

Service-Oriented Architecture, Health Informatics, and How They Relate

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Goal of Clinical Information Systems

Favorably influence the cost and quality of health care (including prevention) by providing pertinent information to providers, administrators, and patients in a timely manner

The specific uses that we need to support

- Data sharing
- Real time decision support
- Sharing of decision logic
- Direct assignment of billing codes
- Bio-surveillance
- Data analysis and reporting
 - Reportable diseases
 - HEDIS measurements
 - Quality improvements
 - Adverse drug events
- Clinical research
 - Clinical trials
 - Continuous quality improvement

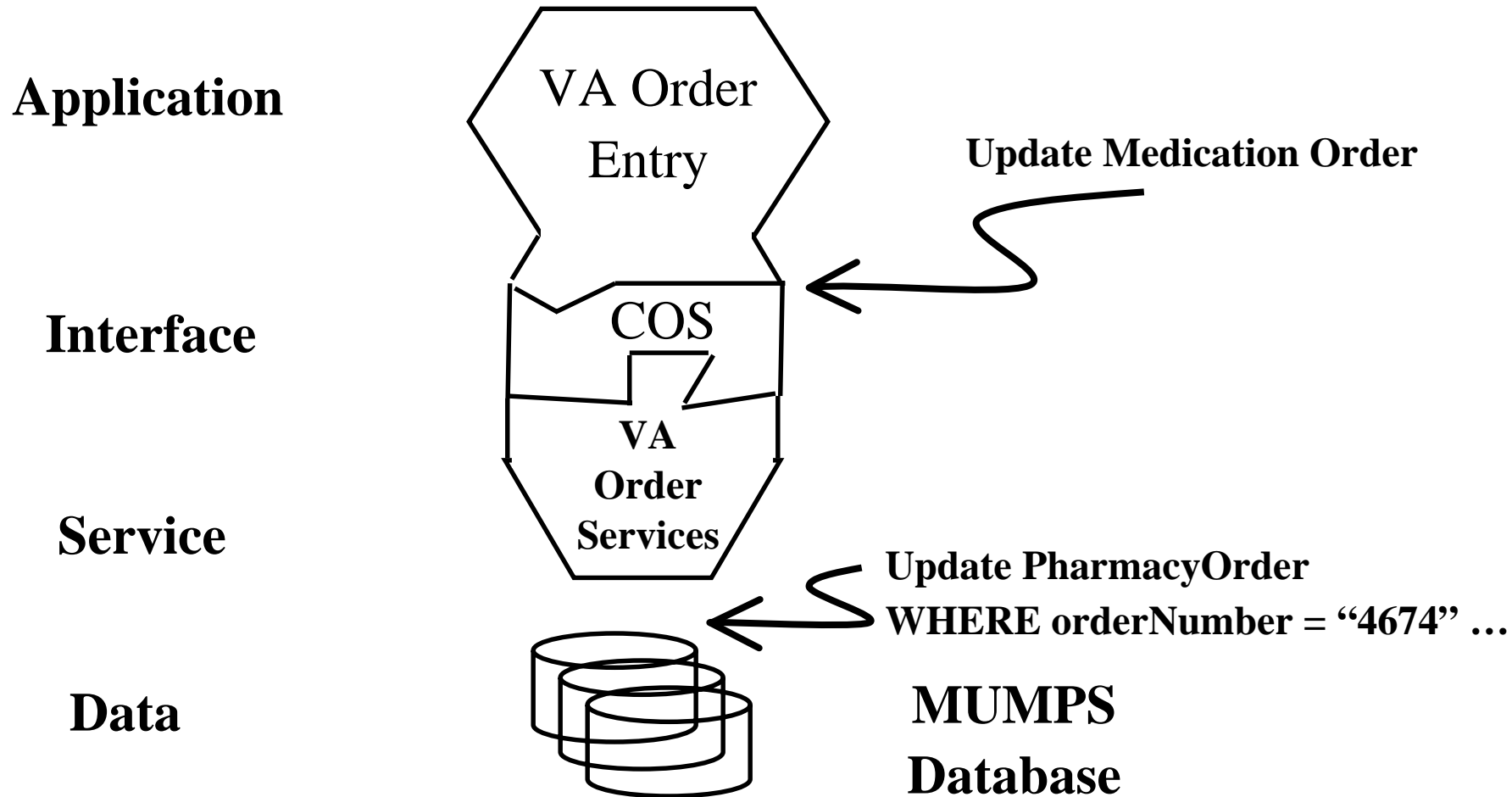
Goals for a future state

- Interoperability
 - Standard API's to patient care services
 - Standard codes
 - Standard data models
- Sharing of decision support modules
- Vendor of data repository adhere to a common service interface, and compete on cost, speed, reliability
- Application developers adhere to a common service interface, and compete on cost, ease of use, innovation

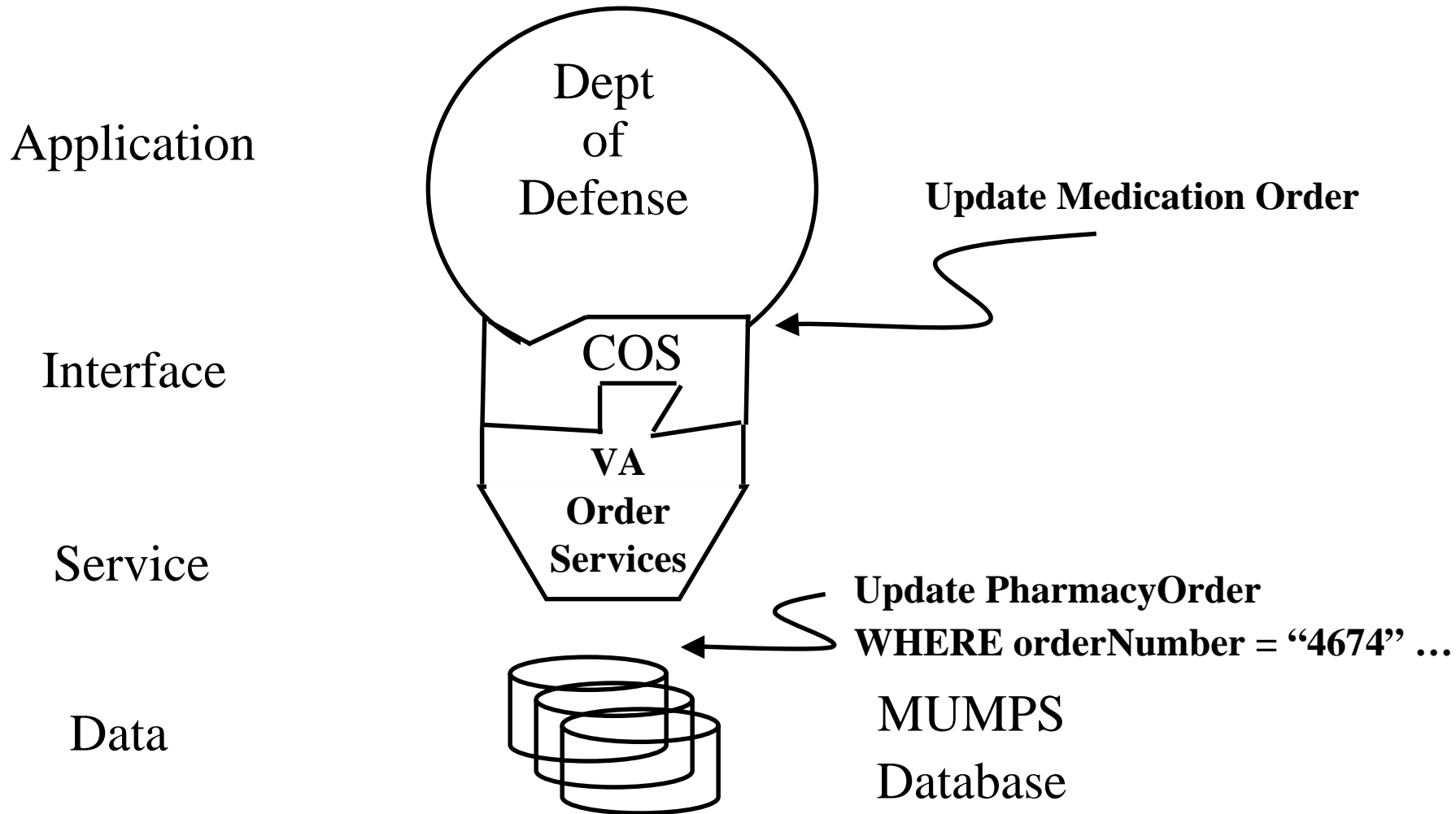
EHR Service API Standards

- One of the activities of the HL7 EHR Technical Committee
- Joint HL7 – OMG activity
- The goal is to provide standard application programming interfaces (APIs) to EHR content
- Client software doesn't have to know about specific vendor data structures and/or how to access them
- Server software can plug and play with many clients
- An opportunity to change how systems are developed

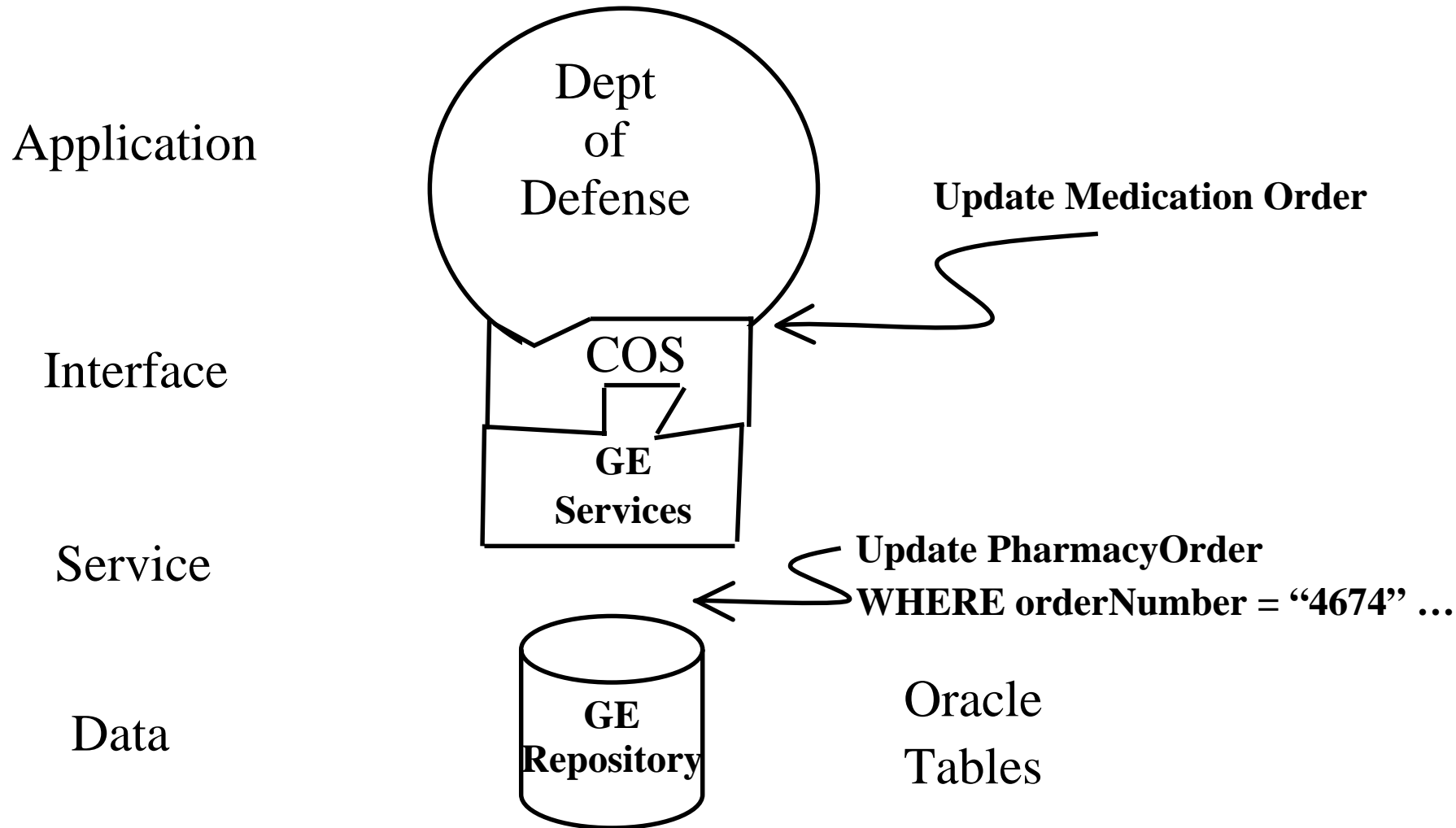
Order Entry API (adapted from Harold Solbrig)



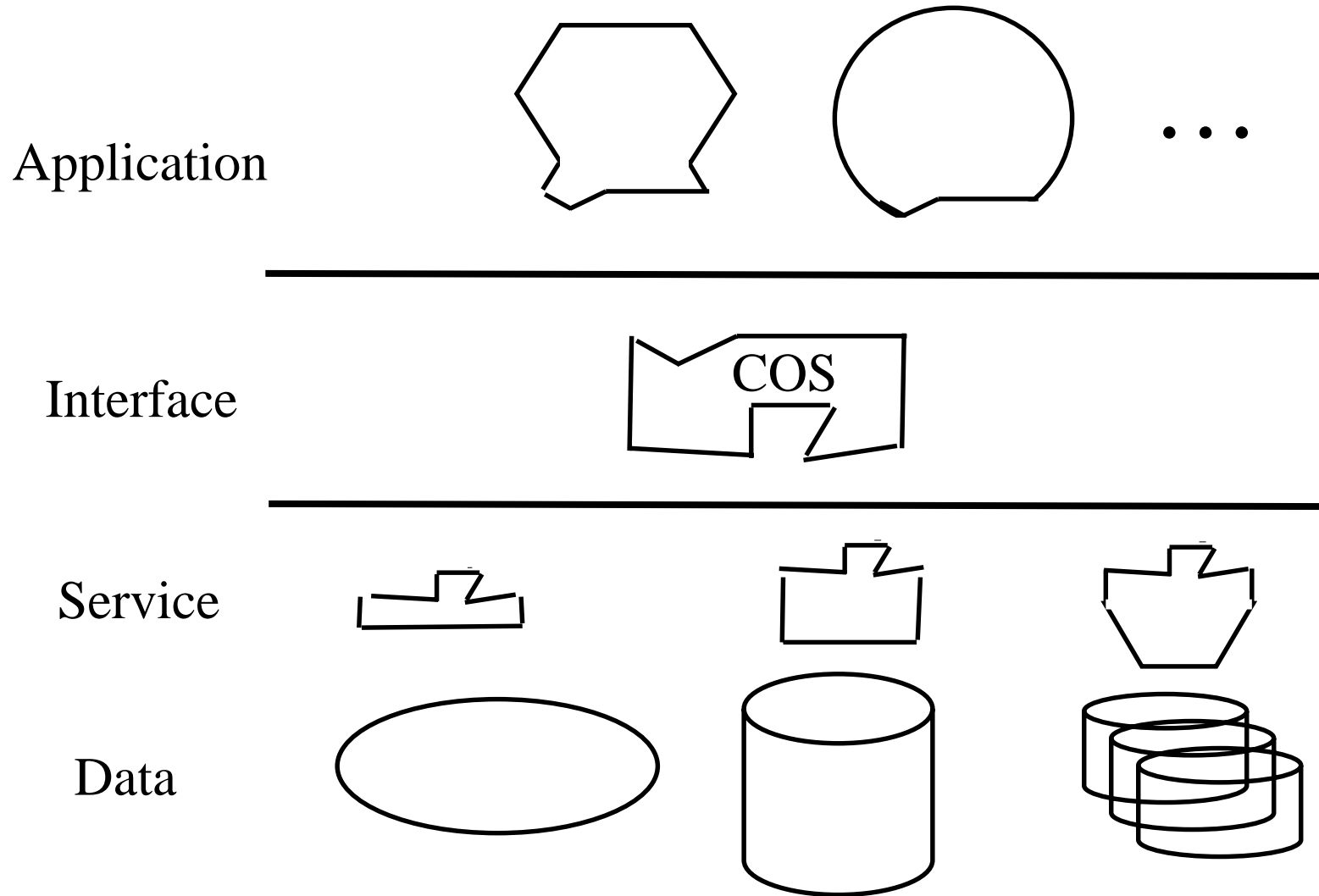
Order Entry API – Different Client, Same Service (adapted from Harold Solbrig)



Order Entry API – Different Server, Same Client (adapted from Harold Solbrig)



Order Entry API (adapted from Harold Solbrig)

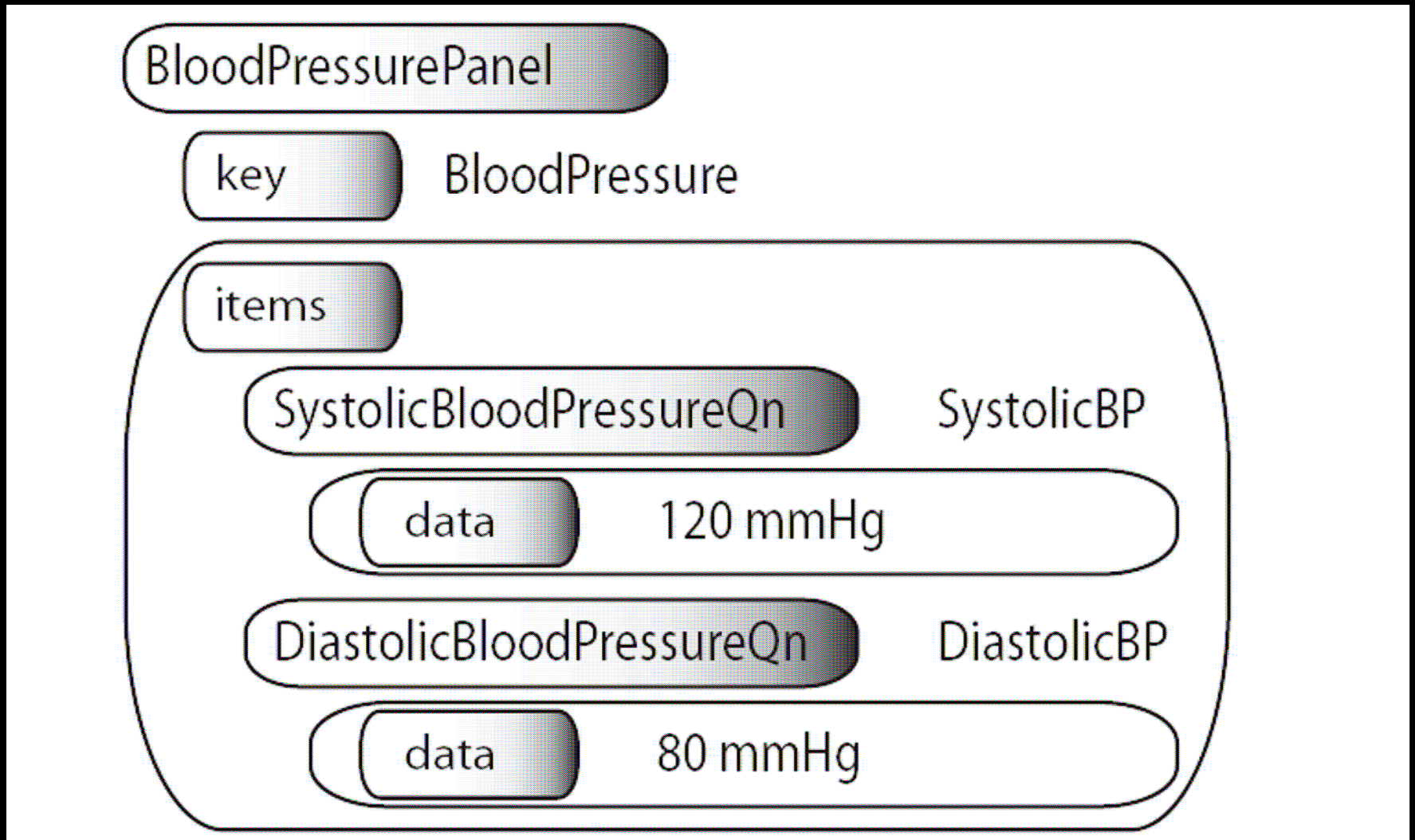


Why do we need detailed
clinical models?

Why do we need detailed clinical models?

- HSSP service definitions like RLUS (Retrieve, Locate, and Update Service), “stops short, however, of mandating the specific information content to be carried by the service...”
- BUT, “To create true interoperability between organizations, it is essential to allow a scalable and extensible model of semantic definition to be included in the description, access, and retrieval of a resource.”

A diagram of a simplified clinical model



Need for a standard model

- A stack of coded items is ambiguous (SNOMED CT)
 - Numbness of right arm and left leg
 - Numbness (44077006)
 - Right (24028007)
 - Arm (40983000)
 - Left (7771000)
 - Leg (30021000)
 - Numbness of left arm and right leg
 - Numbness (44077006)
 - Left (7771000)
 - Arm (40983000)
 - Right (24028007)
 - Leg (30021000)

What if there is no model?

Site #1

Dry Weight:

Site #2

Weight:

- Dry
- Wet
- Ideal

Too many ways to say the same thing

- A single name/code and value
 - *Dry Weight is 70 kg*
- Combination of two names/codes and values
 - *Weight is 70 kg*
 - *Weight type is dry*

Model fragment in XML

Pre-coordinated representation

```
<observation>  
  <cd>Dry weight (LOINC 8340-2) </cd>  
  <value>70 kg</value>  
</observation>
```

Post-coordinated (compositional) representation

```
<observation>  
  <cd>Weight (LOINC 3141-9) </cd>  
  <qualifier>  
    <cd> Weight type (LOINC 8337-8) </cd>  
    <value> Dry (SNOMED CT 13880007) </value>  
  <qualifier>  
    <value>70 kg</value>  
</observation>
```

Relational database implications

Patient Identifier	Date and Time	Observation Type	Observation Value	Units
123456789	7/4/2005	Dry Weight	70	kg
123456789	7/19/2005	Current Weight	73	kg

Patient Identifier	Date and Time	Observation Type	Weight type	Observation Value	Units
123456789	7/4/2005	Weight	Dry	70	kg
123456789	7/19/2005	Weight	Current	73	kg

How would you calculate the desired weight loss during the hospital stay?

More complicated items:

- Signs, symptoms
- Diagnoses
- Problem list
- Family History
- Use of negation – “No Family Hx of Cancer”
- Description of a heart murmur
- Description of breath sounds
 - “Rales in right and left upper lobes”
 - “Rales, rhonchi, and egophony in right lower lobe”

The essentials of the proposition

- The need for the clinical models is dictated by *what we want to accomplish* as providers of health care
- The *best clinical care* requires the use of computerized clinical decision support and automated data analysis
- *Clinical decision support* and *automated data analysis* can only function against *standard structured coded data*
- The *detailed clinical models* provide the *standard structure and terminology* (semantic signifiers) needed for clinical decision support and automated data analysis

What do we model?

- All data in the patient's EMR, including:
 - Allergies
 - Problem lists
 - Laboratory results
 - Medication and diagnostic orders
 - Medication administration
 - Physical exam and clinical measurements
 - Signs, symptoms, diagnoses
 - Clinical documents
 - Procedures
 - Family history, medical history and review of symptoms

Clinical modeling activities

- Netherlands
- United Kingdom - NHS
- Australia
- HL7
 - Patient Care
 - TermInfo
 - Templates
- Tolven
- Intermountain Healthcare – Detailed Clinical Models
- US Government Departments and Agencies
 - VA
 - NIH – Common Data Elements, caBIG

Questions