A311b
Specifying Requirements For DMS Systems Based on NTCIP 1203 Standard

STANDARDS ITS TRAINING

STUDENT SUPPLEMENT

RITA Intelligent Transportation Systems Joint Program Office

A311b: Specifying Requirements for DMS Systems Based on NTCIP 1203 Standard

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Purpose

This participant supplement provides additional information for the Professional Capacity Building (PCB) Module A311b, Specifying Requirements for DMS Systems Based on NTCIP 1203 Standard.

The focus of this module is to assist technical staff in specifying clear requirements from the list of requirements that exist in NTCIP 1203 v03 DMS and in meeting identified user needs. This module will continue to provide participants with information on how to identify the appropriate use of the NTCIP 1203 standard and acquire a DMS system based on what the user is seeking to accomplish as identified by tracing the user needs to the requirements with support from tools and resources such as a Requirements Traceability Matrix (RTM) and Protocol Requirements List (PRL) in following a systems engineering process (SEP). The module will review the pros and cons of selecting requirements not covered by the standard and the need to avoid an orphaned user need or requirement for their system.

This module also helps the user understand the scope of the DMS standard and its versions in continuation with the previous module A311a. This module is to be placed in the context of the SE process as well as in the acquisition curriculum path with I101, A101, A102, A201, and A311a being the prerequisites. This completes the acquisition life cycle leading to the user being able to write specifications. The logical next step for the participant is to consider modules in the testing life cycle, which are T101, T201, and T202, which lead up to the module T311: Applying Your Test Plan to the NTCIP 1203 v03 DMS Standard and other testing modules being developed.

NTCIP 1203 History

- NTCIP v01 was published in 1999
- NTCIP 1203 Amendment 1 was approved in 2001
    - Clarified object definitions and MULTI tags
    - Responded to questions from actual implementations
- NTCIP 1203 v02
    - Adds new functionality (additional support for colors and graphics)
    - Uses a systems engineering approach
    - NTCIP 1203 v02 was first accepted as a recommended standard in 2007
    - A minor revision was developed in 2010 and accepted
- NTCIP 1203 v03 (recommended standard)
    - In balloting (2011)
    - Adds test cases and test procedures. Also adds a Requirement to Test Case Traceability Matrix (RTCTM).

NTCIP 1203 v02 Requirements

Below is a summary of the requirements supported by NTCIP 1203 v02.

3.4 Architectural Requirements

3.4.1 Support Basic Communications
- 3.4.1.1 Retrieve Data
- 3.4.1.2 Deliver Data
- 3.4.1.3 Explore Data

3.4.2 Support Logged Data
- 3.4.2.1 Determine Current Configuration of Logging Service
- 3.4.2.2 Configure Logging Service
- 3.4.2.3 Retrieve Logged Data
- 3.4.2.4 Clear Log
- 3.4.2.5 Determine Capabilities of Event Logging Service
- 3.4.2.6 Determine Total Number of Events

3.4.3 Support Exception Reporting

3.4.4 Manage Access
- 3.4.4.1 Determine Current Access Settings
- 3.4.4.2 Configure Access

3.5 Data Exchange and Operational Environment Requirements

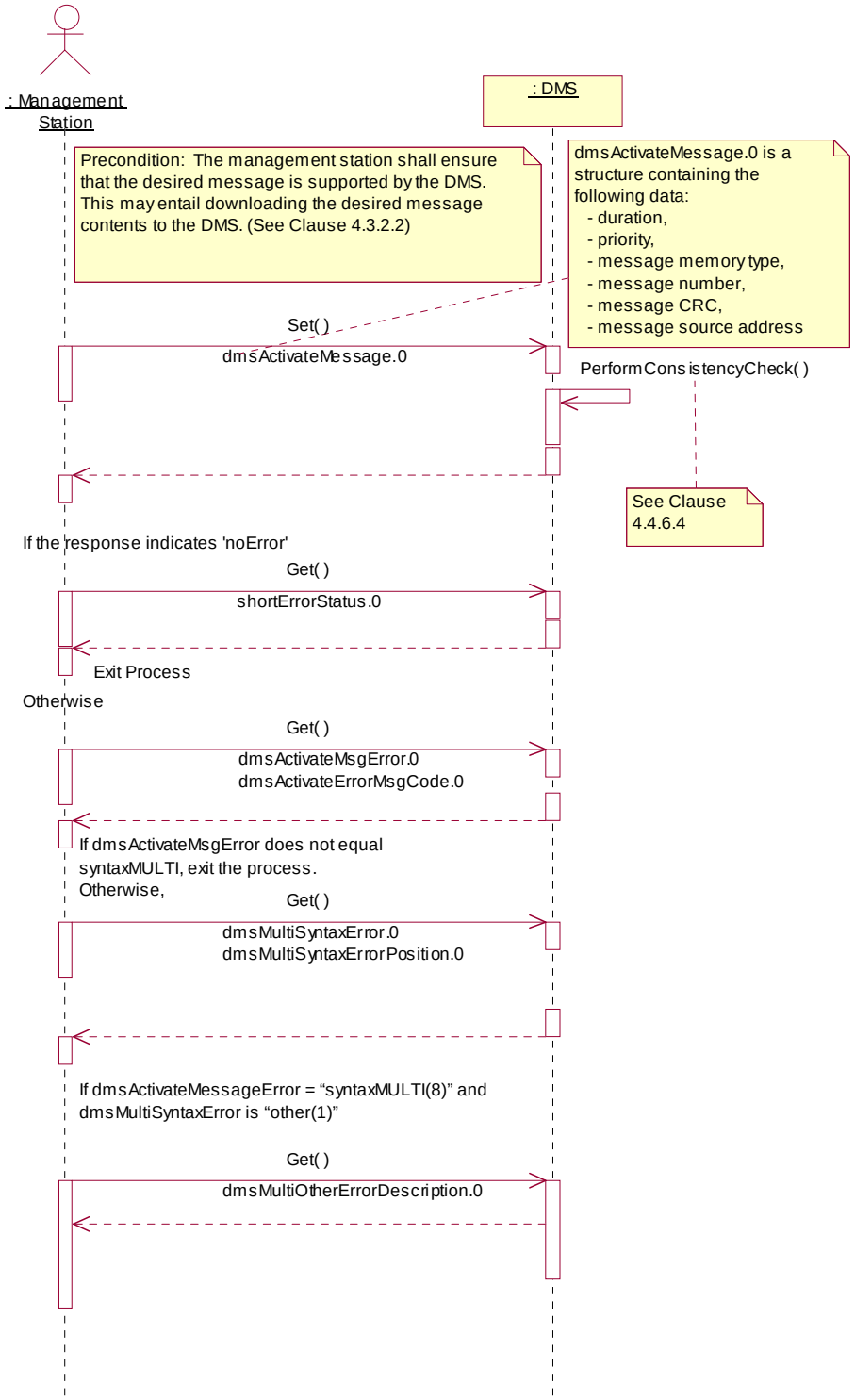
3.5.1 Manage the DMS Configuration
- 3.5.1.1 Identify DMS
  - 3.5.1.1.1 Determine Sign Type and Technology
- 3.5.1.2 Determine Message Display Capabilities
  - 3.5.1.2.1 Determine Basic Message Display Capabilities
    - 3.5.1.2.1.1 Determine the Size of the Sign Face
    - 3.5.1.2.1.2 Determine the Size of the Sign Border
    - 3.5.1.2.1.3 Determine Beacon Type
    - 3.5.1.2.1.4 Determine Sign Access and Legend
  - 3.5.1.2.2 Determine Matrix Capabilities
    - 3.5.1.2.2.1 Determine Sign Face Size in Pixels
    - 3.5.1.2.2.2 Determine Character Size in Pixels
    - 3.5.1.2.2.3 Determine Pixel Spacing
  - 3.5.1.2.3 Determine VMS Message Display Capabilities
    - 3.5.1.2.3.1 Determine Maximum Number of Pages
    - 3.5.1.2.3.2 Determine Maximum Message Length
    - 3.5.1.2.3.3 Determine Supported Color Schemes
    - 3.5.1.2.3.4 Determine Message Display Capabilities
  - 3.5.1.2.4 Delete All Messages of a Message Type with One Command
- 3.5.1.3 Manage Fonts
  - 3.5.1.3.1 Determine Maximum Number of Fonts Supported
  - 3.5.1.3.2 Determine Maximum Character Size
  - 3.5.1.3.3 Determine Maximum Number of Characters per Font
  - 3.5.1.3.4 Retrieve a Font Definition
  - 3.5.1.3.5 Configure a Font

3.5.1.3.6 Delete a Font
3.5.1.3.7 Validate a Font
3.5.1.4 Manage Graphics
3.5.1.4.1 Determine Maximum Number of Graphics
3.5.1.4.2 Determine Maximum Graphic Size
3.5.1.4.3 Determine Available Graphics Memory
3.5.1.4.4 Retrieve a Graphic Definition
3.5.1.4.5 Store a Graphic Definition
3.5.1.4.6 Delete a Graphic
3.5.1.4.7 Validate a Graphic
3.5.1.5 Configure Brightness of Sign
3.5.1.5.1 Determine Maximum Number of Light Sensor Levels
3.5.1.5.2 Configure Light Output Algorithm
3.5.1.5.3 Determine Current Light Output Algorithm
3.5.1.6 Configure Current Speed Limit
3.5.1.7 Configure Low Fuel Threshold Value
3.5.2 Control the DMS
3.5.2.1 Manage Control Source
3.5.2.2 Reset the Sign Controller
3.5.2.3 Control the Sign Face
3.5.2.3.1 Activate a Message
3.5.2.3.2 Manage Default Message Display Parameters
3.5.2.3.2.1 Determine Default Message Display Parameters
3.5.2.3.2.2 Configure Default Background and Foreground Color
3.5.2.3.2.3 Configure Default Flash-On and Flash-Off Times
3.5.2.3.2.4 Configure Default Font
3.5.2.3.2.5 Configure Default Line Justification
3.5.2.3.2.6 Configure Default Page Justification
3.5.2.3.2.7 Configure Default Page On Time and Page Off Time
3.5.2.3.2.8 Configure Default Character Set
3.5.2.3.3 Manage Message Library
3.5.2.3.3.1 Determine Available Message Types
3.5.2.3.3.2 Determine Available Message Space
3.5.2.3.3.3 Define a Message
3.5.2.3.3.4 Verify Message Contents
3.5.2.3.3.5 Retrieve Message
3.5.2.3.4 Schedule Messages for Display
3.5.2.3.4.1 Retrieve a Schedule
3.5.2.3.4.2 Define a Schedule
3.5.2.3.5 Configure Event-Based Message Activation
3.5.2.3.5.1 Configure Messages Activated by Standardized Events
3.5.2.3.5.1.1 Configure Message for Short Power Loss Recovery Event
3.5.2.3.5.1.2 Configure Message for Long Power Loss Recovery Event
3.5.2.3.5.1.3 Configure Message for Power Loss Event
3.5.2.3.5.1.4 Configure Message for Controller Reset Event
3.5.2.3.5.1.5 Configure Message for Communications Loss Event

3.5.2.3.5.1.6 Configure Message for End Message Display Duration Event
3.5.2.3.6 Activate a Message with Status
3.5.2.4 Control External Devices
3.5.2.4.1 Determine Configuration of External Device Ports
3.5.2.4.1.1 Determine Base Configuration of External Device Ports
3.5.2.4.1.2 Further Define Ports
3.5.2.4.1.3 Number of External Devices Supported
3.5.2.4.2 Monitoring of External Devices
3.5.2.4.2.1 Retrieving Data from External Devices
3.5.2.4.3 Controlling of External Devices
3.5.2.4.3.1 Passing Data to External Devices
3.5.2.4.3.2 Determine Status of External Devices
3.5.2.4.4 Controlling of Bi-directionally Connected External Devices
3.5.2.4.4.1 Retrieving Data from External Devices
3.5.2.4.4.2 Passing Data to External Devices
3.5.2.4.4.3 Determine Status of External Devices
3.5.2.5 Control Sign Brightness
3.5.2.5.1 Determine Number of Brightness Levels
3.5.2.5.2 Determine Current Photocell Readings
3.5.2.5.3 Manually Direct-Control Brightness (Version 2)
3.5.2.5.4 Manually Index-Control Brightness (Version 2)
3.5.2.5.5 Manually Control Brightness (Version 1 Only)
3.5.2.5.6 Switch Brightness Control Modes
3.5.2.6 Manage the Exercise of Pixels
3.5.3 Monitor the Status of the DMS
3.5.3.1 Perform Diagnostics
3.5.3.1.1 Test Operational Status of DMS Components
3.5.3.1.1.1 Execute Lamp Testing
3.5.3.1.1.2 Activate Pixel Testing
3.5.3.1.1.3 Execute Climate-Control Equipment Testing
3.5.3.1.2 Provide General DMS Error Status Information
3.5.3.1.3 Identify Problem Subsystem
3.5.3.1.3.1 Monitor Power Errors
3.5.3.1.3.2 Monitor Lamp Errors
3.5.3.1.3.3 Monitor Pixel Errors
3.5.3.1.3.4 Monitor Light Sensor Errors
3.5.3.1.3.5 Monitor Controller Software Operations
3.5.3.1.3.6 Monitor Climate-Control System Errors
3.5.3.1.3.7 Monitor Temperature Warnings
3.5.3.1.3.8 Monitor Humidity Warnings
3.5.3.1.3.9 Monitor Drum Sign Rotor Errors
3.5.3.1.3.10 Monitor Door Status
3.5.3.1.4 Monitor Subsystems Status Details
3.5.3.1.4.1 Monitor Power Error Details
3.5.3.1.4.2 Monitor Lamp Error Details
3.5.3.1.4.3 Monitor Pixel Error Details
3.5.3.1.4.4 Monitor Light Sensor Error Details

Example Informative Figure

The following is an example informative figure showing a graphical depiction of the standardized sequence of events for Activating a Message (Section 4.2.3.1 – Figure 5).



Glossary

The following is a glossary of terms that are used throughout the module

Term	Definition
Agency Specification	A document that has been prepared by an agency to define requirements for a subject item or process when procured by the agency.
Compliance	A condition that exists when an item meets all of the requirements of an agency specification.
Concept of Operations	A document that describes the purpose for a system project, including a description of the current and proposed system, as well as key user needs that the new system is required to address.
Conformance	A condition that exists when an item meets all of the mandatory requirements as defined by a standard. It can be measured on the standard as a whole, which means that it meets all mandatory (and applicable conditional) requirements of the standard or on a feature level (i.e., it conforms to feature X as defined in section X.X.X), which means that it meets all mandatory (and applicable conditional) requirements of the feature.
Dialogs	A sequence of information or message exchanges.
Dynamic Message Sign	Any sign system that can change the message presented to the viewer, such as VMS, CMS, and BOS. It includes the following major components: sign face, sign housing, controller, and, if present, the controller cabinet.
Interchangeability	A condition that exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability and are capable of being exchanged one for the other without alteration of the items themselves, or adjoining items, except for adjustment and without selection for fit and performance.
Interoperability	The ability of two or more systems or components to exchange information and use the information that has been exchanged.
Protocol Requirements List (PRL)	A table mapping user needs with their associated requirements. This table allows procurement personnel to specify the desired features of a DMS or can be used by a manufacturer to document the features supported by their implementation.

Term	Definition
Requirement	A condition or capability needed by a user to solve a problem or achieve an objective.
Requirements Traceability	The ability to follow or study the logical progression among the needs, requirements, and design details in a step-by-step fashion.
Requirements Traceability Matrix (RTM)	A table that links the requirements to the corresponding dialogs and objects.
Specification	A document that specifies, in a complete, precise, verifiable manner, the requirements, design, behavior, or other characteristics of a system or component and, often, the procedures for determining whether these provisions have been satisfied.
Systems Engineering	An interdisciplinary approach and means to enable the realization of successful systems. (INCOSE) An interdisciplinary collaborative approach to derive, evolve, and verify a life cycle balanced system solution that satisfies customer expectations and meets public acceptability. (IEEE)

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Testing

- **IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specification,** IEEE 1998.