Using Oracle Spatial 11g for Clinical Research, Quality Reporting and Associated Data and Workflows

Cleveland Clinic Foundation’s Experience with RDF, WebLogic and SOA
Cardiovascular Information Registry (CVIR) (*"where it all started"*)

- Continuous operation since 1972
- 200,000 patient records
- 20 new cases per day
- 450 "informative" data elements
- Historical emphasis on coronary artery bypass & valve surgery
- Usage:
  - 130+ peer-reviewed journal articles per year
  - Numerous Quality Assessment reports
  - Numerous administrative and outcomes reports
Why RDF? One reason: 
So we can ask complex queries this way

“**FIND** all native aortic valve replacements performed at CCF between January 1, 2000 and December 31, 2004 with a pre-operative diagnosis, as determined by echocardiogram, of moderately severe or severe aortic stenosis and moderate to severe left ventricular impairment.”

“**INCLUDE** operations in which concomitant primary CABG or concomitant mitral or tricuspid valve repair was performed.”

“**EXCLUDE** all patients with any prior valve repair or replacement; or with concomitant pulmonary valve repair; or with concomitant mitral, tricuspid, or pulmonary valve replacement; or with aortic regurgitation greater than moderate degree.”
### Another reason for RDF:

*So we can answer many questions without having to store the “answers”, per se:*

<table>
<thead>
<tr>
<th>Database</th>
<th>2002 - 2007</th>
<th>2008 - Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>STS Adult Cardiac Surgery Database</td>
<td>Any tobacco use history Used &lt; 1 mo. of surgery</td>
<td>Current or recent cigarette smoker &lt; 1 year of surgery (recent changes: within 2 weeks)</td>
</tr>
<tr>
<td>STS General Thoracic Surgery Database</td>
<td>Chew user Cigarette user Pipe user Other tobacco user Days quit before surgery</td>
<td>History of cigarette smoking Never Quit &gt; 1 mo. of surgery Smoked &lt; 1 mo. of surgery</td>
</tr>
<tr>
<td>ACC NCDR CathPCI Registry</td>
<td>History of tobacco use Never Quit &gt; 1 mo. of surgery Used &lt; 1 mo. of surgery</td>
<td>Current or recent cigarette smoker &lt; 1 year of surgery</td>
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Cleveland Clinic
Historic Path to RDF Datastore

- Original DB as Datatrieve (*late ‘90s*)
- Plans to port to RDF datastore with open tools (*early ‘00s*)
  - X-Forms for XML data entry
  - 4Suite for XML to RDF transformation
- Did POC with Cycorp Upper Ontology (*‘07*)
  - Common knowledge, temporal reasoning
  - More expressive natural language queries
  - NLP to SPARQL query construction and optimization
- Operational on Oracle RDF June 30 (*‘10*)
  - Utilizes Oracle Spatial option
Desire to move to commercially supported platform(s)

• Migrated to Oracle 11g Release 2 from open source
  
  *(to minimize “plumbing” support needed)*

  – Conversion took 5 months *(operational June 30)*
    • Reconciled 1317 benchmark queries to all triples from all SPARQL queries
    • Oracle 2.6 x faster than original open source platform

• Developing plans to migrate workflow to SOA
  
  *(taking it to the next level)*

  – Evaluating best mix of BPEL for inter-application WF and RDF for Human Tasks intra-application WF