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NIST has built an HL7 v2.x testing infrastructure and framework to aid in the process of creating conformance testing tools. The testing infrastructure provides a set of services utilized by the test tool framework to build specific instances of tools. A test tool can be specific for a particular domain, or it can be general-purpose. The general-purpose tool is a NIST-hosted web application where a user can upload conformance profiles and test plans to create a test tool. The conformance test tool essentially is generated as a by-product “for free” once the validation artifacts have been created. This liberates the domain experts from the tool building process. Alternatively, the framework can be leveraged, customized, and installed locally. Using the framework, developers can choose to create domain specific or general-purpose web application conformance test tools, access the validation via web services, or incorporate validation via JAR (Java Archive) files or source code. Regardless of the use, the NIST platform can significantly improve the quality of implementation guides, assist in the creation and maintenance of test plans, expedite the stand-up of a validation tool, and, overall, reduce the cost and time of the entire process.

## 7 VRDR Test Tool

A VRDR conformance testing tool is built using the testing infrastructure and framework, the IGAMT-produced conformance profiles, and the TCAMT-produced test plan. The test tool is a web-based application (see [8] to access) that supports both context-free and context-based validation. In addition to performing message validation, the tool provides a browse-able view of the requirements for each conformance profile. In the context-based mode, the test story, test data, and an example message are provided for each test step.

In the context-free mode, the user simply selects the conformance profile to validate against and imports the message. The validation is performed automatically and a report is given. In the context-based mode, the user selects the test step and imports the message to validate. The test tool sets the validation to the conformance profile linked to the test step, performs the validation, and provides a report. In both modes, a tree structure of the message is shown on the left panel of the validation screen and can be used to inspect the content of individual data elements.

## 8 Summary

We presented an end-to-end methodology and platform for developing standards, writing test plans, and creating testing tools in the HL7 v2 technology space. The

platform includes three key foundational components: (1) a tool to create implementation guides and conformance profiles; (2) a tool to create test plans, test cases, and associated test data; and (3) a testing infrastructure and test framework to build testing tools. We demonstrated the approach by creating a test tool for the HL7 v2.6 Vital Records Death Reporting use case. Requirements were captured in IGAMT and exported as conformance profiles. TCAMT was used to create a set of test cases based on the conformance profiles. A conformance test tool was created by combining the validation artifacts with the testing infrastructure and framework.

## 9 References

- [1] Health Level 7 (HL7) Standard Version 2.6, ANSI/HL7, October 2007, <http://www.hl7.org>.
- [2] *Principles for Profiling Healthcare Data Communication Standards*. R. Snelick, F. Oemig. 2013 Software Engineering Research and Practice (SERP13), WORLDCOMP'13 July 22-25, 2013, Las Vegas, NV.
- [3] *Healthcare Interoperability Standards Compliance Handbook*. F. Oemig, R. Snelick. Springer International Publishing Switzerland, ISBN 978-3-319-44837-4, December 2016.
- [4] *HL7 Version 2.6 Implementation Guide: Vital Records Death Reporting, Release 1*. Draft Standard for Trail Use. August 2016. <http://www.hl7.org>.
- [5] *NIST Resources and Tools in Support of HL7 v2 Standards*. <http://hl7v2tools.nist.gov/>
- [6] *CDC National Vital Statistics System: [http://www.cdc.gov/nchs/nvss/evital\\_standards\\_intiative.s.htm](http://www.cdc.gov/nchs/nvss/evital_standards_intiative.s.htm)*
- [7] CDC Public Health Information Network Vocabulary Access and Distribution System (PHIN VADS); <https://phinvads.cdc.gov/>.
- [8] *NIST Vital Records Death Reporting (VRDR) Conformance Testing Tool*; <http://hl7v2-vr-r2-testing.nist.gov>