RESTful SOA and XML

W3C Workshop on Data and Services Integration

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October 2011

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Overview

- Examples of data and services integration challenges (at EMC)
  - Using many different management products collect information about data center entities to assess the state of that data center
    - And if the logical “data center” is, in fact, the cloud?...
  - Search over a variety of content repositories
    - Again, within a data center or in the cloud
  - …
- The EMC CTO office is, in fact, working on developing that “coherent platform” for (both!) data and services integration
- My assertion – the following play a significant role:
  - REST over HTTP
  - XML

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Services Integration: REST with HTTP

Why REST?

- In order to get some standardization and uptake, the principles need to be easy
- The environment is highly distributed and potentially very large
  - that is, **CLOUD**
- Product groups are all building RESTful interfaces
- Resource focus
  - With media-type handling
  - With hyperlinking
  - With caching

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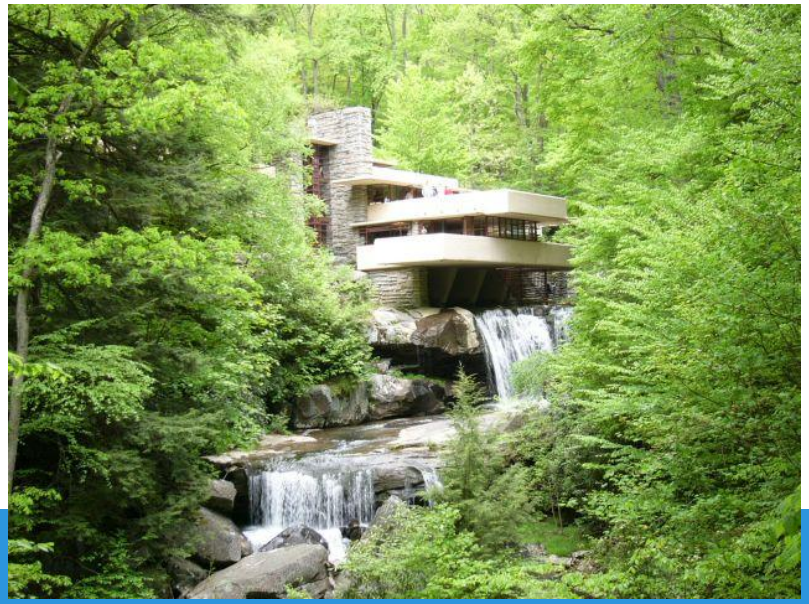
REST Principles

- REST is an architectural style that depends upon:
- Identification and addressability of resources
  - All interesting bits of information are identified with URIs and are usually accessed via URL
- The uniform interface
  - Interaction with resources through a standardized set of operations, with well understood semantics
- Manipulation of resources through representations
  - Media types
- Hypermedia as the engine of application state
  - Hyperlink your resources



And A Few More Details…

- We talk about:
  - The need for stable identifiers and accessors
    - In support of HATEOAS, caching)
  - The need for a mechanism for determining of resource state has changed – eTags
    - In support of caching
  - Not finding a resource is perfectly valid
    - In support of loose coupling
  - And more…

How we address these needs mustn't be "disconnected from the general Web usage"

- That is, I want not only REST, but I want to use HTTP.

- The REST architectural style
- HTTP as the protocol

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How Well Do Existing REST Frameworks Do?

Feature	Java FWs (alone)	Comments
Named Resources	●	URI template support - @RequestMapping("/patients/{pid}")
Define Uniform Interface	●	@RequestMapping (method = RequestMethod.GET) *(+ PUT, POST, DELETE, PATCH, etc.)*
Handle media types	◓	Frameworks do allow bad practices; most don't fully support features like media type parameters
Link to other resources	○	nothing
Implementation		Generally happens with a bunch of java code.

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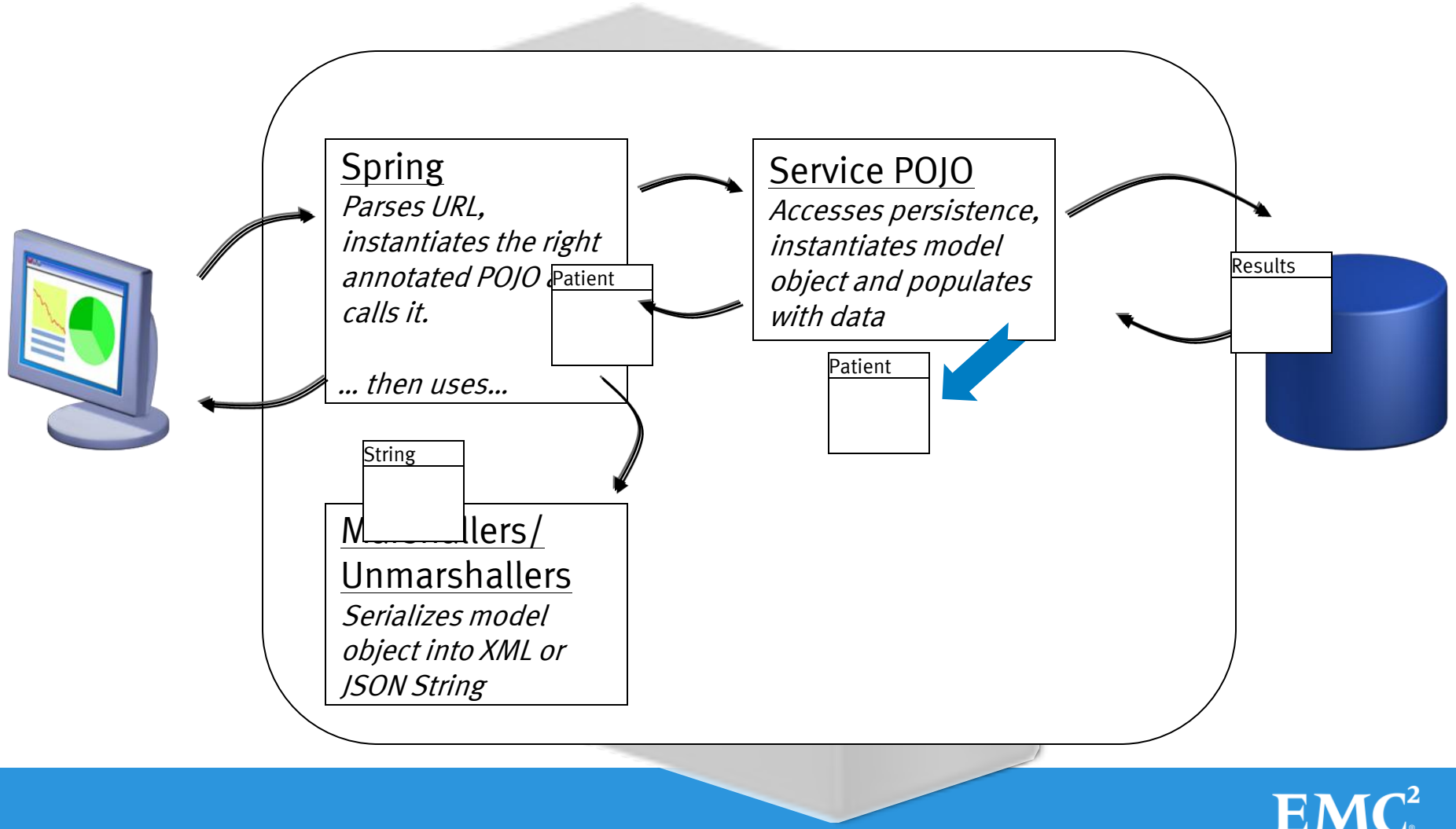
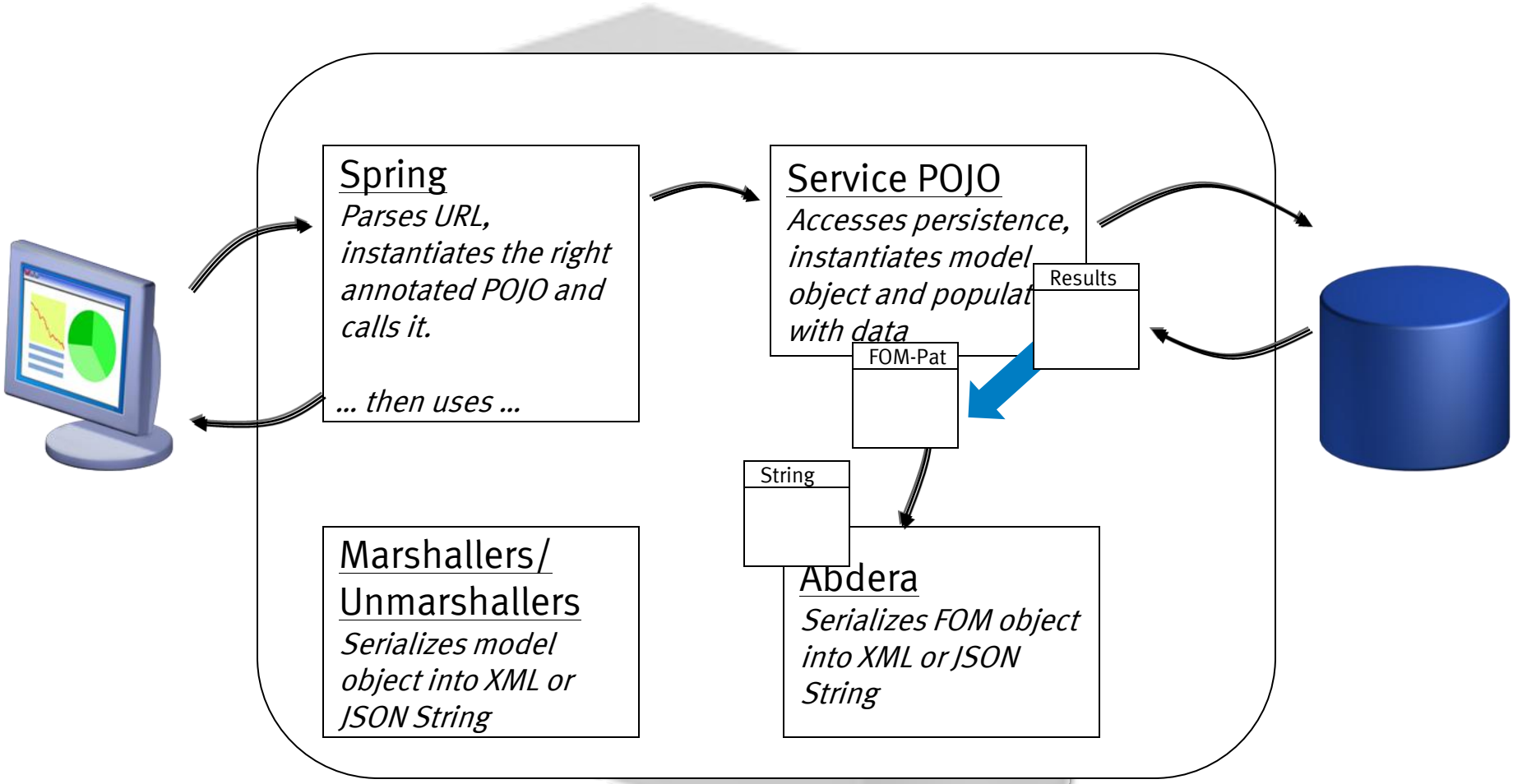
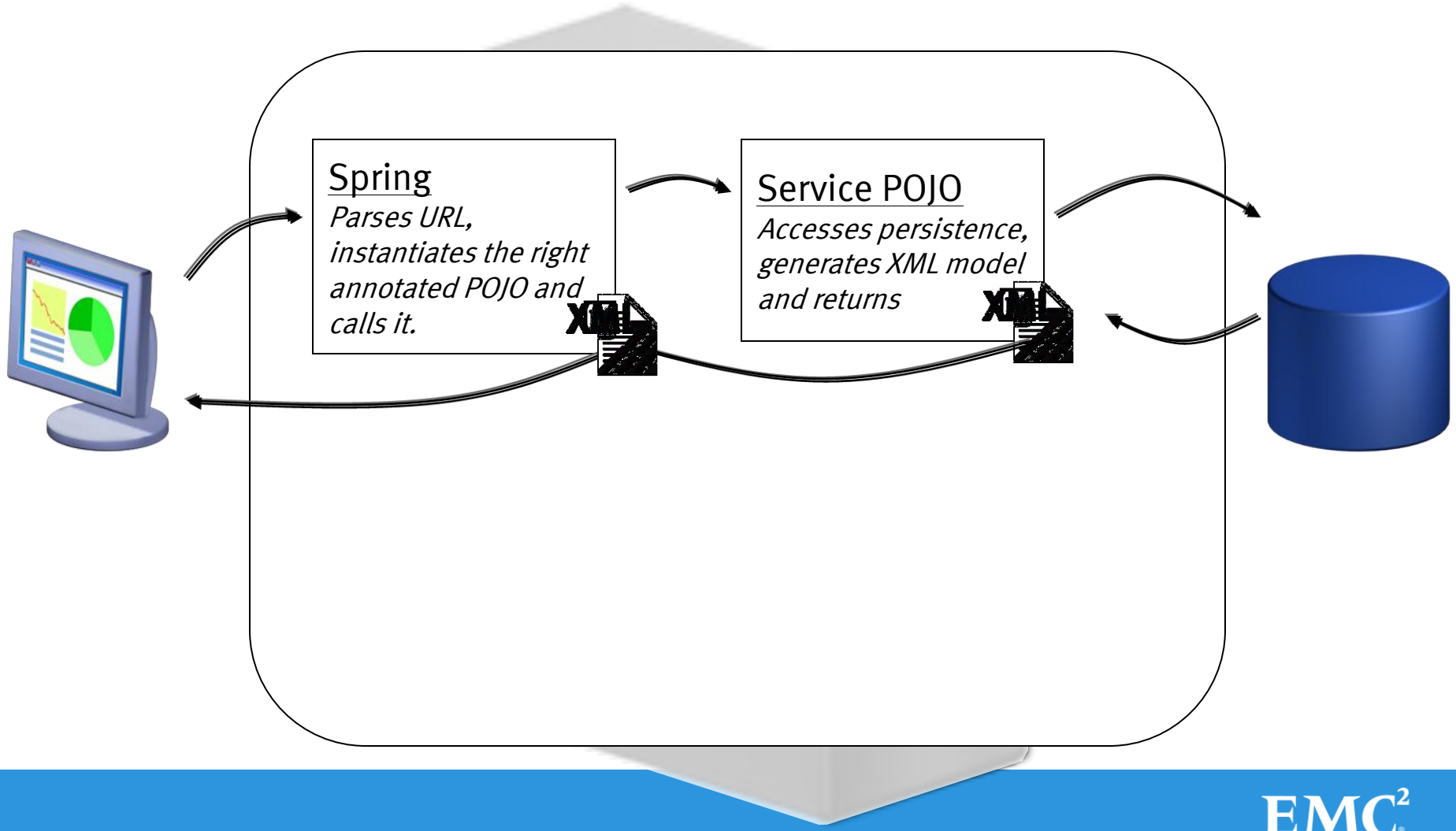
RESTful Service Written in Java



…now if we also want Atom representations



RESTful Service – *XML as the Dial Tone*



XML Technologies are Well Suited to…

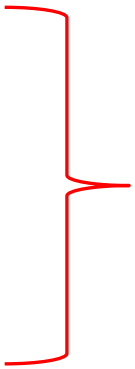
(And the "XML stack has become ubiquitous")

- Transformations to media types
- Hyperlink insertion

```
...
<xsl:template match="p:Patient" mode="inserthere">
    <atom:link rel="self">
      <xsl:attribute name="href"><xsl:value-of select="$baseURL" /></xsl:attribute>
    </atom:link>
    <atom:link rel="prescriptions">
      <xsl:attribute name="href"><xsl:value-of select="concat($baseURL,'/activeprescrip
      </xsl:attribute>
    </atom:link>
    <atom:link rel="episodes">
       <xsl:attribute name="href"><xsl:value-of select="concat($baseURL,'/careepisodes'
       </xsl:attribute>
    </atom:link>
    <atom:link rel="up">
      <xsl:attribute name="href">
        <xsl:value-of select="functx:substring-before-last($baseURL,'/')"/></xsl:attri
    </atom:link>
</xsl:template>
```

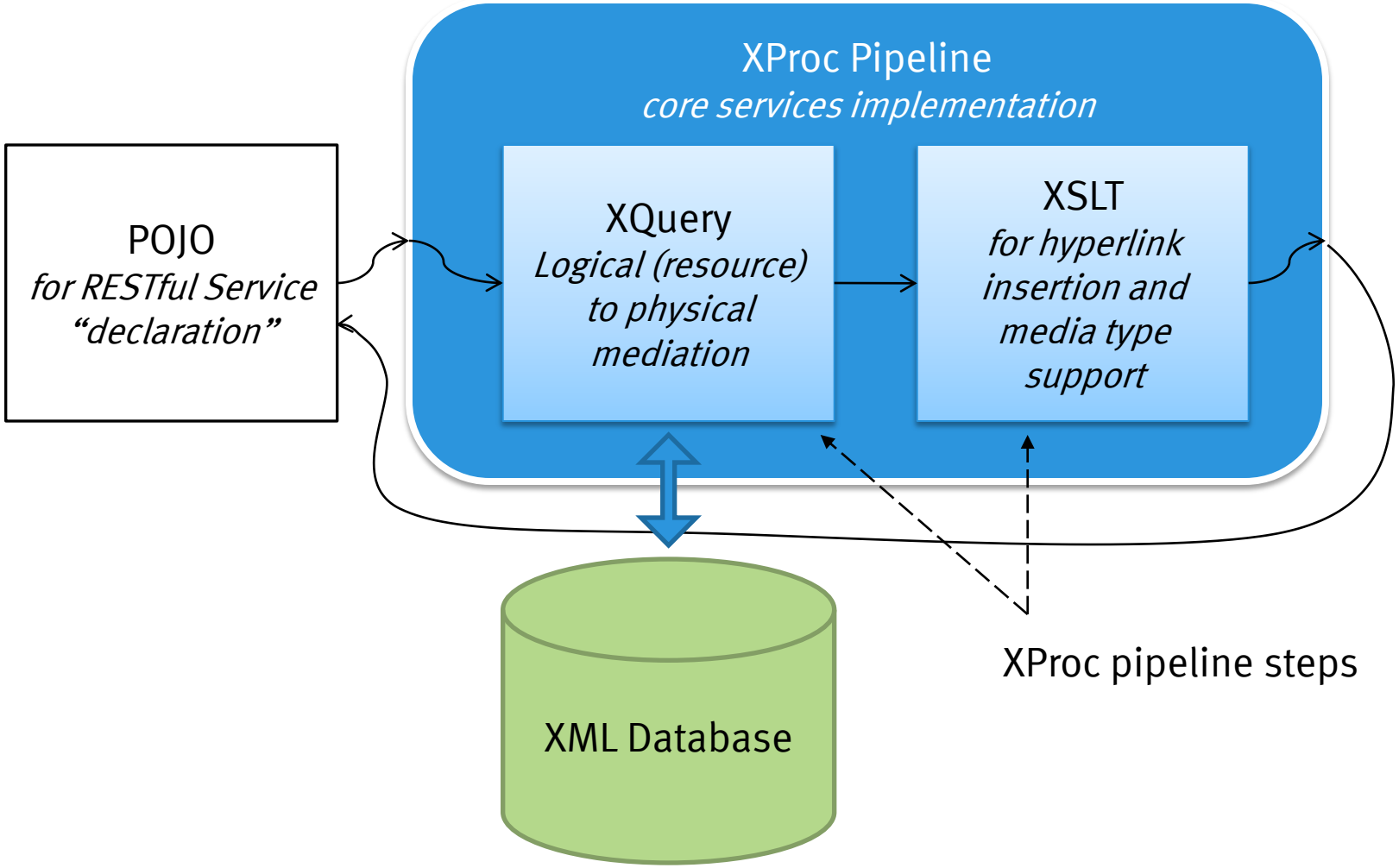
…But are Lacking In Some Things

- Naming
- Uniform interface
- HTTP “libraries”



Things that the Java-based RESTful service frameworks are good at

XML-Centric Implementation



“Declaring” Services

In the POJO:

Encapsulate operation pipeline and design time bindings

```
@Controller
@RequestMapping("/patients")
public class Patients {

  private static XMLProcessingContext m_getPatientsProcessing = null;
  private static XMLProcessingContext m_addPatientProcessing = null;

  public void setAddPatientProcessing (XMLProcessingContext val) {
    m_addPatientProcessing = val;
  }
  ...
  @RequestMapping(method = RequestMethod.POST)
  @ResponseStatus(HttpStatus.CREATED)
  public String addPatient(HttpServletRequest request,
                           HttpServletResponse response, Model model) {
    PipelineInputCache pi = new PipelineInputCache();

    // supply http body as the source for the resource Create pipeline
    pi.setInputPort("source", request.getInputStream());

    // supply current resource URL as the base URL to craft hyperlinks
    String baseUrl = request.getRequestURL().toString();
    pi.addParameter("stylesheetParameters", new QName("baseURL"),
                    request.getRequestURL().toString());

    PipelineOutput output = m_addPatientProcessing.executeOn(pi);

    ...
  }
}
```

Runtime XProc pipeline parameter bindings

Binding Operations to XProc Pipelines

The Spring config:

One XML processing context per operation

```
<bean id="Patients" class="com.emc.cto.healthcare.Patients">
  <property name="getPatients" ref="getPatientsXMLProcessingContext" />
  <property name="addPatient" ref="addPatientXMLProcessingContext" />
  <property name="getPatient" ref="getPatientXMLProcessingContext" />
  <property name="replacePatient" ref="replacePatientXMLProcessingContext" />
  <property name="deletePatient" ref="deletePatientXMLProcessingContext" />
</bean>

<bean id="addPatientXMLProcessingContext‟ class="com.emc.cto.xproc.XProcXMLProcessingContext">
  <property name="xprocPool" ref="xprocPool" />
  <property name="pipelineSource"><value>classpath:resourceCreate.xpl</value></property>
  <property name="inputs">
    <map>
      <entry key="xqueryscript" value="classpath:addPatient.xq" />
      <entry key="stylesheet" value="classpath:hyperlinksPatient.xslt" />
    </map>
  </property>
  <property name="options">
    <map>
      <entry key-ref="iDAssignmentxPath" value="pat:Patient/pat:pid" />
    </map>
  </property>
  <property name="parameters"><map/></property>
</bean>
```

Set design time parameters into the pipeline

Configure the operation with the XProc pipeline

A Proposed Alternative

What if the developer could just write X-things?

```
<webservice>
  <resource uriTemplate="/patients">
    <operation operation="GET">
      <xProcImplementation source="classpath:resourceGet.xpl">
        <parameters>
          <xqueryscript type="file">classpath:getPatients.xq</xqueryscript>
          <hyperlinksSS type="file">classpath:hyperlinksForPatients.xslt</hyperlinksSS>
        </parameters>
      </xProcImplementation>
    </operation>
    <operation operation="GET" uriTemplate="/patients/{patientId}">
      <xProcImplementation source="classpath:resourceGet.xpl">
        <parameters>
          <xqueryscript type="file">classpath:getPatient.xq</xqueryscript>
          <hyperlinksSS type="file">classpath:hyperlinksForPatients.xslt</hyperlinksSS>
          <xqueryparameter type="uriTemplateParameter" variable="patientId"/>
        </parameters>
      </xProcImplementation>
    </operation>
    ...
  </resource>
  ...
</webservice>
```

Epilogue

- Our work on the XML REST Framework is freely available:
  - Version 1, basic framework supporting xDB and XQuery: https://community.emc.com/docs/DOC-6434
  - Version 2, adds hyperlink insertion and XSLT application: https://community.emc.com/docs/DOC-6485
  - Version 3, moves to Spring MVC and includes XProc: https://community.emc.com/docs/DOC-10494
  - Includes:
    - Framework source code
    - Sample application
    - Documentation

- XML Technolgies such as XProc and XSLT are suitable mashup building tools
  - *(more to come on this topic later in the program)*

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THANK YOU