The Electronic Optometric Medical Record

"The Roadmap towards Paperless Practice"

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Agenda

- The paper records: current situation
- Electronic Health Record (EHR): The whole picture
- Electronic Optometric Medical Record (EOMR): definition
- Why EOMR?
- EOMR Fears, Realities, Challenges
- Our methodology
- EOMR: Guidelines for successful implementation
- The implementation plan
- EOMR demo
- Discussion

The Paper record

Issues:

- Possibility patient records being lost / misplaced
  - File may not signed out of file room
  - File may go to different clinics after appts (inter clinic referrals)
  - File handled by several staff, students and faculty members
- Various format and structure
- Handwriting legibility
- Difficult to search and analyze data
- Storage and retrieval of large number of paper records
- …

What are the Electronic Records?

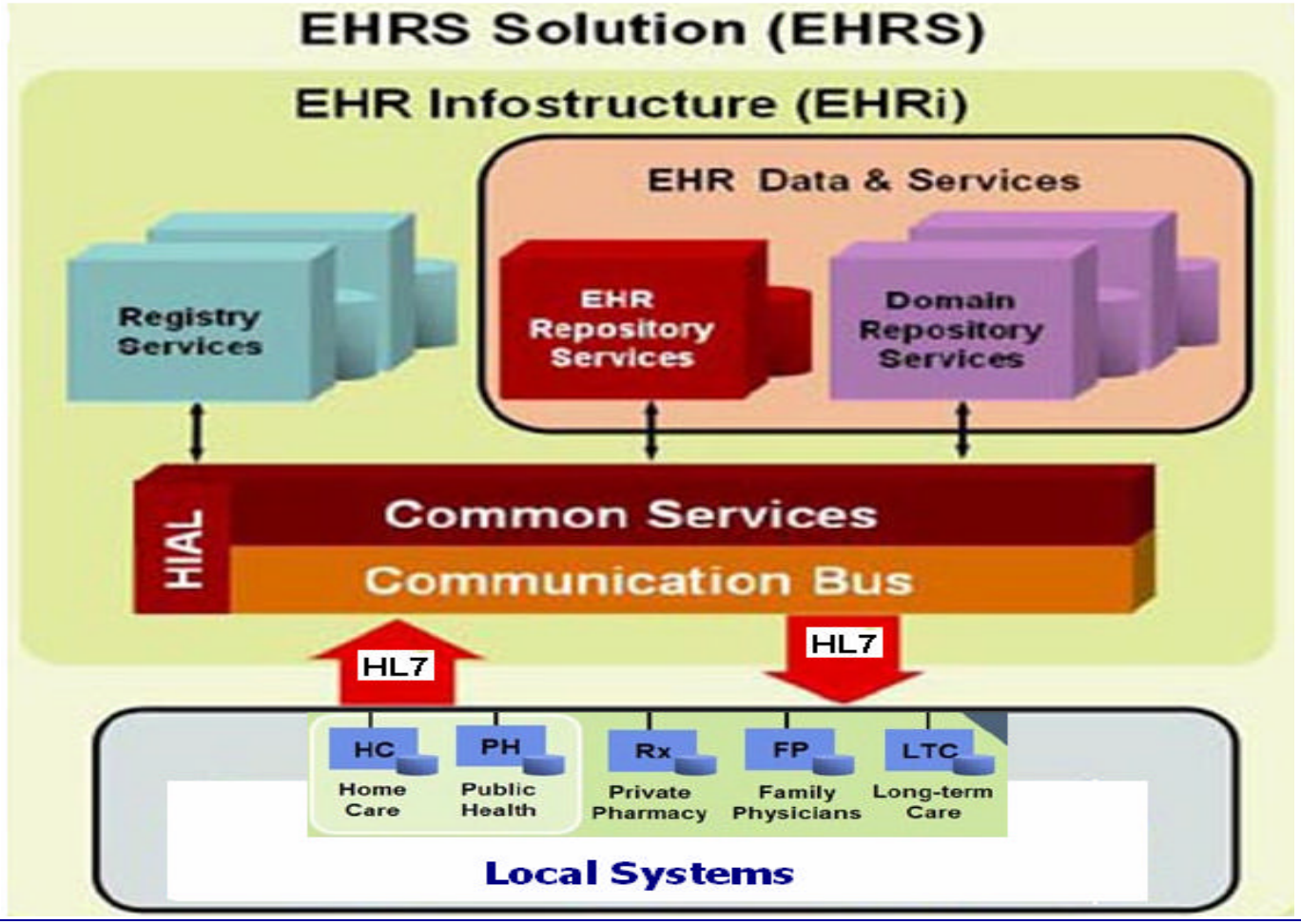
Electronic Health Record (EHR)

- Computer-based Patient Record (CPR), Longitudinal Health Record (LHR)
- Is a repository of all healthcare related information about individuals throughout their lifetime
- Accessible online from many separate, interoperable automated systems within an electronic network

Electronic Medical Record (EMR)

- Storage of one aspect of healthcare related information in local systems, in hospital, clinic, school, home care, etc.
- The building block of the EHR
- e.g. Electronic Optometric Medical Record (EOMR)

EHR: The whole picture



EHR Worldwide

"Three nations embark on EHR voyages"

"Electronic health care just received an intercontinental jump start with the launch of major electronic health record (EHR) projects in Australia, Canada and the United States."

- **USA**
  - President Bush has outlined a plan to ensure that most Americans have electronic health records within the next 10 years.
- **Canada**
  - Canada Health Infoway
  - Released the EHRS business and technology architecture blueprint

file://c:/EHRS.htm

Healthcare organizations and HIT

- Far behind when it comes to the use of information technology
- Under investment
- 100,000 to 200,000 people in US die in hospitals due to potentially preventable errors
- $$$$ Waste:
  - lack of information, repeating un-required tests, ineffective procedures and simple human errors

Technology is not the problem!

It is the process, and the people

EMR Decisions

- Government plans and support
- Academic and research institutes in US and Canada
- Private clinics
- The School of Optometry, University of Waterloo
  - Leader among academic centers
  - leader in teaching and research

EOMR: Expected outcomes

- Improves structure and accuracy of patient records
- Facilitates access to patient personal and health-related information
- Eliminates problems of legibility of the handwritten paper files
- Eliminates the problems of misplacing, altering, losing files
- Facilitate research with real data
- View and compare similar health cases
- Improves the overall healthcare delivery

EOMR: Fears and Realities

- Change the way we do our daily work
  - Leave our comfort zone
  - Change mode (Paper to Electronic real-time mode)

- Complicate our work environment
  - Are we happy with what we are doing now?
  - Current workflow analysis!!

- Makes the eye exam time longer
  - Eventually will become shorter

- Affects Doctor-Patient communication
- Affects Supervisor-Student communication
  - Positive VS Negative view

EOMR: Fears and Reality (Cont.)

Worsen communication	Enhance communication
Decrease Productivity	Increase Productivity
Affect our Expertise	extend our expertise

How System is Implemented and Managed?

Improves communication:

- Interact on computer screens…. Instant messaging
- Patients book their Appt, view their health related Info, get reminder emails, etc.

EOMR: Challenges

- Affects some aspects of the daily work
- Requires all users to learn the new technology
- Changes in the workflow and methods of documentation
- Unrealistic and inconsistent requirements
- Acceptance, Resistance
  - 45 -50 % Failure rate

The most advanced tools are only useful if people use them

Now we need EOMR

- Which way to go?
- Which system to buy?
- Trade shows
- Systems Demo
- RFP

With the technology we need a methodology	

Current situation in healthcare organizations

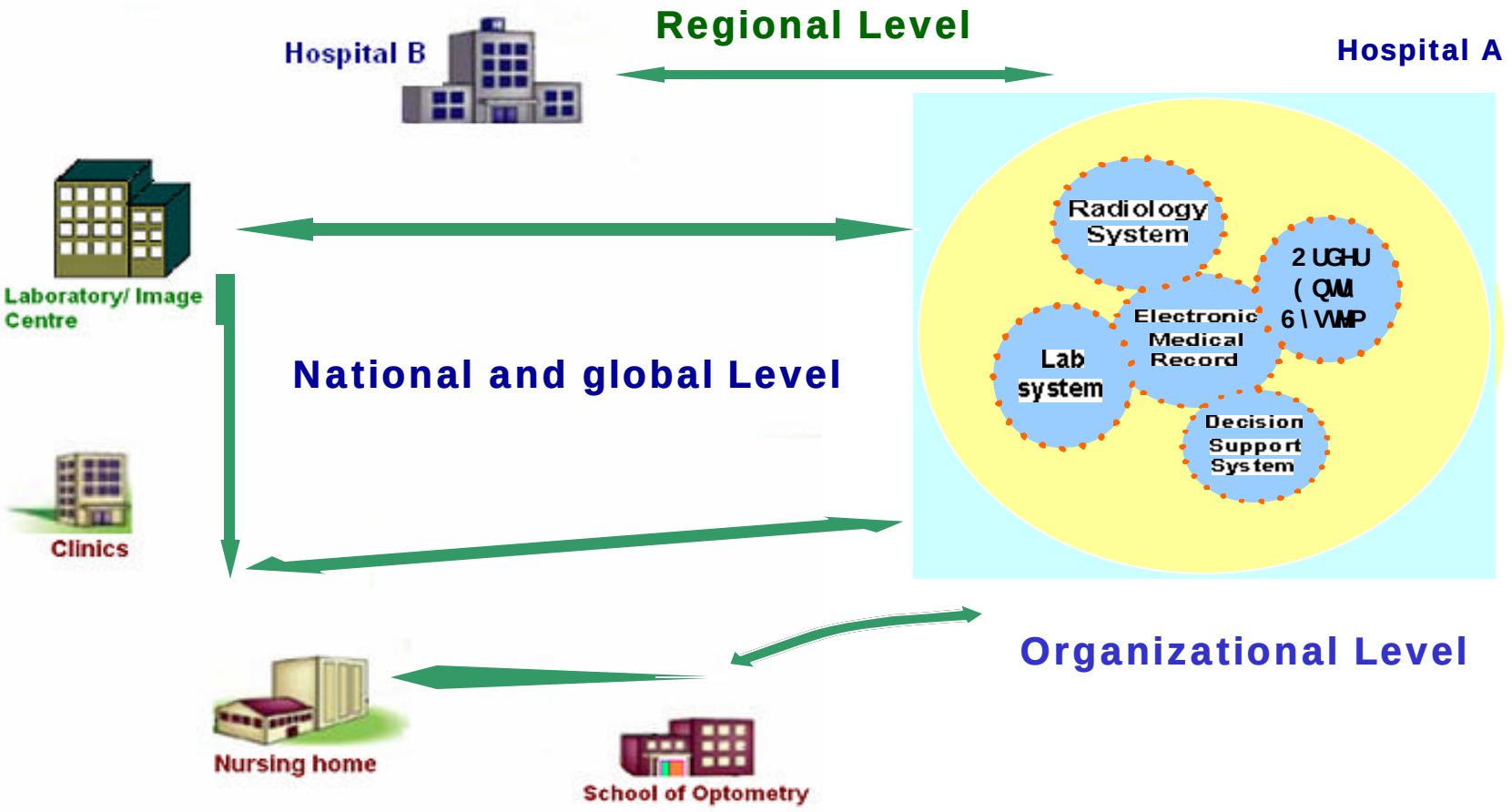
- **Large number of poorly integrated information systems:**
  - Different format, different data structure, different coding
  - Commercial-Off-The-Shelf (COTS)
  - Built in house

- **Overlapping and interdependencies among systems**

- **Isolated islands**
  - Tighter integration
  - Procurement methodology

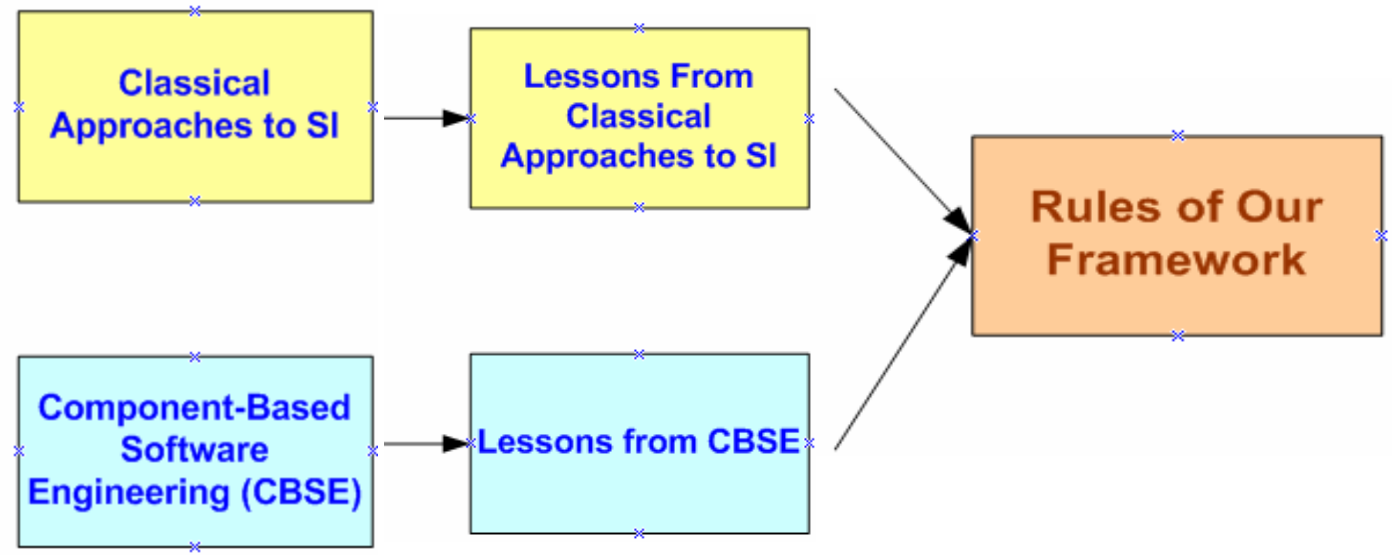
Admission discharge/billing
Anesthesia systems
Cytology systems
Diagnostic image management system
EKG carts containing EKG measures
Endoscopist systems
ER systems
Intensive care monitoring systems
Intravenous fluid infusion control
Laboratory systems
Nurse triage
Order entry systems
Outpatient pharmacy drug dispensers
Pharmacy system
Pulmonary function system
Radiology system
Risk management
Scheduling and clinic charge systems
Surgery scheduling (surgery logs)
Transcription systems
Ventilator management

Levels of systems integration in Healthcare



HIT Framework for Healthcare organizations

Inspired by the main principles and techniques used in the areas of SE, CBSE, Software architecture and SI



Benefits of our Framework

Provides useful guidelines to the following stakeholders:

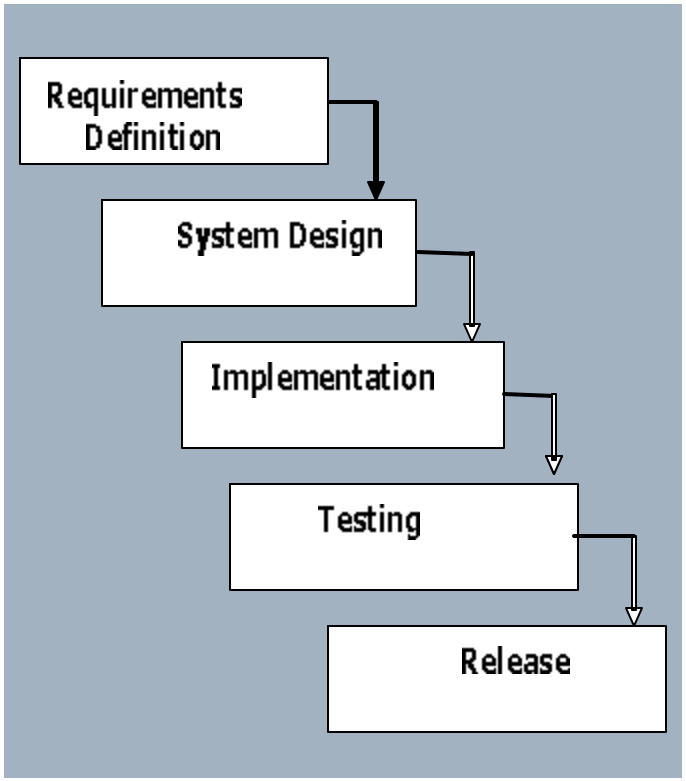
- **Software vendors:** related to developing systems that are integration-ready
- **System integrators:** related to producing coherent systems
- **System procurers:** related to evaluating and selecting appropriate systems within a given context
- **System users:** related to understanding the implications of requested changes or enhancements

The Rules of our Framework

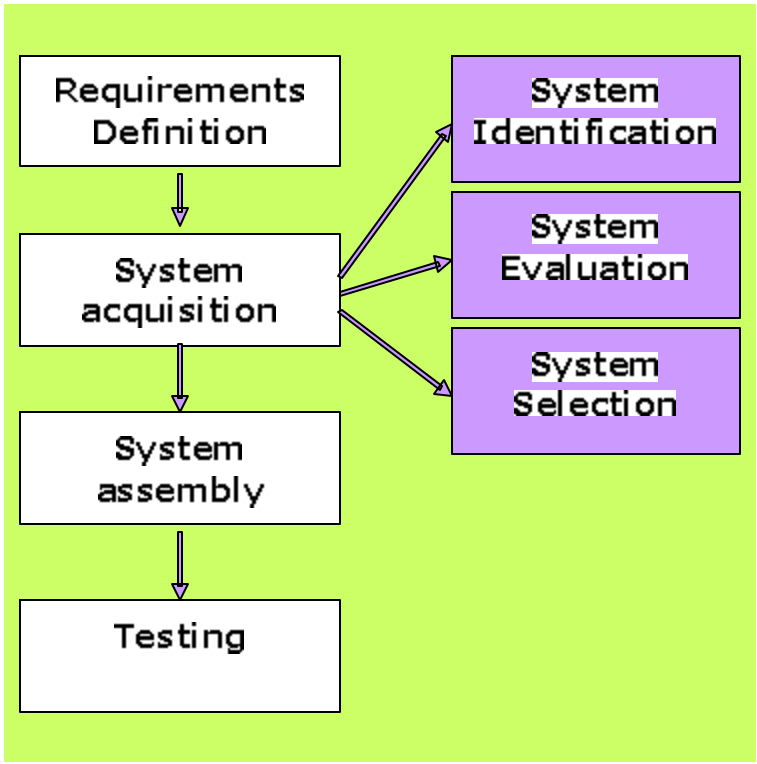
1. Define the overall system's requirements
2. Define the overall system's architecture
3. Select an architectural style
4. Adapt existing systems within the architecture
5. Define and document COTS System's requirements
6. Incorporate the above as criteria in a structured procurement technique
7. Consider future Systems in the architecture
8. Fit the new COTS into the architecture

System Development VS Procurement

SD - Waterfall model



Procurement model



Which way to go?

- Custom make from scratch
  - Development of large and complex systems
    - Negatives:
      - Long time: Years.
      - High cost.
      - We maintain it.
    - Positives:
      - Satisfy needs.
      - We have control.
- Buy a Commercial Off-The-Shelf (COTS)
  - Procurement process
    - Negatives:
      - Does not quit match needs.
      - Someone else has control.
    - Positives:
      - Less time.
      - Reduced cost.
      - Variety of choices.
      - Pre-tested.
      - Someone else maintain it.

Rule #1:
Define the overall enterprise system's REQ

Key activity in SE

- Functional & Non-Functional requirements
- Integration requirements: must address
  - Overall information needs and sources, data and Inter-system Communication standards

Carried further to address

- Information about vendor (Technical abilities, experience, stability in the market, ISO certification, etc.).
- Legal issues related to product procurement (terms and conditions, contract negotiation, licensing, etc.)

Define all the required systems and subsystems

- Which of the existing systems can be used as the building units
- Which systems can be addressed by COTS product or need to be rebuilt from scratch

Rule #1:
Define the overall System's REQ (Cont.)

Tools, techniques for requirements acquisition:

- **Knowledge engineering techniques:**
  - Useful when acquiring and organizing information about categories of products, suppliers, contracts, etc.
- **Requirements acquisition techniques:**
  - Such as ACRE (e.g. Maiden and Rugg, 1996) for acquiring customer requirements
- **Traditional methods of requirements elicitation:**
  - Interviewing customers and domain experts
  - Questionnaire, observation
  - Study of documents and software systems

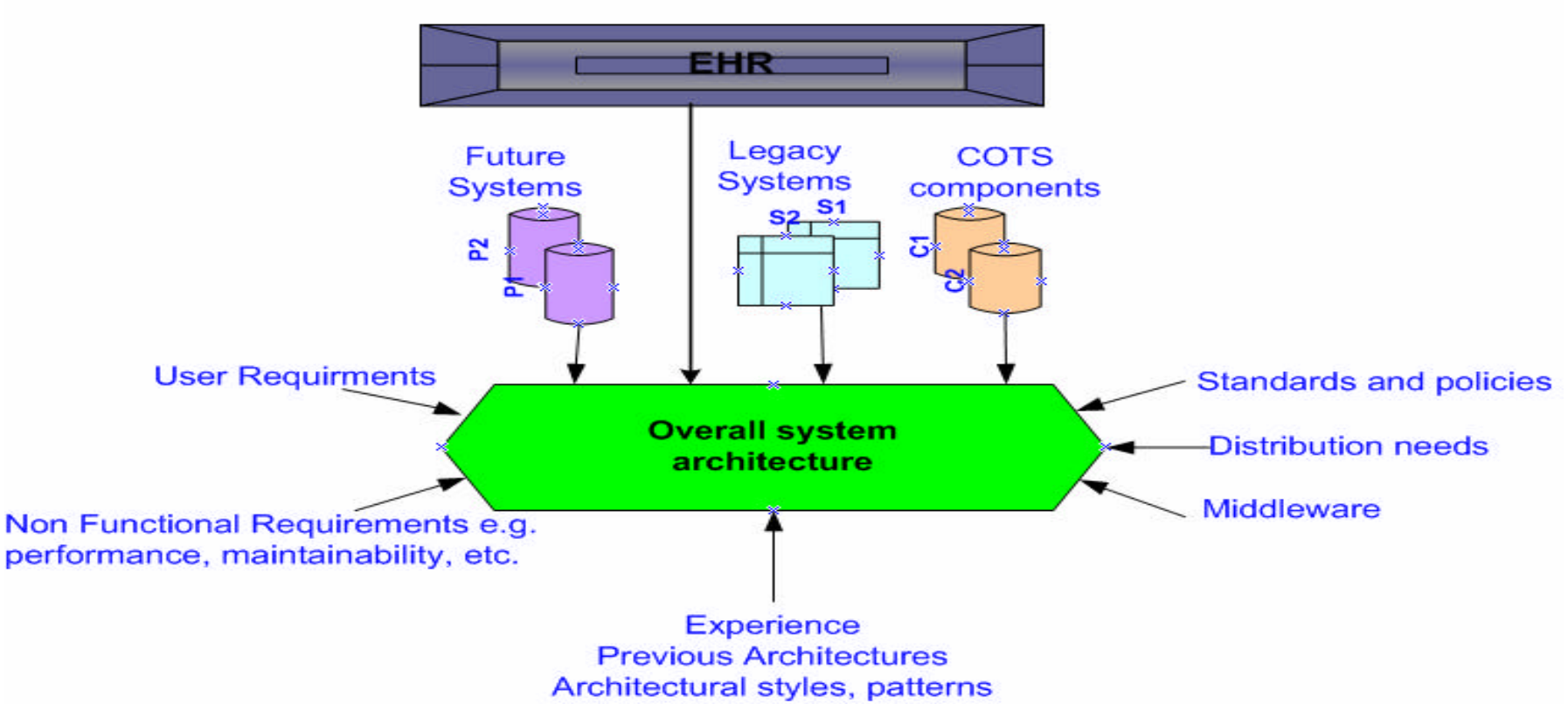
Rule #2:
Define the overall system's architecture

Central engineering activity in SD

- Similarity to building architecture
- D. Berry: Comparison of software architecture and building or remodeling a house

- Overall system architecture is often influenced by:
  - The architecture of the selected systems
  - Existing systems, Legacy systems
  - Existing middleware and standards

Rule #2:
Define the overall architecture (Cont.)



A good architecture is the one that supports the business goals and fulfills the organization's requirements

Rule #3:
Select an architectural style

Set of rules:

- **Identify the systems and connectors, together with**
- **Local or global constraints**

- **Example:**
  - **Layered architecture, pipe-filter, client server, blackboard, database, messaging, etc.**
  - **Strengths and weaknesses**
  - **Choose the proper style according to the problem in hand**

Rule #4:
Adapt existing systems within the architecture

- **Modifying systems using SI techniques:**
  - **Wrappers:** Custom-built pieces of code to separate unwanted functionalities. E.g. ODBC interface
  - **Glue:** Piece of code to overcome mismatches among different systems
  - **System tailoring:** To improve functionality or to allow additional functionalities
  - **Mediator:** can be viewed as an active agent coordinate between processes among different applications

Rule #5:
Define and Document System's REQ

- Addresses domain-specific needs and requirements
- Must extend beyond expected system functionalities
  - Include the system's properties and constraints (e.g., architecture requirements)
- These requirements will serve as evaluation criteria
- Describe the initial requirements at a high level of abstract
  - Consider COTS Systems as "black boxes"
  - Discriminate between systems in the early stages
  - More in-depth requirements when selecting specific COTS systems

Rule # 6:
Incorporate the above criteria in a structured procurement technique

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- Buying systems at random will result in a collection of mismatched parts
- Overcoming the problems associated with the integration of mismatched products is a major challenge
- Evaluating and selecting COTS products are key activities in a successful procurement

Rule # 7:
Consider future systems in the enterprise system architecture

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- Technology is changing at a rapid pace
- Uncertainty about future systems and standards

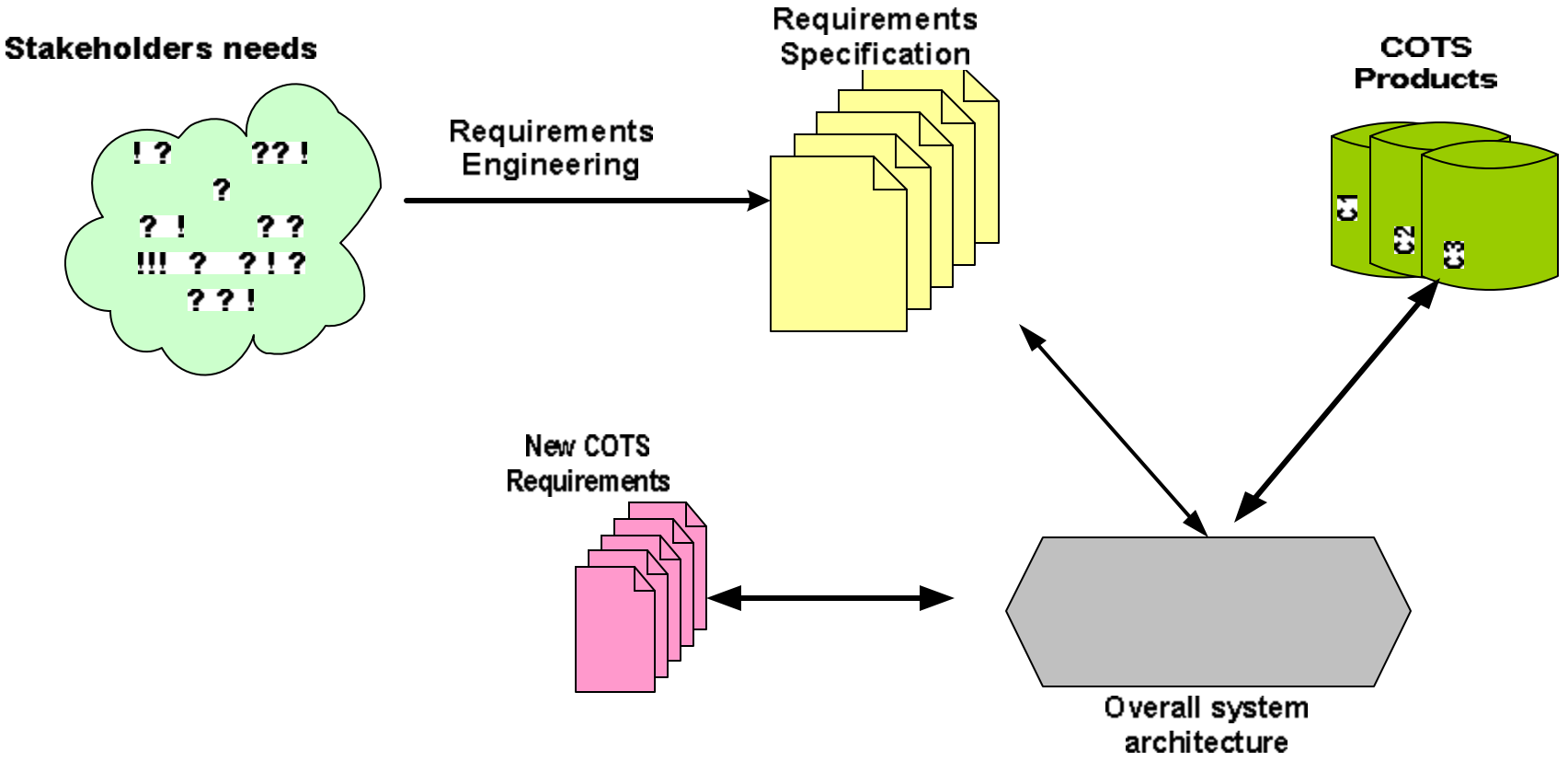
Guiding principles for acquiring new systems:

- Follow standards: HL7 and DICOM
- Buy extensible systems
- Select systems with system interfaces
- Avoid “black box” architecture

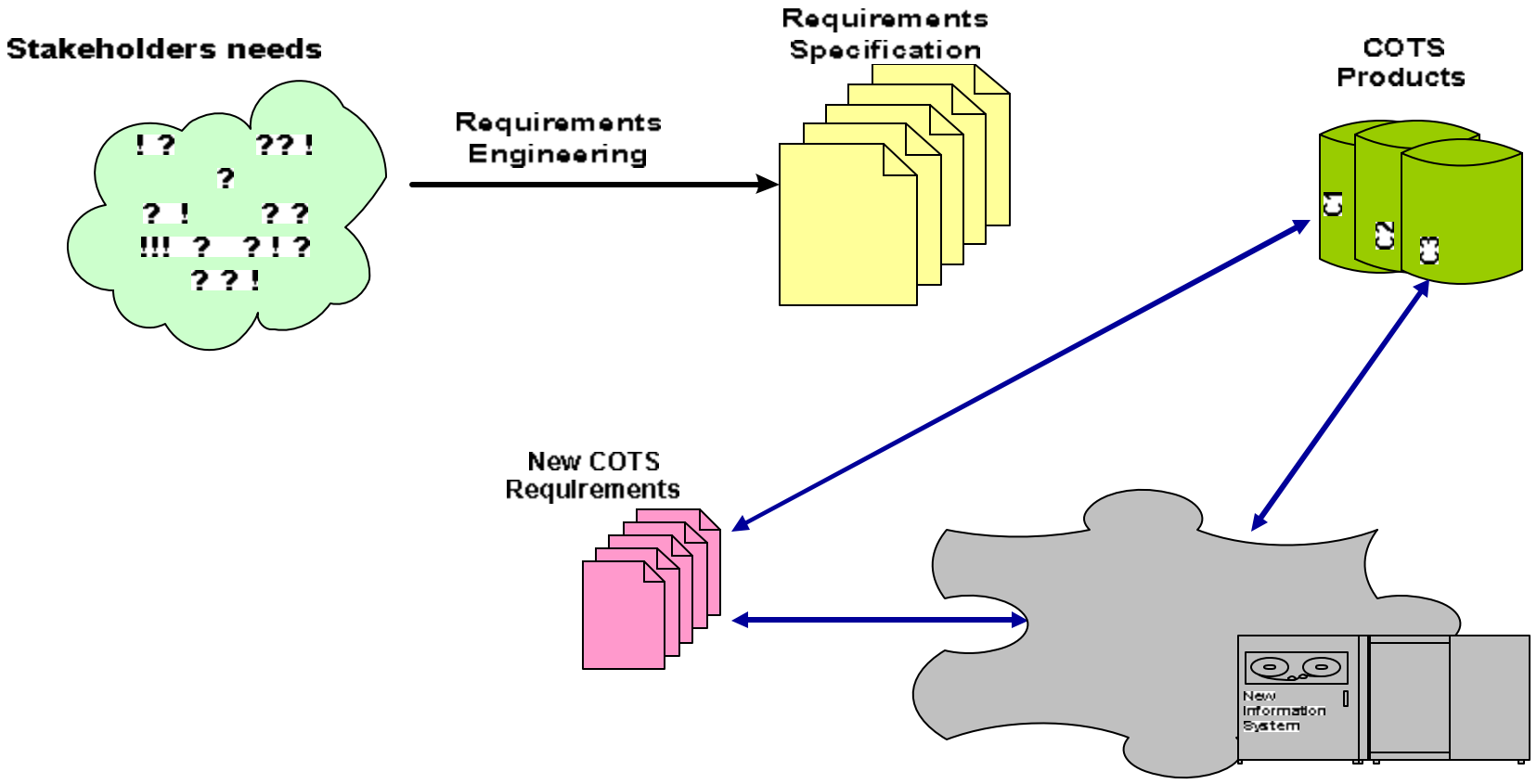
Example of future system: The Electronic Health Record (EHR)

- Key area of research in health informatics
- In Europe, Working group 1 of CEN TC251 (European Committee of Normalization, Technical Committee 251) (www.centc251.org)
  - Developed standards for structuring medical data in a uniform way
- In US, HL7 (www.hl7.org)
  - developed data exchange standards
- In Canada, Canada Health Infoway (www.infoway-inforoute.ca)
  - Released the Electronic Health Record solution (EHRS) business and technology architecture blueprint

The Rules of our Framework

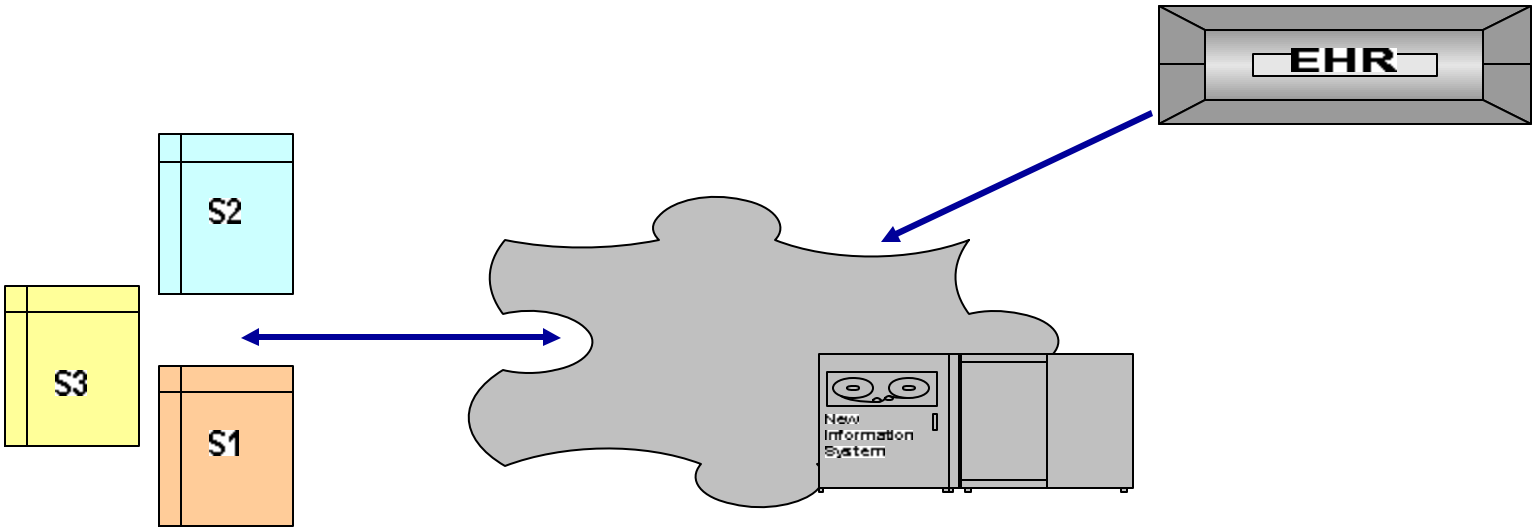


The Rules of our Framework



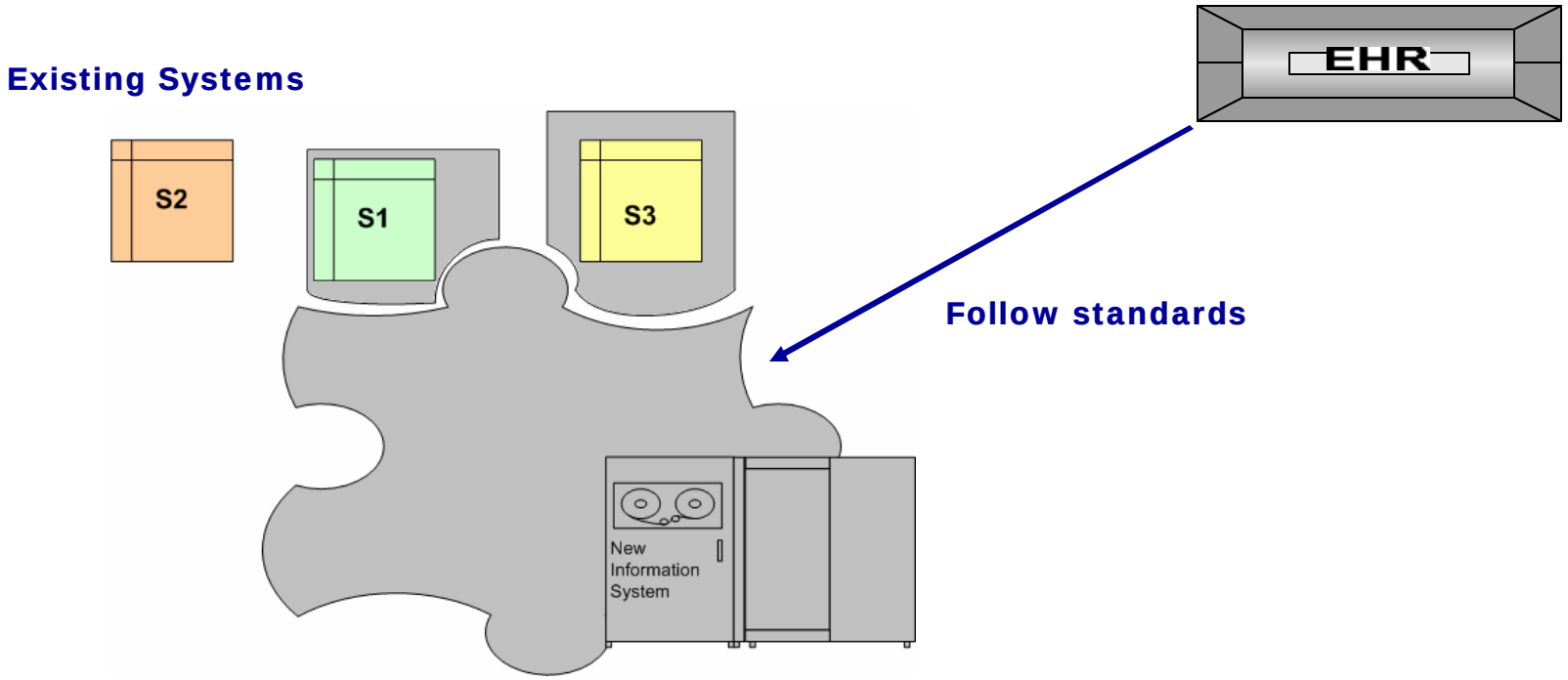
Overall system architecture

The Rules of our Framework



Overall system architecture

The Rules of our Framework



Overall system architecture

EOMR: Guidelines for successful implementation

- Get general consensus (get people to agree on the EOMR implementation)
- Meet key people in your organization
  - Determine interests, barriers, challenges to EOMR
  - Willingness to move towards the paperless EOMR
- Championship
- Project Management
- Expertise… Health Informatics, Technical

EOMR: Guidelines for successful implementation (Cont.)

- Define your Organization requirements
  - Realistic
  - Don’t fulfill everyone’s dream
- Discuss all the EOMR related issues
  - Build VS Buy
  - Which system to chose
  - Evaluation, selection methodology
  - Have a plan
- End Users (commitment, motivation, dedication, time investment)

EOMR: Guidelines for successful implementation (Cont.)

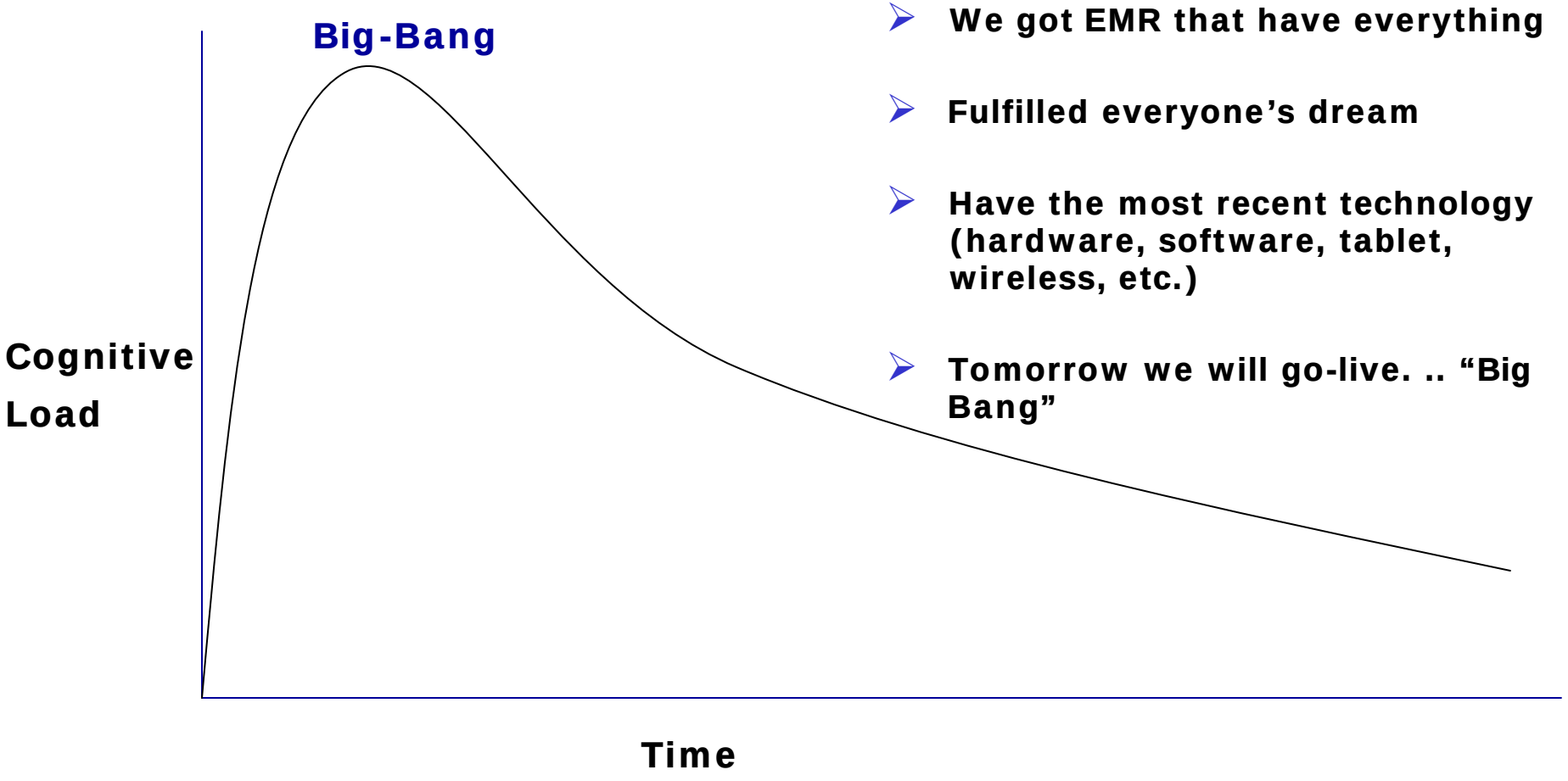
The implementation plan should address all details:

- **Clinical workflow in all specialty clinics**
- **Hardware selection, installation, software configuration, backup, security and performance monitoring**
- **Training**
- **Entering Old data into the system**
- **Maintenance, Testing and improvement**

EOMR: Our Experience

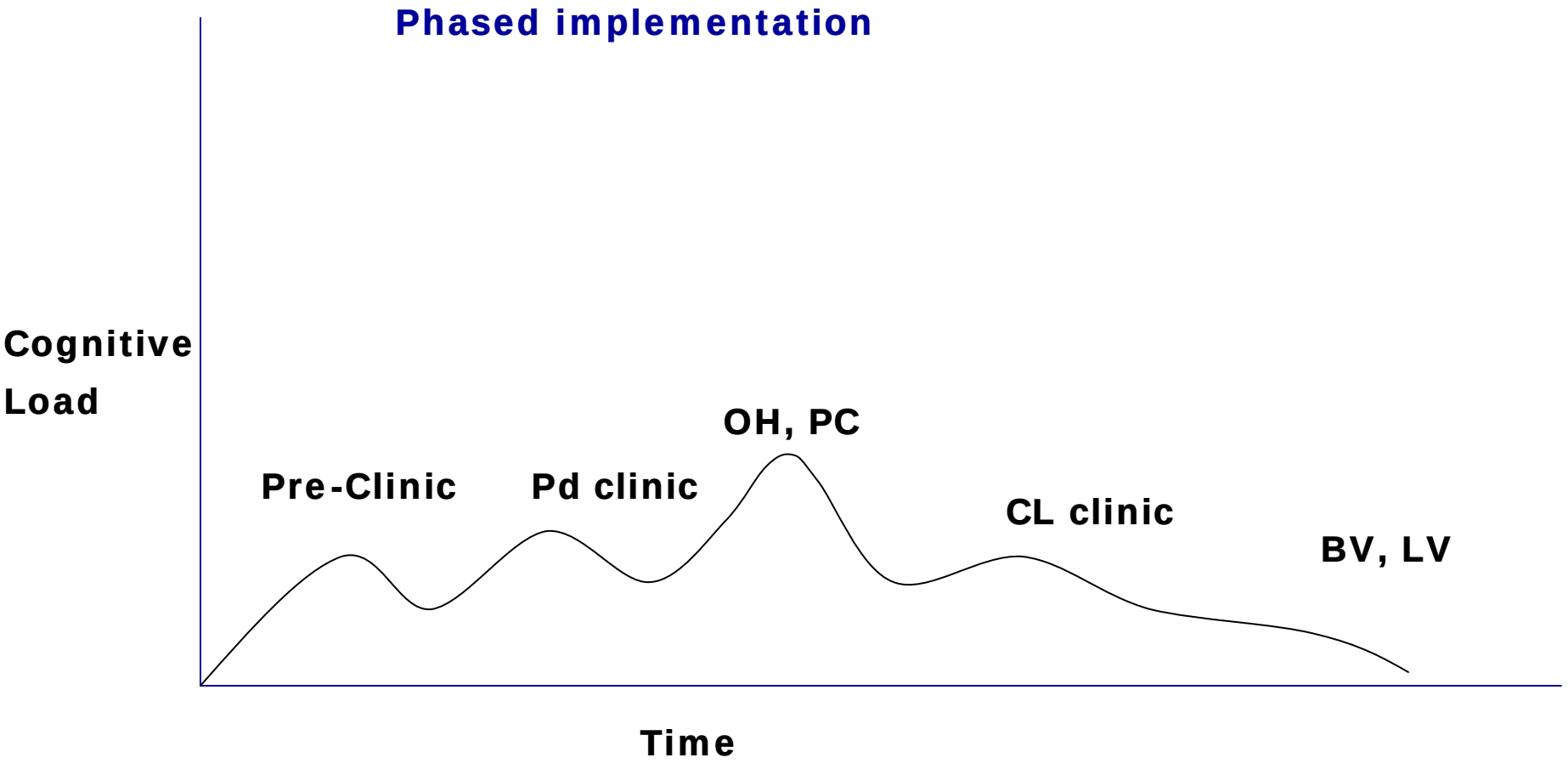
- We did all the work
- We chose the software that will meet our requirements and achieve our goals
- System based on the School's clinics procedures
- We work closely with the vendor fill the gaps
- Vendor's viability and stability in the market

EOMR: Big-Bang Implementation



- We got EMR that have everything
- Fulfilled everyone's dream
- Have the most recent technology (hardware, software, tablet, wireless, etc.)
- Tomorrow we will go-live. .. "Big Bang"

EOMR: Our Implementation Plan



EOMR: Research areas

- Organizational issues
- Sociological aspects of EOMR system
- The impact of the EOMR on the workflow
- The impact on EOMR on Research and teaching
- These aspects are vital

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EOMR Demo

Thank You

Discussion?!