



W E L C O M E



U.S. Department of Transportation
Office of the Assistant Secretary for
Research and Technology



Welcome



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Module A315b Part 1:

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



Updated June 2020



Instructor



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Trevilon LLC



Learning Objectives

Identify NTCIP 1202 v03 Standard Requirements

Explain the Purpose and Benefits of the Requirements
Traceability Matrix (RTM)

Prepare a Project-Level RTM

Prepare an ASC Specification



Learning Objective 1

Identify NTCIP 1202 v03
Standard Requirements

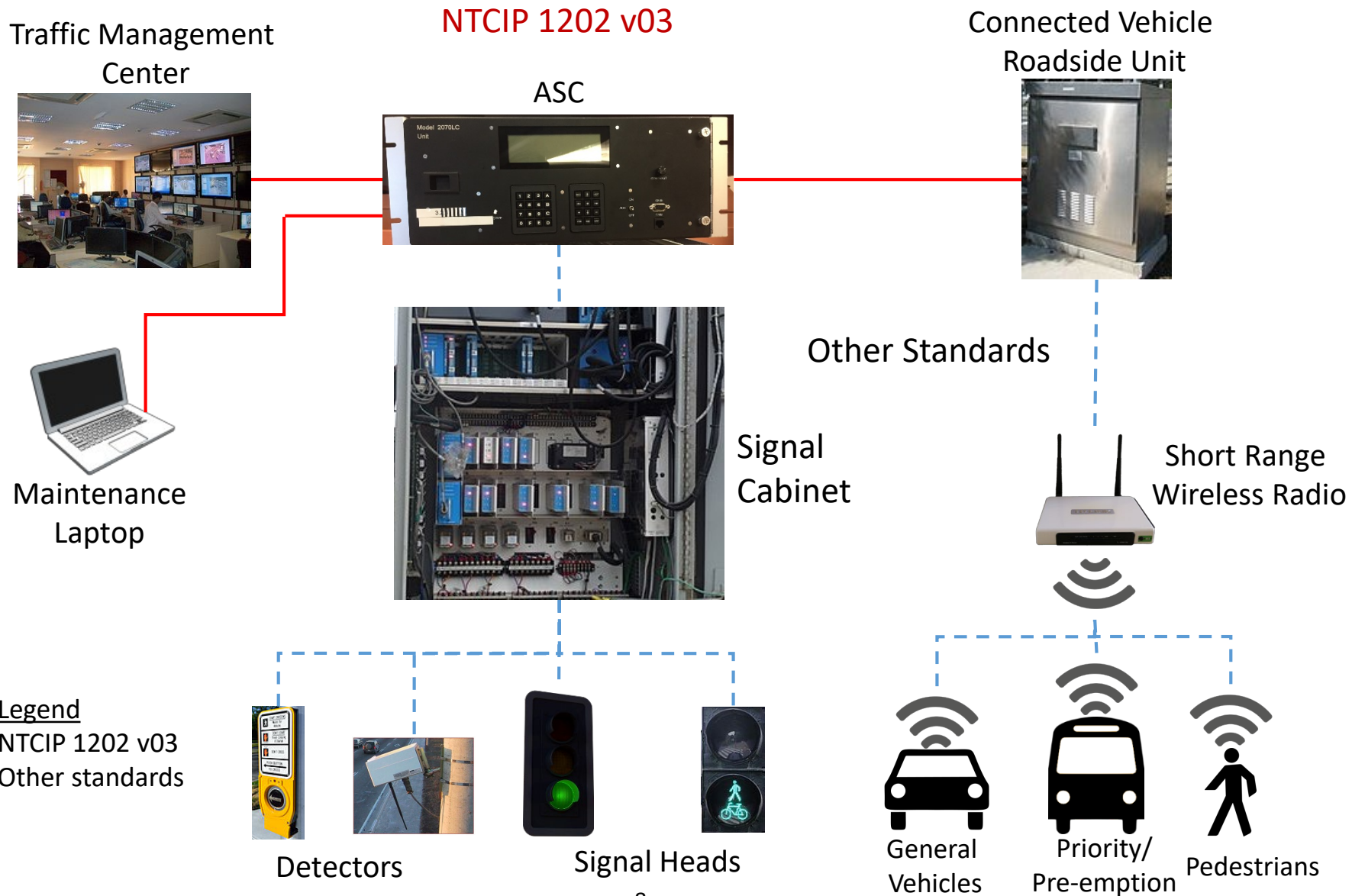


Identify NTCIP 1202 v03 Standard Requirements

Overview

- Scope of NTCIP 1202 v03
- What is a requirement?
- Review the outline of NTCIP 1202 v03
- Format of requirements

Scope of NTCIP 1202 v03





Scope of NTCIP 1202 v03

Changes since v02

- Added systems engineering content
 - User needs
 - Requirements
 - Dialogs
- Added support for new user needs
 - Connected vehicle environment
 - Managing operational performance
 - Exception reporting
 - And others
- Enhanced capabilities for existing user needs
- General maintenance
- Complete list in Annex D





What Is a Requirement?

Goal for Requirements

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



What Is a Requirement?

Goal for Requirements

*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

Types of Requirements in NTCIP 1202 v03

- Functional Requirements
- Design Requirements
- Traceability Requirements



Structure of NTCIP 1202 v03

Outline

- Section 1: General
- Section 2: Concept of Operations
- Section 3: Functional Requirements
includes Protocol Requirements List (PRL)
- Section 4: Dialogs
- Section 5: Management Information Base (MIB)
- Section 6: Block Object Definitions
- Section 7: SAE/NTCIP Object Definitions
- Annex A: Requirements Traceability Matrix (RTM)
- Annex B: Object Tree

Functional (“What”) Requirements
Design (“How”) Requirements
Traceability Requirements
Other text



Structure of NTCIP 1202 v03

Outline

- Annex C: Test Procedures (future)
- Annex D: Documentation of Revisions
- Annex E: User Requests
- Annex F: Generic Concepts and Definitions
- Annex G: SNMP Interface
- Annex H: NTCIP 1201 v03 and NTCIP 1103 v03 Derived Functional Requirements (and dialogs)
- Annex I: Communications Ports Protocols

Functional (“What”) Requirements

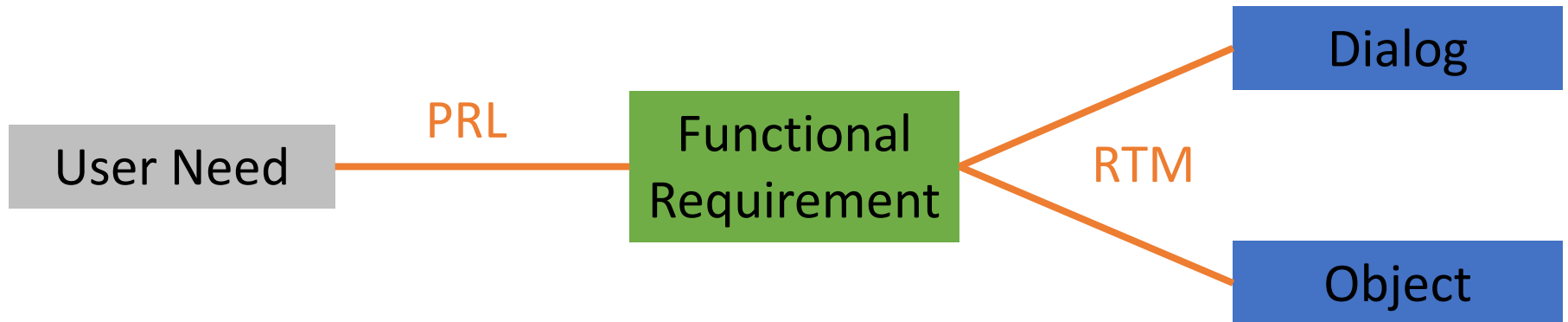
Design (“How”) Requirements

Traceability Requirements

Other text

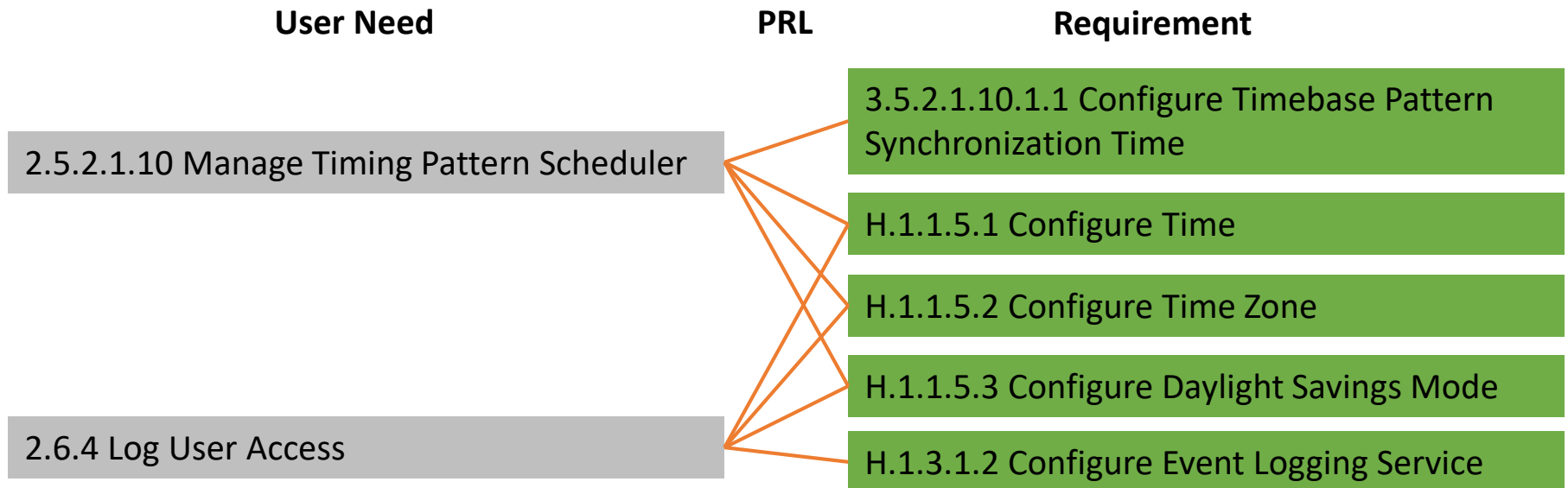
Traceability Requirements

- Traceability is defined in tables
 - PRL (See Module A315a)
 - RTM



Organization of Functional Requirements

- PRL organizes functional requirements by user need
 - Same requirement might be traced to multiple user needs
 - Need to avoid duplicate requirements





Organization of Functional Requirements

- Outline of requirements
 - 3.4 Architectural requirements
 - Basic communications
 - Logged data
 - Exception reporting
 - Access
 - 3.5 Data exchange and operational environment requirements
 - Basic configuration
 - Manage signal operations
 - Detector management
 - Connected vehicles
 - Backward compatibility



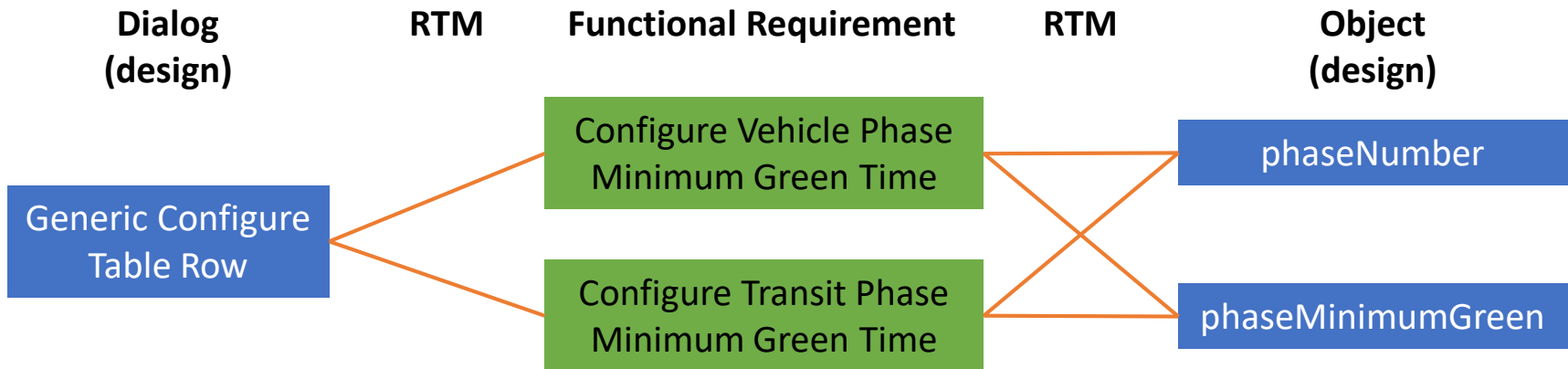
Organization of Functional Requirements

- Outline of requirements (Continued)
 - 3.6 Supplemental non-communications requirements
 - Response times
 - Condition-based transmission start times
 - Signal Phase and Timing (SPaT) performance
 - Annex H
 - H.1.1 Generic configuration
 - H.1.2 Generic status monitoring
 - H.1.3 Generic data retrieval
 - H.1.4 Generic control
 - H.1.5 Generic performance

Organization of Design Requirements

Requirements Traceability Matrix (RTM)

- Each functional requirement involving data exchange traces to:
 - One dialog
 - One or more data elements (called objects)





Organization of Design Requirements

- Dialogs
 - Annex H.2: Generic dialogs
 - Section 4: Custom dialogs
- Data elements (a.k.a. objects)
 - Section 5: Basic signal control objects
 - Section 6: Block object details
 - Section 7: Data adopted from SAE J2735
 - NTCIP 1201: Global objects
 - NTCIP 1103: Protocol-related objects specific to transportation
 - Various RFCs (See Annex I): Generic protocol-related objects



General Format for Functional Requirements

[Localization] [Actor] [Action] [Target] [Constraint]

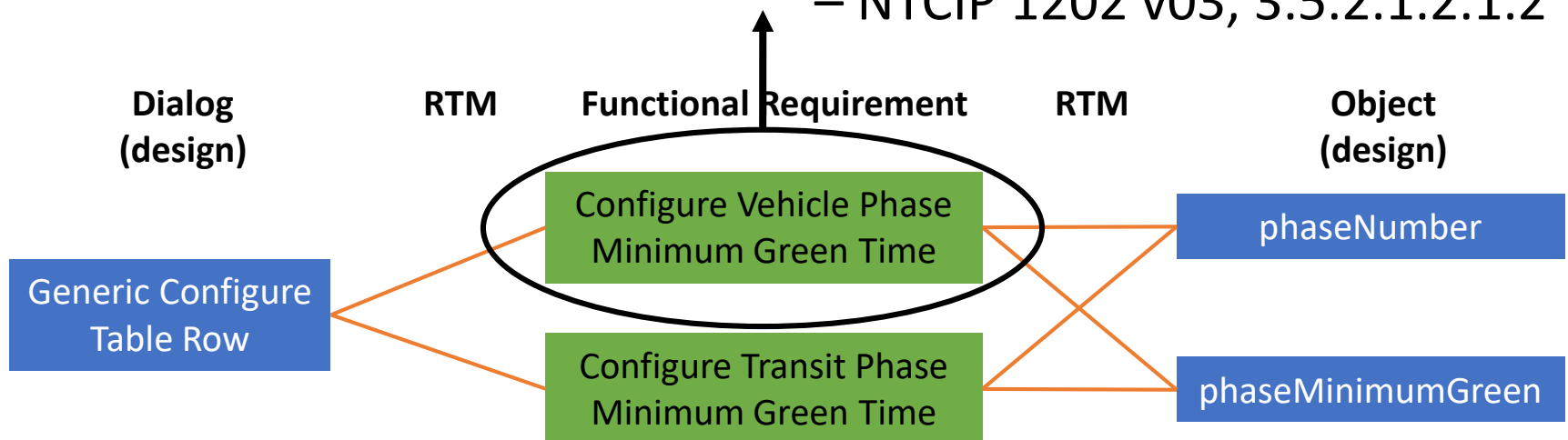
- **Actor:** Who or what does the action
- **Action:** Identifies what is to happen
- **Target:** Identifies what receives the action
- **Optional:**
 - **Localization:** Identifies circumstances under which requirement applies
 - **Constraint:** Identifies how to measure success or failure

Sample Functional Requirement

[Localization] [Actor] [Action] [Target] [Constraint]

Upon request from a management station, the ASC shall store the minimum amount of time the Green indication is to be displayed for a phase in seconds, between 0 and 255 seconds.

– NTCIP 1202 v03, 3.5.2.1.2.1.2

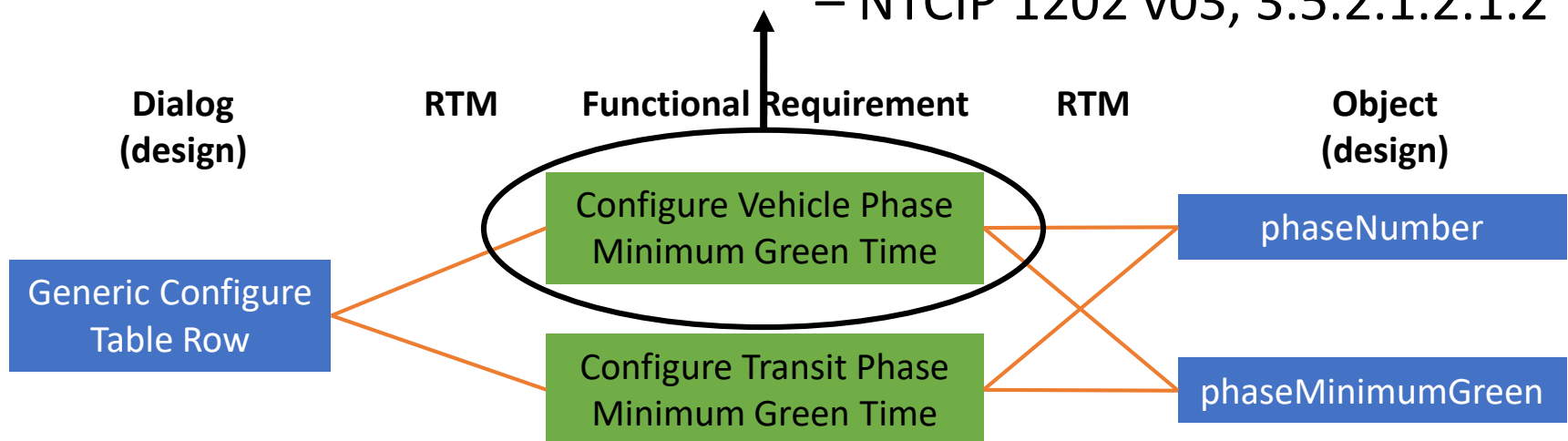


Sample Functional Requirement

[Localization] **[Actor]** [Action] [Target] [Constraint]

*Upon request from a management station, **the ASC** shall store the minimum amount of time the Green indication is to be displayed for a phase in seconds, between 0 and 255 seconds.*

– NTCIP 1202 v03, 3.5.2.1.2.1.2

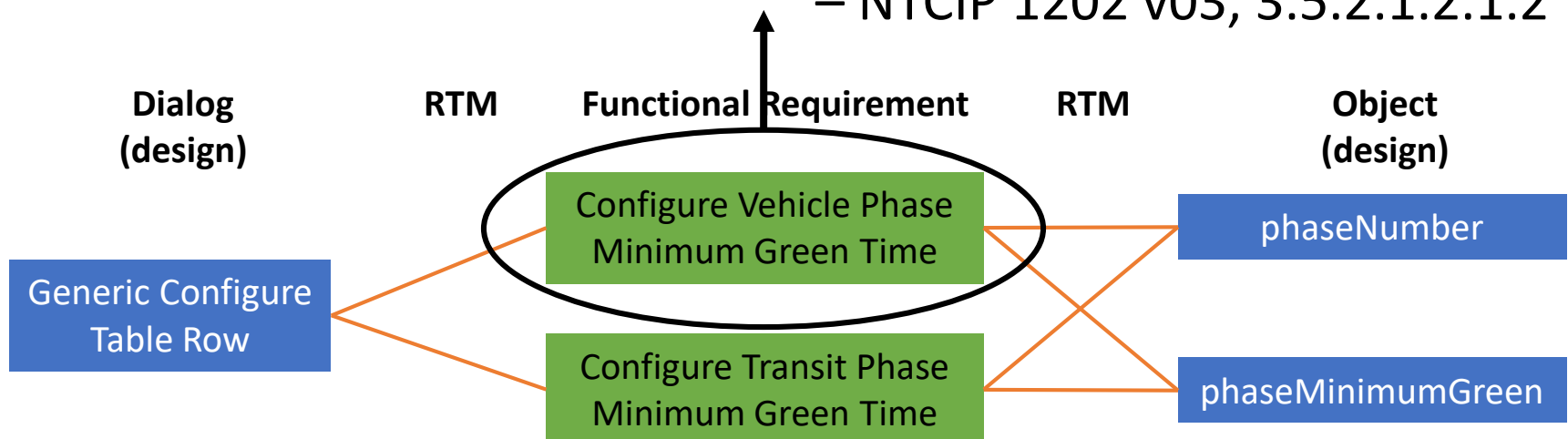


Sample Functional Requirement

[Localization] [Actor] **[Action]** [Target] [Constraint]

*Upon request from a management station, the ASC **shall store** the minimum amount of time the Green indication is to be displayed for a phase in seconds, between 0 and 255 seconds.*

– NTCIP 1202 v03, 3.5.2.1.2.1.2

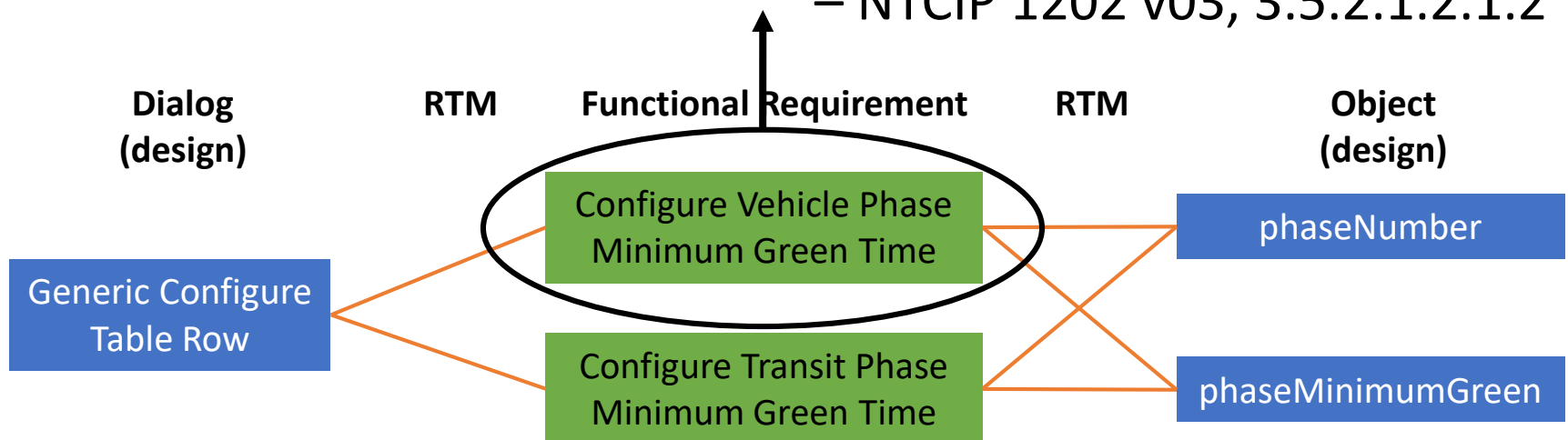


Sample Functional Requirement

[Localization] [Actor] [Action] **[Target]** [Constraint]

*Upon request from a management station, the ASC shall store **the minimum amount of time the Green indication is to be displayed for a phase** in seconds, between 0 and 255 seconds.*

– NTCIP 1202 v03, 3.5.2.1.2.1.2

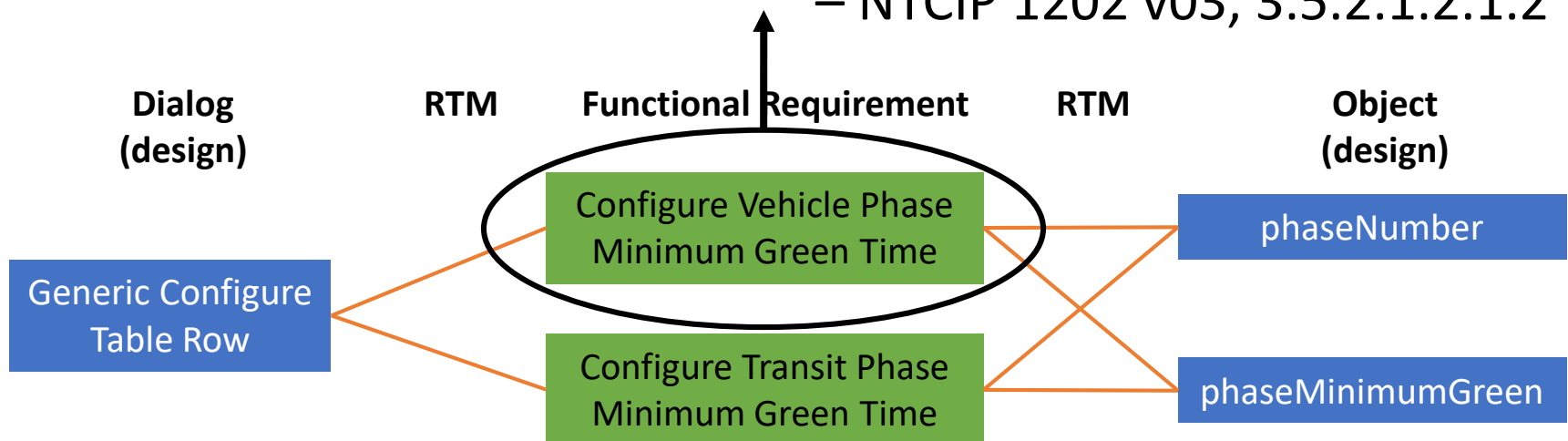


Sample Functional Requirement

[Localization] [Actor] [Action] [Target] **[Constraint]**

*Upon request from a management station, the ASC shall store the minimum amount of time the Green indication is to be displayed for a phase **in seconds, between 0 and 255 seconds.***

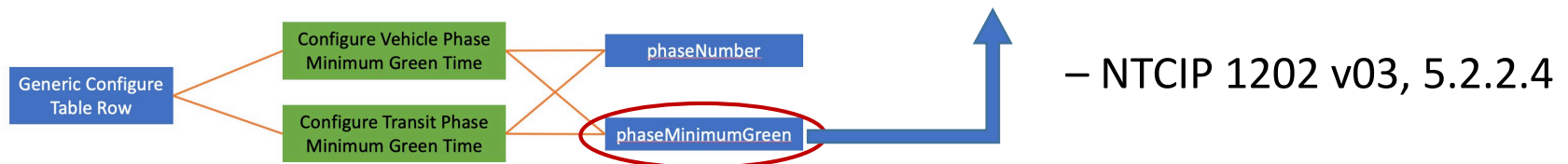
– NTCIP 1202 v03, 3.5.2.1.2.1.2



Structure of Requirements

Sample Object

```
phaseMinimumGreen      OBJECT-TYPE
    SYNTAX      INTEGER (0..255)
    ACCESS      read-write
    STATUS      mandatory
    DESCRIPTION  "<Definition> Phase Minimum Green Parameter in
                seconds (NEMA TS 2 range: 1-255 sec). The first timed
                portion of the Green interval which may be set in
                consideration of the storage of vehicles between the zone
                of detection for the approach vehicle detector(s) and the
                stop line.
    <Object Identifier>1.3.6.1.4.1.1.1206.4.2.1.1.2.1.4
    <Unit> second"
    REFERENCE   "NEMA TS 2 Clause 3.5.3.1 and 3.5.3.2.1.a.(1)"
 ::= {phaseEntry 4}
```



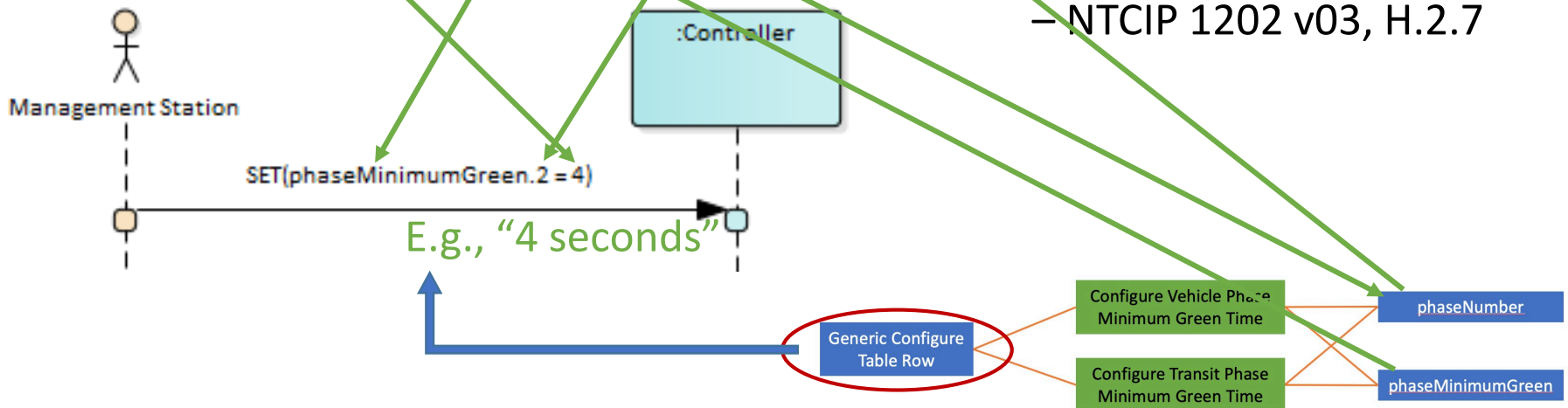
Structure of Requirements

Sample Dialog

The standardized dialog for a management station to configure a table row shall be as follows:

a) (Precondition) The management station shall be aware of which row in the table is to be configured. E.g., "Phase 2"

b) For the specified row, the management station shall SET all objects (to their desired values) referenced by the specific dialog that references this generic dialog, except for the index object(s).





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Question

Which of the following is missing from NTCIP 1202 v03?

Answer Choices

- a) User needs
- b) Functional requirements
- c) Test procedures
- d) All of the above

Review of Answers



a) User needs

Incorrect. NTCIP 1202 v03 added user needs.



b) Functional requirements

Incorrect. NTCIP 1202 v03 added functional requirements.



c) Test procedures

Correct! While NTCIP 1202 v03 includes an Annex C for test procedures, it is empty and left as future work.



d) All of the above

Incorrect. NTCIP 1202 v03 includes both user needs and requirements.



Learning Objective 2

Explain the Purpose and Benefits of the RTM



Purpose and Benefits of the RTM

Overview

- Understand interoperability and interchangeability
- Obtain interoperability and interchangeability

Understand Interoperability and Interchangeability

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



information

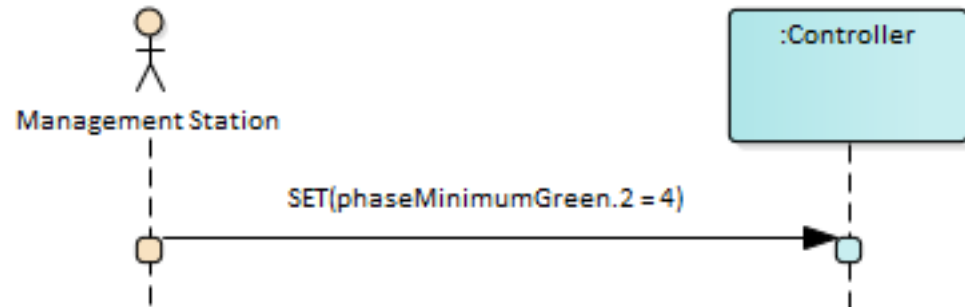


Understand Interoperability and Interchangeability

Interoperability and NTCIP

Degree to which two or more systems, products or components can exchange information

NTCIP standardizes dialogs and protocols



and use the information that has been exchanged

NTCIP standardizes data to be exchanged

```
phaseMinimumGreen    OBJECT-TYPE
    SYNTAX    INTEGER (0..255)
    ACCESS    read-write
    STATUS    mandatory
    DESCRIPTION <<Definition>> Phase Minimum Green Parameter in
        seconds (NEMA TS 2 range: 1-255 sec). The first timed
        portion of the Green interval which may be set in
        consideration of the storage of vehicles between the zone
        of detection for the approach vehicle detector(s) and the
        stop line.
    <Object Identifier>1.3.6.1.4.1.1.1206.4.2.1.1.2.1.4
    <Unit> second"
    REFERENCE "NEMA TS 2 Clause 3.5.3.1 and 3.5.3.2.1.a.(1)"
    ::= {phaseEntry 4}
```

Understand Interoperability and Interchangeability

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





Understand Interoperability and Interchangeability

Interchangeability

*Ability of one product, process or service to be used in place of another to fulfill **the same requirements**.*

- Which Requirements?

- Functional
- Performance
- Electrical
- Environmental
- Structural
- Others

At least partially within scope of
NTCIP 1202 v03
“Interoperability Requirements”

Understand Interoperability and Interchangeability

Roles in Data Exchanges

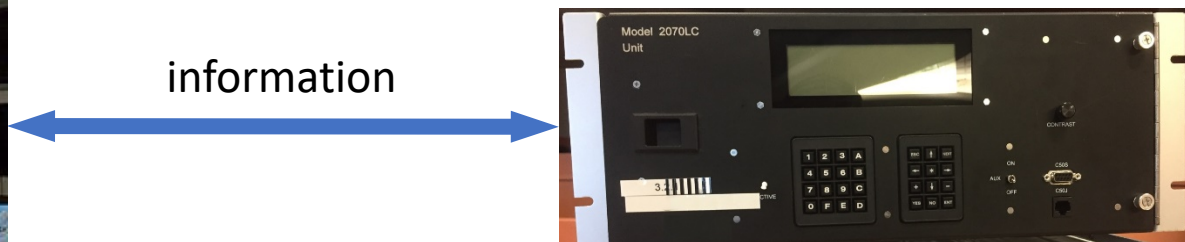
Interoperability entails systems exchanging information

- NTCIP defines two roles within exchanges:
 - **Manager**: Makes requests, receives responses and notifications
 - **Agent**: Responds to requests, generates “unsolicited” notifications

Manager



Agent

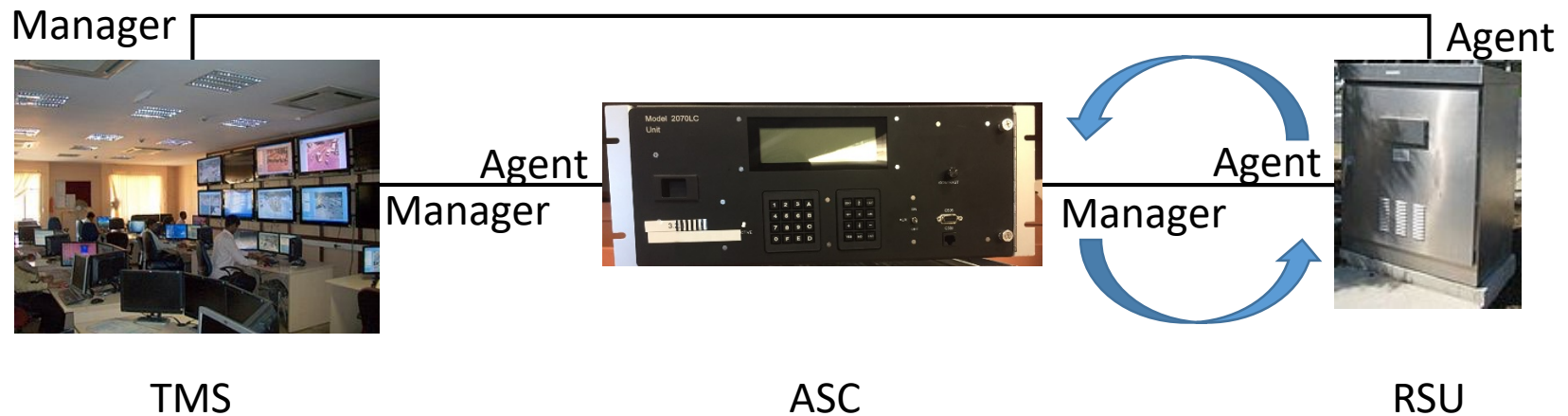


Understand Interoperability and Interchangeability

Roles in Data Exchanges

A product can fulfill both roles, e.g., a signal controller might:

- Act as an agent in communications with the Traffic Management System (TMS)
- Act as a manager in communications with a Roadside Unit (RSU)



NTCIP Interchangeability (for Interoperability)

Combining definitions for **interoperability** and **interchangeability**, we get:

Degree to which one product can be used in place of another to exchange information and use the information that has been exchanged.

- What information?
 - NTCIP standardizes information
 - Support for most information is “optional”
 - What if two devices support different options?



information



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***

- Project PRL identifies the options required for the project
- RTM traces each functional requirement to the information and exchange mechanisms required



information



Obtain Interoperability and Interchangeability

Conformance

Adherence of an implementation to the requirements of one or more specific standards or technical specifications

– ISO/IEC 10641:1993

- Relates to a **standard**
 - or a “technical specification,” which is still a formally approved standards document that has not reached full standards maturity



Obtain Interoperability and Interchangeability

Compliance

Doing what has been asked or ordered, as required by rule or law

– IEEE 730-2014

- Not limited to standards; for example, includes **project specifications**





Obtain Interoperability and Interchangeability

Comparing PRLs

Various Types of PRLs

- **Standard PRL** provides the baseline menu
 - Defines minimum for **conformance**
- **Project PRL** identifies requirements for a project
 - Defines minimum for project-level **compliance**
- **Product PRL** identifies requirements to which a product claims conformance
 - Defines product **capabilities**
- Project and product PRLs can be compared to determine interoperability and interchangeability

Obtain Interoperability and Interchangeability

Project PRL Identifies Options Required for a Project

- Project PRL identifies the options that a project **requires**
- Equipment may “meet or exceed” and provide additional functionality
- See Module A315a for details on tailoring the PRL for a project

UN ID	User Need	FR ID	Func Req't	Conform	Support	Add'l Spec.
2.5.2.1.2	Manage Phase Configurations			M	Yes	
		3.5.2.1.2.1.1	Enable/Disable Phase	M	Yes	
		3.5.2.1.2.1.2	Configure Vehicle Phase Minimum Green Time	M	Yes	
		3.5.2.1.2.1.4	Configure Vehicle Phase Maximum Green Times	M	Yes	
		3.5.2.1.2.1.5	Configure Vehicle Phase Third Maximum Green Times	O	Yes / No	
2.5.2.1.3	Manage Coordination Configurations			O	Yes / No	
		3.5.2.1.3.6.1	Configure Coordination Point – First Phase Green Begin	O.10 (1..*)	Yes / No	
		3.5.2.1.3.6.2	Configure Coordination Point – First Phase Green End	O.10 (1..*)	Yes / No	

Selected sampling of PRL items from NTCIP 1202 v03



Obtain Interoperability and Interchangeability

PRL Defines “What”

What

By itself, project PRL only identifies

- Functional/performance requirements to be supported
- User needs that describe why these requirements might be needed

Project PRL provides the foundation for interchangeability



Obtain Interoperability and Interchangeability

RTM Defines “How”

How

RTM defines design details for each functional requirement

- Project PRL provides foundation for **interchangeability**
- RTM extends the definition to ensure **interoperability**

Obtain Interoperability and Interchangeability

Comparing PRLs

Products that comply with the same **project specification** are:

- **Interoperable**, if they fulfill opposite roles
- **Interchangeable**, if they fulfill the same role(s)

Project Specification includes:

- Project PRL
 - Filled-out PRL from standard
 - Any Supplemental PRL
- Project RTM
 - Standard RTM
 - Any supplemental RTM
- Additional materials



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Question

What does a Project PRL identify?

Answer Choices

- 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

Review of Answers



a) The requirements for a project

Correct! The Project PRL identifies which functional requirements are required for a device within a project.



b) The objects to be supported for a project

Incorrect. Objects to be supported are identified in the RTM.



c) The testing requirements for a project

Incorrect. Testing requirements are not a part of the PRL.



d) All of the above

Incorrect. The PRL does not identify objects or test requirements.



Learning Objective 3

Prepare a Project-Level RTM

Prepare a Project-Level RTM

Overview

- Understanding the Standard RTM
- Trace Requirements with RTM
- Supplementing the RTM, if Needed
- Referencing the RTM
- Understand Benefits of RTM to Stakeholders

Understanding the Standard RTM

- PRL needs to be tailored for each project by selecting options
 - See Module A315a for process
 - See Module A315b Part 2 for special considerations
- RTM provides exactly one design for each functional requirement that includes data exchange
 - No options to select
 - No need to duplicate in a procurement
 - All implementations must support the design to claim support for the associated requirement(s)

Trace Requirements with RTM

Shaded rows indicate groups of functional requirements as organized in the text

FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Additional Specifications
3.5.2	Manage Signal Operations Management Requirements				
3.5.2.1	Manage Signal Configuration Requirements				
3.5.2.1.2	Manage Phase Configuration Requirements				
3.5.2.1.2.1	Configure Phases Requirements				
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	

Trace Requirements with RTM

Functional requirement section number

Functional requirement section title

Section number of one dialog per FR

FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Additional Specifications
3.5.2	Manage Signal Operations Management Requirements				
3.5.2.1	Manage Signal Configuration Requirements				
3.5.2.1.2	Manage Phase Configuration Requirements				
3.5.2.1.2.1	Configure Phases Requirements				
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	

Trace Requirements with RTM

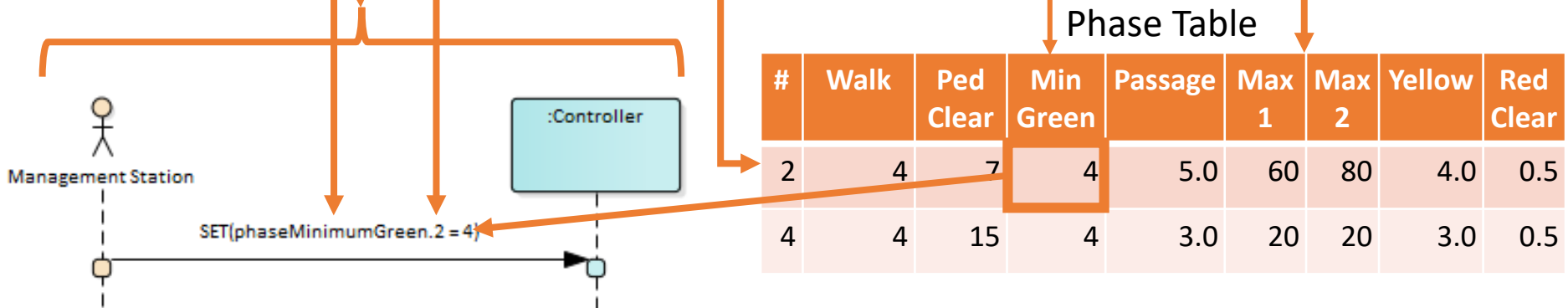
Any additional specifications
Name of each included object
Section number of each included object

FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Additional Specifications
3.5.2	Manage Signal Operations Management Requirements				
3.5.2.1	Manage Signal Configuration Requirements				
3.5.2.1.2	Manage Phase Configuration Requirements				
3.5.2.1.2.1	Configure Phases Requirements				
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	

An empty functional requirement indicates row belongs to the previous functional requirement

Trace Requirements with RTM

FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Additional Specifications
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	



Trace Requirements with RTM

Refines the information on the row

FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Additional Specifications
3.5.2.1.2.1.2	Enable/Disable Phase	4.2.2			
			5.2.2	phaseTable	
			5.2.2.1	phaseNumber	
			5.2.2.21	phaseOptions	Bit 0

phaseOptions OBJECT-TYPE

- Bit 0: Enabled Phase
- Bit 1: Automatic Flash Entry Phase
- Bit 2: Automatic Flash Exit Phase
- Bit 3: Non-Actuated 1
- Bit 4: Non-Actuated 2
- etc.

Trace Requirements with RTM

Standardized Dialogs

- Dialogs can be complex



Figure 8 Set Complex Configuration Parameters

Standardized Dialogs vs Conforming Behavior

Standard defines “standardized dialogs”

- Standardized dialogs establish a baseline for testing
 - All implementations must support the design to claim support for the associated requirement(s)
- SNMP allows a great deal of flexibility in sequence of messages
- Conforming agent implementations must support all sequences supported by object definitions

Supplementing the RTM, if Needed

Project Dialogs

An implementation may have special dialog requirements

- Central system may need to frequently monitor information from multiple functional requirements
- Standardized dialogs are often not the most efficient logic
- NTCIP provides multiple ways to improve efficiency
 - Flexibility of SNMP requests
 - Block objects
 - Dynamic objects
 - Exception reporting

Procurement should specify any custom dialogs and associated performance requirements to ensure proper interoperability

Referencing the RTM

- 140-page RTM generally does not need to be copied
 - The traceability should be constant for all deployments
 - Applicability of any requirement is defined in PRL
- NTCIP copyright limits changes that could legally be made to “Additional Specifications” column
 - If any refinements are needed, better to highlight as separate notes
- If custom extensions are defined, a supplemental RTM should be provided

Benefits of RTM to Stakeholders



Procuring agency

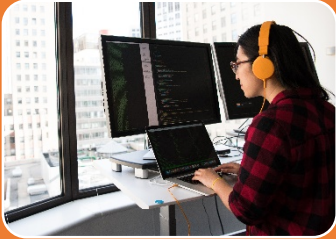
- Simplifies procurement specification / reduces work
- Promotes competitive marketplace
- Promotes interoperability



Operations personnel

- Provides detailed design for desired functionality
- Promotes consistent user interface
- Simplifies field maintenance

Benefits of RTM to Stakeholders



System developers

- Promotes common design for different manufacturers
- Simplifies system integration
- Promotes market for more advanced systems



Manufacturers/vendors

- Promotes common design for different central systems
- Enables a standard product for all clients
- Simplifies procurement specifications / reduces disputes



Conformance testers

- Clearly identifies what must be supported and its design
- Promotes development of common test procedures
- Promotes automation and more rigorous testing



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Question

What does the dialog column in the following table mean?

FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Additional Specifications
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

Review of Answers



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

Incorrect. SNMP provides flexibility in exchanging objects.



b) The dialog defines operations that are prohibited

Incorrect. The dialog does not define operations that are prohibited.



c) The dialog provides a baseline reference for testing

Correct! The dialog provides a baseline that can be used to develop test procedures.



d) All of the above

Incorrect. Answers a and b are not true.



Learning Objective 4

Prepare an ASC Specification

Prepare an ASC Specification

Overview

- Potential issues with a specification
- Interface specification checklist
- Complete specification package



Potential Issues with a Specification

Example Issues

Cause	Possible Result
Not identifying user needs	Compliant system that does not meet needs
Inadequate specification of functional requirements	
Inadequate specification of system dialogs	Inconsistent behavior of the system
Not clearly identifying custom features	Inability to support custom needs
Inadequate specification of communications stack	Non-interoperable system
Inadequate testing	Anomalies occurring after vendor has been paid
Copying someone else's specification	System that does not meet user needs





Interface Specification Checklist

Select User Needs and Requirements

- NTCIP 1202 v03 simplifies process of selecting needs and requirements
- Fill out the project PRL and include in specification
- Include reference to standard RTM



-  Project PRL
-  RTM (by reference)



Interface Specification Checklist

Define any custom items

Add supplements to PRL and RTM to address any customizations

- Custom dialogs: Additional dialogs used by central
- Custom extensions: Additional user needs, requirements, and associated design
 - See Modules A202 and A203



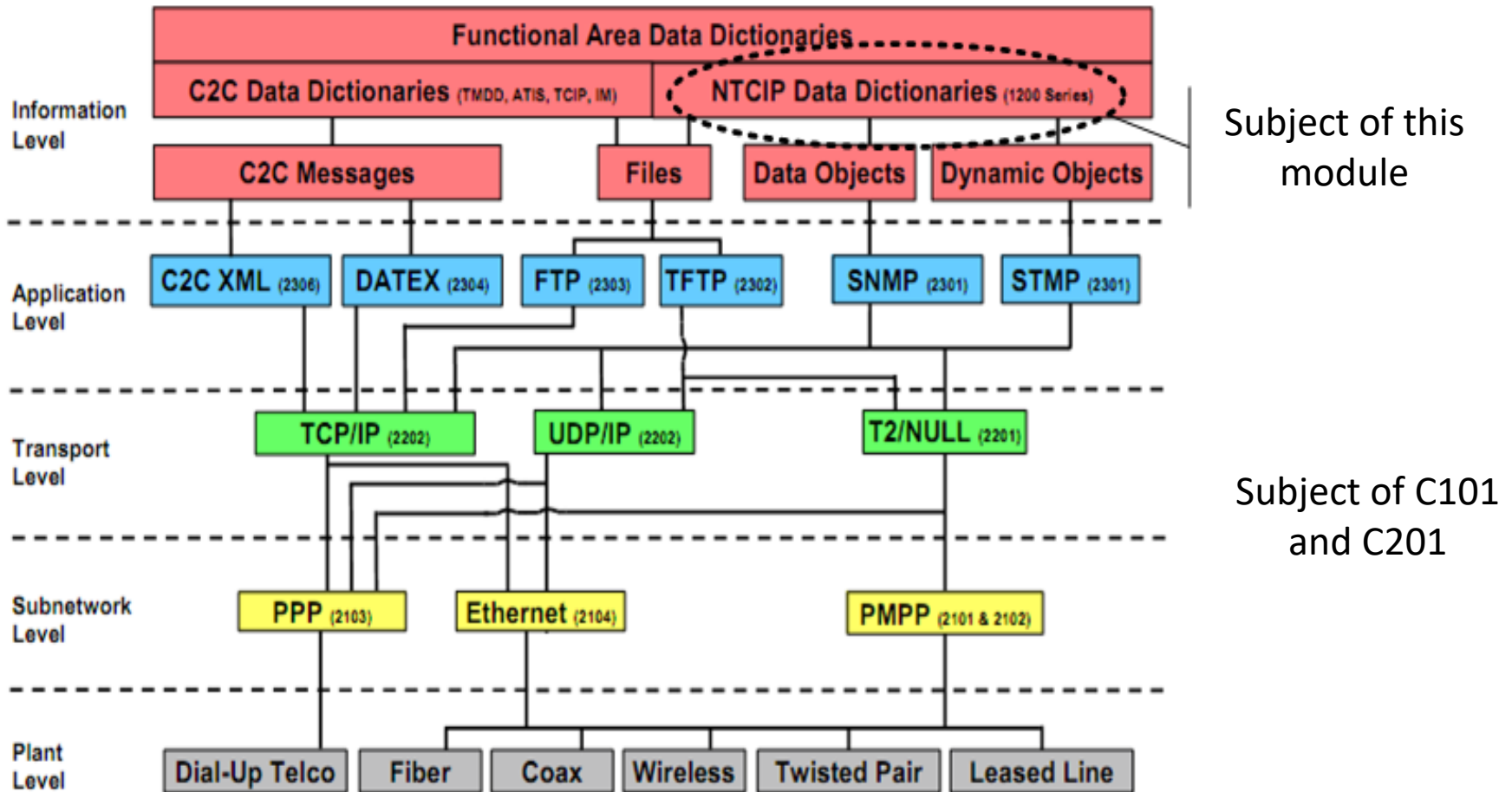
Custom dialogs



Custom extensions

Interface Specification Checklist

Specify Complete Communications Stack



Source: NTCIP 9001v04, Page 12, Figure 4



Communication stack specifications



Interface Specification Checklist

Define Testing Requirements

- Acceptance testing should be clearly defined
 - Without testing, requirements are of limited use
 - Testing requires time and needs to be in budget
 - Test procedures not included in NTCIP 1202 v03
 - Need to consider developing test procedures per Module T202



Testing/acceptance requirements



Interface Specification Checklist

Develop Your Own Specifications








- Specifications should be reviewed for every project
 - Retaining unnecessary requirements can increase costs
 - Omitting requirements can limit functionality



Don't blindly copy specifications

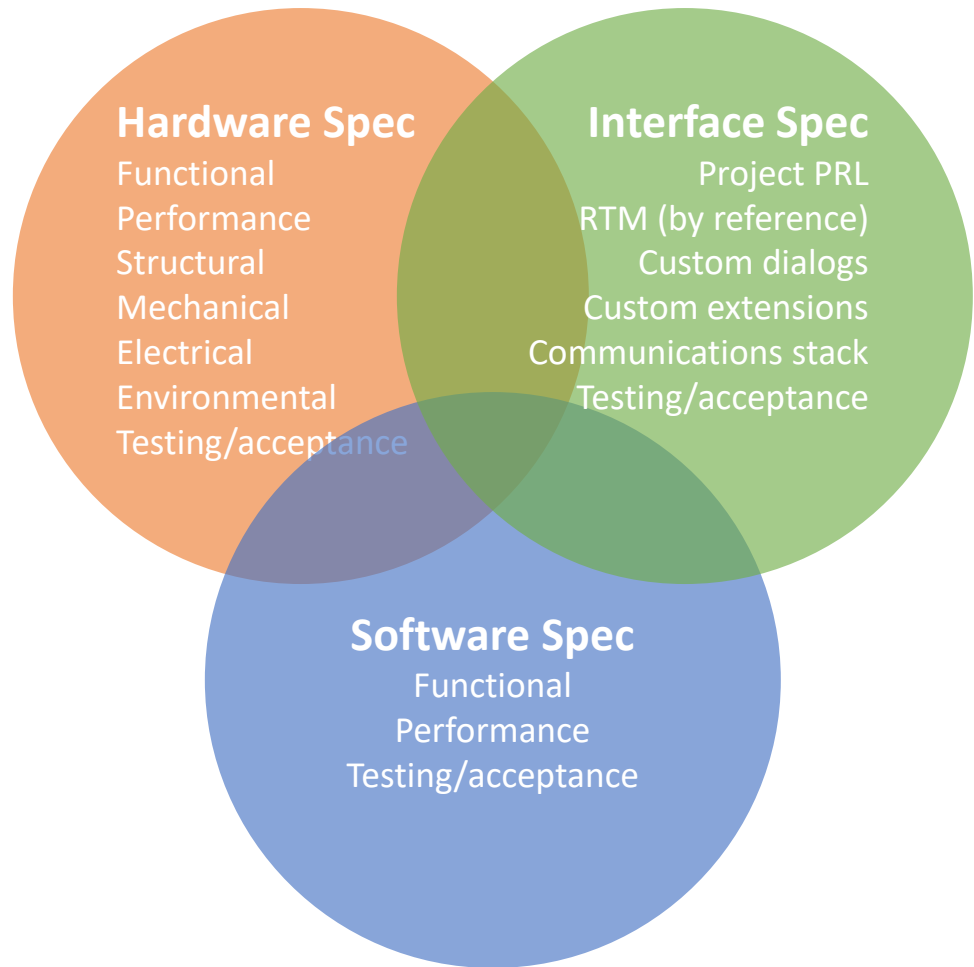


Interface Specification Checklist

-  Project PRL
-  RTM (by reference)
-  Custom dialogs
-  Custom extensions
-  Communication stack specifications
-  Testing/acceptance requirements
-  Don't blindly copy specifications

Example

- Detect “cabinet door open”:
 - Hardware sensor
 - Software to process signal
 - Interface to report condition





Interface Specification Checklist

Specification Might Be Complex

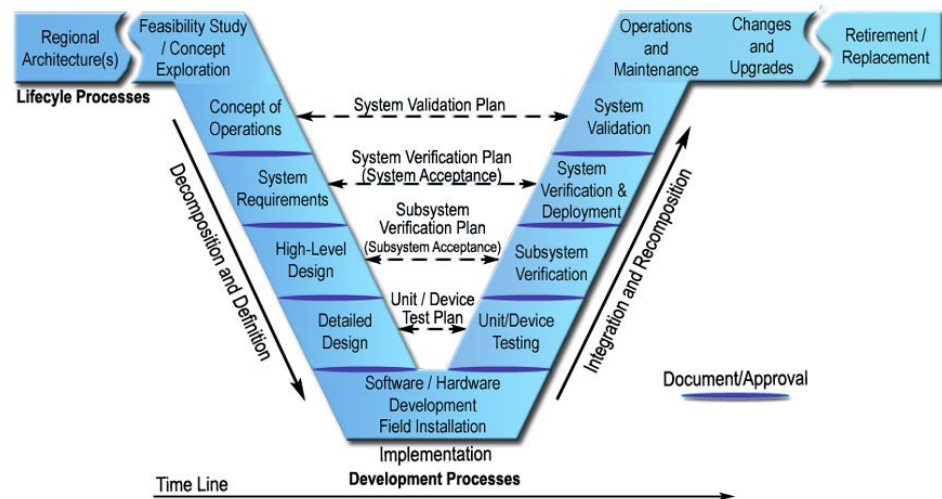
- A component may need to support multiple interfaces
 - Signal controller
 - Old version of NTCIP 1202
 - Current version of NTCIP 1202
 - Other NTCIP functionality on advanced controllers
 - Proprietary interface
 - Multiple communication stacks
 - Central systems
 - Multiple device types
 - Multiple versions
 - Multiple communication stacks



Interface Specification Checklist

Contractual Requirements

- System development
- Internal testing
- Deployment/integration
- Operational/maintenance
- Project management





Interface Specification Checklist

Remember

- Complete all aspects of PRL
 - Including “Additional Specifications”
- Only require what you need
 - Extra features can increase costs
- Specification needs to ensure device can
 - Respond fast enough for central
 - Respond efficiently enough for provided communication network
- Define acceptance and payment

Additional Specifications
The ASC shall support at least _____ phases.





ACTIVITY



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Question

Which of the following is typically not part of the interface specifications?

Answer Choices

- a) Project PRL
- b) Testing requirements
- c) Environmental requirements
- d) Communications stack

Review of Answers



a) Project PRL

Incorrect. The interface specification should include the project PRL.



b) Testing requirements

Incorrect. The interface specification should include testing/acceptance requirements.



c) Environmental requirements

Correct! Environmental requirements are typically not included in an interface specification.



d) Communications stack

Incorrect. The communications stack should be specified in the interface specification.



Module Summary

Identify NTCIP 1202 v03 Standard Requirements

Explain the Purpose and Benefits of the RTM

Prepare a Project-Level RTM

Prepare an ASC Specification



Next Course Module

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

Concepts taught in next module (Learning Objectives):

- 1) Manage Special Considerations for NTCIP 1202 v03
- 2) Incorporate Requirements Not Supported by Standardized Objects

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!