CICS and XML Strategies

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Abstract

- As the use of XML continues to become more prevalent, knowing the options available in the CICS Transaction Server environment become increasingly important. CICS’s Web service support, CICS’s TRANSFORM API command, COBOL’s PARSE verb, and Java parsers are some of the available options, but each of them are surrounded with many details. This session is intended to discuss the various XML usage options in the CICS Transaction Server environment, with a focus on using mapping level capabilities for dealing with common XML-related issues such as string handling and occurring item. Use of zAAP processors for offloading some of the XML parsing will also be discussed.
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Agenda

- Parsing Options
- Places where we parse and generate XML in CICS
  - Web services support
  - EXEC CICS TRANSFORM
  - RESTful Requests
  - ATOM
  - CICS Dynamic scripting
- Common issues when using CICS’s built-in parsing capability
  - xsd:String
  - Occurring Items
  - Adding headers on Web service requests
  - xsd:any and xsd:anyType
  - Multiple Containers

XML Parsing Options on z/OS

- XMLSS (z/OS XML System Services)
  - General-purpose, validating parser, can handle huge messages
  - Parsing is zAAP eligible
- XML Toolkit (XML4C – can work with XMLSS)
- IBM’s Java 6 comes with XML4J and XL TXE-J (Java is zAAP eligible)
  - XML4J
    - Based on Apache Xerces-J 2.9.0
    - Validating Parser
    - Supports JAXP
  - XL TXE-J
    - Non-validating Parser
- COBOL PARSE verb
  - With XMLSS compile option is zAAP eligible (Enterprise COBOL V4.1+)
  - Interactions with XMLSS improved in Enterprise COBOL V4.2
- PLISAXA/PLISAXB/PLISAXC subroutines
- Special-purpose
  - CICS’s ‘shredder’ – non-validating, fast
- Custom/RYO
  - Special-built code for your XML vocabulary could be fast
XML In CICS Applications

- CICS Web services
- EXEC CICS TRANSFORM
- Process XML before getting to CICS
- SCA (when exposing component or composite as a Web service)
- RESTful Interfaces
- ATOM
- Event Processing
  - WBE Format
  - CBE Format
  - Custom Adapter
- Dynamic Scripting and CA1S
  - REST interfaces and ATOM Feeds
  - From Java, PHP, Groovy

Each are discussed on upcoming pages

XML Conversion outside of CICS

- Endpoint of Web service in WAS or ESB
  - Receive Web service request outside CICS, then communicate to CICS using CICS TG, WOLA, WMQ, etc
- WebSphere Message Broker or WESB
  - Request received by ESB – ESB communicates to CICS
- WebSphere Transformation eXtender
  - Used to extend capabilities of ESB or invoke in CICS
  - Industry Transformation Packs
    - SEPA, SWIFT, HIPA EDI, ACORD, more
- DataPower
  - Appliance – can be used for XML transformation
- DB2 pureXML
  - DB2 understands XML
Leave the XML processing to DB2

- **DB2 – pureXML – DB2 9.1+**
  - Store XML with no parsing, mapping or conversion
  - Can be modified using XPath (DB2 V10.1)
  - See developerWorks article for more info on a CICS/DB2 pureXML web service
  - See DB2 InfoCenter for more information on pureXML

- **Using CICS with DB2 pureXML**

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**CICS’ Web Service Support**

![CICS' Web Service Support Diagram](image)
CICS’ Web Service Support

XML with CICS Web Services Assistant

- Batch utilities (DFHWS2LS and DFHLS2WS)
- Initial parse before pipeline processing
  - Done by XMLSS in CICS TS V4.1; zAAP eligible
  - Parse of application specific data in body not zAAP eligible
XML with CICS Web Services Assistant

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RDz “Interpretive XML Conversion”

- Rational Developer for System z (RDz)
  - Run wizards at workstation – COBOL/PLI input
  - Initial parse before pipeline processing
    - Done by XMLSS in CICS TS V4.1; zAAP eligible
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RDz “Compiled XML Conversion”

- RDz generates ‘converter’ programs that contain a COBOL parse verb
  - zAAP eligible when compiled with Enterprise COBOL v4.1 or higher
    - Needs XMLSS compile option
  - Can be used with CICS TX V3 or V4
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XML with CICS Web Services Assistant
XML-ONLY=TRUE
- Can specify XML-ONLY=True with CICS Web Services Assistant or RDz
- MAPPING-LEVEL=2.1 or higher
- SOAP message passed to you, you can use:
  - COBOL PARSE verb, Java (XML4J or others), pass data to DB2 pureXML, use vendor product, or use CICS’s TRANSFORM verb
XML with CICS Web Services Assistant
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- SOAP message passed to you, you can use:
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SCA: Service Component Architecture

- Provide capability to easily develop flexible and reusable CICS application components
  - Rapid assembly and deployment of new Services
  - Express existing applications as re-usable components

- Separation of bindings from application code allows flexible infrastructure changes

- Reduce skills and effort required to view and manage business applications
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Component exposed as XML-based service, promoted as interface to composite

EXEC CICS TRANSFORM

- Available with CICS TS V4.1
- XML to Language Structure or vice versa
- Uses an XSDBind file
  - Created with the CICS XML Assistant or RDz
  - Installed using a BUNDLE resource
  - XSDBind also used with ATOM feeds (not in BUNDLE)
- Can ask for document root element name
- Can request validation
  - Starts Java program for validation
- Can use “interpretive XML conversion” approach
- Can use “compiled XML conversion” approach
  - RDz V7.6+
RESTful Interfaces

- Similar in concept to hyperlinked data
- Lightweight data transfer that leverage the HTTP protocol
- Representational State Transfer
  - Nouns (URLs) indicate what is being worked on
  - Verbs (GET, PUT, POST, DELETE) indicate the action to be performed (List, Create, Read, Update, Delete)
- Format of results is not defined
  - Popular formats of returned data are XML and JSON
- Approaches in CICS
  - CICS WEB API
  - ATOM Feed (CICS TS V4.1 and SupportPac CA8K)
  - PHP (SupportPac CA1S)
  - CICS Dynamic Scripting

### REST request

<table>
<thead>
<tr>
<th>Request URI</th>
<th>HTTP Method</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collection URI, e.g.:</strong></td>
<td>GET</td>
<td>List</td>
</tr>
<tr>
<td><a href="http://xyz.com/prefix/myResource">http://xyz.com/prefix/myResource</a></td>
<td>POST</td>
<td>Create</td>
</tr>
<tr>
<td></td>
<td>PUT</td>
<td>putCollection</td>
</tr>
<tr>
<td></td>
<td>DELETE</td>
<td>deleteCollection</td>
</tr>
<tr>
<td><strong>Member URI, e.g.:</strong></td>
<td>GET</td>
<td>Retrieve</td>
</tr>
<tr>
<td><a href="http://xyz.com/prefix/myResource/rid">http://xyz.com/prefix/myResource/rid</a></td>
<td>POST</td>
<td>postMember</td>
</tr>
<tr>
<td></td>
<td>PUT</td>
<td>update</td>
</tr>
<tr>
<td></td>
<td>DELETE</td>
<td>delete</td>
</tr>
</tbody>
</table>
REST simple sample

- **Request**
  
  GET /mortgage/231677 HTTP/1.1
  Host: www.example.com
  Accept-Language: en
  Charset: UTF-8

- **Response**

  Or

  HTTP/1.1 200 OK
  Language: en_us
  Charset: UTF-8
  Content-Type: text/json
  
  {'principal':"238000","rate":"3.5","type":"5/1 ARM"}

  or

  HTTP/1.1 200 OK
  Language: en_us
  Charset: UTF-8
  Content-Type: text/xml
  
  <mortgage><principal>238000</principal><rate>3.5</rate><type>5/1 ARM</type></mortgage>

XML with RESTful Interfaces

- **REST** leverages the HTTP Protocol
- **Request - Response** data commonly in XML or JSON
  - XML layout can be documented in an XSD
- **Receive request - return response**
  - CICS Dynamic Scripting or SupportPac CA1S
  - CICS Web Support (EXEC CICS WEB commands)
    - You create the XML:
      - `COBOL GENERATE verb, CICS TRANSFORM verb, CICS DOCUMENT API, read the XML from DB2, whatever`
      - EXEC CICS WEB SEND
  - **Can use ATOM** Support to provide RESTful interface
    - CICS TS V4.1 ATOM support or SupportPac CA8K
    - CICS Dynamic Scripting
HTTP request with XML

- REST is more than just returning XML
  - REST leverages the HTTP protocol, uses HTTP status codes, uses HTTP architected headers, uses commonly accepted approaches to adding filters or search criteria
- CICS TRANSFORM verb
  - XML content documented in an XSD
- COBOL PARSE and GENERATE verbs
- Java classes
- CICS DOCUMENT API
- Get the XML from DB2
- Whatever (COBOL string verb / RYO Assembler)

XML with ATOM Feeds

- Expose VSAM file, TS Queue, or program as ATOM feed
- Provides a RESTful interface documented in RFC5023
- ATOM feeds have a defined set of XML tags
  - As per the ATOM Publishing Format (RFC4287)
- General tags (author, etc) values
  - From your ATOM configuration file
  - From file (using 'unstructured' content)
- Data values formulated based on XSDBind file
  - Created with CICS XML Assistant or RDz
  - Same as with TRANSFORM, but not in a BUNDLE
- Data (in the content tag in the entry tag) can be documented in an XSD
- Dynamic Scripting
XML with ATOM Feeds

- **ATOM configuration file contains**
  - Default values for required tags such as ‘author’
  - Describes SERVICE, CATEGORY, COLLECTION or FEED
  - Contains paths for feed or collection, plus more
- **XSDBind file contains**
  - Data layout information so CICS knows how to encapsulate the data in XML tags

For Feed-related tags, CICS uses XMLSS

Data XML parsing and generation is based on XSDBind file created with CICS XML Assistant or RDz:  
- CICS Parses/generates  
- RDz Converter program  
- zAAP eligible when compiled with Enterprise COBOL V4.1+

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ATOM: Example XML

<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom">
<title>Example Feed</title>
<subtitle>A subtitle.</subtitle>
<link href="http://example.org/feed/" rel="self"/>
<link href="http://example.org/"/>
<updated>2003-12-13T18:30:02Z</updated>
<author>
  <name>John Doe</name>
  <email>johndoe@example.com</email>
</author>
<id>urn:uuid:60a76c80-d399-11d9-b91c-0003939e0af6</id>
<entry>
  <title>Atom-Powered Robots Run Amok</title>
  <link href="http://example.org/2003/12/13/atom03"/>
  <id>urn:uuid:1225c695-cfb8-4ebb-aaaa-80da344efa6a</id>
  <updated>2003-12-13T18:30:02Z</updated>
  <summary>Some text.</summary>
  <content><data_content_here/></content>
</entry>
</feed>
CICS Event Processing Adapters

**CICS TS v4.1**

- **EVENT DISPATCHER**
  - CICS Event
  - Sent to one of
  - Capture Points

- **EXEC CICS SIGNAL EVENT**
  - Existing Business Logic

- **Transactions Security Dispatching Monitoring**

**EVENT CAPTURE**

- **CICS Event Tooling:**
  - Create & Deploy Event Binding

**EP Adapter Interfaces**

- WMO EP Adapter
- HTTP EP Adapter
- 'Transaction Start' EP Adapter
- Custom EP Adapter

**CICS generates XML**

**You could create your own XML**

**Output ONLY**
XML / JSON in CICS Dynamic Scripting

- XML
  - xml_encode()
  - xml_decode()
  - XML Renderer
  - simpleXML PHP extension

- JSON
  - Json_encode()
  - Json_decode()
  - JSON Renderer

- ATOM feed
  - ATOM Renderer
  - atom.decode

Common Issues: xsd:string

- Mapping level 1.0: assumed to be 255 bytes
- Mapping level 1.1: xsd:string > 32767 mapped to container
- Mapping level 1.2: DEFAULT-CHAR-MAXLENGTH
  - Allowed you to set the length assumption
- Mapping level 1.2: CHAR-VARYING
  - NO: string mapped to fix-length field (same as 1.0)
  - NULL: string mapped to fix-length field with null delimiter
  - yes: generates a field for the length and a field for the container
    - Could specify DEFAULT-CHAR-MAXLENGTH=32768 to have any xsd:string mapped to a container
- Mapping level 1.2: CHAR-VARYING-LIMIT
  - Point at which we map xsd:string to a container
  - CHAR-VARYING-LIMIT=0 will have any xsd:string mapped to a container
- Mapping level 2.1: CHAR-VARYING=COLLAPSE is the default
xsd:string – example 1

The input value was:

aString(1:aString-length) Delimited by size into MY-Message.

This is just one way of working with an xsd:string. There are additional ways. This approach only allows for a maximum xsd:string size of 255. Could use DEFAULT-CHAR-MAXLENGTH to indicate the max allowed length.

xsd:string – example 2

This is just one way of working with an xsd:string. There are additional ways. This approach accommodates an xsd:string of any length.
Common Issues: occurring items

- WSDL may contain \texttt{minoccurs} and \texttt{maxoccurs}
- DFHWS2LS generates
  - A field for the number of occurrences
  - A field for a container name
  - The container holds all occurrences
- **Mapping level 2.1**
  - Allows you to generate in-line occurring elements
  - \texttt{INLINE-MAXOCCURS-LIMIT} (point at which occurs is not in-line)
  - Supports occurring at group level
    - \texttt{xsd:sequence}, \texttt{xsd:choice}, and \texttt{xsd:all}

Occurring items - getOvenInfo

- Scenario – oven info from specified warehouse

A Warehouse (#12345)
Occurring Items – get Oven Info

One occurrence of a Model

Model MA876 modelid, price, number in stock

Multiple occurrences of a model

Maytag-Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA876</td>
<td>info</td>
</tr>
<tr>
<td>MA345</td>
<td>info</td>
</tr>
<tr>
<td>MA765</td>
<td>info</td>
</tr>
</tbody>
</table>

Amana-Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM123</td>
<td>info</td>
</tr>
<tr>
<td>AM987</td>
<td>info</td>
</tr>
</tbody>
</table>

Warehouse #12345

Ovens

- Maytag, distributor=Joes Oven Supply
  - Model MA876, price=200, inStock=3
  - Model MA345, price=389, inStock=60
  - Model MA765, price=1200, inStock=9
- Amana, distributor=Ovens-are-us
  - Model AM123, price=50, inStock=450
  - Model AM987, price=487, inStock=67

Occurring Items – getOvenInfo

03 brand.

- 06 theName-length PIC S9999 COMP-5 SYNC.
- 06 theName PIC X(40).
- 06 distributor-length PIC S9999 COMP-5 SYNC.
- 06 distributor PIC X(40).
- 06 model-num PIC S9(9) COMP-5 SYNC.
- 06 model-cont PIC X(16).

The brand, name, and distributor are strings, max length is 40, but real string length in the field that ends in length.

And there are multiple Brands

<table>
<thead>
<tr>
<th>Brand</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maytag</td>
<td>info</td>
</tr>
<tr>
<td>Amana</td>
<td>info</td>
</tr>
</tbody>
</table>
Occurring Items - getOvenInfo

```
06 ovenStock.
  09 brand-num PIC S9(9) COMP-5 SYNC.
  09 brand-cont PIC X(16).

OVEN-INVENTORY
   2 Brand-Info

Brand-Info
   Maytag info
   Amana info

Maytag-Models
   MA876 info
   MA345 info
   MA765 info

Amana-Models
   AM123 info
   AM987 info

Model MA876 modelId, price, number in stock
```

 Hmm!

Occurring Items - getOvenInfo

- A different way to look at it.

```
Warehouse #12345
   Ovens
      Maytag, distributor=Joe's Oven Supply
         Model MA876, price=200, inStock=3
         Model MA345, price=389, inStock=60
         Model MA765, price=1200, inStock=9
      Amana, distributor=Ovens-are-us
         Model AM123, price=50, inStock=450
         Model AM987, price=487, inStock=67
```

These are in a container whose name is stored with Ovens

These are in a container whose name is stored with Maytag

These are in a container whose name is stored with Amana
Common Issues: xsd:any xsd:anyType

- Supported in mapping level 2.1
- xsd:any – a way of specifying undefined content in a Web service message
  - Any well-formed XML
  - One xsd:any per scope, but it can have multiple occurrences
- xsd:anyType – base data type from which all simple and complex data types are derived
  - Similar to the way that all Java objects inherit from “Object”
- Generates a field for a container name for data
  - The specified container will contain the data for that element
- Generates a field for a container name for the XMLNSs
  - The specified container will contain the XML namespaces used in the elements data
- Elements with Abstract=”true” are treated like xsd:any

Common Issues: Custom Headers

- Want to specify custom header information based on information in the business logic program….
  - Business logic program (or wrapper) must use channels and containers
  - Business logic program places information to be placed in the header into a container on the current channel (before INVOKE WEBSERVICE)
  - Header handler GETs information from the current channel
    - Constructs a SOAP header
    - Places the SOAP header in the DFHHEADER container
    - CICS places the header in the SOAP message
Mapping Level 3.0 – Multiple Containers

- DFHLS2WS has REQUEST-CHANNEL= and RESPONSE-CHANNEL=
- Bottom-up
- These point to a channel description document

A container can have a single element – great for Java (or other languages)

```xml
<channel name="fund" xmlns=http://www.ibm.com/xmlns/prod/CICS/channel>
  <container name="id" type="char" use="required"></container>
  <container name="name" type="char" use="optional"></container>
  <container name="rating" type="char" use="optional"></container>
  <container name="price" type="char" use="optional"></container>
</channel>
```

A container can have a language structure

```xml
<channel name="fund" xmlns=http://www.ibm.com/xmlns/prod/CICS/channel>
  <container name="fundAdmin" type="char" use="optional">
    <structure location="/WSP0101.CICSLAB.UTIL(FUNDMM)="/>
  </container>
  <container name="fundHistory" type="char" use="optional">
    <structure location="/WSP0101.CICSLAB.UTIL(FUNDHSRY)="/>
  </container>
</channel>
```

Summary

- Parsing Options
- Places where we parse and generate XML in CICS
  - Web services support
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  - CICS Dynamic Scripting
- Common issues when using CICS’s built-in parsing capability
  - xsd:String
  - Occurring Items
  - Adding headers on Web service requests
  - xsd:any and xsd:anyType
  - Multiple Containers
References

- **Intro to XML:**
  - [http://www.w3.org/TR/xmlschema-0/](http://www.w3.org/TR/xmlschema-0/)

- **XML Schema**
  - [http://www.w3.org/TR/xmlschema-1/](http://www.w3.org/TR/xmlschema-1/)
  - [http://www.w3.org/TR/xmlschema-2/](http://www.w3.org/TR/xmlschema-2/)
  - [http://www.w3.org/XML/](http://www.w3.org/XML/)

- **COBOL:**

- **JAVA**

- **Java XML/XSLT for z/OS Performance**

- **C++ Parsing**

- **DB2 XML Parsing**

- **DB2 for z/OS XML Guide – SC18-9858**

- **Using CICS with DB2 pureXML**

- **Web Services in CICS**