HL7 International

• Health Level Seven  
  – Application layer (layer 7) in OSI model for medical purposes

• An international standards development organization (SDO)  
  – Founded in 1987

• Vision: to create the best and most widely used standards in healthcare  
  – Offers a comprehensive set of standards for clinical/medical uses
HL7 Work Groups

- Affiliate Due Diligence
- Anatomic Pathology
- Anesthesia
- Architectural Review
- Arden Syntax
- Attachments
- Board Motions
- Child Health
  - Clinical Decision Support
  - Clinical Genomics
  - Clinical Interoperability Council
  - Clinical Quality Information
  - Clinical Statement
  - Community Based Collaborative Care
  - Conformance & Guidance for Implementation/Testing
- Domain Experts Steering Division
- Education
  - Electronic Health Records
  - Electronic Services
  - Emergency Care
- Financial Management
- Foundation and Technology Steering Division
- Governance and Operations
- Health Care Devices
- Imaging Integration
  - Implementable Technology Specifications
  - Infrastructure and Messaging
  - International Council
  - International Mentoring Committee
- Marketing
  - Mobile Health
- Modeling and Methodology
- Nomination Committee
- Orders and Observations
- Organizational Relations
- Outreach Committee for Clinical Research
- Patient Administration
  - Patient Care
  - Pharmacy
  - Policy Advisory Committee
  - Process Improvement
  - Project Services
  - Public Health and Emergency Response
  - Publishing
- Recognition and Awards
  - Regulated Clinical Research Information Management
  - RIM Based Application Architecture
- Security
  - Services Oriented Architecture
  - Strategic Initiative Committee
  - Structure and Semantic Design Steering Division
  - Structured Documents
- Technical and Support Services Steering Division
- Technical Steering Committee
  - Templates
  - Terminology Authority
  - Tooling
- Vocabulary
Health information standards

Scope of HL7

Information Model
HL7 V3 RIM, EN13606, FHIR, CIMI, ...

Terminology
ICD, SNOMED-CT, LOINC, FMA, ...

Message
Document
API
Service

Transport
HTTP, IHE XDS.b, IHE XDM, ...
Message, Document, and API

- System or Application
  - Message (HL7 V2.X)

- System or Application
  - Document (HL7 CDA)

- System or Application
  - API (HL7 FHIR)

- System or Application

Action

View

Archive

MOBILE APPS
HL7 V2 & V3 Standards

Version 2.x

Messaging

Legacy Standards

Version 3

Foundation

Messaging

Documents

Services

Model Based Standards

CDA / SPL

GELLO
ITS – XML/UML/Abstract Data Types
ITS Structures Transport Specifications
RBAC
Refinement, Constraint and Localization (RCL)
RIM (Reference Information Model)

Common Terminology Services (CTS)
Service Oriented Architecture (SOA) Service Definition

※ Source: HL7  http://www.hl7.org/
HL7 V3

- HL7 V3 RIM (Reference Information Model)
  - Basic data model for HL7 V3 standards
  - Explicit representation of semantics and relationships
  - Consists of six backbone classes
RIM UML Instance Scenario
V3 Message

- Despite great anticipation, V3 messaging is not popular
  - Hardly adopted in US.
  - Some adoptions in Europe, Canada, and Australia
- Major problem: too complex!
- FHIR (Fast Healthcare Interoperability Resources) is next generation messaging from HL7
  - Less complex, more flexible
  - Could be HL7 V4
Clinical Document Architecture (CDA)

- The most widely adopted application of HL7 V3
- For clinical information exchange/sharing between healthcare providers
CDA = Header + Body

• CDA Header
  – Patient, provider, and encounter information

• CDA Body
  – Clinical report
  – Discharge Summary
  – Care Record Summary
  – Progress Note
  – H&P
  – Public health report
  – … any content that carries a signature
CDA Sample

Sample

Good Health

Patient: Henry Levin, the 7th
Birthday: September 24, 1932
Consultant: Robert Doña, MD

History of Present Illness

Henry Levin, the 7th, is a 67 year old with a history of asthma in his teens. He has been able to be weaned off steroids.

Past Medical History

- Asthma
- Hypertension (see HTN cda for details)
- Osteoarthritis, right knee

Medications

- Theodrin 200mg BID
- Preventer inhaler Spuls QID PRN
- Prednisone 20mg qd

- Header
- Body
  - Readable: required
  - Computable: optional

- <recordTarget>
  - <patient>
    - <names>
      - <given>Henry</given>
      - <family>Levin</family>
    - <genderCode>"M"</genderCode>
    - <birthTime value="19320924" />
  - </patient>
  - <providerOrganization>
    - <component>
      - <structuredBody>
        - <section>
          - <component>
            - <section>
              - <component>
                - <content style="Bold">
                  Henry Levin, the 7th
                </content>
              - </section>
            - </component>
          - </section>
        - </section>
      - </structuredBody>
    - </component>
  - </providerOrganization>
- </recordTarget>
- <custodian>
CDA body: Machine processable

Model-based computable semantics

- Observation
- Procedure
- Organizer
- Supply
- Encounter
- Substance Administration
- Observation Media
- Region Of Interest
- Act

Optional
CDA: Incremental semantic interoperability

- Standard HL7 metadata
- Simple XML for point of care human readability
- RIM semantics for reusable computability ("semantic interoperability")
How CDA is derived from the RIM

RIM classes are copied, renamed and constrained

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How the CDA is Developed and Maintained: just enough HL7 Development Framework

<table>
<thead>
<tr>
<th>Reference Information Model</th>
<th>RMIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• subset of RIM</td>
<td></td>
</tr>
<tr>
<td>• tighten constraints</td>
<td></td>
</tr>
<tr>
<td>XML Schema</td>
<td></td>
</tr>
<tr>
<td>• algorithm</td>
<td></td>
</tr>
<tr>
<td>Hierarchical Description</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HL7 and Health Level Seven</th>
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<tbody>
<tr>
<td>1.</td>
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<tr>
<td>5.</td>
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</table>

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Example: Diagnosis of asthma
Example: Diagnosis of asthma

<observation classCode="OBS" moodCode="EVN">
<templateId root="2.16.840.1.113883.10.20.22.4.4"/>
<!-- Problem Observation template -->
:id root="d11275e7-67ae-11db-bd13-0800200c9a66"/>
<code code="409586006"
    codeSystem="2.16.840.1.113883.6.96"
    displayName="Complaint"/>
<statusCode code="completed"/>
<effectiveTime>
    <low value="1950"/>
</effectiveTime>
<value xsi:type="CD" code="195967001"
    codeSystem="2.16.840.1.113883.6.96"
    displayName="Asthma"/>
...

Code is the question: “what is the complaint?”
Value is the answer: “Asthma”
FHIR, FHIR, and FHIR!

- **Fast Healthcare Interoperability Resources**
  - Strong candidate for HL7 V4
  - More rigorous than V2, more flexible than V3
  - Mostly likely replace V2 and V3 messaging
  - Likely replace CDA, but not so sure
Background

- Increasing pressure to broaden scope of sharing
  - Across organizations, disciplines, even borders
  - Mobile & cloud-based applications
  - Faster – integration in days or weeks, not months or years

- JSON Report
  - API-level standards are needed
Manifesto

- Focus on Implementers
- Target support for common scenarios
- Leverage cross-industry web technologies
- Require human readability as base level of interoperability
- Support multiple paradigms & architectures
FHIR is Free!

- Unencumbered – free for use, no membership required
- [http://hl7.org/fhir](http://hl7.org/fhir) + other versions
- Licensed under CC0: True public domain
- Any use is allowed
- HL7 enforces the trademark protection
  - FHIR™ and
  - Logo
Paradigm

- 4 interoperability paradigms
Paradigm - REST

- REST (REpresentational State Transfer)
  - One of S/W Architectures
  - HTTP URI + HTTP Method

<table>
<thead>
<tr>
<th>REST Element</th>
<th>Meaning</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource</td>
<td>resource</td>
<td>HTTP URI</td>
</tr>
<tr>
<td>Method</td>
<td>method for resource</td>
<td>HTTP Method(CRUD)</td>
</tr>
<tr>
<td>Message</td>
<td>contents of Method</td>
<td>HTTP Message Pay Load</td>
</tr>
</tbody>
</table>
Resource

- Small logically discrete units of exchange
- Defined behavior and meaning
- Known identity / location (URI)
- Smallest unit of transaction
FH Irving Resources

Additional Resources will be added in the future. A list of hypothesized resources can be found on the HL7 wiki. Feel free to add any you think are missing or engage with one of the HL7 Work Groups to submit a proposal to define a resource of particular interest.
FHIR Timeline (planned)

- First Draft
- 1st STU
- ~ 2nd STU
- ~ 3rd STU
- R4

Web3D & HL7 Collaboration

• HL7 Messages & Documents  
  ➔ automatic visualization of clinical info

• Clinical semantics ←→ Graphical representation
  – Terminology/Ontology
    • FMA – Anatomy focused
    • SNOMED – Clinical concepts focused
  – Information model v. terminology
    • Severe pain in the left thumb
    • Suspected lung cancer