A315b: Understanding Requirements for Actuated Traffic Signal Controllers (ASC) Based on NTCIP 1202 v03 Standard Part 1 of 2

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1. Module Description

This module is designed to assist technical staff in understanding the structure of requirements contained in NTCIP 1202 v03 and using this material to develop unambiguous, complete, and well-written specifications. This module was updated in 2020 to incorporate changes made to the updated (v 03) standard, which added explicit user needs and requirements and extended functionality to include the connected vehicle environment.

2. Introduction/Purpose

The focus of this module is to assist technical staff in developing specifications for an ASC system that meets identified user needs in an interoperable fashion. This module assumes that the participant, having taken A315a, understands the structure and use of the standard PRL to produce a project-level PRL that identifies the needs and requirements for a specific project. The module then builds upon that understanding to describe what else needs to be included within a procurement specification to ensure interoperability and interchangeability.

3. Overview

Module A315b Part 1 provides an overview of the scope of NTCIP 1202 v03 and identifies the additions since v02, which include the following:
- Systems engineering content, including user needs, requirements, and dialogs
- Support for new user needs such as those related to the connected vehicle environment
- Various enhanced capabilities

The module continues to explain the different types of requirements and design content contained within the standard and how the Requirements Traceability Matrix (RTM) can be used to trace between the elements. The module also explains how each of these elements are presented and explained within the text of the standard.

The module then explains how these elements are used to enable interoperability and interchangeability of components, which was the main goal of the NTCIP effort. With this background, the module describes how the RTM is used to ensure that specifications provide an unambiguous definition of this design and how this table benefits all stakeholders.

Finally, the module presents how the PRL and RTM can be used in a procurement specification and provides a checklist of items that should be considered when producing such a specification.

The module also introduces Part 2 of this course, which will go into more detail about specific ASC-specific issues that deserve special consideration during the development of the specification.

4. Frequently Asked Questions

4.1. What is the required NTCIP response time for an ASC?

The response time for an NTCIP device is measured from the receipt of the last byte of a request to the transmission of the first byte of the response.

Clause 3.2.4 of NTCIP 1103 v03 defines a default response time for any NTCIP device to be 100 milliseconds plus one millisecond per byte of the variable bindings field, unless otherwise specified.

Clause 3.6.1 of NTCIP 1202 v03 further restricts the default response time for any ASC to be 25 milliseconds, unless otherwise specified (e.g., in project specifications).

4.2. Why do some manufacturers charge for providing their MIBs?

A management information base (MIB) is the text file that defines the data that can be accessed via the Simple Network Management Protocol (SNMP), which is the main protocol used by NTCIP.

The standard ASC MIB is defined in NTCIP 1202 v03, but a specific manufacturer might only support a subset of the standard MIB and might support additional data (e.g., to support user-requested and/or proprietary features). The NTCIP allows the definition of additional data so that innovative features can be developed; this ensures that the standard remains relevant as new technologies are developed.

The NTCIP standards do not attempt to define contractual details between agencies and manufacturers; they are limited to technical specifications. As a result, manufacturers are allowed to develop features to respond to emerging needs. While access to these custom features must conform to a base set of interface rules (e.g., every piece of data must be registered with a globally-unique identifier), there is no requirement that details of these features be publicly disclosed.

This allows manufacturers to invest in research and development of new features while having confidence their resulting intellectual property rights can be protected. However, if an agency hires a manufacturer to develop a feature, it makes sense for the agency to require the release of the documentation to the agency as a work for hire. Likewise, an agency can require delivery of documentation as a part of an acquisition, potentially with right to share the materials with others, but the details of these agreements are left to the industry to determine.

4.3. Why doesn't NTCIP 1202 cover the interface to the cabinet?

Every NTCIP standard starts with a defined scope. The interface to the cabinet was not within the scope of the NTCIP 1202 effort. However, the basic interface between a traffic signal controller and traditional traffic equipment is already well-defined and consists largely of simple inputs and output switches on discrete channels. More advanced electronic monitoring of cabinet equipment is not currently defined.

5. Glossary

Term	Definition
Compliance	Doing what has been asked or ordered, as required by rule or law – IEEE 730-2014
Conformance	Adherence of an implementation to the requirements of one or more specific standards or technical specifications – ISO/IEC 10641:1993
Interchangeability	Ability of one product, process or service to be used in place of another to fulfill the same requirements – ISO/IEC Guide 2:2004
Interoperability	Degree to which two or more systems, products or components can exchange information and use the information that has been exchanged – ISO/IEC 25010:2011
NTCIP interchangeability	Degree to which one product can be used in place of another to exchange information and use the information that has been exchanged
Project-level NTCIP interchangeability	Ability of one product to be used in place of another to exchange and use the information required for a specific project
PRL	Protocol Requirements List, a table that traces user needs to functional requirements
Product PRL	A PRL that specifies which optional user needs and requirements are required to claim compliance to a project specification
Project PRL	A PRL that indicates which optional user needs and requirements are implemented by a specific product
Standard PRL	A PRL that identifies user needs and requirements as being optional or mandatory for claiming conformance to the standard
RTM	Requirements Traceability Matrix, a table that traces functional requirements to design elements, which include dialogs and objects
Requirement	A statement that identifies a system, product or process characteristic or constraint, which is unambiguous, clear, unique, consistent, stand-alone (not-grouped), and verifiable, and is deemed necessary for stakeholder acceptability – INCOSE 2010

6. Reference to Other Standards

- Institute of Electrical and Electronics Engineers, IEEE 730 *IEEE Standard for Software Quality Assurance Processes*. IEEE 2014.

- International Organization for Standardization, ISO/IEC 25010 *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — System and software quality models.* ISO 2011.

- International Organization for Standardization, ISO/IEC Guide 2 *Standardization and related activities – General vocabulary*. ISO 2004.

- International Organization for Standardization, ISO/IEC 10641 *Information technology – Computer graphics and image processing – Conformance testing of implementations of graphics*. ISO 1993.

- NTCIP, NTCIP 1202v03: Object Definitions for Actuated Signal Controllers (ASC) Interface, NTCIP Joint Committee. November 2017

- NTCIP, NTCIP 9001: *NTCIP Guide v04*, NTCIP Joint Committee. July 2009.

- National Electrical Manufacturers Association, *NEMA Standards Publication TS 2-2016 v03.07 Traffic Controller Assemblies with NTCIP Requirements.* NEMA, 2016

- Society of Automotive Engineers, *SAE J2735 Dedicated Short Range Communications (DSRC) Message Set Dictionary*, SAE V2X Communications Steering Committee, November 2009.

7. Learning Objectives

a. **Identify NTCIP 1202 v03 Standard Requirements**
Provides an overview of the scope of NTCIP 1202 v03 and how this has changed since v02, also presents an overview of the types of requirements contained within the standard.

b. **Explain the Purpose and Benefits of the RTM**
Describes how the RTM is used to obtain interoperability and interchangeability of system components.

c. **Prepare a Project-Level RTM**
Explains that the standard RTM does not need to be customized in any way, but explains that there may be reasons to extend the RTM to support custom features and/or to add requirements to support custom dialogs.

d. **Prepare an ASC Specification**
Identifies some of the limitations in some specifications and how these can be overcome with the use of the standard in preparing your specification.

8. Study Questions

1. **Which of the following is missing from NTCIP 1202 v03?**

   a) User needs

   b) Functional requirements

   c) Test procedures

d) All of the above

2. **What does a project PRL identify?**

   a) The functional requirements for a project

   b) The objects to be supported for a project

   c) The testing requirements for a project

   d) All of the above

3. **What does the dialog column in the following table mean?**

FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Add'l Specs
3.5.2.1.2.1.2	Configure Vehicle Phase Minimum Green Time	H.2.7			
			5.2.2	phaseTable	
			5.2.2.1	phaseNumber	
			5.2.2.4	phaseMinimumGreen	

   a) The dialog is the only way to exchange the objects

   b) The dialog defines operations that are prohibited

   c) The dialog provides a baseline reference for testing

   d) All of the above

4. **Which of the following is typically not part of the interface specifications?**

   a) Project PRL

   b) Testing requirements

   c) Environmental requirements

   d) Communications stack

9. Icon Guide

The following icons are used throughout the module to visually indicate the corresponding learning concept listed out below, and/or to highlight a specific point in the training material.

1) **Background information:** General knowledge that is available elsewhere and is outside the module being presented. This will be used primarily in the beginning of slide set when reviewing information readers are expected to already know.

2) **Tools/Applications:** An industry-specific item a person would use to accomplish a specific task, and applying that tool to fit your need.

3) **Remember:** Used when referencing something already discussed in the module that is necessary to recount.

4) **Refer to Student Supplement:** Items or information that are further explained/detailed in the Student Supplement.

5) **Example:** Can be real-world (case study), hypothetical, a sample of a table, etc.

6) **Checklist:** Use to indicate a process that is being laid out sequentially.