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U.S. Department of Transportation

Office of the Assistant Secretary for
Research and Technology

Welcome

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A306b:
Specifying Requirements for Electrical and Lighting Management Systems (ELMS) Based on NTCIP 1213 Standard v03

Instructor

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Learning Objectives

Review the **structure** of the NTCIP 1213 v03 Standard

Use the **Protocol Requirements List** (PRL) and then the **Requirements Traceability Matrix** (RTM) to specify the standardized structure of requirements

Include the requirements from the PRL and RTM in the **ELMS Communications Interface specification**

Explain conditions and context for **extending the standard**

Learning Objective 1

Review the **structure** of the NTCIP 1213 v03 Standard

Structure of NTCIP 1213 v03

- Section 1: General

- Section 2: Concept of Operations

- Section 3: Functional Requirements

- Section 4: Dialog

- Section 5: Management Information Base

- Annex A: Requirements Traceability Matrix (RTM)

- Annex B: Object Tree

- Annex C: Test Procedures

Capabilities of NTCIP 1213 Systems

Control and monitoring of terminal devices for:

- Roadway lighting
- Ground fault safety
- Revenue grade power metering
- Vehicle to Grid Infrastructure
- Vehicle to Infrastructure (V2I) communications
- Electrical distribution network (the Smart Grid)
- Electric vehicle charging infrastructure

Capabilities of NTCIP 1213 Systems – System Configurations

Gateway

NTCIP 1213

NTCIP 1213

Management Center

Field Devices

Capabilities of NTCIP 1213 Systems – US DOT Framework

Capabilities of NTCIP 1213 Systems – U.S. Smart Grid Framework

NIST Smart Grid Framework 1.0 January
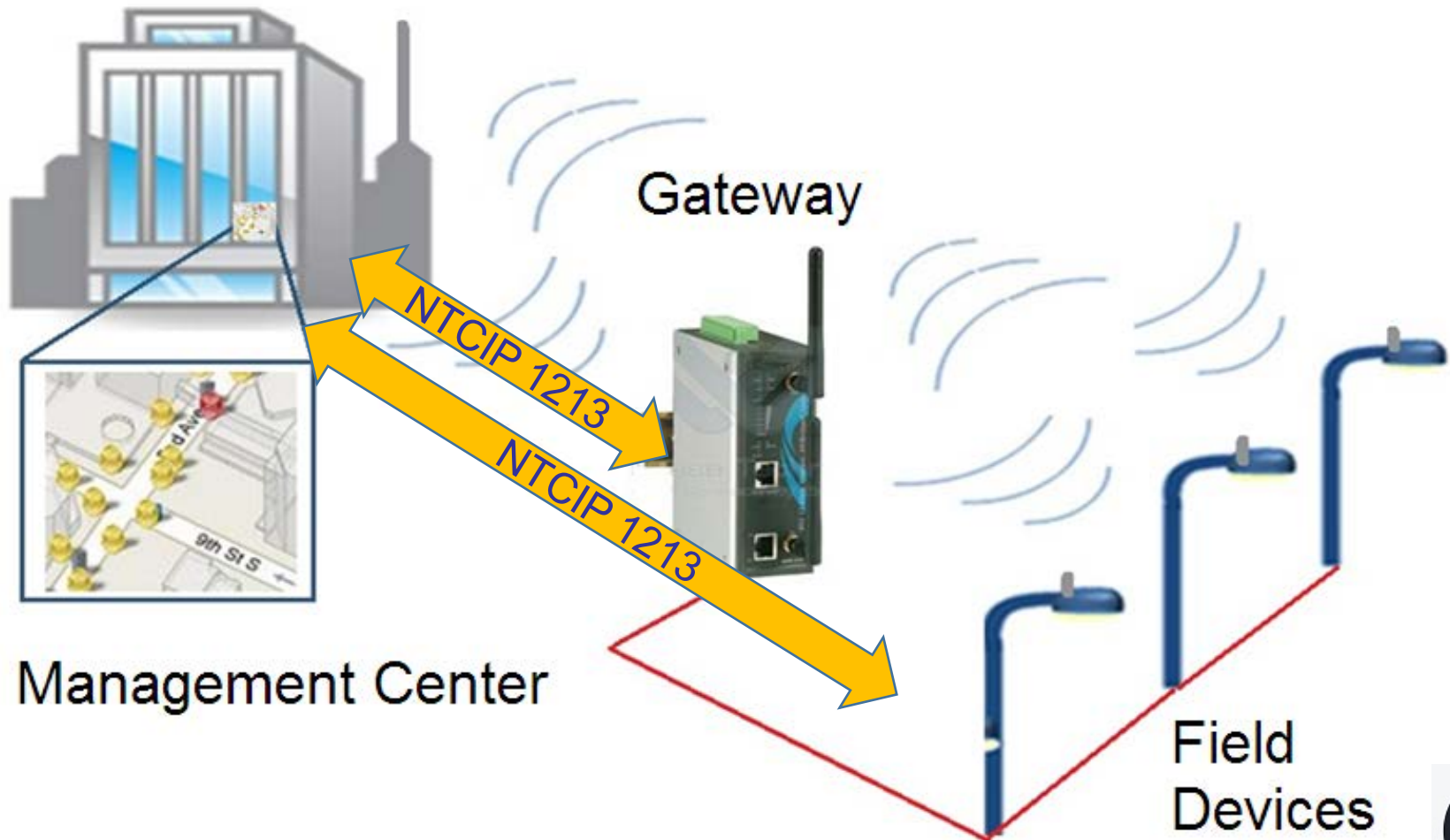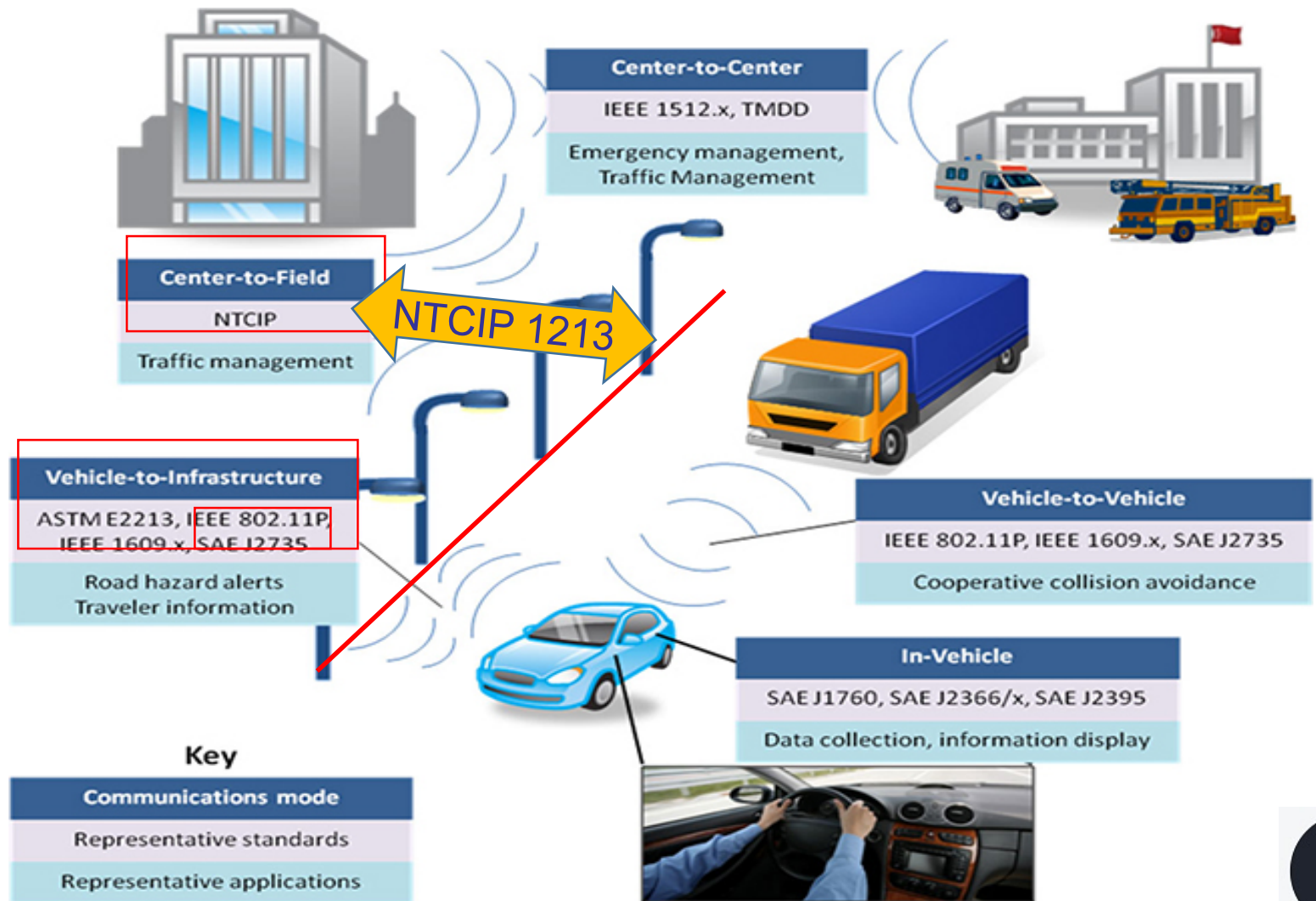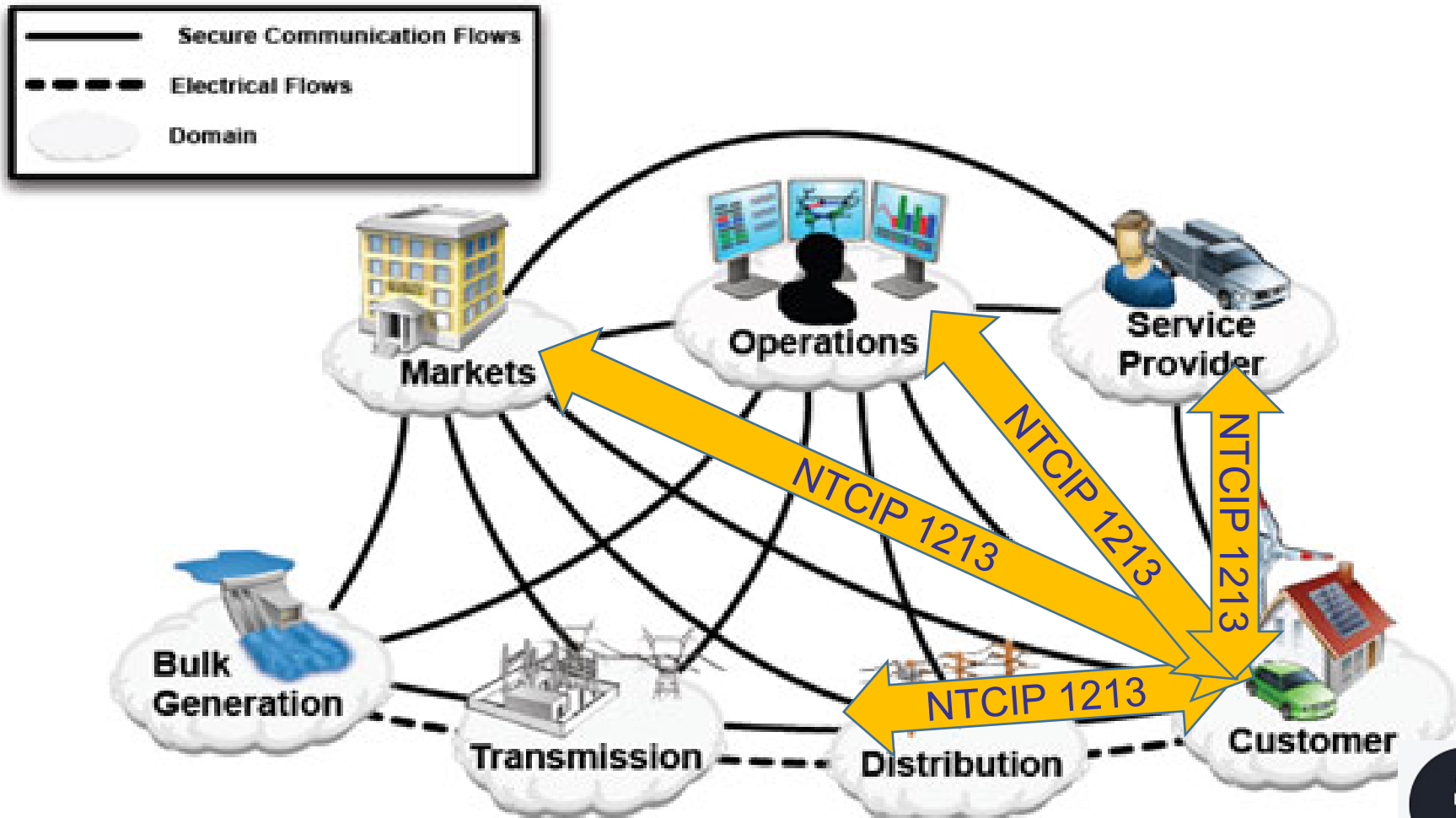
Structure of the NTCIP 1213 Standard – Missing Components of the Standard

- Does not include Test Cases for Compliance Testing

- Need to be produced for each project

- For more on testing, please examine:

  - T101: Introduction to ITS Standards Testing

  - T201: How to Write a Test Plan

  - T202: Overview of Test Design Specifications, Test Cases, and Test Procedures

  - T306: Applying Your Test Plan to the Electrical and Lighting Management Systems Based on NTCIP 1213 ELMS Standard v03

From User Needs to Functional Requirements

- Focus on Requirements:
  - Functional
  - Architectural
  - Data Exchange

User Needs and Functional Requirements

- Measurable Functional Requirements are derived from the Stakeholder's User Needs

- Each Functional Requirement must have an underlying User Need

- Each User Need must have a dependent Functional Requirement

User Needs: A Review

- User Needs are compiled from all stakeholders

- They are the textual representation of "what needs to be accomplished"

ACTIVITY

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Which choice is <u>not</u> a capability of the NTCIP 1213 standard?

Answer Choices

a) Roadway lighting, including scheduling and zoning

b) Safety: electrical leakage anomalies, including power quality and ground fault issues

c) Revenue grade power metering

d) The physical size of electrical cabinets

Review of Answers

a) Roadway lighting, including scheduling and zoning

   Incorrect. This is a core capability of NTCIP 1213.

b) Safety: electrical leakage anomalies, including power quality and ground fault issues

   Incorrect. This is a core capability of NTCIP 1213.

c) Revenue grade power metering

   Incorrect. This is a core capability of NTCIP 1213.

d) The physical size of electrical cabinets

   Correct! NTCIP 1213 does not support sizing of electrical cabinets.

Learning Objectives

Review the **structure** of the NTCIP 1213 v03 Standard

Use the **Protocol Requirements List** (PRL) and then the **Requirements Traceability Matrix** (RTM) to specify the standardized structure of requirements

Learning Objective 2

Use the **Protocol Requirements List** (PRL) and then the **Requirements Traceability Matrix** (RTM) to specify the standardized structure of requirements

Use the PRL

- The PRL is a table that is a tool included in the standard for use by the system developers, agency specifiers, and producers of ELMS equipment

- Properly traces user needs to requirements

- Within a PRL, select a given range of a requirement

- Implement the design as specified in the standard (RTM)

Use the PRL to Ensure Interoperability

A Section of the PRL Table

Protocol Requirements List (PRL) Table						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.21		Configure ELMS Device for Adaptive Operation		O	Yes / No	
		3.5.4.23	Configure ELMS Device for Adaptive Operation	O	Yes / No	
		3.5.4.23.1	Configure Connected Vehicle Speed Setpoint	O	Yes / No	
		3.5.4.23.2	Configure Connected Vehicle Direction Setpoint	O	Yes / No	
		3.5.4.23.3	Configure Connected Vehicle Location Setpoint	O	Yes / No	
		3.5.4.23.4	Configure Connected Vehicle Ambient Light Level Setpoint	O	Yes / No	
		3.5.4.23.5	Configure Connected Vehicle Headlight Status Setpoint	O	Yes / No	
		3.5.4.23.6	Configure Connected Vehicle Road Friction Setpoint	O	Yes / No	

User Needs in the PRL Table

	Protocol Requirements List (PRL) Table					
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
2.5.2.1.21		Configure ELMS Device for Adaptive Operation		O	Yes / No	
		3.5.4.23	Configure ELMS Device for Adaptive Operation	O	Yes / No	
		3.5.4.23.1	Configure Connected Vehicle Speed Setpoint	O	Yes / No	
		3.5.4.23.2	Configure Connected Vehicle Direction Setpoint	O	Yes / No	
		3.5.4.23.3	Configure Connected Vehicle Location Setpoint	O	Yes / No	
		3.5.4.23.4	Configure Connected Vehicle Ambient Light Level Setpoint	O	Yes / No	
		3.5.4.23.5	Configure Connected Vehicle Headlight Status Setpoint	O	Yes / No	
		3.5.4.23.6	Configure Connected Vehicle Road Friction Setpoint	O	Yes / No	

User Needs in the PRL Table

Protocol Requirements List (PRL) Table						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.21		Configure ELMS Device for Adaptive Operation		O	Yes / No	
		3.5.4.23	Configure ELMS Device for Adaptive Operation	O	Yes / No	
		3.5.4.23.1	Configure Connected Vehicle Speed Setpoint	O	Yes / No	
		3.5.4.23.2	Configure Connected Vehicle Direction Setpoint	O	Yes / No	
		3.5.4.23.3	Configure Connected Vehicle Location Setpoint	O	Yes / No	
		3.5.4.23.4	Configure Connected Vehicle Ambient Light Level Setpoint	O	Yes / No	
		3.5.4.23.5	Configure Connected Vehicle Headlight Status Setpoint	O	Yes / No	
		3.5.4.23.6	Configure Connected Vehicle Road Friction Setpoint	O	Yes / No	

User Need – Retrieve Luminaire Information

2.5.2.1.21

Configure ELMS Device for Adaptive Operation

A management station may need to configure the ELMS device for adaptive operation. Adaptive operation includes adjusting light levels based on ambient light levels, as well as connected vehicle sensor and status information.

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EXAMPLE

Use the PRL to Trace User Needs to Requirements

Functional Requirement Identifier

Protocol Requirements List (PRL) Table						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.21		Configure ELMS Device for Adaptive Operation		O	Yes / No	
		3.5.4.23	Configure ELMS Device for Adaptive Operation	O	Yes / No	
		3.5.4.23.1	Configure Connected Vehicle Speed Setpoint	O	Yes / No	
		3.5.4.23.2	Configure Connected Vehicle Direction Setpoint	O	Yes / No	
		3.5.4.23.3	Configure Connected Vehicle Location Setpoint	O	Yes / No	
		3.5.4.23.4	Configure Connected Vehicle Ambient Light Level Setpoint	O	Yes / No	
		3.5.4.23.5	Configure Connected Vehicle Headlight Status Setpoint	O	Yes / No	
		3.5.4.23.6	Configure Connected Vehicle Road Friction Setpoint	O	Yes / No	

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Use the PRL to Trace User Needs to Requirements

Functional Requirements Column

Protocol Requirements List (PRL) Table						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.21		Configure ELMS Device for Adaptive Operation		O	Yes / No	
		3.5.4.23	Configure ELMS Device for Adaptive Operation	O	Yes / No	
		3.5.4.23.1	Configure Connected Vehicle Speed Setpoint	O	Yes / No	
		3.5.4.23.2	Configure Connected Vehicle Direction Setpoint	O	Yes / No	
		3.5.4.23.3	Configure Connected Vehicle Location Setpoint	O	Yes / No	
		3.5.4.23.4	Configure Connected Vehicle Ambient Light Level Setpoint	O	Yes / No	
		3.5.4.23.5	Configure Connected Vehicle Headlight Status Setpoint	O	Yes / No	
		3.5.4.23.6	Configure Connected Vehicle Road Friction Setpoint	O	Yes / No	

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Requirements for Retrieve Luminaire Information

3.5.4.23.3

Configure Connected Vehicle Location Setpoint

The ELMS device shall allow a management station to configure the connected vehicle location setpoint from within the ELMS device.

Within a PRL, Selecting a Given Range of a Performance Requirement (Collecting Information)

Examining the PRL's Project Criteria

Supplemental Requirement ID	Supplemental Requirement	Conformance	Project Requirement	Additional Project Requirements
3.5.5	Supplemental Requirements for Live Data	M	Yes	
3.5.5.1	Live Data Response Time	M	Yes	The device shall initiate the transmission of the appropriate response (assuming that the device has permission to transmit) within **125** millisecond(s) of receiving the last byte of the request, plus 1 millisecond for each byte in the response variable-bindings field

Completing the PRL

By compiling your project-specific User Needs and examining the dependent functional requirements, you can select which optional features are to be required in your project-specific implementation.

Conformance to the Standard

Conformance Column in the PRL

User Need ID	User Need	FR ID	Functional Requirement	Conformance	Project Requirement	Additional Project Requirements
2.4.2.1.4	Configure for Scheduled Operation			O	Yes / No	
		3.4.1.4.1.	Configure Luminaire for Scheduled Operations	O.1 (1..*)	Yes / No	
		3.4.1.4.2	Configure Electrical Service for Scheduled Operations	O.2 (1..*)	Yes / No	
		3.4.1.4.3.	Configure Branch Circuit for Scheduled Operations	O.3 (1..*)	Yes / No	
		3.4.1.4.4.	Configure Devices in Zone for Scheduled Operations	O.4 (1..*)	Yes / No	

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Question

Which of the below is <u>not</u> a reason to use the PRL?

Answer Choices

a) To identify User Needs

b) To perform a test for compliance

c) To identify Functional Requirements

d) To develop a project-specific specification

Review of Answers

a) To identify User Needs

Incorrect. The PRL does include User Needs.

b) To perform a test for compliance

Correct! Testing is not part of the NTCIP 1213 Standard v03, but must be designed and documented during the project.

c) To identify Functional Requirements

Incorrect. The PRL does include Functional Requirements.

d) To develop a project-specific specification

Incorrect. The PRL is used to develop a project-specific specification.

Learning Objectives

Review the **structure** of the NTCIP 1213 v03 Standard

Use the **Protocol Requirements List** (PRL) and then the **Requirements Traceability Mat**rix (RTM) to specify the standardized structure of requirements

Include the requirements from the PRL and RTM in the **ELMS Communications Interface specification**

Learning Objective 3

Include the requirements from the PRL and RTM in the ELMS Communications Interface specification

User Need/Functional Requirement Relationship

- In order to build a project-specific specification, you will trace the connections between your project-specific user needs

- As you encounter optional requirements in the PRL, you will decide whether these are required in your project-specific implementation

- You will document this by circling "Yes" or "No" in the appropriate row of the PRL

- Next we will examine a real-world example

CASE STUDY

SHERIFF DISPATCH

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Using the PRL to Build a Specification: Washington State DOT Case Study

In preparing the communications interface specification for a large bridge and tunnel project, many user needs were identified.

Using the PRL to Build a Specification: Washington State DOT Case Study

These User Needs include the ability to:

- Control lighting system lumen output by current ambient light level (adaptive lighting)

- Control lighting fixtures by zones of branch circuits

- Configure branch circuits into alternate zones

- Configure, control, and monitor branch circuits

- Configure schedules for branch circuit zones

- Report exceptional conditions in a near real-time basis

- Override schedules as required

- Provide Live Data as well as Logged Data

Using the PRL to Build a Specification: Washington State DOT Case Study

These User Needs **do not** include the ability to:

- Configure, control, or monitor

    ▫ Luminaires

    ▫ Electrical services

    ▫ Ground fault equipment

    ▫ Arc fault equipment

- Provide Smart Grid information to the local electric utility

Photo: Gridaptive Technologies

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Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Live Data

User Need ID	User Need	FR ID	Functional Requirement	Conformance	Project Requirement	Additional Project Requirements
2.4.1	Operational User Needs			M	Yes	
2.4.1.1	Provide Live Data			M	Yes	
		3.3.1.1	Retrieve Data	M	Yes	
		3.3.1.2	Deliver Data	M	Yes	
		3.3.1.3	Data Retrieval and Data Delivery Action Performance	M	Yes	
		3.5.5.1	Live Data Response Time	M	Yes	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Off-Line Log Data

2.4.1.2		Provide Off-line Log Data		O	Yes / No	
	3.3.2.1	Retrieve Configuration of Logging service		M	Yes	
	3.3.2.2	Configure Logging Service		M	Yes	
	3.3.2.4	Clear Log		M	Yes	
	3.3.2.5	Retrieve Capabilities of Event Logging Services		M	Yes	
	3.3.2.6	Retrieve Number of Events Currently Logged		M	Yes	
	3.3.2.7	Set Time		M	Yes	
	3.3.2.8	Retrieve Current Time		M	Yes	
	3.3.2.9	Set Daylight Saving Time Mode		M	Yes	
	3.3.2.10	ELMS Pre-defined Event Configurations		M	Yes	
	3.3.2.10.1	Supported Event Classes		M	Yes	
	3.5.4	Supplemental Requirements for Event Logs		M	Yes	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Luminaire Switch State Logging

2.4.1.2.1		Provide Luminaire Switch State Logging	O	Yes / No	
	3.3.2.10.2	Luminaire Switch State Log	O	Yes / No	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Luminaire Lamp Condition Logging

2.4.1.2.2		Provide Luminaire Lamp Condition Logging		O	Yes / No	
		3.3.2.10.3	Luminaire Lamp Condition Log	O	Yes / No	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Luminaire Burn Condition Logging

2.4.1.2.3	Provide Luminaire Burn Condition Logging		O	Yes / No	
	3.3.2.10.4	Luminaire Burn Condition Log	O	Yes / No	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Periodic Luminaire Burn Time Logging

2.4.1.2.4	Provide Periodic Luminaire Burn Time Logging		O	Yes / No	
	3.3.2.10.5	Periodic Luminaire Burn Time Log	O	Yes / No	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Periodic Luminaire Temperature Logging

2.4.1.2.5	Provide Luminaire Temperature Logging		O	Yes / No	
	3.3.2.10.6	Luminaire Temperature Log	O	Yes / No	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Periodic Luminaire Pole Condition Logging

2.4.1.2.6		Provide Luminaire Pole Condition Logging		O	Yes / No	
	3.3.2.10.7		Luminaire Pole Condition Log	O	Yes / No	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Relay Switch State Logging

2.4.1.2.7		Provide Relay Switch State Logging	O	Yes / No	
	3.3.2.10.8	Relay Switch State Log	O	Yes / No	

Using the PRL to Build a Specification: Washington State DOT Case Study

Provide Power Meter Switch State Logging

2.4.1.2.8	Provide Power Meter Switch State Logging		O	Yes / No	
	3.3.2.10.9	Power Meter Switch State Log	O	Yes / No	

Completing the Project-Level PRL

Washington State DOT Case Study – Summary

- In this section, we have examined a short example of objects to be excluded or included in your project-specific specification when completing the PRL.

- For your project, you will examine each requirement in the PRL.

- A full version of the PRL is located within the standard as well as in the Student Study Guide.

SUPPLEMENT

Using the Requirements Traceability Matrix (RTM)

- How the RTM traces to a single design
- The RTM maps requirements to a specific design
- Annex A contains the RTM

Using the Requirements Traceability Matrix (RTM)

Requirement ID Column

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.3	Operational Environment Requirements				
3.3.1	Provide Live Data				
3.3.1.1	Retrieve Data				
		4.2.1	Generic SNMP Get Interface		
3.3.1.2	Deliver Data				
		4.2.3	Generic SNMP Set Interface		
3.3.1.3	Data Retrieval and Data Delivery Action Performance				
		4.2.1	Generic SNMP Get Interface		
		4.2.2	Generic SNMP Get-Next Interface		
		4.2.3	Generic SNMP Set Interface		
3.3.2	Provide Off-line Log Data				
3.3.2.1	Retrieve Configuration of Logging service				
		4.2.1	Generic SNMP Get Interface		

Using the Requirements Traceability Matrix (RTM)

Requirement Column

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.3.1	Configure Luminaire for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
				5.4.1.15	luminaireLightThreshold
				5.4.1.16	luminaireHoldInterval
				5.4.1.17	luminaireLightHysteresis
				5.4.1.18	luminaireDelayInterval
3.4.1.3.2	Configure Electrical Service for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.6	electricalserviceMode
				5.5.1.19	electricalserviceLightThreshold
				5.5.1.20	electricalserviceHoldInterval
				5.5.1.21	electricalserviceLightHysteresis
				5.5.1.22	electricalserviceDelayInterval

Using the Requirements Traceability Matrix (RTM)

Dialog ID Column

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.3.1	Configure Luminaire for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
				5.4.1.15	luminaireLightThreshold
				5.4.1.16	luminaireHoldInterval
				5.4.1.17	luminaireLightHysteresis
				5.4.1.18	luminaireDelayInterval
3.4.1.3.2	Configure Electrical Service for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.6	electricalserviceMode
				5.5.1.19	electricalserviceLightThreshold
				5.5.1.20	electricalserviceHoldInterval
				5.5.1.21	electricalserviceLightHysteresis
				5.5.1.22	electricalserviceDelayInterval

Using the Requirements Traceability Matrix (RTM)

Dialog Column

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.3.1	Configure Luminaire for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
				5.4.1.15	luminaireLightThreshold
				5.4.1.16	luminaireHoldInterval
				5.4.1.17	luminaireLightHysteresis
				5.4.1.18	luminaireDelayInterval
3.4.1.3.2	Configure Electrical Service for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.6	electricalserviceMode
				5.5.1.19	electricalserviceLightThreshold
				5.5.1.20	electricalserviceHoldInterval
				5.5.1.21	electricalserviceLightHysteresis
				5.5.1.22	electricalserviceDelayInterval

Using the Requirements Traceability Matrix (RTM)

Object ID Column

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.3.1	Configure Luminaire for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
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				5.4.1.18	luminaireDelayInterval
3.4.1.3.2	Configure Electrical Service for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.6	electricalserviceMode
				5.5.1.19	electricalserviceLightThreshold
				5.5.1.20	electricalserviceHoldInterval
				5.5.1.21	electricalserviceLightHysteresis
				5.5.1.22	electricalserviceDelayInterval

Using the Requirements Traceability Matrix (RTM)

Object Column

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.3.1	Configure Luminaire for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
				5.4.1.15	luminaireLightThreshold
				5.4.1.16	luminaireHoldInterval
				5.4.1.17	luminaireLightHysteresis
				5.4.1.18	luminaireDelayInterval
3.4.1.3.2	Configure Electrical Service for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.6	electricalserviceMode
				5.5.1.19	electricalserviceLightThreshold
				5.5.1.20	electricalserviceHoldInterval
				5.5.1.21	electricalserviceLightHysteresis
				5.5.1.22	electricalserviceDelayInterval

Using the Requirements Traceability Matrix (RTM)

Summarizing the RTM:

The RTM

- Maps each requirement to one specific design
- Is a precise dialog
- Is a precise list of objects
- All of the objects must be supported if the requirement is supported

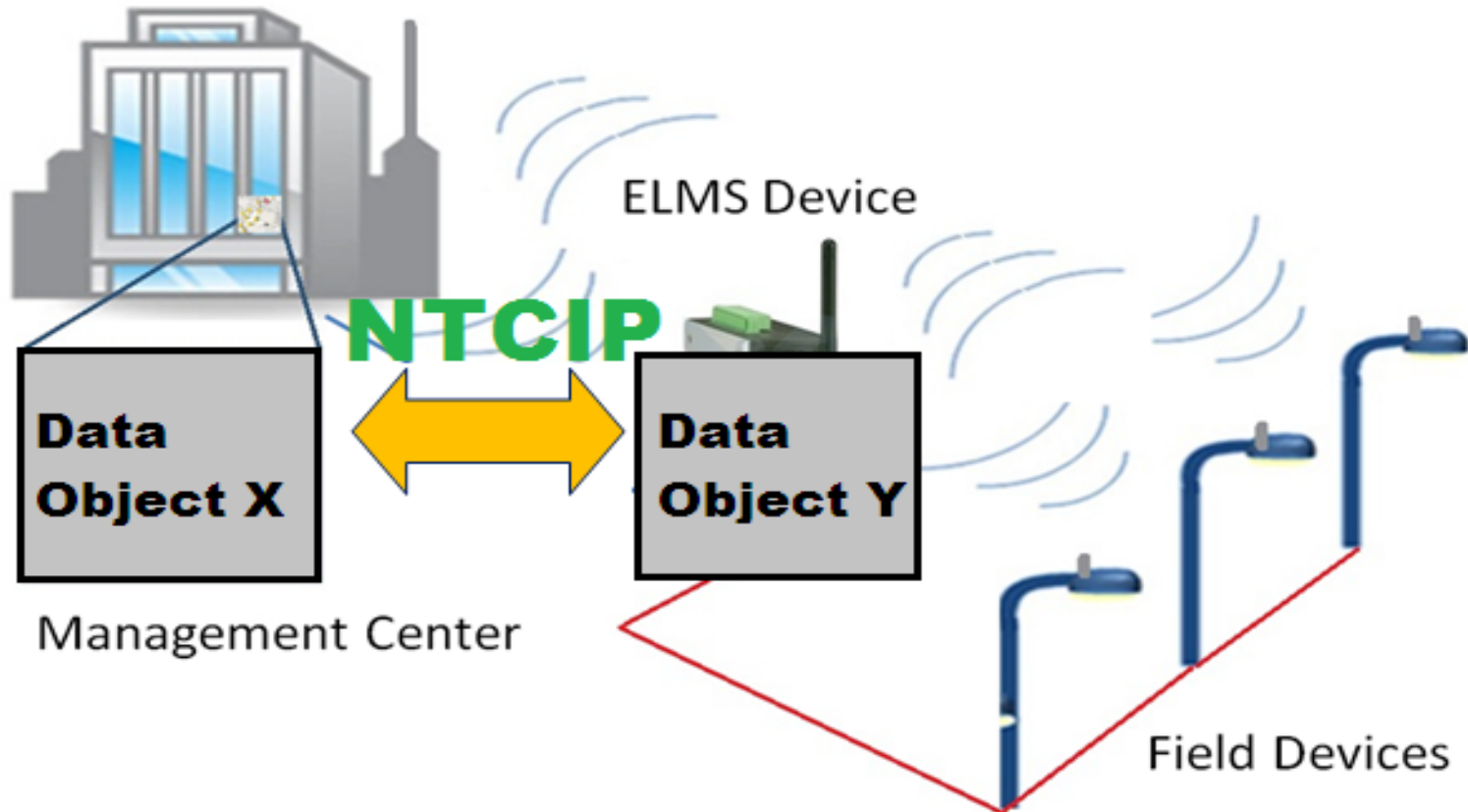# Using the Requirements Traceability Matrix (RTM)

How to Compare for Interoperability:

- The RTM provides interoperability of requirements
- The PRL indicates which requirements are supported
- Comparison of PRLs allows quick determination of interoperability

Using the Requirements Traceability Matrix (RTM)

Comparison of PRLs for Interoperability and Interchangeability:

Using the Requirements Traceability Matrix (RTM)

Comparison of PRLs for Interoperability:

- If both the Traffic Management System (TMS) and the ELMS support a feature
  - Interoperability is provided
- If the TMS supports, but ELMS does not
  - TMS can still use other features (typically)
  - TMS can still interoperate with feature with other devices
- If ELMS supports, but TMS does not
  - Feature could be used by other/future TMSs
  - Feature can potentially be used manually
- In order to ensure interoperability, both sides of the interface must implement the same dialog and objects as specified in the standard. This will give off-the-shelf interoperability.

Using the Requirements Traceability Matrix (RTM)

Comparison of PRLs for Interchangeability

- Both support a feature
    - Equipment is interchangeable for feature

- New equipment supports; old one does not
    - New equipment is interchangeable (meets or exceeds)

- Old equipment supports; new ones do not
    - Feature will not be supported
    - Is feature needed?

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What does the following table mean?

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.3.1	Configure Luminaire for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
				5.4.1.15	luminaireLightThreshold
				5.4.1.16	luminaireHoldInterval
				5.4.1.17	luminaireLightHysteresis
				5.4.1.18	luminaireDelayInterval

a) All of the objects must be supported

b) All of the objects must be supported if the requirement is supported

c) At least one of the objects must be supported

d) At least one of the objects must be supported if the requirement is supported

Review of Answers

a) All of the objects must be supported

Incorrect. They only need to be supported if the requirement has been selected in the PRL.

b) All of the objects must be supported if the requirement is supported

Correct!

c) At least one of the objects must be supported

Incorrect. If the requirement is selected, all of the objects must be supported.

d) At least one of the objects must be supported if the requirement is supported

Incorrect. If the requirement is supported, all of the objects must be supported.

Learning Objectives

Review the **structure** of the NTCIP 1213 v03 Standard

Use the **Protocol Requirements List** (PRL) and then the Requirements Traceability Matrix (RTM) to specify the standardized structure of requirements

Include the requirements from the PRL and RTM in the **ELMS Communications Interface specification**

Explain conditions and context for **extending the standard**

Learning Objective 4

Explain conditions and context for extending the standard

Extending the Standard

- Conditions and context for extending the standard

- Specify requirements not covered by the standard

- Adding missing requirements identified through best practices

Extending the Standard Complicates Interoperability and Interchangeability

- Not achievable unless all design details are known

- Extensions are relatively custom solutions, resulting in:
  - Increased specification costs
  - Increased development costs
  - Increased testing costs
  - Increased integration costs
  - Longer deployment timeframe
  - Increased maintenance costs

Extending the Standard Complicates Interoperability and Interchangeability

Extensions should only be considered when:

- NTCIP features are inadequate to meet need
- Benefits of extension outweigh added costs

Extending the Standard Complicates Interoperability and Interchangeability

Extended equipment should be designed to:

- Appropriately integrate with NTCIP-only deployments
- Minimize added complexity

ACTIVITY

Which of the choices below is a reason to extend an ELMS system specification?

Answer Choices

a) The existing system uses a nonstandard method

b) There is an unmet need that justifies the added cost

c) You want to use your specification to favor a specific vendor

d) The standardized solution is overly complex

Review of Answers

a) The existing system uses a nonstandard method

   Incorrect. Doing this will prolong the expensive customized approach for another generation.

b) There is an unmet need that justifies the added cost

   Correct! Sometimes you just have to accept the added cost.

c) You want to use your specification to favor a specific vendor

   Incorrect. This can trap you into a proprietary solution.

d) The standardized solution is overly complex

   Incorrect. Some NTCIP features are complex to allow flexibility, but costs of custom solutions far outweigh any costs due to added complexity.

Module Summary

Review the **structure** of the NTCIP 1213 v03 Standard

Use the **Protocol Requirements List** (PRL) and then the **Requirements Traceability Matrix** (RTM) to specify the standardized structure of requirements

Include the requirements from the PRL and RTM in the **ELMS Communications Interface specification**

Explain conditions and context for **extending the standard**

We Have Now Completed A306a and A306b in the ELMS Curriculum

Module A306a: Understanding **User Needs** for Electrical and Lighting Management Systems (ELMS) Based on NTCIP 1213 Standard v03

Module A306b: Specifying **Requirements** for Electrical and Lighting Management Systems (ELMS) Based on NTCIP 1213 Standard v03

Module T306: Applying Your **Test Plan** for Electrical and Lighting Management Systems Based on NTCIP 1213 ELMS Standard v03

Next Course Module

Module T306: Applying Your Test Plan for Electrical and Lighting Management Systems Based on NTCIP 1213 v03 Standard

Concepts taught in next module (Learning Objectives):

1) Describe ELMS Testing

2) Describe ELMS Test Plan Application

3) Identify Relevant Elements of an ELMS Test Plan

4) Describe Adaptation of a Test Plan

Thank you for completing this module.

Feedback
Please use the Feedback link below to provide us with your thoughts and comments about the value of the training.

Thank you!