Outline of the Talk

• Introduction
• Foundations – Processes and tools for building manufacturing exchange specifications
• Focus
  – Building quality into specifications
    • Validation Tools
    • Quality of Design Tool (QOD)
    • Naming and Design Rules
  – Using specifications
    • Constraint Generator
• Summary
# Testbed Team

<table>
<thead>
<tr>
<th>Permanent NIST Staff</th>
<th>Guest Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon Frechette</td>
<td>Salifou Sidi-Mahaman</td>
</tr>
<tr>
<td>KC Morris</td>
<td>Severin Tixier</td>
</tr>
<tr>
<td>Josh Lubell</td>
<td>Zheng Wang</td>
</tr>
<tr>
<td><strong>Contractor</strong></td>
<td>Julien Cuviller</td>
</tr>
<tr>
<td>Betty Harvey</td>
<td>Antoine Gerardin</td>
</tr>
<tr>
<td></td>
<td>Olivier Marie-Rose</td>
</tr>
<tr>
<td></td>
<td>Matt Molek (summer 2009)</td>
</tr>
</tbody>
</table>
Motivation

- Standards development and deployment takes too long with too many quality issues.
- Qualify issues slow the adoption of standards.
- Manufacturing and business organizations repeating the same mistakes.
Industry Efforts Encounter Similar Problems

- NIST B2B Interoperability Testbed
  - XML-based interoperability project with the automotive and aerospace industries
- NIST AEX Testbed
  - XML-based interoperability project with the building construction industry
- Product Data Exchange and Validation Testing activities
  - Data exchange-based integration project, not XML-based (ISO10303: STEP)
- Common characteristics
  - Specifications are segmented
  - Data exchange specifications evolve as integration projects proceed
What We Are Doing

- Mechanisms to build standards faster with higher quality
- Infrastructure to enable the exchange of manufacturing, supply chain, and business data
- Support for the creation of manufacturing and business data exchange specifications including
  - Development
  - Testing and Validation
  - Deployment testing
- Tools based on XML and W3C standards – the current implementation mechanism
- Requirements for next generation of tools based on new implementation mechanisms, such as, Web Services, OWL, UML, MOF, etc.
Our Foundation

We Described a Process for Building Manufacturing Exchange Specifications
Exchange Specifications are Bridges
A Process for Building Interoperability Bridges

- Design the bridge
- Test the design
- Build the foundation
- Assemble the structure
- Test the bridge

- Many components are standardized
- Many standards are used
Make that a *robust* process!
Exchange Specification (ES)  
Development Life Cycle

A guideline for building industrial strength data exchange bridges, that provides

• Detailed analysis of the development process for content standards
  – Terminology you use to exchange information
• Architecture for implementing that process
• Outline of requirements for tools
ES Development Life Cycle

Manage ES Development Life Cycle

Target Applications
Integration Requirement Document
External Ontologies
Classification Schemes
Business Rules
Library of Semantically Coherent ES
ES Supporting Materials
Test Suites

Requirements
Sample Exchange Data

Transformation Engines
Editing/Encoding Tools
Validation Tools
Test Suite Development Tools
Test Tools
Rule Engines
Semantic Analysis Tools
Documentation Tools
Decomposition of the ES Development Life Cycle

- NIST Tools—2008
- NIST Tools—2010
OAGi’s Development Process for BODs

Tools — 2008

New Tools — 2010
Construct BODs

- **Extend BODs** (A2.1)
  - Requirements
  - XML Schema Grammar
  - OAGIS Documentation
  - NDR Guidelines

- **Create new BODs/Nouns** (A2.2)
  - Requirements
  - UML Tools for class diagrams
  - XML Schema editor
  - New XML components

- **Qualify BOD** (A2.3)
  - Design Rules
  - XML Schema.xsd
  - Naming Guidelines
  - XML Tools
  - Qualified Schema
  - Map of Requirements to Schema Elements
  - Change Requests
  - Table of Terms

- **Analyze Data Coverage** (A2.4)
  - Sample Data
  - Revised Schemas
  - Spreadsheet
  - XML Validation Tools

- **Extented BODS**
  - Requirement Gaps
Recent Tool Development to support Construction

- Quality of Design Stand-alone tool released
- Quality of Design Tool sharing environment
- XML Schema and Instance Validation Page improved
- XML Schema and Instance Validation Service prototyped
Quality of Design Tool—NDR testing and sharing

Rule 1, Test 1

Rule 2, Test 2

Rule N, Test N

QOD

XSD of rule structure

Rule Input & Test GUI

Common Rule Database

Executable Tests (Schematron, JESS)

XSD of doc structure

Sharing GUI

Rule Selection

Schema to Check

Schema Compliance Report

Custom NDRs
Quality of Design Stand-alone Tool
QOD web version – choice of Test Profiles

<table>
<thead>
<tr>
<th>ID</th>
<th>Version</th>
<th>Name</th>
<th>Owner</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAGI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAGI-9.0-ABIE</td>
<td>0</td>
<td>OAGI ABIE Profile (v9.0)</td>
<td>OAGI</td>
<td></td>
</tr>
<tr>
<td>OAGI-9.0-BOD</td>
<td>0</td>
<td>OAGI BOD Profile - Specific rules to</td>
<td>OAGI</td>
<td></td>
</tr>
<tr>
<td>OAGI-9.0-General</td>
<td>0</td>
<td>OAGI General Profile - Rules that can</td>
<td>OAGI</td>
<td></td>
</tr>
</tbody>
</table>
Select From Existing Tests

View Test Requirements | View Test Profiles | View Test Cases

Showing 47 - 56 of 539 Test Requirement Version(s)

<table>
<thead>
<tr>
<th>ID</th>
<th>Version</th>
<th>Status</th>
<th>Name</th>
<th>Owner</th>
<th>Description</th>
<th>Tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXAMPLE-0-OAGI9R-79</td>
<td>0</td>
<td>draft</td>
<td>Use of xsd: any</td>
<td>EXAMPLE</td>
<td>xsd:anyAttribute MUST NOT be Element in an XML schema</td>
<td>Attribute</td>
</tr>
<tr>
<td>EXAMPLE-0-OAGI9R-92</td>
<td>0</td>
<td>draft</td>
<td>Use of xsd:all</td>
<td>EXAMPLE</td>
<td>xsd:all element MUST NOT be Element in an XML schema</td>
<td>Element</td>
</tr>
<tr>
<td>EXAMPLE-0-SSM2</td>
<td>0</td>
<td>draft</td>
<td>Namespaces</td>
<td>EXAMPLE</td>
<td>[SSM2] A schema in a UnitsML represents SSM</td>
<td>SSM</td>
</tr>
<tr>
<td>EXAMPLE-0-STA-1</td>
<td>0</td>
<td>draft</td>
<td>Relations To</td>
<td>EXAMPLE</td>
<td>[STA1] The UnitsML schema design STA</td>
<td>STA1</td>
</tr>
<tr>
<td>EXAMPLE-0-STA-2</td>
<td>0</td>
<td>draft</td>
<td>Relations To</td>
<td>EXAMPLE</td>
<td>[STA2] The UnitsML schema design STA</td>
<td>STA2</td>
</tr>
<tr>
<td>OAGI-9-0-R-10</td>
<td>0</td>
<td>active</td>
<td>Elements</td>
<td>OAGI</td>
<td>Element, attribute and type names</td>
<td></td>
</tr>
<tr>
<td>OAGI-9-0-R-100</td>
<td>0</td>
<td>active</td>
<td>Use of</td>
<td>OAGI</td>
<td>Each xsd documentation MUST use the attribute</td>
<td></td>
</tr>
<tr>
<td>OAGI-9-0-R-16</td>
<td>0</td>
<td>draft</td>
<td>ABIE global</td>
<td>OAGI</td>
<td>ABIE global element</td>
<td></td>
</tr>
<tr>
<td>OAGI-9-0-R-17</td>
<td>0</td>
<td>draft</td>
<td>For each ABIE</td>
<td>OAGI</td>
<td>For each ABIE, a named</td>
<td></td>
</tr>
<tr>
<td>OAGI-9-0-R-25</td>
<td>0</td>
<td>active</td>
<td>BOD Root</td>
<td>OAGI</td>
<td>OAGI BOD root schema modules</td>
<td></td>
</tr>
</tbody>
</table>
Test Case Detail
Schema Validation

Upload an XML Schema or a ZIP file containing XML schemas to test against the W3C standard specification for XML Schemas.

Specify an Schema/XML file:

Browse

If you uploaded a ZIP file, please specify the TARGET schema file name including the path, starting from the ROOT directory:

ProcessPurchaseOrder.xsd

Choose your parser(s):

☑ Xerces v2.9.1
☑ JING v20081028
☐ MSV v20081113 SUN MULTI-SCHEMA XML VALIDATOR

Enter your email address if you would like the results sent to you (in XML format):

The schema for this instance can be found here. Additionally, an example stylesheet is available for displaying the results in HTML and can be customized as the user wishes.

Validate Schema

Return to Main Menu
Jump to Instance Validation
Go to Naming Report Page
XML Schema and Instance Validation Page

Instance Validation

Upload an XML instance and choose to validate it against an uploaded XML schema(s) or one listed below.

Specify an XML file:

[File path]

Select a schema:

- Upload schema
  - Please specify schema/zip file: [Browse...]
  - If you uploaded a ZIP file, please specify the TARGET schema file name including the path, starting from the ROOT directory:

  - OAGI v9.4.1
  - AIAAG
  - UBL v1.0
  - UBL v2.0
  - StratML

Choose your parser(s):

- Xerces v2.9.1
- JING v20081028
- MSV v20081113
- JAXP v1.4.2
- LibXml2 v2.7.6
XML Validation Service

- Newest project
- Exploring ways to make testbed capabilities available to users
- Soliciting interest
- Defining interfaces—input and output
- Potential use for upgrading to OAGIS 9.5
Customize BOD

Study BOD
A4.1

- Target Applications
- Table of Terms
- Integration Scenarios
- Sample Data
- BOD schema
- UML or other Diagrams
- Diagramming Tools
- Documentation Engine

Augment BOD
A4.2

- HTML Documentation
- Visualization Diagrams
- Target Applications
- Business Rules
- Transaction Requirements
- Sample Data
- BOD schema
- Test Suite Development Tools
- Schematron Tools

Transform BOD
A4.3

- Validation Tools
- BOD schema
- Sample Data
- XSLT Engine
- Schema Lightener/Flattener

Test Pilot BOD
A4.4

- Mapping Table
- Integration Requirements
- Target System Requirements
- Validation Test Suites
- Usage Guidelines
- Implementation Schema
- Change Requests

Implementation Schema
Recent Tool Development to support Customization

• Constraint Generator prototype released
• EDI to XML converter researched and prototyped
• Agile Test Framework (ATF)
Constraint Generator

The state in the shipping address must be either MD, DC, or VA.
EDI to XML converter

- Prototyped for constraint generator but not released
- Converts the EDIFACT library into XML since XML is easier to work with
- Started with ISO standard describing EDI to XML conversion but defined a simpler format
- Tested with EDIFACT d04a messages used by AIAG
- Soliciting interest
Agile Test Framework

- Service Machine
  - Pluggable TC 1
  - Pluggable TC 2
- SUT
  - Test User
- Test Bed
  - Content Verification Tool
  - Test Time Trigger
- Test Infrastructure
  - Test Sequence Engine
  - Event Board
  - Test Configuration Engine
- Test User Interaction Delegator
- Message Capturing Tool
- Test Case Developer
- Abstract Test Case
- Test Case Manager
- Executable Test Cases
- Harness Script
- Configured Test Component
- Interface for Pluggable Test component
- Pluggable Test Component
- Design Model of Pluggable Test Component
- Test Infrastructure
- TF Provider
## Recent Tools for XML-based Exchange Specification

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of Design Testing Tool</td>
<td>Online</td>
</tr>
<tr>
<td>Test Suites for NDR from DON, OAG, UNCEFACT, and others</td>
<td>Online</td>
</tr>
<tr>
<td>Quality of Design Authoring Tools</td>
<td>Available on sourceforge</td>
</tr>
<tr>
<td>Quality of Design Collaboration Tools (QOD Version 2)</td>
<td>On line soon</td>
</tr>
<tr>
<td>Quality of Design Standalone</td>
<td>Available for download</td>
</tr>
<tr>
<td>XML Validation pages</td>
<td>Redesigned pages now online</td>
</tr>
<tr>
<td>Constraint Generator</td>
<td>Prototype with limited distribution</td>
</tr>
<tr>
<td>EDI to XML converter</td>
<td>Prototype</td>
</tr>
<tr>
<td>Web services for Specification Testing</td>
<td>Design phase</td>
</tr>
</tbody>
</table>
Summary

• ES Development Life Cycle is a recipe for building robust exchange specifications
• Drives development of tools and capabilities to support a repeatable process
• Focuses NIST’s work on unique role in supporting standards and delineates role with respect to more generic commercial tools
• Maximizes reuse of work to serve a diverse collection of customers
Current Publications

- Framework for XML Schema Naming and Design Rules Development Tools
- Development Life Cycle for Semantically Coherent Data Exchange Specification
- Documenting and Implementing Guidelines with Schematron
- Framework for XML Schema Naming and Design Rules Development Tools
- QOD Standalone Users Guide
- NDRProfile Schema Version 1.0 User Guide
- User's Guide for the Quality of Design Testing Tool and the Content Checker
- Implementing XML Schema Naming and Design Rules
- XML Schema Validation Process for CORE.GOV
- A Tool Kit for Implementing XML Schema Naming and Design Rules
- XML Schema Design Quality Test Requirements
- An XML Schema Naming Assister for Elements and Types
- Development Life Cycle and Tools for XML Content Models
- Testing Requirements to Manage Data Exchange Specifications in Enterprise Integration - A Schema Design Quality Focus
- A Business-to-Business Interoperability Testbed: An Overview
- Using Business Process Specifications and Agents to Integrate a Scenario-Driven Supply Chain
Websites

• NIST Services

• NIST Publications
d=Testbed-

• Developer’s site
  – http://qod.sourceforge.net/