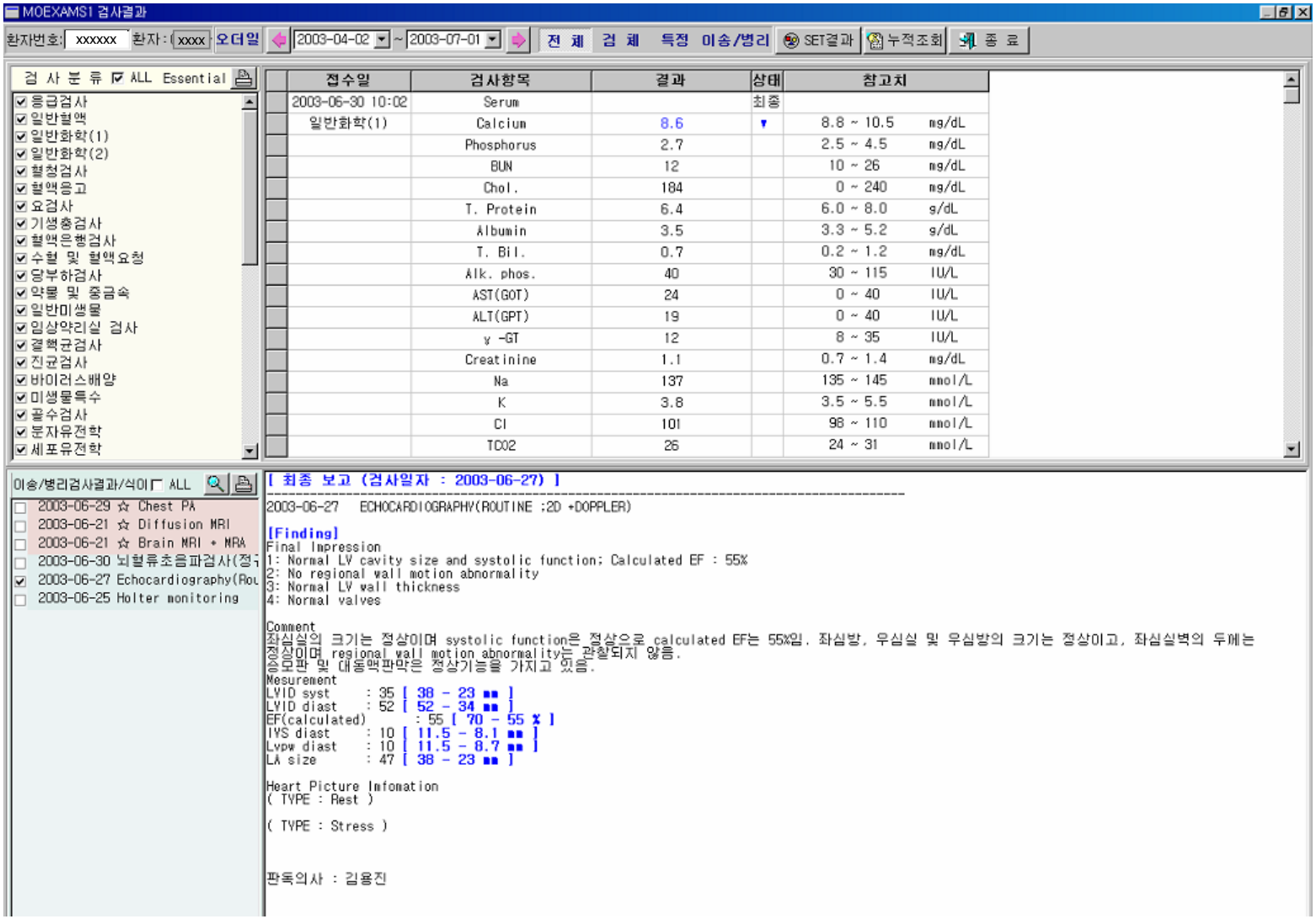
Interface for Result Report

ECHOCARDIOLOGY SYSTEM



Data transferred to HIS

ECHOCARDIOLOGY SYSTEM



접수일	검사항목	결과	상태	참고치	
2003-06-30 10:02	Serum		최종		
일반화학(1)	Calcium	8.6	▼	8.8 ~ 10.5	mg/dL
	Phosphorus	2.7		2.5 ~ 4.5	mg/dL
	BUN	12		10 ~ 26	mg/dL
	Chol.	184		0 ~ 240	mg/dL
	T. Protein	6.4		6.0 ~ 8.0	g/dL
	Albumin	3.5		3.3 ~ 5.2	g/dL
	T. Bil.	0.7		0.2 ~ 1.2	mg/dL
	Alk. phos.	40		30 ~ 115	IU/L
	AST(GOT)	24		0 ~ 40	IU/L
	ALT(GPT)	19		0 ~ 40	IU/L
	γ -GT	12		8 ~ 35	IU/L
	Creatinine	1.1		0.7 ~ 1.4	mg/dL
	Na	137		135 ~ 145	mmol/L
	K	3.8		3.5 ~ 5.5	mmol/L
	Cl	101		98 ~ 110	mmol/L
	TCO2	26		24 ~ 31	mmol/L

Thank You

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