Outline

• What is HL7?
• What is XML?
• HL7 Central Methodologies
• HL7 XML Projects
• Summary
What is HL7?

- Provider community
- Broad variety of transactions
- 2000 members, virtually all major vendors
- Deep market penetration
- Rapidly expanding international participation
HL7 Standards

• Medical Logic
• Visual Integration
• Applied Medical Vocabulary
• Messaging
  – Versions 2.x -- X12-like syntax
    • (XML adaptation)
  – Version 3 -- XML at least
• Clinical Documents (XML)
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XML: What’s the Big Deal?

Disintermediation!
Many estimates are that this will rapidly grow to ten times consumer-to-business.

- C2B: mostly browser-to-application
- B2B: much more application-to-application
XML is:

- Syntax “disintermediation”
- A symbol of the general notion of Internet-based disintermediation, especially B2B
- Tool disintermediation
The Internet As Disintermediator

Internet

Application

Web Server

engine

Application

Engine

Browser

Firewall

Application

Application

engine
What is XML

• XML: Extensible Markup Language
• XML is a “metalanguage”
• Subset of Standard Generalized Markup Language
• Recommendation from W3C
  – W3C == World Wide Web Consortium
  – Formally Adopted on 10-February-1998
Markup is a set of notations about text. Often it is used to give instructions on how text is displayed, but it can also be used to help interpret the text.
<table>
<thead>
<tr>
<th>A</th>
<th>A poem as it might be printed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O Rose thou art sick. The invisible worm, That flies in the night In the howling storm: Has found out thy bed Of crimson joy: And his dark secret love Does thy life destroy.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B.</th>
<th>The poem in the nroff markup language.</th>
</tr>
</thead>
<tbody>
<tr>
<td>.ce The SICK ROSE .sp 2 O Rose thou art sick. .br The invisible worm, .br That flies in the night .br In the howling storm: .sp 1 Has found out thy bed .br Of crimson joy: .br And his dark secret love .br Does thy life destroy.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C.</th>
<th>The poem in a hypothetical SGML markup language</th>
</tr>
</thead>
</table>
| <anthology> <poem><title>The SICK ROSE</title> <stanza> <line>O Rose thou art sick.</line> <line>The invisible worm,</line> <line>In the howling storm:</line> <line>Has found out thy bed</line> <line>Of crimson joy:</line> <line>And his dark secret love</line> <line>Does thy life destroy.</line> </stanza> </stanza> <stanza> <line>Has found out thy bed</line> <line>Of crimson joy:</line> <line>And his dark secret love</line> <line>Does thy life destroy.</line> </stanza> </poem> <!-- more poems go here --> </anthology>
XML: eXtended Markup Language

- XML is a “metalanguage”
  - Language for defining other languages

```xml
<anthology>
  <poem>
    <title>The SICK ROSE</title>
    <stanza>
      <line>O Rose thou art sick.</line>
      <line>The invisible worm,</line>
      ...
    </stanza>
  </poem>
  ...
</anthology>
```
XML: eXtended Markup Language

- XML is a “metalanguage”
  - Language for defining other languages

```xml
<legal_brief>
  <case> Tweetie v Wabbit </case>
  <prepared_by>
    <atty>
      <f>E</f> Fudd </l>
    </atty>
  </prepared_by>
</legal_brief>
```

```
Court Schedule
Fudd, E. Tweetie v. Wabbit
...
```
XML: eXtended Markup Language

• XML is a “metalanguage”
  – Language for defining other languages

XHTML, Poetry, and Legal Brief are “applications” of XML

Get rich quick
Send Me All Your Money and trust me.
XML Components

- **elements**
  - `<ElementName>element content</ElementName>`

- **attributes**
  - `<ElementName AttributeName="attribute value">element content</ElementName>`
<PRERESSION>

Amoxicillin

<FOR>250 mg. capsule</FOR>

<DISPENSE>30</DISPENSE>

<DOSAGE>1 cap(s)</DOSAGE>

<INSTRUCTIONS>3 times daily until gone</INSTRUCTIONS>

<REFILL>0</REFILL>

<SUBSTITUTE>may substitute</SUBSTITUTE>

<NUMBER NOTYPE="DEA">AB1234567</NUMBER>

</PRESCRIPTION>
The "XML Family" of Standards

- XHTML -- HTML revised
- XSL: Extensible Style Language
- XML Schemas
- Namespaces
- Pointers
- Domain Object Model
- Digital Signatures (!!)
What is XML

• Well-formed vs. Valid
  – well-formed == “balanced parens”
  – valid == well-formed AND conforms to the constrains specified in the “document type definition”

• Document Type Definition (DTD)
  – defines the grammar for a language
    • a large subset of Context Free Grammars
  – a schema definition
XML Schema Languages

- **Document Type Definitions (DTD)**
  - no data types
  - global element definitions

- **Microsoft XDR**

- **XML Schemas + namespaces**
  - structures
  - data types
Outline

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- What is XML?
- HL7 Central Methodologies
- HL7 XML Projects
- Summary
• Reference Information Model
  – multi-expert consensus process
  – facilitation/harmonization
  – ~120 classes
  – “subject classes”
  – state analysis

• Vocabulary
  – not reinvent
  – validate for use
  – crosswalks and realms
  – same experts; facilitation/harmonization
Outline

- What is HL7?
- What is XML?
- HL7 Central Methodologies
- HL7 XML Projects
  - Version 2.x
  - Version 3 Messages
  - Patient Record Architecture
- Summary
XML and Version 2.x

- Standard mapping from fields and segments to XML elements
- No structural changes
- Useful for access to mapping tools
XML and Version 3

- The syntax handles recursion
- Parsers are “free”
- Self-documenting data files
- XML-related tools
  - viewing
  - testing
  - conversion
- Availability of trained personnel
Version 3 Message Definition Process

Reference Information Model

Domain Information Model

Use Case Model

interaction Model

Refined Message Information Model

Hierarchical Message Description

Common Message Element Type

Vocabulary
## Hierarchical Message Descriptions

<table>
<thead>
<tr>
<th>Class or Property of Class (Attribute or Association)</th>
<th>Rim Source Class</th>
<th>Message Element Name</th>
<th>Message Element Short Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>C00_RIM_0092Da_1</td>
<td>XML_example</td>
<td>Ballot</td>
<td>BallNote</td>
</tr>
<tr>
<td>Ballot</td>
<td>Ballot</td>
<td>Ballot</td>
<td>Ballt</td>
</tr>
<tr>
<td>comments_txt</td>
<td>Ballot</td>
<td>comments_txt</td>
<td>commentsTxt</td>
</tr>
<tr>
<td>dttm</td>
<td>Ballot</td>
<td>dttm</td>
<td>dttm</td>
</tr>
<tr>
<td>vote_cd</td>
<td>Ballot</td>
<td>vote_cd</td>
<td>vote</td>
</tr>
<tr>
<td>votes_on</td>
<td>Ballot</td>
<td>votes_on_Proposed_item</td>
<td>votesOn_PropsDltm</td>
</tr>
<tr>
<td>ballot_period_tmr</td>
<td>Proposed_item</td>
<td>ballot_period_tmr</td>
<td>ballotPeriodTmr</td>
</tr>
<tr>
<td>content_txt</td>
<td>Proposed_item</td>
<td>content_txt</td>
<td>contentTxt</td>
</tr>
</tbody>
</table>
Information About a Message Element

- Type
- Cardinality
- Null?
- Update mode
- Vocabulary domain
- Constraint--includes conditional use
- Conformance
**Version 2.3 Instance and Type Definition**

**Figure 7-4. OBR attributes**

<table>
<thead>
<tr>
<th>SEQ</th>
<th>LEN</th>
<th>DT</th>
<th>OPT</th>
<th>RP / #</th>
<th>TBL #</th>
<th>ITEM #</th>
<th>ELEMENT NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>SI</td>
<td>C</td>
<td></td>
<td></td>
<td>00237</td>
<td>Set ID - OBR</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>EI</td>
<td>C</td>
<td></td>
<td></td>
<td>00216</td>
<td>Placer Order Number</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>EI</td>
<td>C</td>
<td></td>
<td></td>
<td>00217</td>
<td>Filler Order Number +</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>CE</td>
<td>R</td>
<td></td>
<td></td>
<td>00238</td>
<td>Universal Service ID</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>ID</td>
<td>X</td>
<td></td>
<td></td>
<td>00239</td>
<td>Priority</td>
</tr>
</tbody>
</table>
<Labrs3P00 T="Labrs3P00">
  <Labrs3P00.PTP T="PTP">
    <PTP.primrPrsnm T="PN">
      <fmn T="ST">Sample</fmn>
      <gvn T="ST">George</gvn>
      <mdn T="ST">H</mdn>
    </PTP.primrPrsnm>
  </Labrs3P00.PTP>
  <Labrs3P00.SIOO_L T="SIOO_L">
    <SIOO_L.item T="SIOO">
      <SIOO.filrOrdId T="IID">LABGL110801</SIOO.filrOrdId>
      <SIOO.placrOrdId T="IID">DMCRES387209373</SIOO.placrOrdId>
      <SIOO.InsncOf T="MSRV">
        <MSRV.unvSvcId T="CE">19768-2</MSRV.unvSvcId>
        <MSRV.svcDesc T="TX">CELL COUNTS+DIFFERENTIAL TESTS (COMPOSITE)</MSRV.svcDesc>
      </SIOO.InsncOf>
      <SIOO.SRVE_L T="SRVE_L">
        <SRVE_L.item T="SRVE">
          <SRVE.name T="CE">4544-3</SRVE.name>
          <SRVE.svcEvntDesc T="ST">HEMATOCRIT (AUTOMATED)</SRVE.svcEvntDesc>
          <SRVE.CLOB T="CLOB">
            <CLOB.obsvnValu T="NM">45</CLOB.obsvnValu>
            <CLOB.refsRng T="ST">39-49</CLOB.refsRng>
            <CLOB.clnRlvnBgnDtm T="DTM">199812292128</CLOB.clnRlvnBgnDtm>
          </SRVE.CLOB>
          <SRVE.spcmRcvdDtm T="DTM">199812292315</SRVE.spcmRcvdDtm>
        </SRVE.L.item>
      </SIOO.L.item>
    </Labrs3P00.SIOO_L>
  </Labrs3P00>
</Labrs3P00>
HL7 Standard Development Tools

- Rational Rose
- Repository
- Schema
- XSL
- PDF Documents
- XML Document
- Software Tools
- Rose Tree
The Patient Record Architecture

• Multi-layered schema consisting of three layers
  ■ A basic, abstract layer to exchange narrative documents (ProseDoc)
  ■ A layer that provides simple classification (ClinicalContent)
  ■ A layer that requires greater clinical semantics
A Transformation

Architectural Forms specify how tags are changed:

**APPLICATION**

Transform `<PRESCRIPTION>` to `<PLAN>`

```
<PRESCRIPTION>

<MEDNAME MED="Amoxil">
Prescribed medication: Amoxil
</MEDNAME>
```

**PRA**

```
CC.CLIENT.ETN="PRESCRIPTION">
<MENTION DOMAIN="Kona Example"
NORMALIZED.CONTENT="Amoxil"
CC.CLIENT.ETN="MEDNAME">
Prescribed medication: Amoxil
</MENTION>
```
A person can read all the contents of all the notes

A computer can search all the notes based on Level One admin. Data, and do smart processing on Op-notes based on the PRA subset
Why not Just Standardize Schemas?

- Schemas support process
- A single document may need multiple schemas in a single organization
- Achieving consensus across organizations takes longer
- Schemas evolve as organizations use them
PRA and the Central Methodologies

- **Vocabulary**
  - identical coding requirements

- **Information model**
  - basis for level one header
  - basis for structure of higher order architectural DTDs

- **Uses HMDs to document documents**
Busy Booth

HL7 Demos at HIMSS '99
What is it? by the numbers:

- 10 vendors
- 7 applications use prototype HL7 documents
- 8 applications use prototype V3 XML messages; one application uses version 2.3
- 6 applications involve some message/document interactivity
- 3 document types: the PRA LevelOne architecture, a History & Physical and a Progress Note
- 12 message types including registrations, lab orders and results, query/response, and one document envelop
What is it? the applications:
- clinical data repository
- clinical document repository
- lab system
- electronic health record system
- transcription system
- medical intranet
- patient administration
- "widget"
- interface engine
HL7-XML Demo HIMSS ‘99

Clinical Data Repository

Medical Intranet

Document Repository

Document Management

Interface Engine

Lab

EMR

Transcription

Patient Administration
Trade Show Zen

• Easier to get software engineering resources for standards-groups prototypes
• Fixed deadline
• Internal visibility to standards efforts within large companies.
• If you want to communicate with a Klingon, speak Klingon; if you want to communicate with Marketing ...
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The Gotchas for XML Messaging

- Not a patch to an existing parser
  - recursion
  - choice
- Message sizes substantially larger
Limitations of XML

- Many important features “not soup yet”
- An XML-valid message is not an HL7-valid message
- Implication:

  There will always be a post-processor driven by HL7 specifications
Limitations of Mapping/Transforms

- No silver bullet
- Important uses
  - same concepts with different names
  - data presentation
  - reducing detail
- Little help for
  - different concepts
  - creating detail that was not there
“No sensible decision can be made any longer without taking into account not only the world as it is, but the world as it will be. . . .”

- Design decisions require cautious optimism about change.
- Five years from now, if HL7 does not use XML, people will, at best, be amused by our quaint eccentric ways.
- These comments from May, 1999.
Cross-Industry “Standards” Efforts

Figure 1: Message constructed from multiple schemas

Example Message

```xml
<Envelope>
  <From> <Org>Able Family Practice</Org> <Applic_role>Medical Record</Applic_role></From>
  <To> <Org>Baker Care Manager</Org> <Applic_role>Diabetes Mgt</Applic_role></To>
  <Action>Request Referral</Action>
  <Request_Referral_Message>
    <Patient> <Person_name>Jones</Person_name> <Telephone>999 555-1212</Telephone> <Pt_ID>1234</Pt_ID></Patient>
    <Refer_from_phys> <Person_name>Smith, M.D.</Person_name> <Telephone>999 121-5555</Telephone>
      <Provider_ID>AX4734-8</Provider_ID></Refer_from_phys>
    <Refer_to> <Orgn_name>Opthalmology, PA</Orgn_name> <Telephone>999 777-5555</Telephone>
      <Provider_ID>X4217-3</Provider_ID></Refer_to>
    <Purpose>Diabetic Retinopathy</Purpose>
  </Request_Referral_Message>
</Envelope>
```

Source: GartnerGroup
- Oasis -- yes
- (ebXML) -- yes ??
- Microsoft/BizTalk -- ??
Does XML Disintermediate Standards?

• The magic bullet view:
  – Yes! And about time! Standards groups are too slow, and it is too hard to get my way

• The real issues:
  – authority
  – broad consensus
  – consistency
XML Summary

- A better Syntax (plus disintermediation)
- Disintermediate tools
- Enables Internet Disintermediation
- For HL7, it’s the place to be
- No magic bullet