Advancing HL7 v2 to New Heights:
A Platform for Developing Specifications, Test Plans, and Testing Tools

IHIC
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HL7 v2 is Alive and Well!
End-to-End Strategy

- Specification of Requirements
- Development of Specifications
- Development of Test Cases
- Testing Infrastructure
- Platform to build and manage tools

- NIST builds the platform—let domain experts create and maintain guides, test cases, and tool instances via productivity tools
Why a Better Approach is Needed

- Ambiguous and inconsistent HL7 v2 IGs
- Inadequate conformance mechanisms to specify requirements
- Misuse and misunderstanding of conformance concepts
- Limited/outdated tools to help in standards development
- Lack of tools to create test cases and example messages
- Example messages in IGs are always wrong
- Conformance Testing bound to the quality of the IG
- Conformance Testing tools are often not rigorous/complete
- Conformance Testing Tools are expensive to build
- Conformance Testing Tools are expensive to maintain
- Lack of tools to assist in creating conformance tools
- Testing Platform to meet the stages of testing
- Lack of tooling to migrate from national IGs to local implementations easily
- Lack of complete standards development life-cycle (tooling)
NIST HL7 v2 Platform Overview

- IGAMT – Implementation Guide Authoring and Management Tool → Specification
- TCAMT – Test Case Authoring and Management Tool → Test Plans
- Testing Infrastructure and Framework
- Testing Tool → Conformance Testing
NIST Integrated Platform

1. Single source of truth
2. Word HTML
3. Standard Constraints
4. Standard Constraints and Test Case Constraints
5. Testing Resources
6. Testing Infrastructure & Framework
7. General-purpose Validation Tool (GVT)
8. Test Plan
9. NIST Testing Tools (Web Apps)
10. Standard Constraints and Data Quality Constraints
11. Used to integrated in 3rd party environments

= XML

National Institute of Standards and Technology (NIST)
Towards Interoperability

Trading Partner A

Use Cases

Reduced Negotiations & Translations

Trading Partner B

Standards

Profiling  Implementation  Testing

Requirements
Improve Requirement Specification

- Profile Components
  - “Un-conflate” requirements
  - Extend requirement specification for new use cases
- Data Type Specialization
- Segment Definition Specialization
- Value Set Definition and Binding
- Explicit Conformance Statements
- Expanded Conditional True/False Outcomes
- Explicit Condition Predicates
- Co-constraints
- Understanding of existing conformance constructs
- Definition and use of Conformance Key Words
- “a clean-up of v2” → from lessons learned…
IGAMT Demo: Creating Value Sets and Value Set Binding (2:07)

NIST IGAMT
Implementation Guide Authoring and Management Tool

DEMO

and Identification Number for Organizations
XPN – Extended Person Name
XTN – Extended Telecommunication Number

3.6 Value Sets
HL7.2.5.1 0001 – Administrative Sex
HL7.2.5.2 0002 – Marital Status
HL7.2.5.3 0003 – Event type
HL7.2.5.4 0004 – Patient Class
HL7.2.5.5 0005 – Race
HL7.2.5.6 0006 – Religion
HL7.2.5.7 0007 – Admission Type
HL7.2.5.8 0009 – Ambulatory Status
HL7.2.5.9 0010 – Physician ID
HL7.2.5.10 0018 – Patient Type
HL7.2.5.11 0021 – Bed Debt Agency Code
HL7.2.5.12 0022 – Billing Status
HL7.2.5.13 0023 – Admit Source
HL7.2.5.14 0032 – Charge/Price indicator
HL7.2.5.15 0038 – Order status
HL7.2.5.16 0042 – Company Plan Code
HL7.2.5.17 0044 – Contract Code
HL7.2.5.18 0045 – Courtesy Code
HL7.2.5.19 0046 – Credit Rating
HL7.2.5.20 0061 – Check digit scheme
HL7.2.5.21 0063 – Relationship
HL7.2.5.22 0064 – Financial class
HL7.2.5.23 0066 – Employment Status
HL7.2.5.24 0068 – Guarantor Type
HL7.2.5.25 0069 – Hospital Service
HL7.2.5.26 0072 – Insurance Plan ID
HL7.2.5.27 0073 – Interest Rate Code
HL7.2.5.28 0076 – Message type
HL7.2.5.29 0078 – Abnormal flags
HL7.2.5.30 0080 – Nature of Abnormal Testing
HL7.2.5.31 0085 – Observation result status

Value Set: 0001
Updated: 01/12/2017 16:00, HL7 Version: 2.5.1

Metadata
Definition
Delta
%Cross-References
Pre-Text Structure Post-Text

Value Set Definition Attribute

Extensibility Not Defined
Stability Not Defined
Content Definition Not Defined

Source Code System
HL70001

Content
Codes Per Page: 30

Filter
By Value
By Description
By Code System
By Usage

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
<th>CodeSystem</th>
<th>Usage</th>
<th>Comments</th>
</tr>
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<tbody>
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<td>O</td>
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</tr>
<tr>
<td>U</td>
<td>Unknown</td>
<td>HL70001</td>
<td>P</td>
<td></td>
</tr>
</tbody>
</table>
Validation Process

- **HL7 v2 Standard**
- **HL7 v2 Data Base**
- **IGAMT Model (v2 messages)**
- **IGAMT**
  - User Selects Message and Constrains to Use Case Requirements
- **Profile Schema**
- **XML Profile Instance**
  - Message
  - Vocabulary
- **Message Instance**
- **Validation Engine**
- **Validation Report**

**“Automated”**
User defines requirements in IGAMT—”high level tool”

**“Dynamic”**
Contains “codified” requirements as defined in IGAMT

**“Static”**
Interprets and makes assertions against message instance
IGAMT and GVT Demo: Validation Tools (1:08)

HL7 Version 2.8.2 Implementation Guide: Immunization Messaging with enhanced query

Conformance Profile: VXU^V04^VXU_V04

Updated 09/11/2017 10:49

3. Message Infrastructure
   3.1. Profile Components
   3.2. Conformance Profiles
   [1] VXU^V04^VXU_V04_Z22-Send an Unsolicited Immunization Event
   [3] ADT*AS1*ADT_A05-Z24-Send Demographics Only Content
   [4] OBX*OB1*OB1-Z34-Request a Complete Immunization History
   [5] OBX*OB1*OB1-Z44-Request an Evaluated Immunization History and Forecast
   [6] OBX*OB1*OB1-Z54-Request a Complete Immunization History With Evaluation and Forecast
   [8] RSP*K11*RSP_K11-Z32-Respond with a Complete Immunization History
   [9] RSP*K11*RSP_K11-Z33-Respond with a No Person Found Message
   [10] RSP*K11*RSP_K11-Z42-Respond with an Evaluated History and Forecast
   3.3. Composite Profiles
   3.4. Segments and field descriptions:
# TCAMT and GVT Demo: Creating Test Cases and Context-based Testing (1:48)

## List of Test Plans

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
<th>Date</th>
<th>Actions</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>New TestPlan</td>
<td></td>
<td></td>
<td>2017/05/03 16:37:18</td>
<td></td>
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<td>2</td>
<td>Demo</td>
<td>wqe</td>
<td></td>
<td>2017/05/03 16:37:18</td>
<td></td>
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<tr>
<td>3</td>
<td>Demo12</td>
<td>wqe</td>
<td>init</td>
<td>2017/05/03 16:37:18</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>EIP</td>
<td>Case Reporting for Food Net</td>
<td></td>
<td>2017/07/19 09:42:17</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NIST</td>
<td>Demo Test Plan</td>
<td>1.0</td>
<td>2017/04/13 42:58</td>
<td></td>
</tr>
</tbody>
</table>
Profile Components

Use as Building Blocks
- Base Profile Component + Profile Component 1 + Profile Component 2 = Profile 1
- Base Profile Component + Profile Component 1 + Profile Component 3 = Profile 2
- Profile 1 + Profile Component 5 + Profile Component 6 = Profile 4

Reuse and Replacement
- Base Profile Component + Profile Component 1 + Profile Component 3 = Profile 2

Requirement Substitution
- Profile 1 + Profile Component 5 + Profile Component 6 = Profile 4

Expanding a Use Case
- Profile 1 + Profile Component 4 = Profile 3
- LRI Profile + Public Health Component = LRI Profile

- Specify requirements subset and then construct solution
- Reuse components as “building blocks”
Managing Localizations

- Profile Components can be used to manage localizations
- Aids in making comparisons
- Profiling and validation tools are helpful in profile management and validation

![Diagram showing profile components and composite profile](image-url)

Base Profile

Profile Component

Composite Profile

National Level Profile for Send Immunization History

- **Maryland Profile Component**
- **Texas Profile Component**
- **Michigan Profile Component**
- **Wisconsin Profile Component**

= = = =
Status

- IGAMT
  - 2 HL7 Balloted IGs Created (May 2017)
  - Many others now using

- TCAMT
  - Used for ONC, ARIA, HIMSS Test Plans

- Testing Tools
  - “Hand-built” Tools
    - Many (General, ONC, AIRA, HIMSS, IHE, etc.)
  - GVT-General Validation Tool Emerging

- Various tool components used for years
What Next?

- Production Quality
- More Features
- HL7 v2 ballot process—initial discussions
  - IGs created with IGAMT
  - Collaborative (on-line)
  - Context-free test tool is done when IG is done
- HL7 v2+ moving to on-line standard
  - IGAMT produces IGs in HTML
Thank You!

Questions

Contact: robert.snelick@nist.gov

Tool Portal: hl7v2tools.nist.gov
Extra Slides
# NIST HL7 v2 Tool Portfolio

- [https://hl7v2tools.nist.gov](https://hl7v2tools.nist.gov)

<table>
<thead>
<tr>
<th>Standard</th>
<th>Owner</th>
<th>Testing Program</th>
<th>Links</th>
</tr>
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<tbody>
<tr>
<td>Immunization R1.4*</td>
<td>CDC</td>
<td>✓ ONC 2014 Ed. Certification</td>
<td><a href="http://hl7v2-iz-testing.nist.gov">http://hl7v2-iz-testing.nist.gov</a></td>
</tr>
<tr>
<td>Immunization R1.5*</td>
<td>CDC</td>
<td>✓ ONC 2015 Ed. Certification ✓ AIRA IIS Assessment ✓ HIMSS/CDC EHR Certification</td>
<td><a href="http://hl7v2-iz-r1.5-testing.nist.gov">http://hl7v2-iz-r1.5-testing.nist.gov</a> [<a href="http://iztool-cdc.hit.icsl.net:8080/iztool">http://iztool-cdc.hit.icsl.net:8080/iztool</a>]</td>
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<tr>
<td>Syndromic Surveillance R1.1*</td>
<td>CDC/ISDS</td>
<td>✓ ONC 2014 Ed. Certification</td>
<td><a href="http://hl7v2-ss-testing.nist.gov">http://hl7v2-ss-testing.nist.gov</a></td>
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<tr>
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<td>✓ ONC 2015 Ed. Certification</td>
<td><a href="http://hl7v2-ss-r2-testing.nist.gov">http://hl7v2-ss-r2-testing.nist.gov</a></td>
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<tr>
<td>LRI R1 DSTU R1</td>
<td>HL7/ONC</td>
<td>✓ ONC 2014 Ed. Certification</td>
<td><a href="http://hl7v2-lab-testing.nist.gov">http://hl7v2-lab-testing.nist.gov</a></td>
</tr>
<tr>
<td>ELR (Reportable Labs) R1.0*</td>
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<td>✓ ONC 2014/2015 Ed. Certification</td>
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</tr>
<tr>
<td>LOI R1 DSTU R2</td>
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<td>✓ ONC Pilot Testing</td>
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<tr>
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<td>HL7/ONC</td>
<td>✓ ONC Pilot Testing</td>
<td><a href="http://hl7v2-lab-r2-testing.nist.gov">http://hl7v2-lab-r2-testing.nist.gov</a></td>
</tr>
<tr>
<td>eDOS R2 DSTU R2</td>
<td>HL7/ONC</td>
<td>✓ ONC Pilot Testing</td>
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<td>Vital Records DR R1</td>
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<td>✓ CDC ✓ IHE Connect-a-thon</td>
<td><a href="http://hl7v2-vr-r2-testing.nist.gov">http://hl7v2-vr-r2-testing.nist.gov</a></td>
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<tr>
<td>Height and Weight</td>
<td>CDC/IHE</td>
<td>✓ CDC ✓ IHE Connect-a-thon</td>
<td><a href="http://hl7v2-cf-validator.nist.gov">http://hl7v2-cf-validator.nist.gov</a></td>
</tr>
</tbody>
</table>

*State Registries use for on-boarding ✓ Unknown number of local installations
## NIST Productivity Tool – IGAMT

<table>
<thead>
<tr>
<th>Standard</th>
<th>Developer</th>
<th>Use</th>
<th>HL7 Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunization HL7 R1</td>
<td>CDC</td>
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<td>HL7 v2.8.2</td>
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<tr>
<td>Immunization R1.5</td>
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<td>HL7 v2.5.1</td>
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<td>Syndromic Surveillance R2.?</td>
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<td>✓ In Progress</td>
<td>HL7 v2.5.1</td>
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<td>Syndromic Surveillance R2.0</td>
<td>NIST</td>
<td>✓ NIST Internal for ONC 2015 Ed. Certification</td>
<td>HL7 v2.5.1</td>
</tr>
<tr>
<td>Vital Records Birth Reporting</td>
<td>CDC</td>
<td>✓ May 2017 HL7 Ballot</td>
<td>HL7 V2.6</td>
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<tr>
<td>LOI R1 DSTU R2</td>
<td>NIST</td>
<td>✓ NIST Internal-In Progress</td>
<td>HL7 v2.5.1</td>
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<tr>
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<td>HL7 v2.5.1</td>
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<tr>
<td>Patient Care Devices (PCD)</td>
<td>NIST</td>
<td>✓ NIST Internal-In Progress for IHE</td>
<td>HL7 v2.6</td>
</tr>
<tr>
<td>Electronic Case Reporting</td>
<td>CDC</td>
<td>✓ In Progress</td>
<td>HL7 v2.6</td>
</tr>
<tr>
<td>Local Use</td>
<td>Vendors/States</td>
<td>✓ Unknown</td>
<td>Unknown</td>
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</tbody>
</table>

✓ = 50+ registrations (many new coming from the CDC)

IGAMT-generated implementation guides balloted by HL7
# NIST Productivity Tool – TCAMT

<table>
<thead>
<tr>
<th>Standard</th>
<th>Developer</th>
<th>Use</th>
</tr>
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<tbody>
<tr>
<td>Immunization R1.5</td>
<td>CDC/CNI/HIMSS</td>
<td>✓ HIMSS Certification</td>
</tr>
<tr>
<td>Immunization R1.5</td>
<td>CDC/NIST</td>
<td>✓ ONC 2015 Ed. Certification</td>
</tr>
<tr>
<td>Immunization R1.5</td>
<td>AIRA</td>
<td>✓ AIRA IIS Assessment Program</td>
</tr>
<tr>
<td>Syndromic Surveillance R2.0</td>
<td>ISDS/NIST</td>
<td>✓ ONC 2015 Ed. Certification</td>
</tr>
<tr>
<td>Vital Records Death Reporting</td>
<td>CDC/NIST</td>
<td>✓ IHE Pre-connect-a-thon/Connect-a-thon, CDC</td>
</tr>
<tr>
<td>Vital Records Birth Reporting</td>
<td>CDC/NIST</td>
<td>✓ IHE Pre-connect-a-thon/Connect-a-thon, CDC – In Planning</td>
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<tr>
<td>LOI R1 DSTU R2</td>
<td>NIST</td>
<td>✓ NIST Internal-In Progress</td>
</tr>
<tr>
<td>LRI R1 DSTU R2</td>
<td>NIST</td>
<td>✓ NIST Internal-In Progress</td>
</tr>
<tr>
<td>eDOS R2 DSTU R2</td>
<td>NIST</td>
<td>✓ NIST Internal-In Progress</td>
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<tr>
<td>Patient Care Devices (PCD)</td>
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</tr>
<tr>
<td>ePrescribing</td>
<td>NIST/NCPDP</td>
<td>✓ Tool in development (Adapted)</td>
</tr>
</tbody>
</table>

TCAMT allows domain experts to develop test scenarios and test cases, with example messages—set in the foundation of the XML Profile created in IGAMT.

Scenarios can be created to test capabilities, workflow, functional requirements, and robustness via “negative” testing.
NIST HL7v2 End-to-End Platform

Requirements
- HL7 v2 IG Template
- Use Case Development
- Message Profiling
- Vocabulary Profiling
- Disposition Traceability
- Libraries
- Document Generator
- Utilities
  - Implementation Guide Authoring & Management Tool

Scenarios
- Test Plan Development
- Test Case Development
- Constraint Generator
- Data Management
- Message Generation
- Test Script Generator
- Document Generator
- Test Case Management and Authoring Tool

Infrastructure
- Conformance Profiles (XML)
- Vocabulary Libraries (XML)
- Test Case Specific Context Files (XML)
- Data Sheets
- Juror Documents
- Test Plan Execution Script (XML)
- Test Plan English Document

Tool Instances
- Testing Components
- Test Agents
- Execution Engine
- Validation Engine
- Message Generation Engine
- Report Generation
- Transport
- GUI Components
- Testing Framework

Web Application
- Domain Specific
- Test Plans
- Test Cases
- Validation
- Profile Viewer
- Vocabulary Viewer
- Examples
- Transport
- Documentation
- Testing Tools

User Input

Tool Generated
<Structure>
  </Field>
  - <Field Name="Patient Name" Max="#" Min="1" Usage="R" ItemNo="00108" ConLength="1" MaxLength="250" MinLength="1" Flavor="XPN_IZ_001" Datatype="XPN">
    - <Structure>
      - <Component Name="Family Name" Usage="R" ConLength="1" MaxLength="194" MinLength="1" Flavor="FN" Datatype="FN">
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        - <SubComponent Name="Own Surname Prefix" Usage="O" ConLength="1" MaxLength="20" MinLength="0" Flavor="ST" Datatype="ST"/>
        - <SubComponent Name="Own Surname" Usage="O" ConLength="1" MaxLength="50" MinLength="0" Flavor="ST" Datatype="ST"/>
        - <SubComponent Name="Surname Prefix From Partner/Spouse" Usage="O" ConLength="1" MaxLength="20" MinLength="0" Flavor="ST" Datatype="ST"/>
        - <SubComponent Name="Surname From Partner/Spouse" Usage="O" ConLength="1" MaxLength="50" MinLength="0" Flavor="ST" Datatype="ST"/>
      </Component>
    </Structure>
  </Field>
  <Component Name="Given Name" Usage="R" ConLength="1" MaxLength="30" MinLength="1" Flavor="ST" Datatype="ST"/>
  <Component Name="Suffix (e.g., JR or III)" Usage="O" ConLength="1" MaxLength="20" MinLength="0" Flavor="ST" Datatype="ST"/>
  <Component Name="Prefix (e.g., DR)" Usage="O" ConLength="1" MaxLength="20" MinLength="0" Flavor="ST" Datatype="ST"/>
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  <Component Name="Name Type Code" Usage="R" ConLength="1" MaxLength="199" MinLength="0" Flavor="ID" Datatype="ID" Binding="HL70200_IZ"/>
  <Component Name="Name Representation Code" Usage="O" ConLength="1" MaxLength="1" MinLength="1" Flavor="ID" Datatype="ID" Binding="HL70465"/>
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      <SubComponent Name="Alternate Text" Usage="O" ConLength="1" MaxLength="199" MinLength="0" Flavor="ST" Datatype="ST"/>
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    - <Structure>
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  </Component>
  - <Component Name="Name Assembly Order" Usage="O" ConLength="1" MaxLength="1" MinLength="1" Flavor="ID" Datatype="ID" Binding="HL70444"/>
    - <Structure>
      <SubComponent Name="Effective Date" Usage="O" ConLength="1" MaxLength="26" MinLength="1" Flavor="TS" Datatype="TS"/>
      <SubComponent Name="Time" Usage="R" ConLength="1" MaxLength="24" MinLength="0" Flavor="DTM" Datatype="DTM"/>
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  </Component>
</Structure>
Local Profiles and Test Tools

- **Standard**
  - Constrainable Profile
  - Constrainable or Implementation Profile

- **Base Standard**
  - HL7 V2.5.1 VXU V04 Message Definition

- **National Level (ONC Certification)**
  - CDC HL7 V2.5.1 VXU V04 Profile
  - Texas HL7 V2.5.1 VXU V04 Profile
  - Wisconsin HL7 V2.5.1 VXU V04 Profile

- **Local**
  - NIST Validation Engine
    - Texas HL7 V2.5.1 VXU V04 Profile
    - CDC HL7 V2.5.1 VXU V04 Profile
    - Wisconsin HL7 V2.5.1 VXU V04 Profile

- **NIST Immunization Validation Tool**

R. Snelick March 2015
Value Set Specification

- Most IGs assign the entire code system to the data element
- This method indicates a precise value set definition and binding specification
- Provides implementers the tools to be specific

<table>
<thead>
<tr>
<th>Concept Domain = Identifier Type</th>
<th>Binding ID</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>Value Set Root Name = HL70203_USL</td>
<td>Strength</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Extensibility</td>
<td>Closed</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td>Stability</td>
<td>Static</td>
<td>Static</td>
<td>Static</td>
<td>Static</td>
</tr>
<tr>
<td></td>
<td>Profile ID</td>
<td>LRI</td>
<td>LRI</td>
<td>LRI</td>
<td>LRI</td>
</tr>
<tr>
<td></td>
<td>Binding</td>
<td>PID-3.5</td>
<td>PID-18.5</td>
<td>ORC-12.13</td>
<td>OBX-23.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
<th>Usage</th>
<th>Usage</th>
<th>Usage</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN</td>
<td>Account Number</td>
<td>E</td>
<td>R</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>BA</td>
<td>Bank Account Number</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>DL</td>
<td>Drivers License Number</td>
<td>P</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>FI</td>
<td>Facility Identifier</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
</tr>
<tr>
<td>MR</td>
<td>Medical Record Number</td>
<td>R</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>NPI</td>
<td>National Provider Identifier</td>
<td>P</td>
<td>E</td>
<td>R</td>
<td>P</td>
</tr>
<tr>
<td>PT</td>
<td>Patient External Identifier</td>
<td>R</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>SS</td>
<td>Social Security Number</td>
<td>P</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>XX</td>
<td>Organization Identifier</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Element Name (Identifier Type)</th>
<th>Value Set</th>
<th></th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>PID-3.5</td>
<td>Patient Identifier List</td>
<td>HL70203_USL.1</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>PID-18.5</td>
<td>Patient Account Number</td>
<td>HL70203_USL.2</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>ORC-12.13</td>
<td>Ordering Provider</td>
<td>HL70203_USL.3</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>OBX-23.7</td>
<td>Performing Organization Name</td>
<td>HL70203_USL.4</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>
Value Set Specification

- Value Set Binding is within the context of the specific element—not to the data type as a whole
- NIST Profile XML supports construct
- IGAMT tooling and NIST validation supports construct

<table>
<thead>
<tr>
<th>Element</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Code</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Patient Identifier List</td>
<td>R</td>
<td>1</td>
<td></td>
<td>USR 2.8.2</td>
<td>CX_I0201</td>
</tr>
<tr>
<td>1. ID Number</td>
<td>R</td>
<td></td>
<td>15</td>
<td>USR 2.8.2</td>
<td>ST_I0201</td>
</tr>
<tr>
<td>2. Identifier Check Digit</td>
<td>0</td>
<td></td>
<td>4</td>
<td>HL7 2.8.2</td>
<td>ST</td>
</tr>
<tr>
<td>3. Check Digit Scheme</td>
<td>0</td>
<td></td>
<td></td>
<td>HL7 2.8.2</td>
<td>ID</td>
</tr>
<tr>
<td>4. Assigning Authority</td>
<td>R</td>
<td></td>
<td></td>
<td>USR 2.8.2</td>
<td>HD_I0201</td>
</tr>
<tr>
<td>5. Identifier Type Code</td>
<td>R</td>
<td></td>
<td></td>
<td>USR 2.8.2</td>
<td>ID_I0201</td>
</tr>
<tr>
<td>6. Assigning Facility</td>
<td>0</td>
<td></td>
<td></td>
<td>HL7 2.8.2</td>
<td>HD</td>
</tr>
</tbody>
</table>
Conditional Usage

Usage Construct: C(a/b)

C: Usage indicator
a: Usage for TRUE outcome
b: Usage for FALSE outcome

Condition Predicate: Condition statement that determines TRUE or FALSE Outcome (Must be computable from within the object it applies)

Examples:

C(R/X)
C(RE/X)
C(R/RE)
C(O/X)
C(RE/O)

Support of any combination of usage indicators in conditionals. Also provides explicit Condition Predicates

Very few standards support the detailed specificity of conditionals described here—nor are condition predicates explicitly stated

HL7 V2.x
C(R/X) \rightarrow C
C(RE/X) \rightarrow CE
Explicit Conditional Predicates

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Usage</th>
<th>DT</th>
<th>Predicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identifier</td>
<td>RE</td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Text</td>
<td>C(R/RE)</td>
<td>ST</td>
<td>If CE.1 (Identifier) is not valued.</td>
</tr>
<tr>
<td>3</td>
<td>Name of Coding System</td>
<td>C(R/X)</td>
<td>ID</td>
<td>If CE.1 (Identifier) is valued.</td>
</tr>
<tr>
<td>4</td>
<td>Alternative Identifier</td>
<td>O</td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Alternative Text</td>
<td>O</td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Alternative Name of Coding System</td>
<td>O</td>
<td>ID</td>
<td></td>
</tr>
</tbody>
</table>

- Most v2 specifications never made the condition predicate explicit.
- IGAMT provide a predicate builder and enforces a predicate for conditional usage.
### Explicit Conformance Statements

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Usage</th>
<th>DT</th>
<th>Predicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>RXA-1</td>
<td>Give Sub-ID Counter</td>
<td>RE</td>
<td>NM</td>
<td>IZ-28: The value of RXA-1 (Give Sub-ID Counter) SHALL be '0'.</td>
</tr>
<tr>
<td>RXA-2</td>
<td>Administration Sub-ID Counter</td>
<td>R</td>
<td>NM</td>
<td>IZ-29: The value of RXA-2 (Administration Sub-ID Counter) SHALL be '1'.</td>
</tr>
<tr>
<td>RXA-3</td>
<td>Date/Time Start of Administration</td>
<td>R</td>
<td>TS</td>
<td>IZ-TS_NZ: The value of RXA-3.1 (Time) SHALL be formatted with YYYYMMDD.</td>
</tr>
<tr>
<td>RXA-4</td>
<td>RXA-4: Date/Time End of Administration</td>
<td>O</td>
<td>TS</td>
<td></td>
</tr>
<tr>
<td>RXA-5</td>
<td>Administered Code</td>
<td>R</td>
<td>CE</td>
<td></td>
</tr>
<tr>
<td>RXA-6</td>
<td>Administered Amount</td>
<td>R</td>
<td>NM</td>
<td>IZ-49: If the value of RXA-5.1 (Identifier) is '998', then the value of RXA-6 (Administered Amount) SHALL be '999'.</td>
</tr>
</tbody>
</table>

- Most v2 specifications don’t define explicit conformance statements; instead “requirement-looking” comments are embedded in the narrative text.
- IGAMT provides a conformance statement builder.
Co-Constraints

- Used to express dependencies among a set of data values
- Observations typically have co-constraints
- Co-constraints can be expressed in a table format, as shown below (preferred) or with explicit complex conformance statements

<table>
<thead>
<tr>
<th>LOINC (OBX-3)</th>
<th>Description</th>
<th>Data Type (OBX-2)</th>
<th>Value Set (OBX-5)</th>
<th>Units (OBX-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30973-2</td>
<td>Dose number in series</td>
<td>NM</td>
<td>Not applicable</td>
<td>“NA” from HL70353</td>
</tr>
<tr>
<td>59782-3</td>
<td>Number of doses in series</td>
<td>NM</td>
<td>Not applicable</td>
<td>“NA” from HL70353</td>
</tr>
<tr>
<td>59783-1</td>
<td>Status in Immunization series</td>
<td>CE</td>
<td>Local Value Set</td>
<td></td>
</tr>
<tr>
<td>30956-7</td>
<td>Vaccine Type</td>
<td>CE</td>
<td>CVX - Vaccine Group</td>
<td></td>
</tr>
<tr>
<td>30980-7</td>
<td>Date next dose is due</td>
<td>DT_D</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>59779-9</td>
<td>Immunization Schedule</td>
<td>CE</td>
<td>ScheduleIdentifier</td>
<td></td>
</tr>
<tr>
<td>30963-3</td>
<td>Vaccine funding source</td>
<td>CE</td>
<td>FundingSource</td>
<td></td>
</tr>
</tbody>
</table>
# Co-Constraints: Complex Dependencies

<table>
<thead>
<tr>
<th>Meta Data</th>
<th>IF Column</th>
<th>THEN Columns</th>
<th>User Columns</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>T</td>
<td>C</td>
<td>U</td>
<td>OBX-3</td>
</tr>
<tr>
<td>Group ID</td>
<td>01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>P</td>
<td>*</td>
<td>R</td>
<td>321</td>
</tr>
<tr>
<td>02</td>
<td>S</td>
<td>1</td>
<td>R</td>
<td>32</td>
</tr>
<tr>
<td>03</td>
<td>S</td>
<td>1</td>
<td>S</td>
<td>111</td>
</tr>
<tr>
<td>Group ID</td>
<td>02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>P</td>
<td>*</td>
<td>S</td>
<td>342</td>
</tr>
<tr>
<td>05</td>
<td>S</td>
<td>*</td>
<td>S</td>
<td>675</td>
</tr>
<tr>
<td>Group ID</td>
<td>03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>P</td>
<td>1</td>
<td>R</td>
<td>01</td>
</tr>
</tbody>
</table>
Data Type Flavors

- Create a specialization of a data type for a specific use
  - i.e., constrain the data type
- Can be reused
- Promotes consistency
Data Type Flavor – Example 1

**Data Type: CE**

<table>
<thead>
<tr>
<th>Name</th>
<th>Usage</th>
<th>Data Type</th>
<th>Value Set/Single Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identifier</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>2. Text</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>3. Name of Coding System</td>
<td>0</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
</tr>
<tr>
<td>4. Alternate Identifier</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>5. Alternate Text</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>6. Name of Alternate Coding System</td>
<td>0</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
</tr>
</tbody>
</table>

**Data Type: CE_01**

<table>
<thead>
<tr>
<th>Name</th>
<th>Usage</th>
<th>Data Type</th>
<th>Value Set/Single Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identifier</td>
<td>R</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>2. Text</td>
<td>R</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>3. Name of Coding System</td>
<td>R</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
</tr>
<tr>
<td>4. Alternate Identifier</td>
<td>X</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>5. Alternate Text</td>
<td>X</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>6. Name of Alternate Coding System</td>
<td>X</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
</tr>
</tbody>
</table>
### Data Type: CE

<table>
<thead>
<tr>
<th>Name</th>
<th>Usage</th>
<th>Data Type</th>
<th>Value Set/Single Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identifier</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>2. Text</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>3. Name of Coding System</td>
<td>0</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
</tr>
<tr>
<td>4. Alternate Identifier</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>5. Alternate Text</td>
<td>0</td>
<td>HL7 2.5.1 ST</td>
<td></td>
</tr>
<tr>
<td>6. Name of Alternate Coding System</td>
<td>0</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
</tr>
</tbody>
</table>

### Data Type: CE_02

<table>
<thead>
<tr>
<th>Name</th>
<th>Usage</th>
<th>Data Type</th>
<th>Value Set/Single Code</th>
<th>Predicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identifier</td>
<td>RE</td>
<td>HL7 2.5.1 ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Text</td>
<td>C(R/RE)</td>
<td>HL7 2.5.1 ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Name of Coding System</td>
<td>C(R/X)</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
<td></td>
</tr>
<tr>
<td>4. Alternate Identifier</td>
<td>RE</td>
<td>HL7 2.5.1 ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Alternate Text</td>
<td>RE</td>
<td>HL7 2.5.1 ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Name of Alternate Coding System</td>
<td>RE</td>
<td>HL7 2.5.1 ID</td>
<td>0396</td>
<td></td>
</tr>
</tbody>
</table>
Data Type Libraries

- **Master Data Type Library**
  - Create standardized flavors
  - CWE → CWE_01, CWE_02, CWE_03, etc.
  - Immutable
  - End user uses like base data type—they complete the rest of the specification
    - E.g., a specific value set binding
  - Provides consistent definitions for doing the same thing!

- **User Data Type Library**
  - User create customized data type flavors for reuse
  - Can share libraries
  - Flavors created from Base and/or Master Data Types
Segment Flavors
Profiling Multiple Occurrences

- Different Data Type Flavor for each component occurrence (repetition)

- May provide additional constraints based on:
  - order
  - “one-of”
  - content, e.g., name type code

- Similar to FHIR Slicing

```xml
<comp name="comp 1" usage="R"/>
<comp name="comp 1" usage="X"/>
<comp name="comp 2" usage="R"/>
<comp name="comp 2" usage="X"/>
<comp name="comp 3" usage="RE"/>
<comp name="comp 3" usage="R"/>
<comp name="comp 4" usage="X"/>
<comp name="comp 4" usage="R"/>
```
IGAMT

- Tool to create standards
- Narrative + Message Definition
- Built-in template
- Supports current conformance constructs
- Enforces conformance rules
- Promotes consistency in requirements
- Single source of truth
- New profile schema (for XML profile instances)
- XML export is gateway to other services
- Constraints for context-free testing
HL7 v2 Profiling Overview

HL7 v2 Message Structure

VXU

Unsolicited vaccine history

MSH

PID

PD1

NK1

PV1

IN1

IN2

IN3

ORC

RXA

RXA-1

RXA-2

RXA-3

RXA-4

RXA-5

RXA-6

RXA-7

RXA-8

RXA-9

RXR

OBX

OBX

OBX

OBX

NTE

HL7 Base Standard

Gender (PID-8)

Value | Description
--- | ---
M | Male
F | Female
O | Other
A | Ambiguous
N/A | Not Applicable

Data Type 1 | Usage | Length
--- | --- | ---
Element 1 | R | 32
Element 2 | O | 128
Element 3 | O | 16
Element 4 | O | 32

Constrainable Profile

VXU

Unsolicited vaccine history

MSH

PID

PD1

NK1

PV1

IN1

IN2

IN3

ORC

RXA

RXA-1

RXA-2

RXA-3

RXA-4

RXA-5

RXA-6

RXA-7

RXA-8

RXA-9

RXR

OBX

OBX

OBX

OBX

NTE

Gender (PID-8)

Value | Description
--- | ---
M | Male
F | Female
O | Other
A | Ambiguous
N/A | Not Applicable

Data Type 1 | Usage | Length
--- | --- | ---
Element 1 | R | 32
Element 2 | R | 128
Element 3 | C(R/X) | 16
Element 4 | X | 0

National Level Profile

Precise Requirements

Explicit Constraint: OBX-11 (Status) SHALL be valued "F".
NIST IGAMT (HL7 v2 tool)

- Implementation Guide Authoring and Management Tool (IGAMT)
- Message Profiling and IG Authoring
- Full authoring capabilities
- Message Validation and Generation are handled in separate NIST Tools
- Includes the latest HL7 v2.x conformance model
TCAMT

- Tool Test Plans and Test Cases
- Narrative + Test Case Definitions
- Import XML profiles in IGAMT format
- XML profiles provide underlying model
- NIST-built constraint mechanism
- Expands testing capabilities
- Example/test messages \(\leftarrow\) Powerful notion
- Single source of truth
- XML export is gateway to other services
- Constraints for context-based testing
Testing Infrastructure & Framework

- Provides core services
  - E.g., Validation Engine
- Building Blocks
- XML profiles provide underlying model
- NIST-built constraint mechanism
- Automatic assertion generation
- Expands testing capabilities
- Builds test/example messages
- XML export is gateway to other services
- Single source of truth
NIST HL7 v2 Platform

- Platform to build and manage tools
- Transfers tooling to standard developers
- SMEs create targeted test cases
- Low barrier to entry for non-techies
- Single source for modifications
- Changes are propagated through the platform—less error prone
- Reduces costs
- Reduces maintenance effort (quick updates)
- Promotes tool sustainability (tool longevity)
  - Other tools start all over again for updates
Local Profiles

Standard

Constrainable Profile

Constrainable or Implementable Profile

Implementable Profile

HL7 V2.5.1 VXU V04 Message Definition

CDC HL7 V2.5.1 VXU V04 Profile

Texas HL7 V2.5.1 VXU V04 Profile

Wisconsin HL7 V2.5.1 VXU V04 Profile

Texas HL7 V2.5.1 VXU V04 Profile (As Implemented)

Wisconsin HL7 V2.5.1 VXU V04 Profile (As Implemented)

Base Standard

National Level (ONC Certification)

Local
Types of Testing

Phase 1: Capabilities Testing (Conformance Testing)
- Vendor Product
- Testing Tool
- Results
- Certification Criteria:
  - National Requirements (National Profile)
  - Vendor Product (Test Environment)

Phase 2: Capabilities Testing (Conformance Testing)
- Installed Vendor Product
- Testing Tool
- Results
- Certification Criteria:
  - Add Local Requirements (Implementation Profile)
  - Vendor Product (Configured and Installed)

Phase 3: Site Specific Testing (Interoperability Testing)
- Site A: Installed Certified Product
  - Working Interface
  - Harmonize local requirements
  - Conformance
  - Interoperability
- Site B: Installed Certified Product
  - Conformance
  - Interoperability
- Site A Specific:
  - Revised Test Cases
  - Local Requirements
  - Local Regulations
- Site B Specific:
  - Configuration
  - Local Testing
  - Results

Constrainable Profile
- National Requirements
- Local Requirements
- Compatible Profiles
- Implementable

Implementable Profile
- Implementable Profiles
Extra Slides

Testing
Context-free Testing

- HL7 v2 message validation example

- Sender-oriented testing
- No Test Cases provided
- Context (Test Scenario, etc.) is unknown to validation tool
- May be used to test any message created by an EHR
- Provides a simple and convenient method for testing message structure and most vocabulary
Context-free Validation
Context-based Testing

- Test scenario and data given
- Expands the scope of testing
- Type of testing used in ONC EHR-S certification testing
- Capability Testing

Test Case

Test Story
- Sets the clinical backdrop

Test Data
- Typical data available in the real world

Implementation Guide
- Technical Requirements

Test Tool

Validation

Validation Report

Tester

Enters Test Data

EHR

HL7 V2 Message

Content

Requirements

Content expands technical requirement testing capabilities and enables content testing.
Context-based Testing

- Test Story gives the test scenario
- Test Data indicates the real-world data
- Content Assertions indicates how content will be validated
Context-based Testing

- Defines the criteria that are used by the test tool to assess the test data that populate each element in a message
- Tells the Tester if the test data in a specific field can be changed, the source of the test data, and to what level of precision the validation tool will assess the data

<table>
<thead>
<tr>
<th>Test Data Categorization</th>
<th>Description</th>
<th>Testing Implications</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indifferent</td>
<td>No test data are provided as part of the test case.</td>
<td>No additional validation.</td>
<td>The validation is indifferent to the presence of data or specific content in the message element. Meaning: Value or don’t value this data element.</td>
</tr>
<tr>
<td>Presence</td>
<td>Test data are provided as part of the test case; content indifferent.</td>
<td>Validated for the presence of data.</td>
<td>The specific content is not pertinent to the test cases for the purpose of testing. The test data can be modified. Meaning: Value this data element.</td>
</tr>
<tr>
<td>Presence-Length</td>
<td>Test data are provided as part of the test case; minimum length of the content is expected.</td>
<td>Validate for the presence of data to a minimum length.</td>
<td>The specific content is not pertinent to the test cases for the purpose of testing, but the length of the content is. The test data can be modified as long as the minimum length of the test data is maintained. Meaning: Value this data element to a minimum length.</td>
</tr>
<tr>
<td>Value</td>
<td>Test data are provided as part of the test case; specific content is provided and expected.</td>
<td>Validate for the presence of data and for specific content.</td>
<td>The specific content (or choice of content) is provided and is expected to be present in the message. The test data can only be modified with data in the allowable data set. In some cases the set is a single constant. Meaning: Value this data element with the test data options provided.</td>
</tr>
<tr>
<td>Non-presence</td>
<td>No test data are provided as part of the test case and no content for this message element is expected.</td>
<td>Validate for the non-presence of data.</td>
<td>Content is not specified in the test case and is not expected to be present in the message. Meaning: Don’t value this data element.</td>
</tr>
</tbody>
</table>
Context-based Validation

NIST Immunization Test Suite 1.8.0

Test Step: IZ-AD-1.1_Send_V04_Z22

Test Story
Test Data Specification
Message Content
Example Message

FULL
- Description
- Comments
- Pre Condition
- Post Condition
- Test Objectives
- Evaluation Criteria
- Notes for Testers

Description
A two month old male infant, Russell Clinton Richardson, is brought to a clinic for a well child visit by his mother Maria Elizabeth Richardson (nee Billington) and his father John Williams Richardson. A clinic staff member collects basic patient demographic information including name, date of birth and sex. A clinic provider, Wilma Thomas (physician ID 654) reviews the patient's vaccination history and determines that the child previously received Hepatitis B vaccine 1 day after birth and 1 month after birth. The staff member determines that the patient needs DTaP, Hib, IPV, Rotavirus and Pneumococcal vaccinations. Because of the patient's status of Native American, he qualifies for all Vaccine For Children (VFC) supplied vaccines under the status of VFC eligible - American Indian/Alaska Native. The parents are given 5 Vaccine Information Sheets (VIS) to review. After reading them, they agree that the child should receive all the vaccinations recommended. They also agree that the data should be shared once it is incorporated into the local IIS. They indicate that reminders and recalls may be sent by any method. Appropriate doses of DTaP/Hib/IPV (Periaq), Rotavirus (RotaTeq) and Pneumococcal (Prevenar 13) are selected from the clinic's stock of publically funded vaccines. A clinician, Lily Jackson (ID 7854) prepares and administers the doses to the patient and enters the data into the EHR and transmits it to the IIS.

Comments
No Comments

Pre Condition
No PreCondition

Post Condition
No PostCondition

Test Objectives
Create an administration message containing historical (using CVX) and new administrations (using NDC)
Support for next of kin
Support for patient consent
Support for VS
Support for funding source
Support for VFC data.
Context-based Validation
Context-based Validation

- Validation Results with Content Violations

<table>
<thead>
<tr>
<th>Path</th>
<th>Description</th>
<th>Line #</th>
</tr>
</thead>
<tbody>
<tr>
<td>PID[1]-11[1]</td>
<td>Content - Expected content is missing. The empty value at PID-11.5 (Zip or Postal Code) is expected to be present.</td>
<td>2</td>
</tr>
<tr>
<td>RXA[1]-5[1].1</td>
<td>Content - Invalid content (based on test case fixed data). The value ‘00005-1971-01’ at ‘Component RXA-5.1 (Identifier)’ does not match the expected value ‘49281-0560-05’.</td>
<td>7</td>
</tr>
</tbody>
</table>
Inspection Testing

- Receiver-oriented Testing
- Use of an inspection (Juror) Document
- Can be used for Incorporation and Display Testing
- Test Tool provides the stimulus
- Can have levels of storage requirements
Test Receiving Applications

- Can be used to test incorporation and display
- Proctor uses Inspection Check List (Juror Document)
Test Receiving Applications

- Import Test Message
- Tool provides Inspection Check List
Test Functional Requirements

- Create scenarios to invoke a capability of the SUT
- Use context-based testing to validate expected content in the response message
# View Messaging Requirements

## NIST Immunization Test Suite 1.0.0

### Profile: VXU-Z22

#### Validation | Report | Profile Viewer | Value Sets

<table>
<thead>
<tr>
<th>Datatypes</th>
<th>Conformance Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Usage</td>
</tr>
<tr>
<td>RXA-1: Give Sub-ID Counter</td>
<td>R</td>
</tr>
<tr>
<td>RXA-2: Administration Sub-ID Counter</td>
<td>R</td>
</tr>
<tr>
<td>RXA-3: Date/Time Start of Administration</td>
<td>R</td>
</tr>
<tr>
<td>RXA-4: Date/Time End of Administration</td>
<td>O</td>
</tr>
<tr>
<td>RXA-5: Administered Code</td>
<td>R</td>
</tr>
<tr>
<td>RXA-6: Identification</td>
<td>R</td>
</tr>
<tr>
<td>RXA-6: Alternate Text</td>
<td>RE</td>
</tr>
<tr>
<td>RXA-5: Name of Coding System</td>
<td>R</td>
</tr>
<tr>
<td>RXA-5: Alternate Identifier</td>
<td>O</td>
</tr>
<tr>
<td>RXA-5: Alternate Text</td>
<td>C (RE/X)</td>
</tr>
<tr>
<td>RXA-5: Name of Alternate Coding System</td>
<td>C (RX)</td>
</tr>
<tr>
<td>RXA-6: Administered Amount</td>
<td>R</td>
</tr>
<tr>
<td>RXA-7: Administered Units</td>
<td>C (RX)</td>
</tr>
</tbody>
</table>
View Vocabulary Requirements