Curriculum Development Centers Program

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Component 8 Installation and Maintenance of Health IT Systems

Unit 7

System Interfaces and Integration

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What We'll Cover

- Definitions of interface and integration
- Why are integration capabilities important?
- What is an interface?
- Types of protocols
- Interoperability standards, e.g. HL7
  - How HL7 works
- Integration & EHR systems

What are Interface and Integration?

- Interface
  - Point of interaction between components
  - Mappings, translation tables
  - Example: Practice management system shares data with EHR via software interface.
  - Must be managed as systems get updated
- Integration
  - Process of combining various subsystems into larger system, ensuring that subsystems function together as a whole
  - IT: linking computing systems and software applications, physically or functionally

Why are Integration Capabilities Important?

- Healthcare often involves many isolated systems that increasingly need to be interfaced with EHR systems.
  - Too expensive to replace: cost of purchase + manpower + training + lost productivity
  - Tailored to meet specific departmental needs

Pre-Existing Systems to Consider with an EHR

- Clinical information
  - Vital sign measurements
  - Results reporting
  - Clinical documentation
  - Order management, computerized provider order entry (CPOE)
  - Consults tracking
  - Clinical rules engine, alerts, reminders
  - Patient education
- Patient management
  - Patient registration
  - Admission/discharge/transfer (ADT)
  - Scheduling
- Labs
  - Chemistry
  - Microbiology
  - Anatomic pathology
- Pharmacy/Medications
  - Inpatient, outpatient
  - Barcoding, electronic medication administration record (MAR)
  - Adverse drug reactions (ADRs)
- Radiology
  - General radiology
  - Nuclear medicine
  - Clinical image viewing (PACS)
- Nutrition and food service
  - Food service management
  - Clinical nutrition

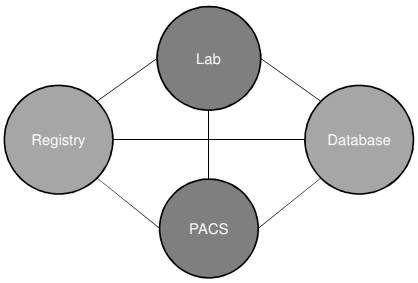
Common Interface Methods

- Point-to-point
  - Direct connection between each component
- Interface engine
  - Connected via centralized location

Interface Method: Point-to-Point

- Traditional method
- Requires that each component have direct connection points to other components
- Disadvantages: Labor-intensive to set up and maintain; can require a large number of connections
- Advantage: direct, secure linkage

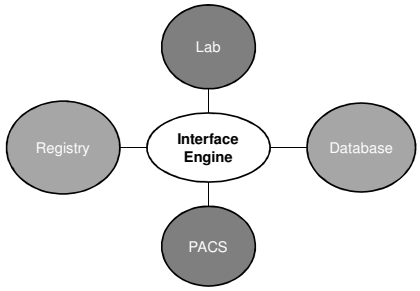
Point-to-Point Illustration



Interface Method: Interface Engine

- Routes data through centralized location, reduces number of separate connectivity points
- Advantages: flexible, scalable, easier to install and maintain, data consolidation, centralized management
  - Good option if unable to purchase full-featured EHR.
- Older-generation interface engines had disadvantage of high cost: long time to build, extensive programming, scripting skills.

Interface Engine Illustration



Types of Interface Protocols

- eXtensible Markup Language (XML)
- Fixed-length formats
- Variable-length delimited formats
- Java
- HL7 (Health Level 7)
  - Widely used for interfacing between healthcare systems

HL7 as a Protocol

- Name “Health Level 7” refers to 7th layer of ISO OSI reference model: “application” layer.
- HL7 represents ANSI (American National Standards Institute) at ISO (International Org. for Standardization) for health data.
- HL7 messages
  - Based on messaging protocol.
  - Body comprised of many purposed segments, each on own line.
  - Segments denoted by 3-letter notation indicating purpose.

Why is HL7 Important?

- First standard protocol for communication between EHR components.
- Allows for open system architecture (rather than closed/proprietary)
  - Interfacing between systems
  - Independent of vendor
  - New systems can be added without modifying original source code.

What is the HL7 Standard?

- Method for moving clinical data between independent medical applications in near-real time
- Structured, message-oriented framework for communicating between healthcare applications
- Acknowledged healthcare industry standard
- Not “plug and play”, but designed to be customizable

How do HL7 Messages Work?

- Sent & received by various EHR applications as requests and updates are made.
- 3-letter acronym at beginning of first line denotes message type.
- Single segment (line) contains many different fields/sub fields separated by delimiters, e.g.:

|	Pipe	Field delimiter
^	Carrot	Sub-field delimiter
~	Tilde	Repeating field delimiter
\	Backslash	Escape character
&	Ampersand	Sub-sub-field delimiter

HL7 Examples

- What can we tell from this segment?

```
NK1||Smith^John^^^^|SPO||(919)5
55-5555||EC||||||||||||||||||||
```

  - "NK1" = "Next of Kin" segment
  - "John" = subfield in third field of segment.
  - 5 of first 8 fields of this segment contain data.

HL7 Examples (cont'd)

- Sample full HL7 message:

```
MSH|^~\&||GA0000||MA0000|199705221605||VX
Q^V01|19970522GA40|T|2.3.1|||AL
QRD|199705221605|R|I|19970522GA05|||25^RD
|^SMITH^JOHN^FITZGERALD^JR|VXI^VACCINE
INFORMATION^HL70048|^SIIS
QRF|MA0000||||256946789~19900607~MA~MA999
99999~88888888~SMITH^JACQUELINE^LEE~BOUVI
ER~898666725~SMITH^JOHN^FITZGERALD~822546
618
```

  - A lot can be gleaned from the first line.

HL7 Examples (cont'd)

- First line of message:

```
MSH|^~\&||GA0000||MA0000|19970522
1605||VXQ^V01|19970522GA40|T|2.3.
1|||AL
```

  - "MSH" denotes "New Message".
  - 9th field always tells what the message will be, with 2 subsets. "VXQ^V01" = vaccination history query.

HL7 Examples (cont'd)

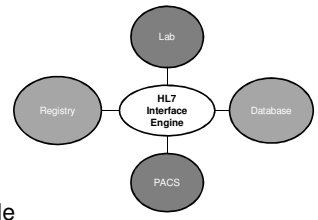
- Rest of message:

```
QRD|199705221605|R|I|19970522GA05|||25^RD|^SMITH^JOHN^F
ITZGERALD^JR|VXI^VACCINE INFORMATION^HL70048|^SIIS
QRF|MA0000|||256946789~19900607~MA~MA99999999~88888888
~SMITH^JACQUELINE^LEE~BOUVIER~898666725~SMITH^JOHN^FITZ
GERALD~822546618
QRD|199705221605|R|I|19970522GA05|||25^RD|^SMITH^JOHN^F
ITZGERALD^JR|VXI^VACCINE INFORMATION^HL70048|^SIIS
QRF|MA0000|||256946789~19900607~MA~MA99999999~88888888
~SMITH^JACQUELINE^LEE~BOUVIER~898666725~SMITH^JOHN^FITZ
GERALD~822546618
```

  - "QRD" = Query definition segment.
  - "QFR" = Segment query filter.
  - Dozens of segment headers.

HL7 Interface Engine

- Helpful for incorporating EHR into legacy environment.
- Different standards: conceptual, document, application, messaging
- Flexible, customizable



Integration Between EHRs

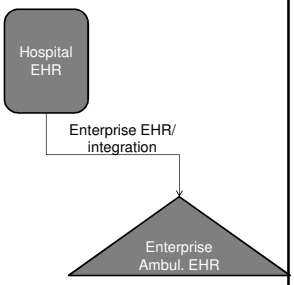
- EHR integration is growing trend.
  - "Interoperability": enabling healthcare entities to share patient information
  - Enhancing billing/payment & reform initiatives
  - Streamlining workflows between hospitals & clinics
  - Meeting HITECH "meaningful use" criteria
- Integration is still maturing. More standards and practices are being developed.

Integration Between EHRs (cont'd)

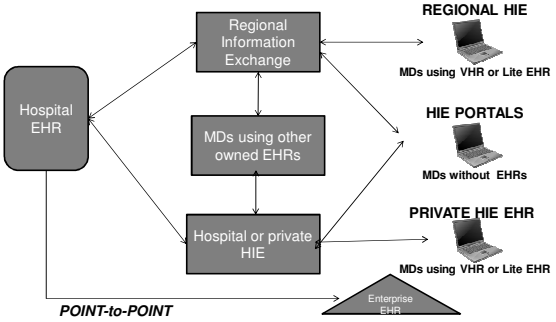
- To demonstrate "meaningful use", EHRs must be able to exchange information with other certified EHR systems beyond their own environments.
  - Also need to link hospital EHR to ambulatory EHRs.
- Two methods for interfacing:
  - Point-to-point
  - Health Information Exchange (HIE)

Point-to-Point EHR Interface

- Traditional connection method
- Connect via variety of media
- Drawbacks: cost, customization, high maintenance



Point-to-Point vs. HIE



Summary

- Interface – A point of interaction between components.
- Integration – Combining various subsystems into one larger system and ensuring subsystems function together as a whole.
- Disparate systems require some way to connect to newer EHR systems to ensure interoperability.
- Point-to-point connectivity – Traditional method requiring that each component have direct connection points to other components.
- Interface Engines – Allow disparate systems to connect to each other more efficiently via interface that deciphers info from each component.

Summary (cont'd)

- HL7 messaging
  - Standard of choice for communication between different EHR components.
  - Based on messaging standard, uses groupings of segments to relay information throughout EHR system in near-real time.
  - Promotes "open architecture", which allows anyone to interface systems using appropriate protocols, independent of vendor.
- Health Information Exchanges act as interface engines for healthcare institutions for an entire region.

Reference

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