Project Summary
Texas Department of Transportation

0-5003: Development of TxDOT Procedures and Specifications for Testing Device Compliance to NTCIP Standards

Background

The National Transportation Communications for ITS Protocol (NTCIP) standards define the words (referred to as objects) that convey information and rules (referred to as protocols) used to exchange information in an intelligent transportation system (ITS). By establishing a common set of words in device-specific data dictionaries (referred to as object definition standards), both parties in any exchange of information should be able to understand what is being said, the meaning of the words, and how to react to them (interoperability). By establishing the rules for exchanging the words, different system components can share a common communications infrastructure (compatibility). By establishing conformance to the words and rules, system components can be replaced with similar components from different vendors (interchangeability).

One problem with any written standard or specification is that words and their meanings are subject to interpretation. Another problem is that not everyone follows the rules. These problems lead to the question of how to ensure that ITS devices use the right words and follow the rules. The answer to the question is through specific wording in specifications and thorough testing. Project 0-5003 examined how to accomplish those two tasks.

What the Researchers Did

To address the issue of testing device conformance to NTCIP standards, the researcher first examined how Texas Department of Transportation (TxDOT) specifications deal with NTCIP requirements and the current testing processes within the agency. The intent was to understand where TxDOT stands in requiring NTCIP and how NTCIP testing fits within TxDOT's testing program. The researcher analyzed what testing tools are available and on which previous NTCIP testing efforts TxDOT might capitalize.

Other aspects of this project were to develop sample test procedures, to look at supporting documentation issues, and to provide estimates for future development. The sample test procedures were converted to scripts to automate the actual testing. The research also examined the content of training courses to provide an understanding of NTCIP from a standards perspective and from an agency perspective.

What They Found

The analysis of the specifications showed that TxDOT's approach is to refer to a separate document for the specifics of NTCIP requirements rather than add them to the general specification. The researcher believes that this is the correct approach but should be taken one step further.

Research Performed by:

Texas Transportation Institute,
The Texas A&M University System

Research Supervisor:
Robert De Roche, TTI

Researcher:
Kevin Balke, TTI

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Separating the NTCIP requirements into separate information and communications requirements would alleviate the need to restate the object and conformance group requirements if communications requirements change. For example, a device's object support would not change if one switches from serial to Ethernet communications.

The format of test procedures in this research generally follows the guidelines that appear in NTCIP 8007. Those guidelines suggest a format that includes a "results" column. The Protocol Requirements List (PRL) already in a number of NTCIP standards includes "object support" and "supported values" columns. The researcher found that using a test procedure and the PRL to record the outcome of the tests standardizes the reporting of results.

In the context of testing, risk management calls for balancing rigorous testing and the time and resources available. In some cases, sample testing can be just as effective as a rigorous test procedure that provides full coverage of the possible conditions. However, this research illustrates a case in which a rigorous test procedure uncovers a potential problem that may not have been evident in sample testing.

The NTCIP 1202 standard for actuated signal controllers does not have a means to enter detector actuations prior to their being routed to phase service calls. Controllers apply delay, extending, and switching logic to detector actuations before routing.

What This Means

Some of the recommendations and conclusions of this research are:

- The efforts to develop test procedures for NTCIP suggest that agencies now have guidance and templates to follow when considering any aspect of testing, whether it be NTCIP or not. With minor modifications, a test procedure that checks conformance to NTCIP can check for compliance to specifications and be useful in other aspects of a testing program.
- Even though there are plans to add test procedures to some of the NTCIP standards, there are areas where an agency can facilitate its own testing program and make a contribution to the overall effort. For example, an agency that has testing procedures for data collection and monitoring devices (covered by NTCIP 1206) could convert the procedures to the NTCIP format, automate them using NTCIP testing tools, and then propose the procedures for inclusion in the standard.
- Integrating Hardware-in-the-Loop (HITL) and testing software can provide traffic signal controller detector input capabilities not available through NTCIP. Additions to the HITL software interface could provide an independent means of verifying controller status.
- One issue to consider is how different people in different locations would perform NTCIP testing. If an agency uses one of the freely available testing tools then this is not an issue. However, for an agency wanting to use customized test procedures, this might entail purchasing an agency-wide license for the testing software.

For More Information:
Research Engineer - Wade Odell, TxDOT, 512-465-7403
Project Director - Fabian Kalapach, TxDOT, 512-506-5112
Research Supervisor - Robert De Roche, TTI, 979-845-6154

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Texas Department of Transportation
Research and Technology Implementation Office
P.O. Box 5080
Austin, Texas 78763-5080
512-465-7403