WELCOME

RITA Intelligent Transportation Systems
Joint Program Office

Welcome

- Shelley Row, P.E., PTOE
- Director
- ITS Joint Program Office
- Shelley.Row@dot.gov

WWW.PCB.ITS.DOT.GOV/STANDARDSTRAINING

A321b
Specifying Requirements for Traffic Management Systems Based on TMDD v3.0 Standard

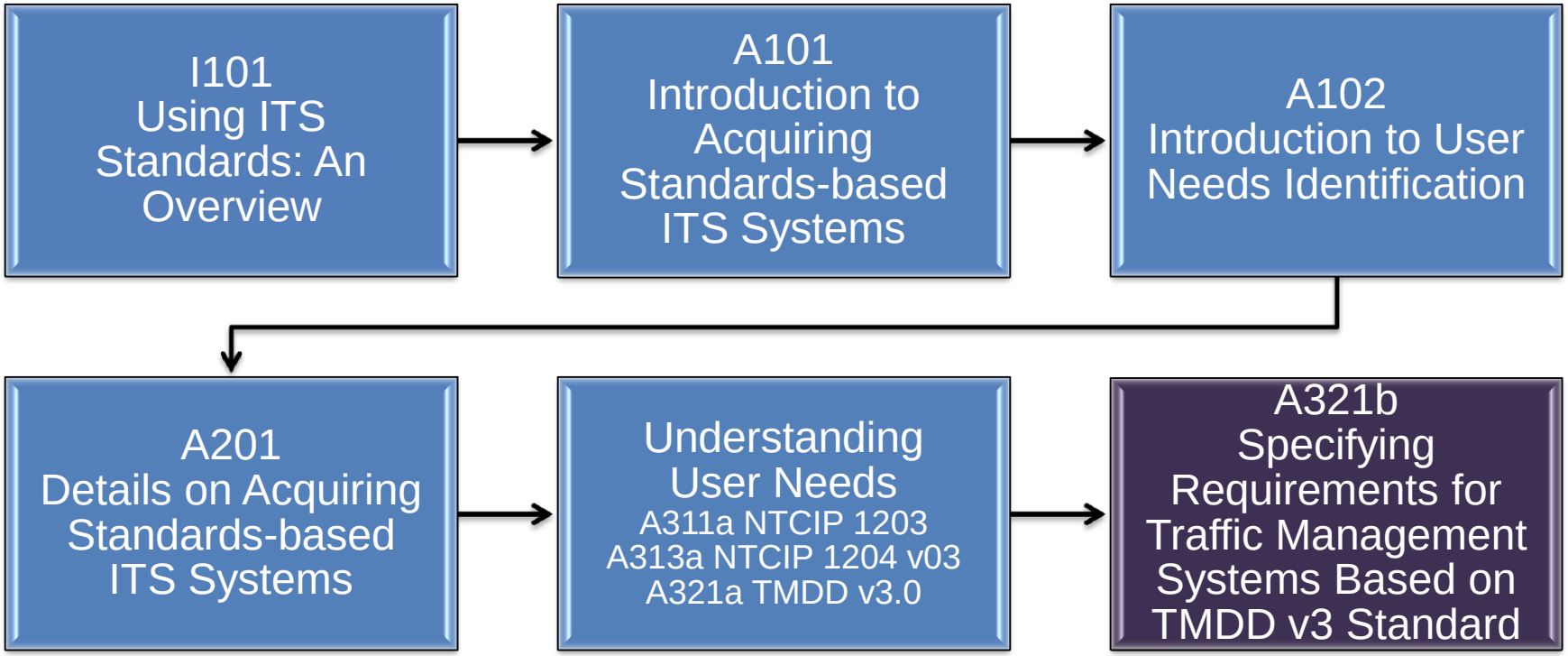
Target Audience

- Engineering and planning staff
- Emergency management and public safety
- Traffic management center (TMC) and operations staff
- System developers
- Public and private sectors
- Coders

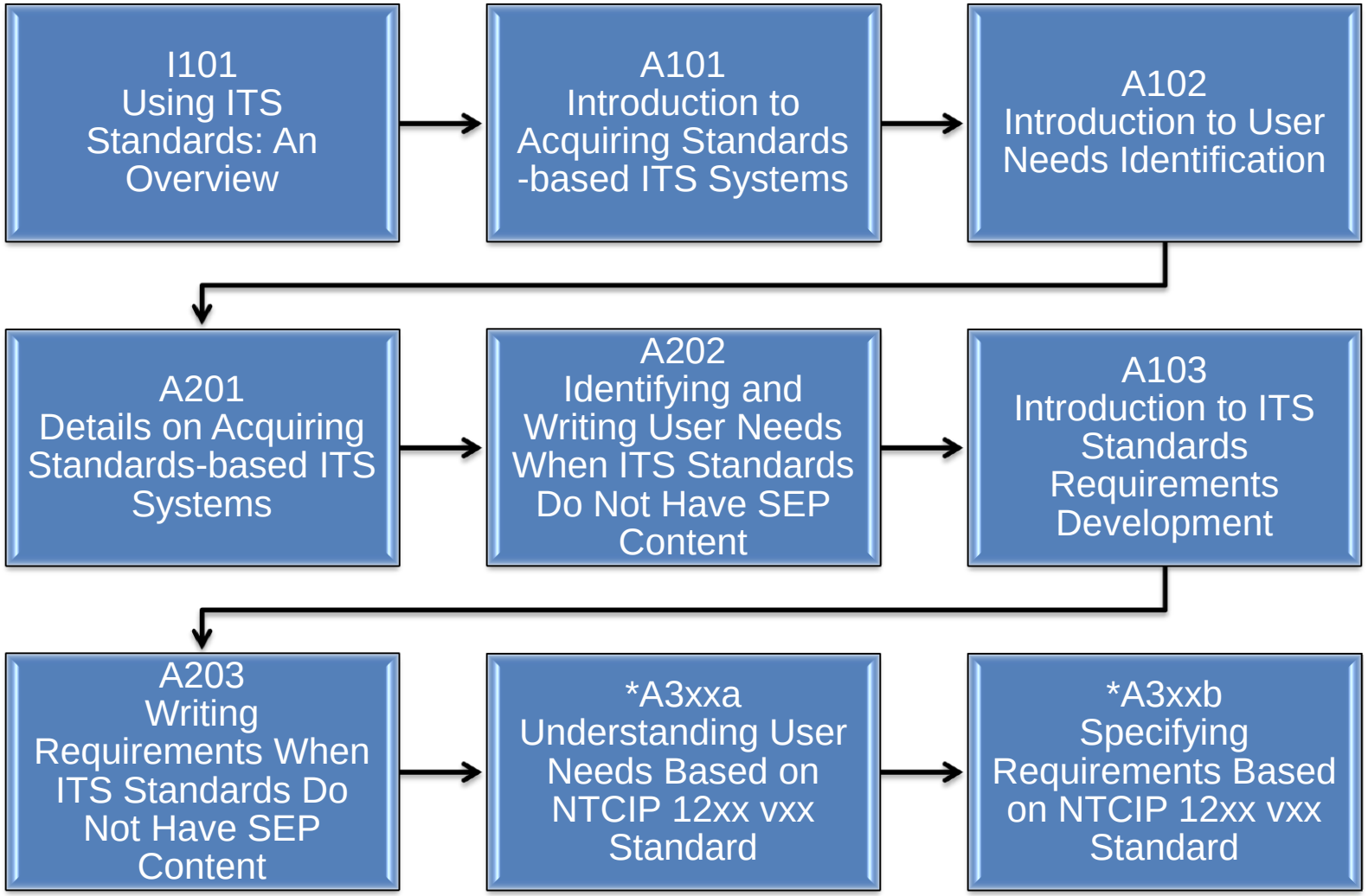
Instructor

Raman K. Patel, Ph.D., P.E.
President
RK Patel Associates, Inc.
New York, NY, USA

Curriculum Path (SEP)



Curriculum Path (Non-SEP)



*Expected in year 2 training modules

Recommended Prerequisites

- I101 Using ITS Standards: An Overview
- A101 Introduction to Acquiring Standards-based ITS Systems
- A102 Introduction to User Needs Identification
- A201 Details on Acquiring Standards-based ITS Systems
- A321a Understanding User Needs for Traffic Management Systems Based on TMDD v3.0 Standard

Recommended Prerequisites (cont.)

Basic knowledge of the following areas is helpful:

- Intelligent Transportation Systems (ITS)
- Managing ITS deployment projects
- Government procurement processes
- Benefits of standards
- Systems Engineering Process (SEP)
- Traffic Management Centers (TMCs)

Learning Objectives

1. Discuss continuity with the TMDD user needs module Module A321a:
   - Structure of the standard
   - Role of NRTM
2. Understanding requirements
3. How to use Requirements Traceability Matrix (RTM) to specify standardized design concepts

Learning Objectives (cont.)

4. Discuss the use of requirements from the NRTM and RTM in the specification
5. How to extend TMDD v3.0 standard
6. Introduce the TMDD v3.0 Guide as a resource

Review of Module A321a

Key Areas

1. TMDD v3.0 standard supports ***system interface*** development for Center-to-Center Communications.

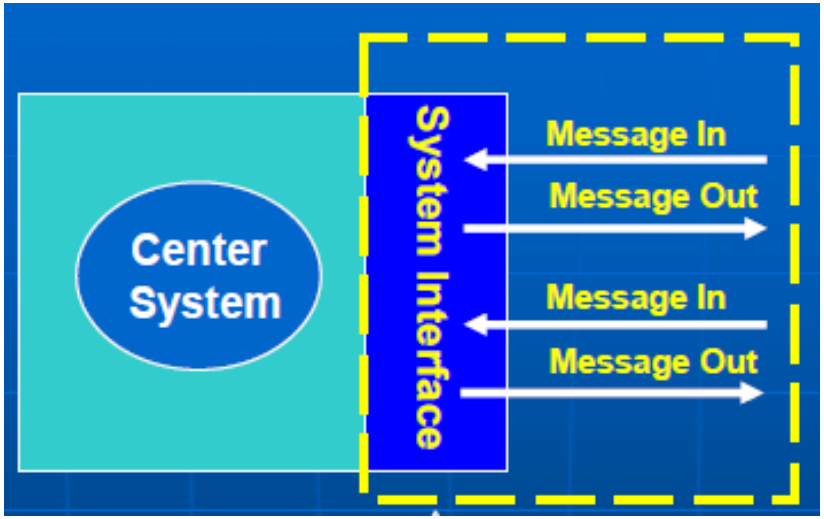
2. **Structure** provides definitions of user needs, requirements, and data concepts for specification.

3. Covers **operational needs** in 8 categories.

4. Teaches how to develop Needs to Requirements Traceability Matrix (**NRTM**) for a project.

What is a System Interface?

"a system interface is a shared boundary across which information is passed"



System Interface (SI) Implementation

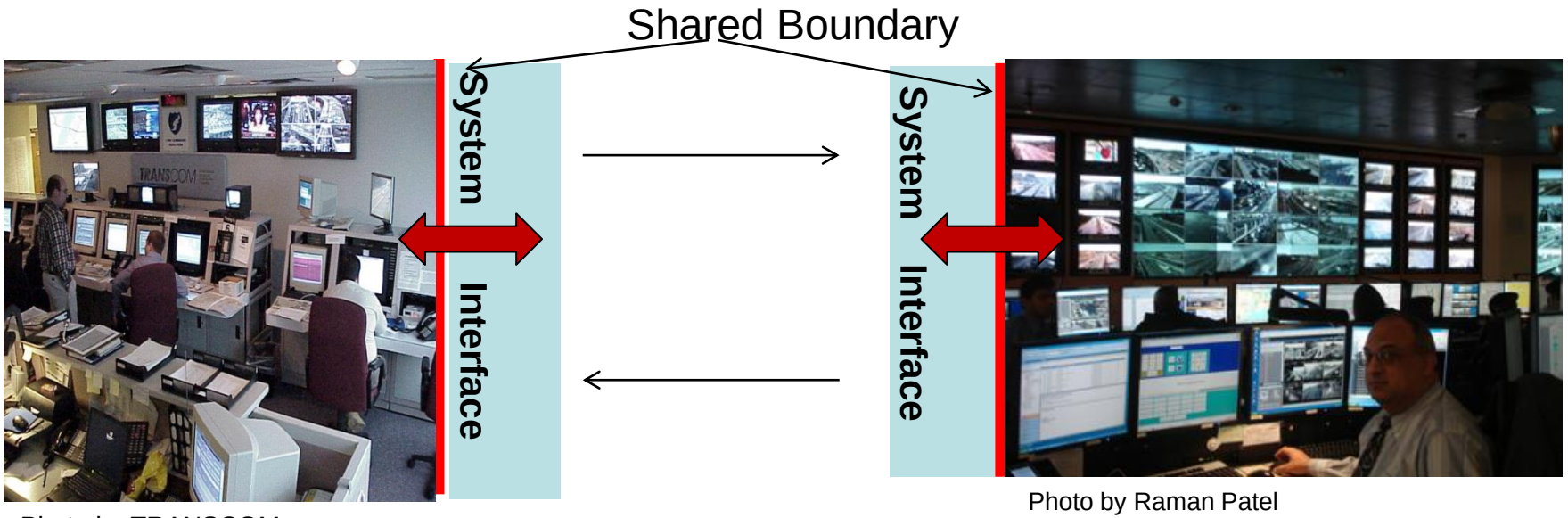


Photo by TRANSCOM

Photo by Raman Patel

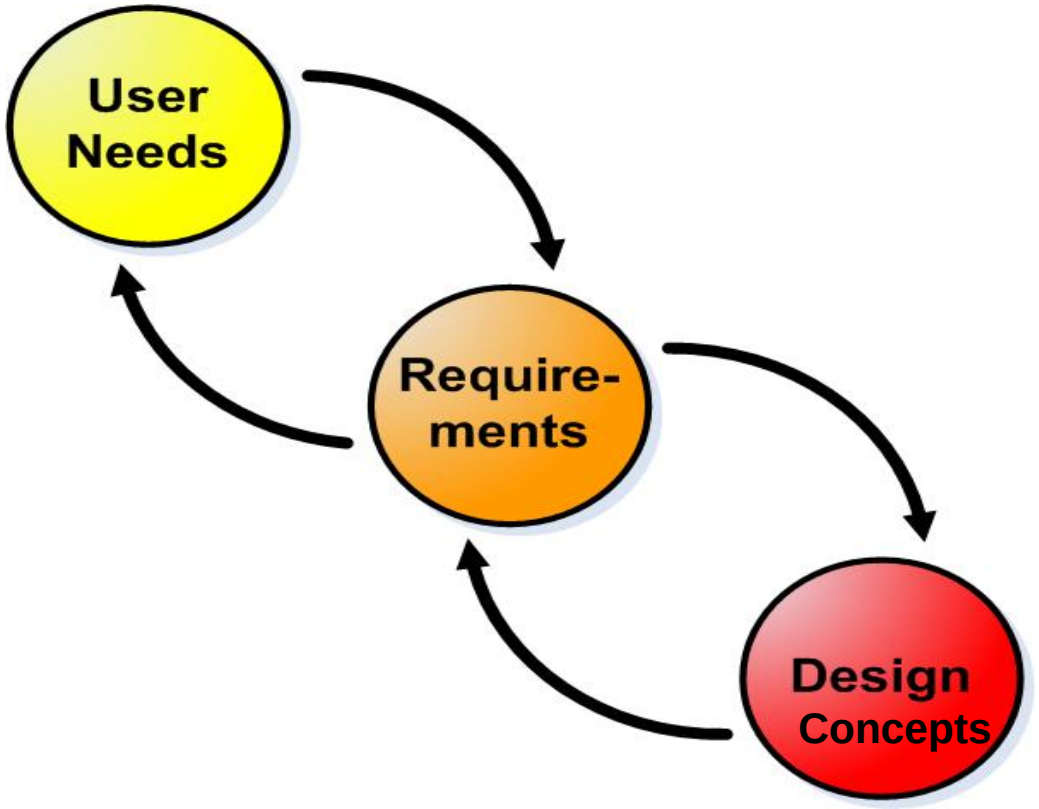
SI Uses:

- Manage assets and other entities
- Manage information
- Monitor status
- Control devices

System Interface Components

Description of what the interface must do to support operations (address problem-situation)

Written in "*shall*" language, specific requirements to satisfy user needs (functionality)



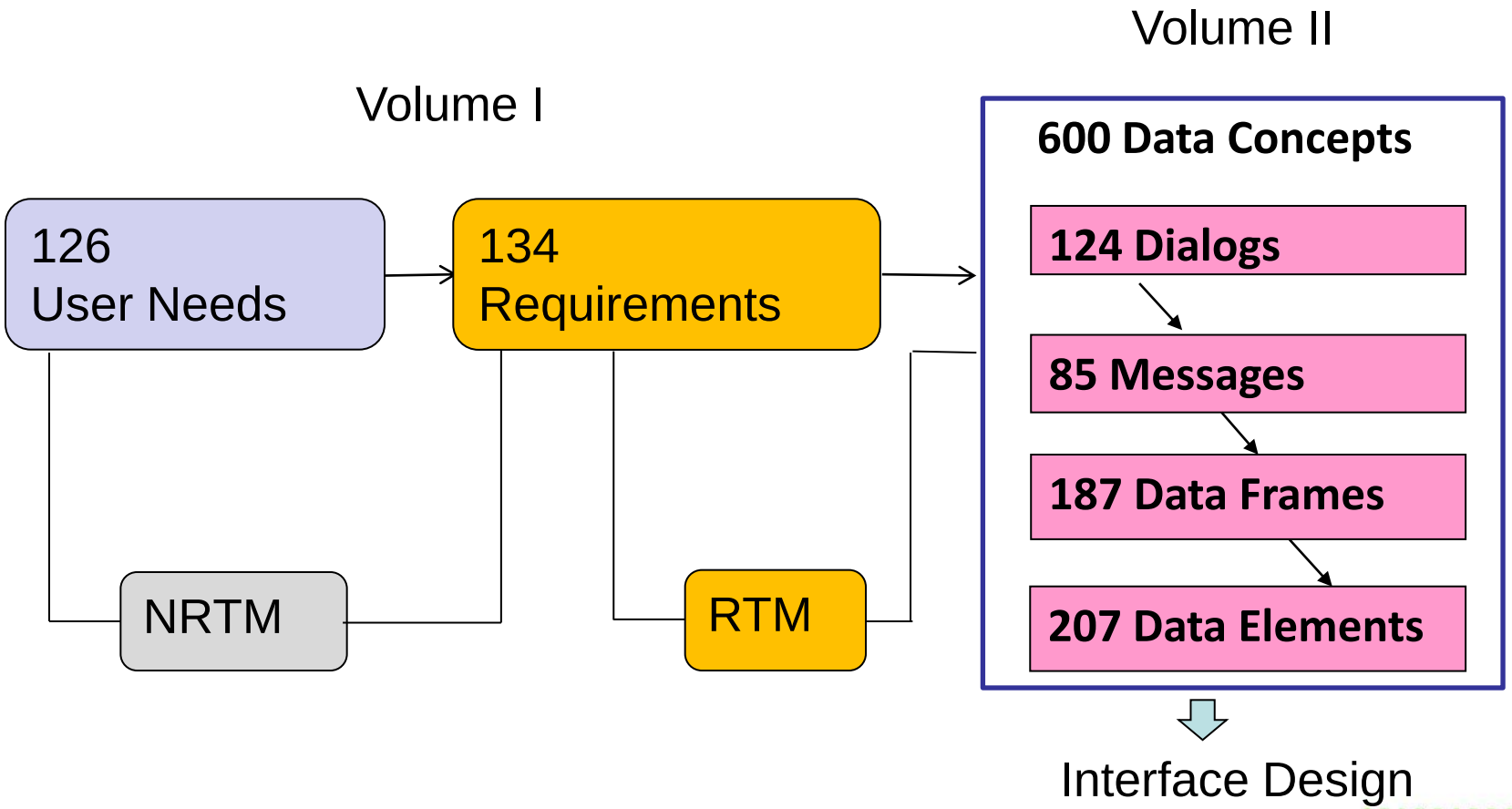
Only standard-supplied design data concepts are used to fulfill requirements (each requirement is "designed")

User Needs and Requirements Supported

1. Connection Management
2. Support Authentication and Restrictions
3. Provide Information on Organization
4. Event Information Sharing
5. Provide Roadway Network
6. Provide Devices Inventory, Status, and Control
7. Share Data for Archiving
8. Accept Null Values

Defined in TMDD v3 Volume I

TMDD v3.0 Standardized Definitions



Preparing NRTM for the Project

Select User Needs from Section 2, Volume I based on the project's operational needs

Example: Need to verify DMS status control

UN ID	User Need	UN Selected	Req. ID	Req.	Conformance	Support	Other Req.
2.3.6.4.5		YES	3.3.6.1.4.2		Mandatory	YES	

Contents of Device Control Request Response

Allocate requirements as per the NRTM on page 174, Volume I

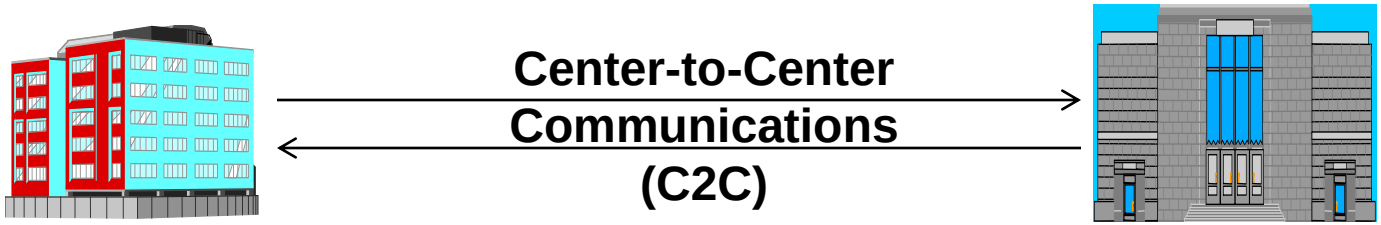
Achieving *"Off-the-Shelf"* Interoperability

Emphasis

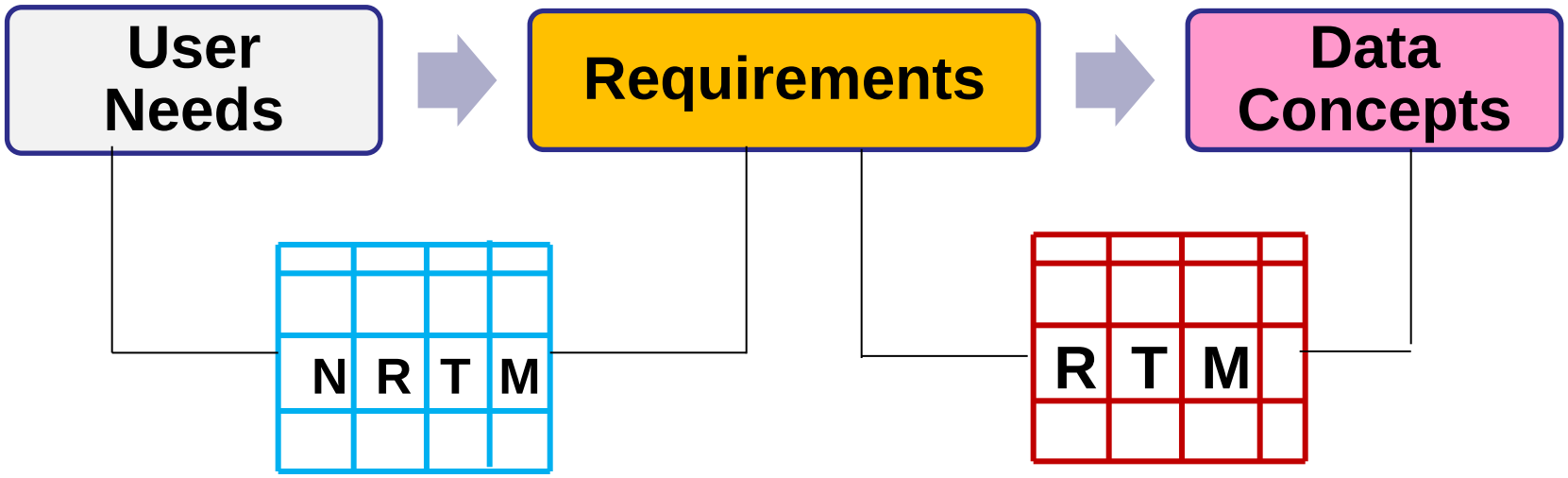
- Specification ***shall*** only use:
  - Design solution specified in the standard for each user need and their allocated requirements
  - Proprietary solutions are not allowed

Summary of Learning Objective #1

- TMDD v3.0 standard supports development of a system interface for operational needs
- Centers implement system interface to achieve interoperability



Summary of LO #1 (cont.)



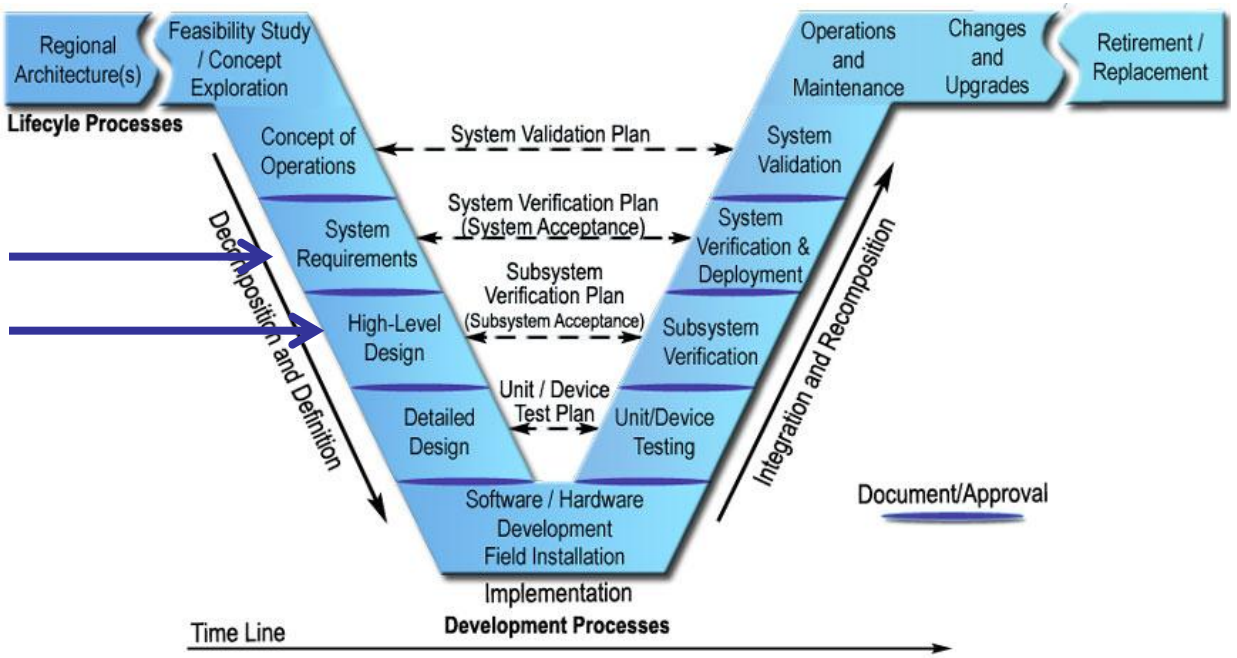
Module A321a teaches how to prepare project NRTM

Module A321b teaches how to prepare project RTM

Life Cycle Process

Where do Requirements/Data Concepts fit?

Requirements
Data Concepts



Understanding Requirements

- To satisfy some aspects of a user need, a requirement describes in detail:
  - What information is and how it is exchanged with an external center
  - What functionality is supported across the system interface

Example: Structure of a Requirement

Req. ID 3.3.6.1.5.1 (Volume I)

Req. Title *Send DMS Control Response Upon Request*

Description An owner center **shall respond** to an authorized external center requesting remote control of a DMS via a one-time control request with a message containing the status of the request.

Classification of Requirements

- **Mandatory (M)**: standard requirement for conformance:
  - e.g. 3.3.6.1.5.1 *Send DMS Control Response Upon Request*
- **Optional (O)**: user requirement for compliance

Both must be included in the project specification

Example: How Requirements are Allocated

10 requirements are allocated to one user need

UN ID	User Need	UN Selected	Req. ID	Require-ment	Confor-mance	Support	Other Req.
2.3.6.4.5	Need to Verify DMS Control Status	**YES**	**3.3.6.1.4.2**			**Yes**	
			3.3.6.1.4.2.1			**Yes**	
			3.3.6.1.4.2.2.1			**Yes**	
			3.3.6.1.4.2.2.2			**Yes**	
			3.3.6.1.4.2.2.3			**Yes**	
			3.3.6.1.4.2.2.4			**Yes**	
			3.3.6.1.5.1			**Yes**	
			3.3.6.1.5.2			**Yes**	
			3.3.6.1.5.3			**Yes**	
			3.3.6.5.4			**Yes**	

Note: Project NRTM references Support column with YES

Example (cont.)

Requirements shown in column 5

3.3.6.1.4.2 *Contents of Device Control Request Response* (M)
An owner center shall send a device control request response to an external center.

3.3.6.1.4.2.1 *Required Device Control Response Content* **(M)**
3.3.6.1.4.2.2.1 Operator Identifier **(O)**
3.3.6.1.4.2.2.2 Operator Lock Identifier **(O)**
3.3.6.1.4.2.2.3 Owner Center Organization **(O)**
3.3.6.1.4.2.2.4 Operator Last Revised Date and Time **(O)**
3.3.6.1.5.1 *Send Device Control Status Upon Request* **(M)**
3.3.6.1.5.2 *Contents of the Device Control Status Request* **(M)**
3.3.6.1.5.3 *Contents of Device Control Status Response* **(M)**
3.3.6.5.4 *Request DMS Control Status* **(M)**

How is a Requirement Implemented?

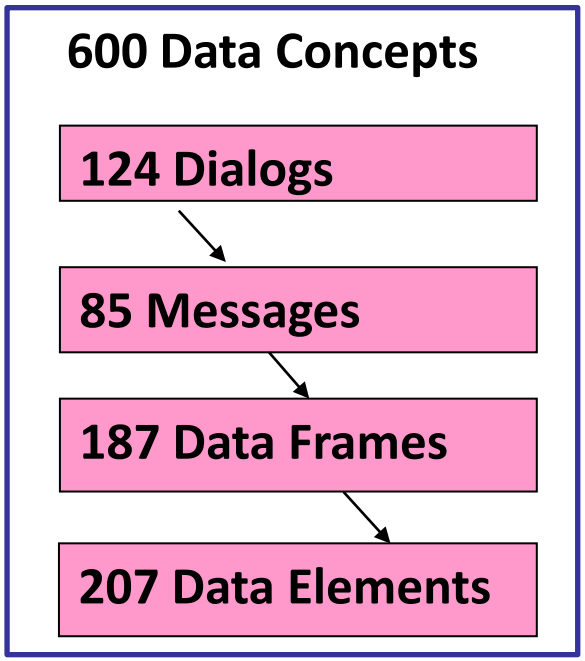
Each requirements is fulfilled with a single design using data concepts from the RTM

1. Standard provides a separate data concept for each requirement
2. Project uses only data concept linked to the selected requirement

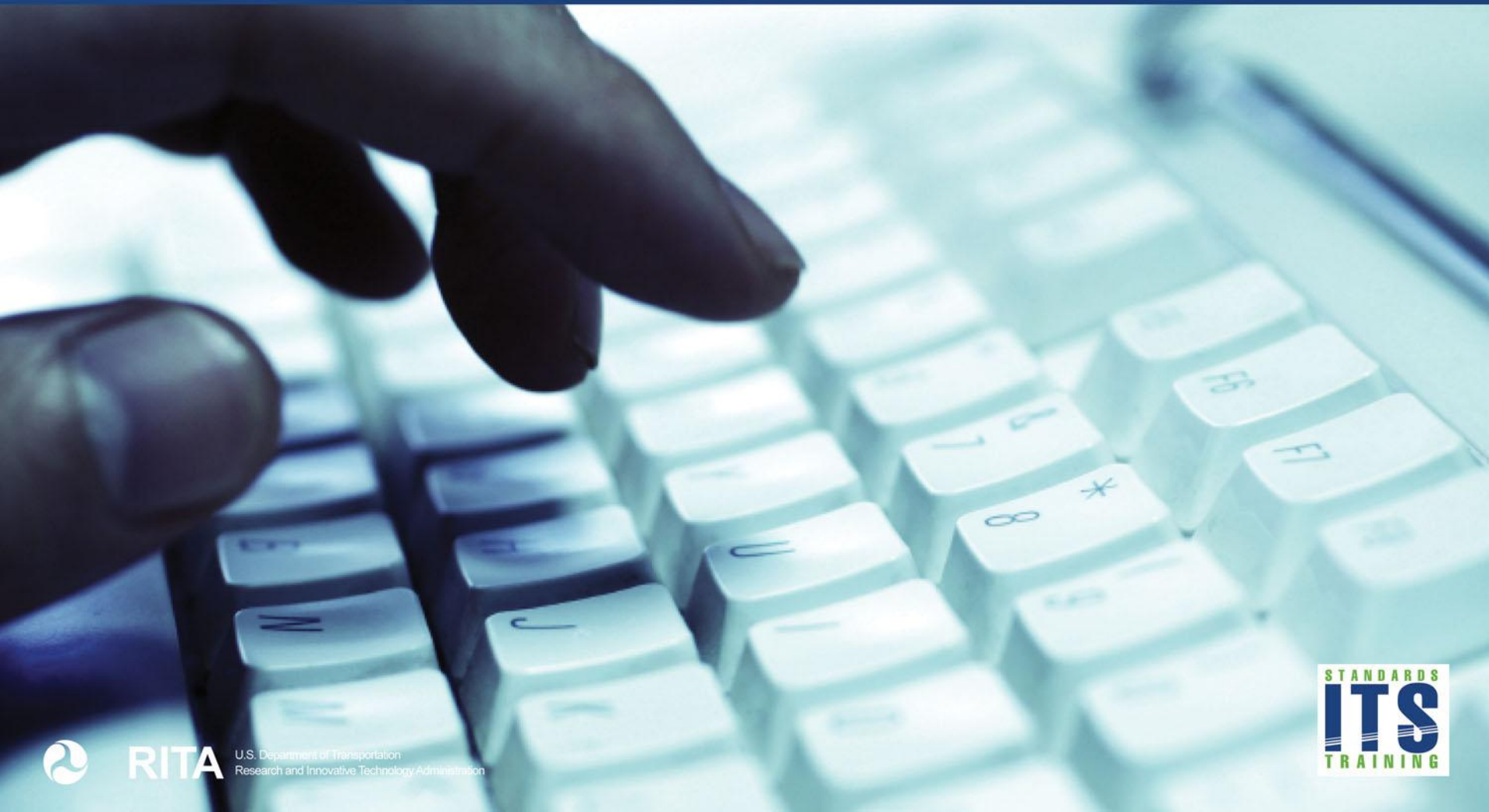
Understanding Data Concepts (DCs)

Types of Data Concepts

1. **Dialogs**
   - sequence of message exchanges
2. **Messages**
   - information content being exchanged
3. **Data Frames**
   - grouping of data elements
4. **Data Elements**
   - basic units of data



ACTIVITY



RITA U.S. Department of Transportation
Research and Innovative Technology Administration

STANDARDS ITS TRAINING

What determines requirements for a system interface project?

Type your response in the chat room

Discuss

Do we select all 134 requirements? **No**

Do we select only mandatory ones? **No**

Do we select based on the project's needs? **Yes**

Example: Share Control of Devices

2.3.6.2 Need to Verify a DMS Control Status

Req. ID		
3.3.6.1.4.2	**Contents of Device Control Request Response**	**M**
3.3.6.1.4.2.1	**Required Device Control Response Content**	**M**
3.3.6.1.4.2.2.1	Operator Identifier	O
3.3.6.1.4.2.2.2	Operator Lock Identifier	O
3.3.6.1.4.2.2.3	Owner Center Organization	O
3.3.6.1.4.2.2.4	Operator Last Revised Date and Time	O
3.3.6.1.5.1	**Send Device Control Status Upon Request**	**M**
3.3.6.1.5.2	**Contents of the Device Control Status Request**	**M**
3.3.6.1.5.3	**Contents of Device Control Status Response**	**M**
3.3.6.5.4	**Request DMS Control Status**	**M**

M-Mandatory **O-Optional**

Summary of Learning Objective #2

- Detailed requirements are listed in Section 3 of Volume I
- Mandatory requirements must be selected YES
- Each requirement is fulfilled with a single design using DCs in RTM

Requirements Traceability Matrix (RTM)

- Each requirement is traced to a single data concept type with Requirement ID
- RTM reduces design work
- Helps to achieve interoperability

Volume I
Section 3

Volume II
Section 3

Requirement ID	Requirement Title	Dialog	Data Concept Name	DC Type	Standard Clause

RTM Provides a Design Solution for Each Requirement

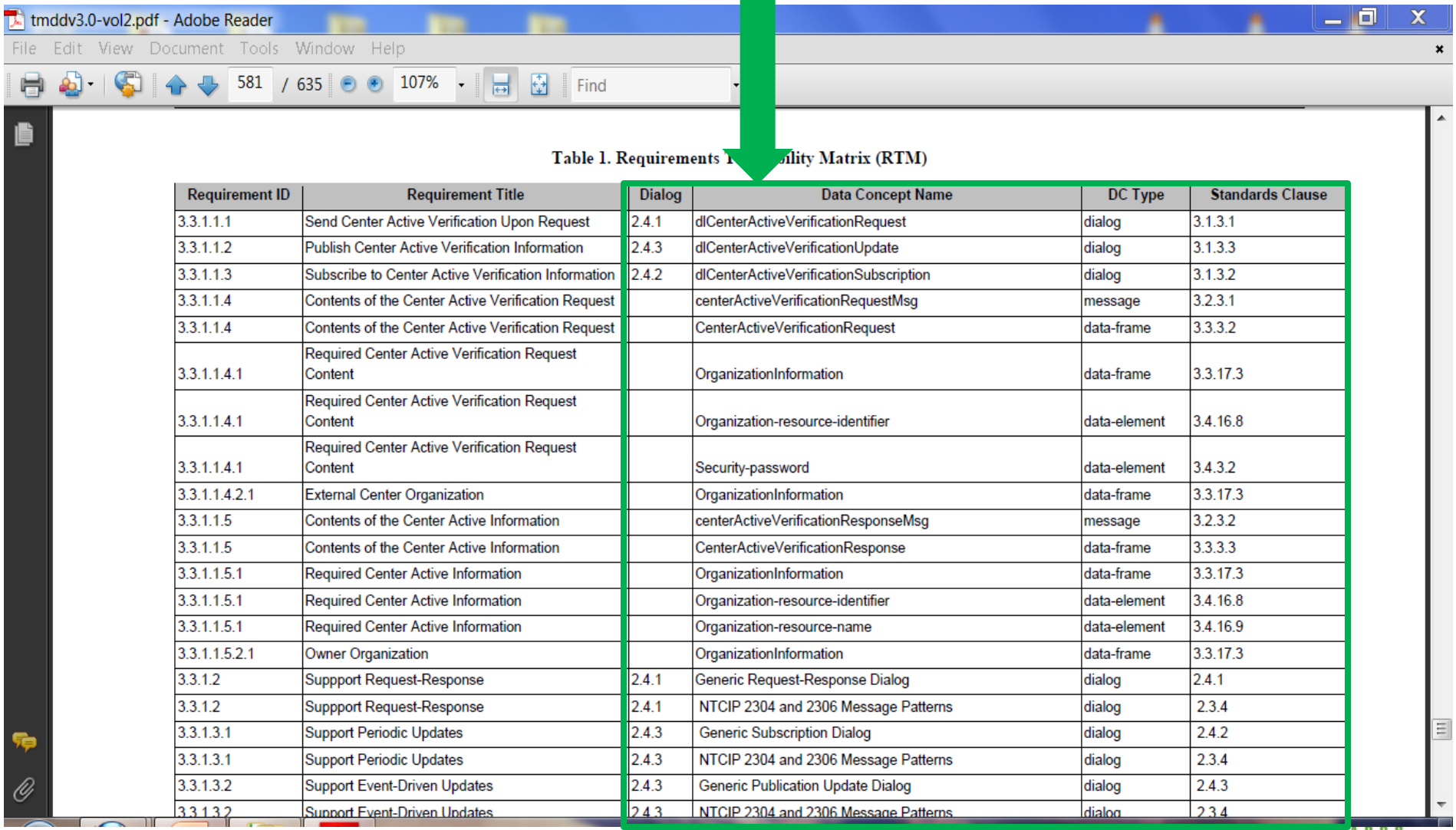


Table 1. Requirements Traceability Matrix (RTM)

Requirement ID	Requirement Title	Dialog	Data Concept Name	DC Type	Standards Clause
3.3.1.1.1	Send Center Active Verification Upon Request	2.4.1	dlCenterActiveVerificationRequest	dialog	3.1.3.1
3.3.1.1.2	Publish Center Active Verification Information	2.4.3	dlCenterActiveVerificationUpdate	dialog	3.1.3.3
3.3.1.1.3	Subscribe to Center Active Verification Information	2.4.2	dlCenterActiveVerificationSubscription	dialog	3.1.3.2
3.3.1.1.4	Contents of the Center Active Verification Request		centerActiveVerificationRequestMsg	message	3.2.3.1
3.3.1.1.4	Contents of the Center Active Verification Request		CenterActiveVerificationRequest	data-frame	3.3.3.2
3.3.1.1.4.1	Required Center Active Verification Request Content		OrganizationInformation	data-frame	3.3.17.3
3.3.1.1.4.1	Required Center Active Verification Request Content		Organization-resource-identifier	data-element	3.4.16.8
3.3.1.1.4.1	Required Center Active Verification Request Content		Security-password	data-element	3.4.3.2
3.3.1.1.4.2.1	External Center Organization		OrganizationInformation	data-frame	3.3.17.3
3.3.1.1.5	Contents of the Center Active Information		centerActiveVerificationResponseMsg	message	3.2.3.2
3.3.1.1.5	Contents of the Center Active Information		CenterActiveVerificationResponse	data-frame	3.3.3.3
3.3.1.1.5.1	Required Center Active Information		OrganizationInformation	data-frame	3.3.17.3
3.3.1.1.5.1	Required Center Active Information		Organization-resource-identifier	data-element	3.4.16.8
3.3.1.1.5.1	Required Center Active Information		Organization-resource-name	data-element	3.4.16.9
3.3.1.1.5.2.1	Owner Organization		OrganizationInformation	data-frame	3.3.17.3
3.3.1.2	Suppport Request-Response	2.4.1	Generic Request-Response Dialog	dialog	2.4.1
3.3.1.2	Suppport Request-Response	2.4.1	NTCIP 2304 and 2306 Message Patterns	dialog	2.3.4
3.3.1.3.1	Support Periodic Updates	2.4.3	Generic Subscription Dialog	dialog	2.4.2
3.3.1.3.1	Support Periodic Updates	2.4.3	NTCIP 2304 and 2306 Message Patterns	dialog	2.3.4
3.3.1.3.2	Support Event-Driven Updates	2.4.3	Generic Publication Update Dialog	dialog	2.4.3
3.3.1.3.2	Support Event-Driven Updates	2.4.3	NTCIP 2304 and 2306 Message Patterns	dialog	2.3.4

Data Concepts Representation

Data Encoding Formats

- Abstract Syntax Notation 1 (ASN.1)

  Based on ISO 14817
- XML (extensive Markup Language)

  Based on SAE J2630 Schema

Note:

- Only one format is used in the project RTM
- For interoperability the same format must be used

Example
Data Element in ASN.1 Representation

DEFINITION: Current volume for the link expressed in vehicles per hour.

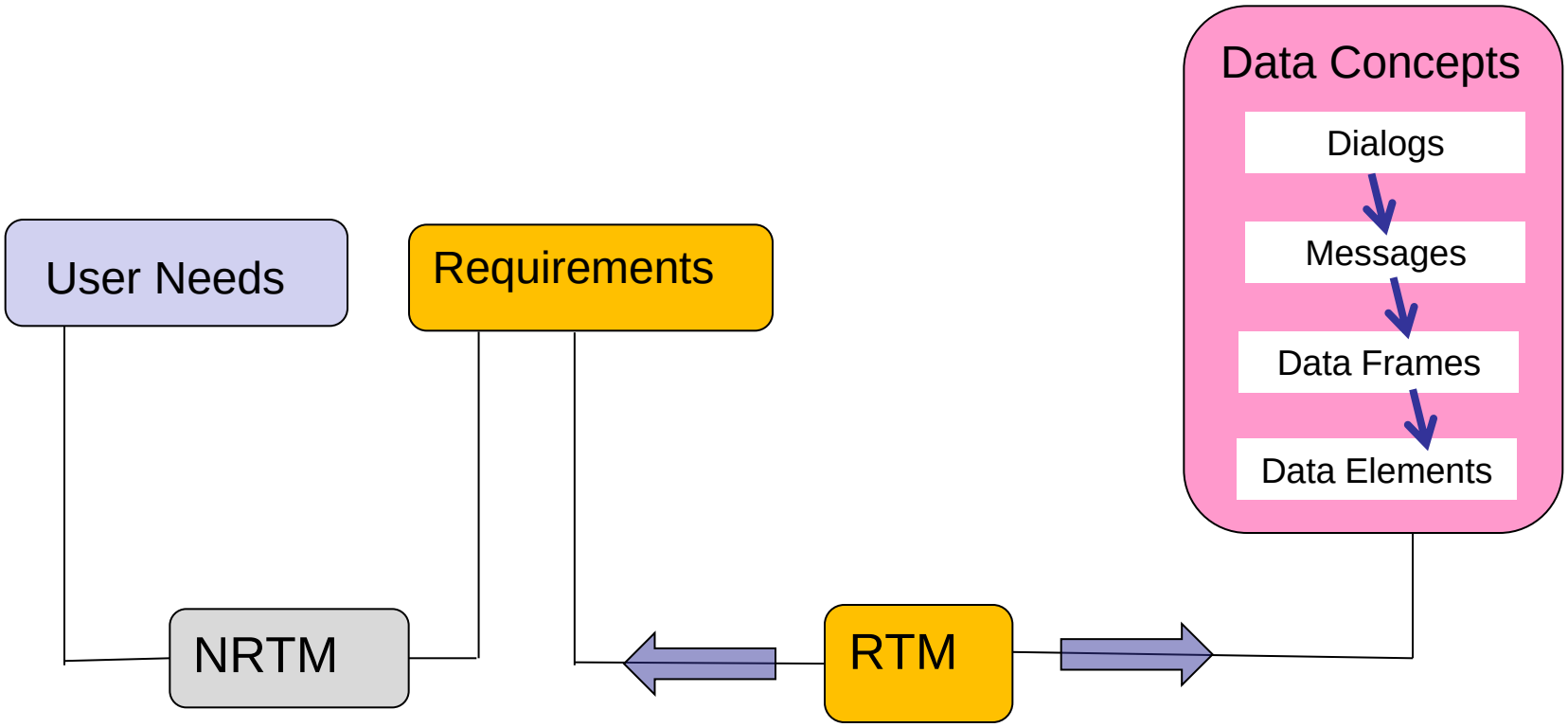
link-volume ITS-DATA-ELEMENT ::= {
DESCRIPTIVE-NAME "Link.Link-volume:rt"
ASN-NAME "Link-volume"
ASN-OBJECT-IDENTIFIER { tmddDataElements 181 }
DEFINITION "Current volume for the link expressed in vehicles per hour."
DESCRIPTIVE-NAME-CONTEXT {"Manage Traffic"}
DATA-CONCEPT-TYPE data-element
STANDARD "TMDD"
DATA-TYPE " Link-volume ::= INTEGER (1..100000)
"
FORMAT "ASN.1 encoding"
UNIT-OF-MEASURE "vehicles per hour"
VALID-VALUE-RULE "see the ASN.1 DATA-TYPE"
}
"
}

Example
Data Element in XML Representation

DEFINITION: Current volume for the link expressed in vehicles per hour.

```
<xs:simpleType name="Link-volume">
        <xs:restriction base="xs:unsignedInt">
                <xs:minInclusive value="1"/>
                <xs:maxInclusive value="100000"/>
        </xs:restriction>
</xs:simpleType>
```

Forward/Backward Traceability with RTM

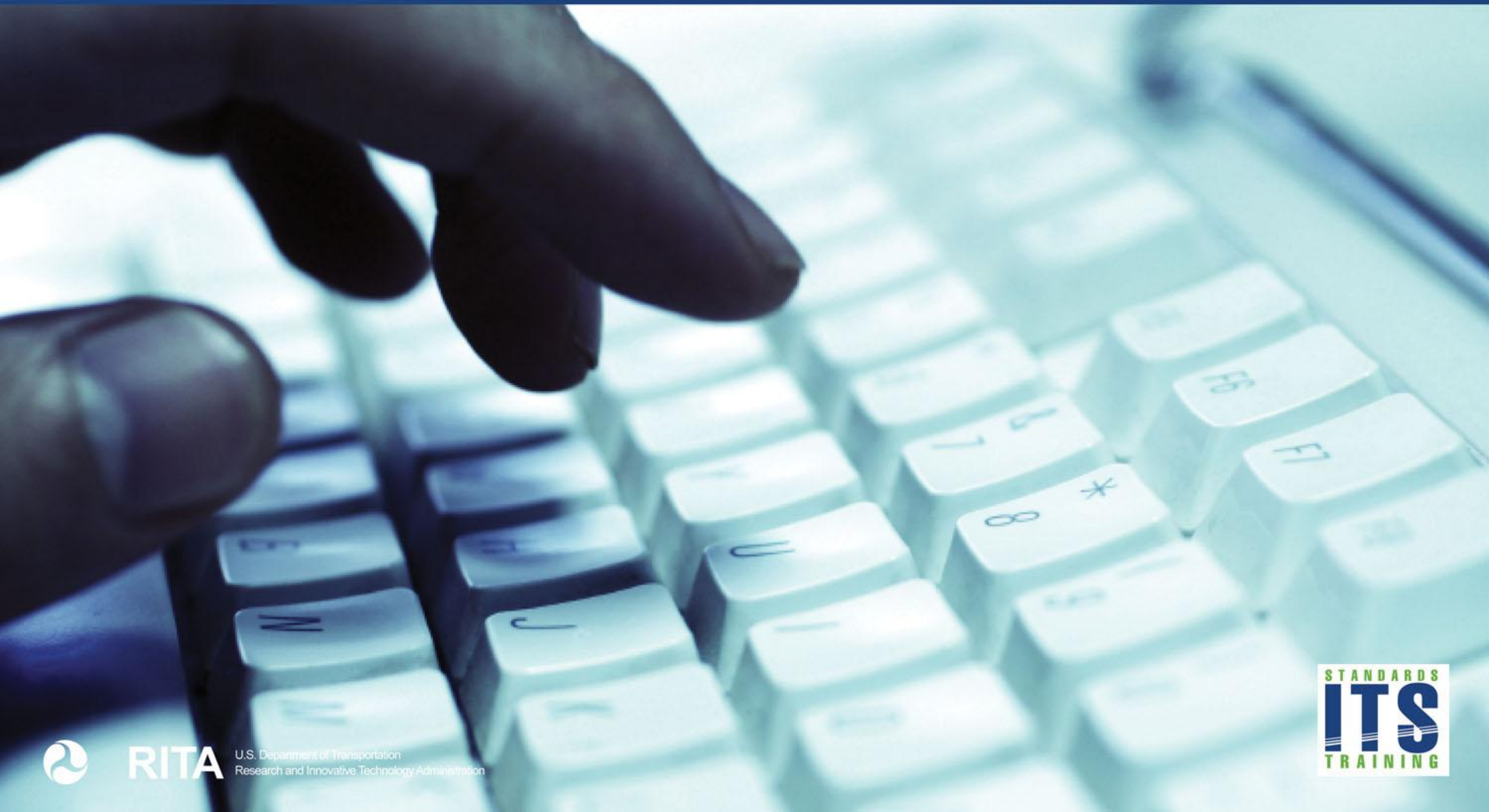


Every *requirement* is traced in both directions

Beneficiaries of RTM

The specification writer	• Using RTM, details in the project specification what data concepts are to be implemented
The user	• Uses RTM as a checklist for the desired interoperability with others
The system integrator	• Uses RTM as a checklist to reduce risk of failure to conform to the standard and comply with the specification
The supplier	• Through RTM, gains details on the data concepts to be included in the implementation

ACTIVITY



RITA U.S. Department of Transportation
Research and Innovative Technology Administration

STANDARDS ITS TRAINING

What Are the Key Functions of a Project RTM?

Type your response in the chat room

Summarize RTM Functions

- Project RTM ties the **requirements** to **data concepts** and provides a reference to verify that all **requirements** are contained in the System Interface **specification**.

Summarize Conditions for Interoperability

Type your response in the chat room

Summary of Conditions for C2C Interoperability

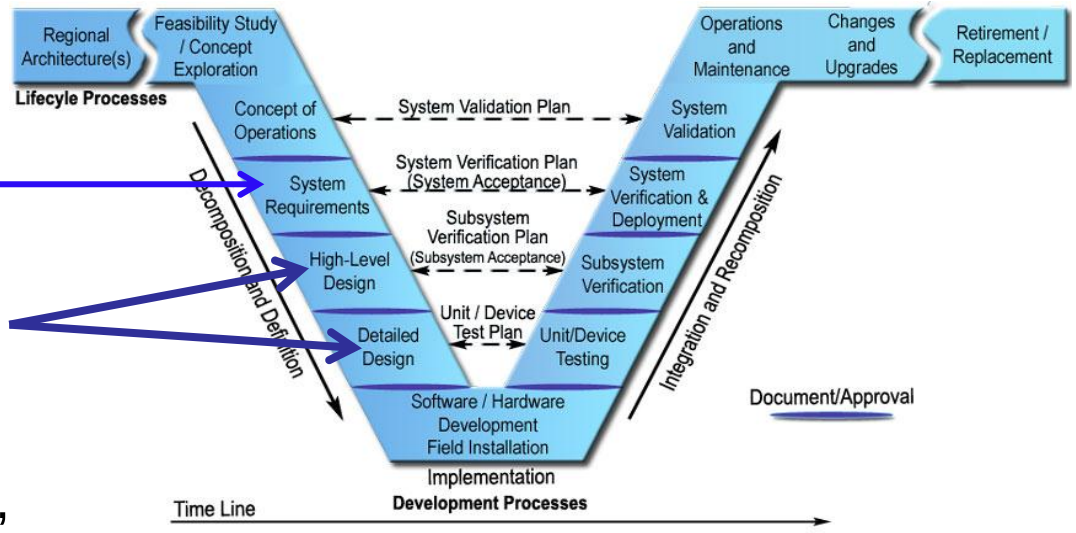
1. Use project **NRTM** to choose the same set of user needs and associated requirements.
2. Use project **RTM** to use the standardized design concepts (solutions).
3. Use a common communication **protocol** .

Concerned centers must adhere to these conditions.

From Requirements to Data Concepts Using RTM

First, elect **requirements** that will satisfy project-selected user needs.
(Using NRTM on pages 174-295 ,Volume I)

Next: use the **specified data concepts** for fulfilling elected requirements.
(Using RTM on pages 580-635, Volume II)



Supplement pages 12-16 provides details

Data Concepts Organization: Dialog-Message-Data Frame-Data Element

Example of CCTV Requirements Traced to DCs

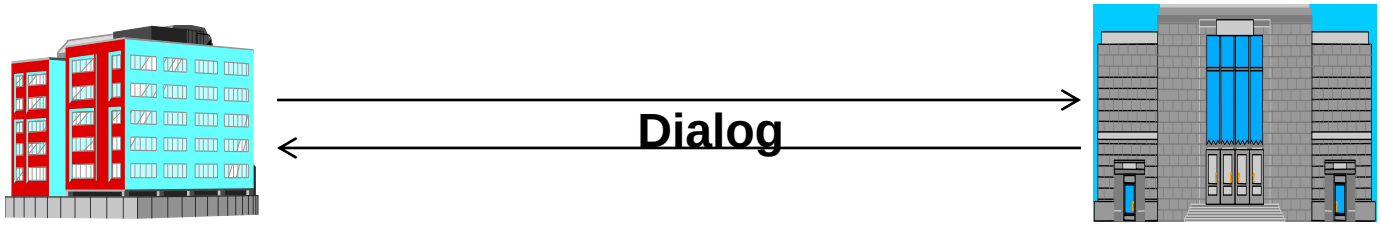
Volume-I, Section 3

Volume-II, Section 3

Requirement ID	Requirement Title	Dialog	Data Concept Name	DC Type	Standards Clause
3.3.6.3.1.5.2.9	Camera Iris Limit		ntcip:RangeIrisLimit	data-element	NTCIP1205:3.2.10
3.3.6.3.2.1	Send CCTV Status Information Upon Request	2.4.1	dlCCTVStatusRequest	dialog	3.1.2.4
3.3.6.3.2.2	Publish CCTV Status Information	2.4.3	dlCCTVStatusUpdate	dialog	3.1.2.5
3.3.6.3.2.3	Subscribe to CCTV Status Information	2.4.2	dlDeviceInformationSubscription	dialog	3.1.5.3
3.3.6.3.2.4	Contents of the CCTV Status Request		deviceInformationRequestMsg	message	3.2.5.4
3.3.6.3.2.5	Contents of the CCTV Status Information		cCTVStatusMsg	message	3.2.2.3
3.3.6.3.2.5	Contents of the CCTV Status Information		CCTVStatus	data-frame	3.3.2.4
3.3.6.3.2.5.1	Required CCTV Status Content		DeviceStatusHeader	data-frame	3.3.5.13
3.3.6.3.2.5.2.1	CCTV Error		Device-error	data-element	3.4.5.7
3.3.6.3.2.5.2.2	CCTV Format		Cctv-image-supported	data-element	3.4.2.2
3.3.6.3.2.5.2.3	CCTV Pan Position		ntcip:PositionPan	data-element	NTCIP1205:3.5.1
3.3.6.3.2.5.2.4	CCTV Tilt Position		ntcip:PositionTilt	data-element	NTCIP1205:3.5.2

Generic Dialogs

Dialogs Describe a Sequence of Messages



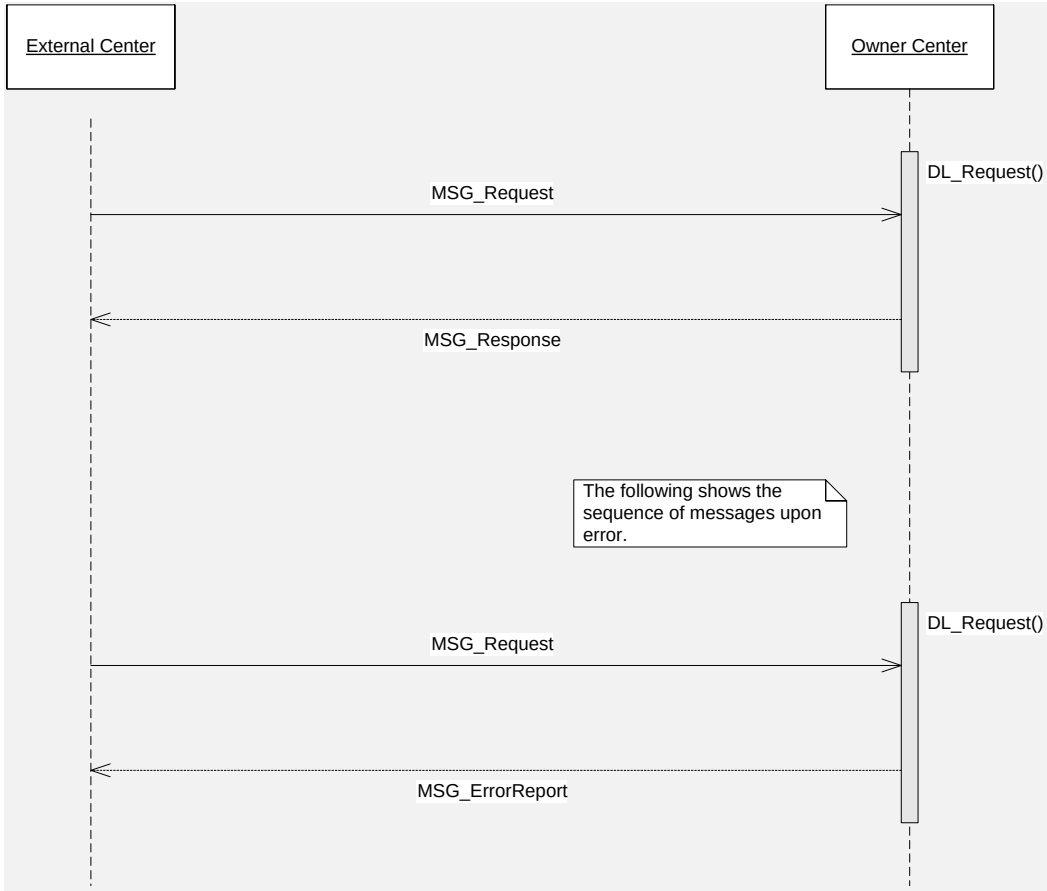
- Types Dialogs:
  - 2.4.1 Request-Response Dialog
  - 2.4.2 Subscription Dialog
  - 2.4.3 Publication Dialog

Generic Dialog 2.4.1 Request-Response

- EC initiates the request to send information or a control message
- OC responds with a message
- Upon error OC returns an error message

M-Mandatory

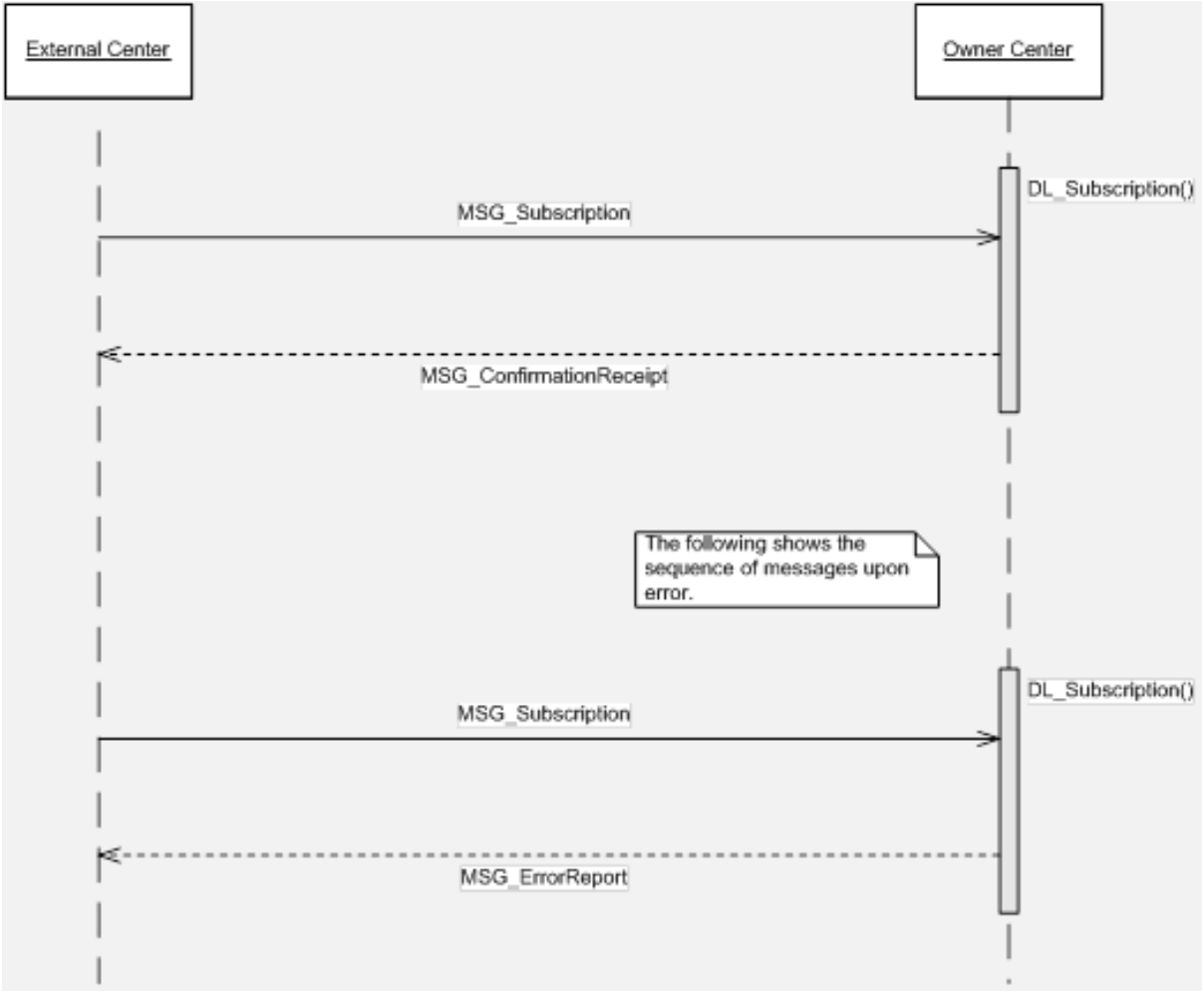
Sequence Diagram



Generic Dialog 2.4.2 Subscription

- EC initiates the subscription message
- Message is accepted by the OC
- Mandatory for generation of information updates receipt.
- Upon error, the OC shall return an *error message.*

Sequence Diagram



Generic Dialog 2.4.3 Publication

- Upon acceptance of a subscription dialog, an OC shall provide information updates to an EC
- Upon error, the OC shall return an *error message.*

(publication message is same as a response)

Sequence Diagram

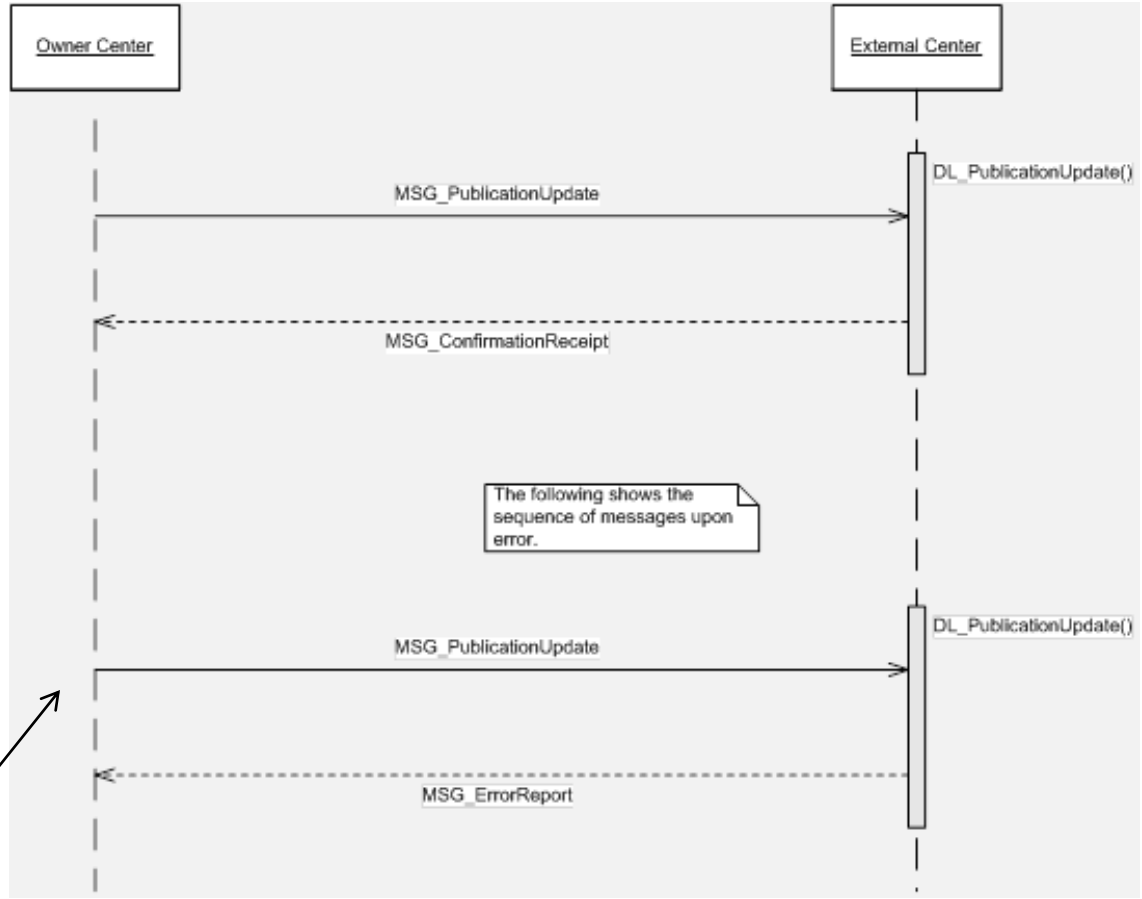
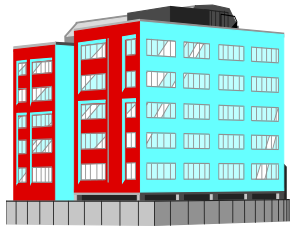


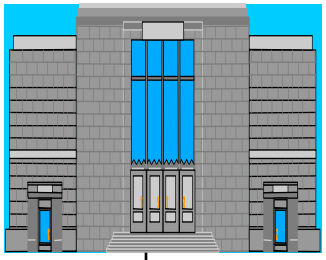
Illustration of 2.4.1 Dialog

Display a New Message on a DMS



dlDMSControlRequest

deviceControlResponseMsg



messages

Major Accident
15 MI NB
ALT I-10 WB

Example of a Partially Populated RTM

Display a Message on a Remote DMS

dlDMSControlRequest

Requirement ID	Requirement Title	Dialog	Data Concept Name	Data Concept Type	Standard Clause
3.3.6.1.4.1	Contents of Device Control Request Header		DeviceControlRequestHeader	data-frame	3.3.5.2
3.3.6.1.4.1.1	Required Device Control Request Header Content		OrganizationInformation	data-frame	3.3.17.3
3.3.6.5.3.1	Send DMS Control Response Upon Request	2.4.1	dlDMSControlRequest	dialog	3.1.6.1
3.3.6.5.3.2	Contents of DMS Control Request		dMSControlRequestMsg	message	3.2.6.1
3.3.6.5.3.2.1	Required DMS Control Request Content		DeviceControlRequestHeader	data-frame	3.3.5.2
3.3.6.5.3.2.2.1	Beacon Control		ntcip:DmsMessageBeacon	data-element	NTCIP 1203:5.6.8.6
3.3.6.5.3.3	Contents of DMS Control Response		deviceControlResponseMsg	message	3.2.5.2

Selection of Data Concepts Using RTM: DMS Example-Exhibit 3.6
(Source: TMDD v3.0 Guide Based on TMDD v3.0 standard)

Example: Dialog Traces to a Requirement

Volume II

Requirement ID	Requirement Title	Dialog	Data Concept Name	Data Concept Type	Standard Clause
3.3.6.5.3.1	Send DMS Control Response Upon Request	2.4.1	dlDMSControlRequest	dialog	3.1.6.1

Example: Messages Traces to a Dialog

Volume II

Requirement ID	Requirement Title	Dialog	Data Concept Name	Data Concept Type	Standard Clause
3.3.6.5.3.1	Send DMS Control Response Upon Request	2.4.1	dlDMSControlRequest	dialog	3.1.6.1

DEFINITION

A request-response dialog that allows an EC to request an OC to perform a control action on an OC DMS.

3.1.6.1 XML REPRESENTATION

<operation xmlns="http://schemas.xmlsoap.org/wsdl/" name="DlDMSControlRequest">
<**input message="tns:MSG_DMSControlRequest"/>**
<output message="tns:MSG_DeviceControlResponse"/> <fault name="errorReport" message="tns:MSG_ErrorReport"/></operation>

Tracing Messages in ASN.1 Representation

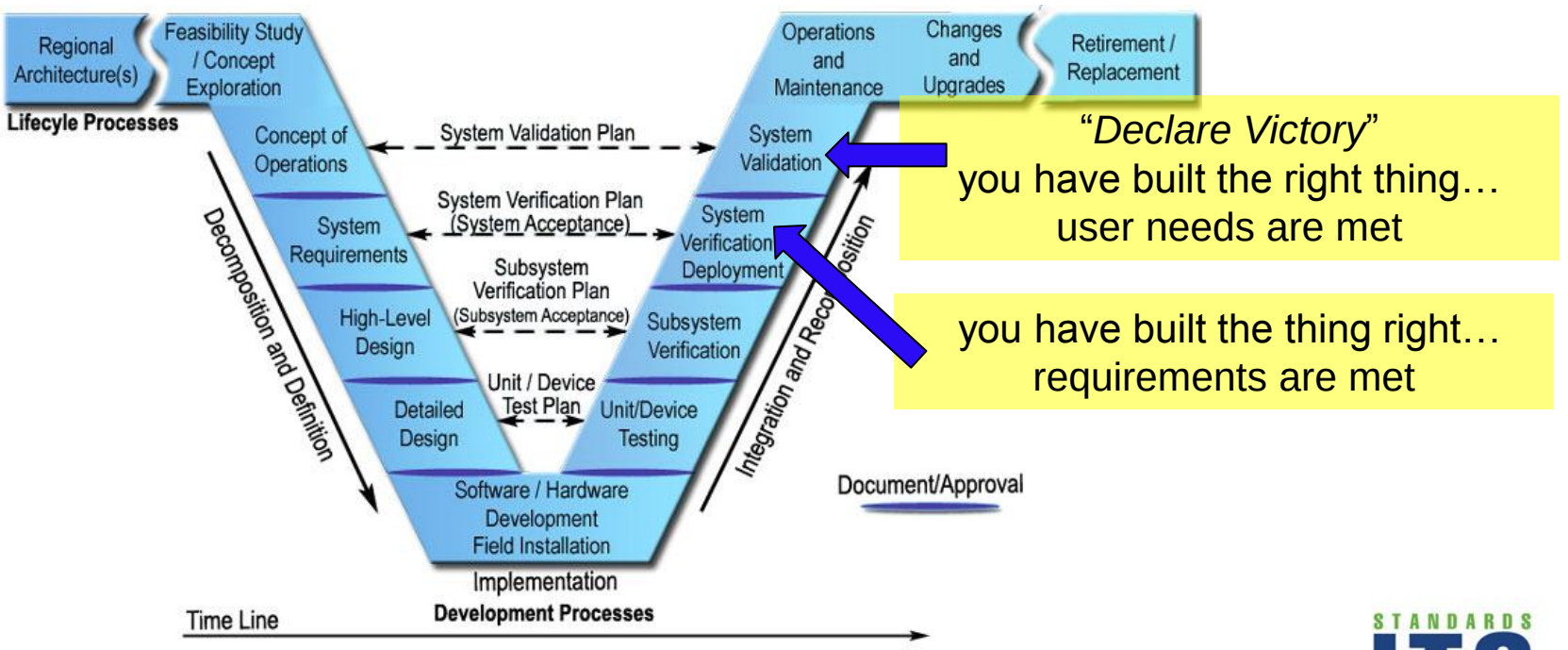
3.1.6.1.3 ASN.1 REPRESENTATION
dlDMSControlRequest ITS-INTERFACE-DIALOGUE ::= {
DESCRIPTIVE-NAME "ExternalCenter<-DlDMSControlRequest->OwnerCenter"
ASN-NAME "DlDMSControlRequest"
ASN-OBJECT-IDENTIFIER { tmddDialogs 22 }
URL "R-R.gif"
DEFINITION "A request-response dialog that allows an external center to request an owner center to perform a control action on an owner center's dynamic message sign."
DESCRIPTIVE-NAME-CONTEXT {"Manage Traffic"}
ARCHITECTURE-REFERENCE { "traffic control coordination"
}
ARCHITECTURE-NAME {"U.S. National ITS Architecture"}
ARCHITECTURE-VERSION {"6.0"}
DATA-CONCEPT-TYPE interface-dialogue
STANDARD "TMDD"
REFERENCED-MESSAGES {
{ **tmddMessages 22 }, -- Input**
{ tmddMessages 18 }, -- Output
{ tmddMessages 10 } -- Fault
}
REFERENCED-OBJECT-CLASSES {
{ tmddObjectClasses ownerCenter(18) },
{ tmddObjectClasses externalCenter(9) }
}
}

Verification of Requirements

1. Requirements are complete
2. Requirements are traced to DCs through RTM

Verification of Requirements (cont.)

3. Requirements are met at all stages
4. System verification and acceptance



Achieving Off-the-Shelf Interoperability

- Centers must choose:
  - Same data-encoding format for data representation: ASN.1 or XML
  - Specify same user needs, requirements, and data concepts
  - Deploy a common communication protocol

Information on Standards

Standards for System Interface Implementation

- TMDD v3.0 standard
  (Available at http://www.ite.org/standards/distribution.asp)

- Application Protocols
  NTCIP 2306 C2C XML OR NTCIP 2304 C2C DATEX
  (Available at www.ntcip.org/library)

Summary of Learning Objective #4

- RTM provides design-data concepts for each requirement
- Dialogs allow conversation-messaging with each other
- RTM is used for tracing every DC to each requirement
- Centers must use same DCs for interoperability

Extending TMDD Standard

- TMDD Standard can be extended using rules in Section 1.6.1, Volume I
- Anyone considering such an extension should contact ITE for further consultation
- Consult TMDD v3.0 Guide

Example: Student Supplement page 26

Conformance

- Specification shall include all mandatory and selected optional user needs
- Specification shall include mandatory and optional selected requirements for all project needs (mandatory/selected optional)
- Must use all data concepts for a selected requirement by RTM
- Consult T101 course for details

What is the Purpose of the Guide?

- Companion to the TMDD v3.0 Standard
- Summarizes key parts of the standard
- Guides on specification preparation
- Provides guidance on system interface implementation
- Published July 2011 by ITE

  (Available at http://www.ite.org/standards/distribution.asp)

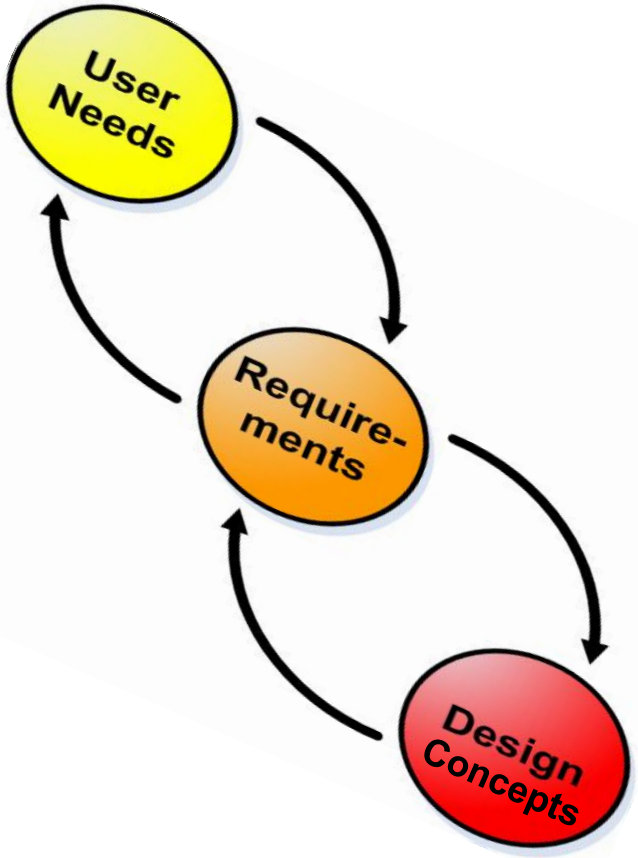
Key Questions Addressed by the Guide

	Question	Guide		TMDD Standard	
		Chapter	Section	Volume	Section
1	What is the purpose of this guide?	1	1.1	-	-
2	What is the scope of the TMDD Standard v3.0?	1	1.2	I	1.1
3	What are the key parts of the standard?	2	2.2	I	1.8
4	Is TMDD v3.0 backward compatible?	1	1.9	I	1.7
5	What are the conditions for conformance to the TMDD standard?	2	2.7	I	1.6
6	What is conformance? How is it different than compliance?	2	2.7	I	1.6
7	What if my needs are not met by the TMDD?	2	2.8	I	1.6.1
8	Which additional standards do I need to implement TMDD?	4	4.2.1-4.2.2	I	1.2
9	How can I prepare my specification for C2C system interface?	4	4.3	I	2,3
10	How does TMDD trace to the National ITS Architecture?	4	4.3.1	I	4
11	Where can I find TMDD design content?	4	4.3.5	II	2,3,4
12	Where can I find information on other ITS standards?	Ref. Tables	-	-	-
13	How was the TMDD standard developed?	1	1.8	I	-
14	How can I get TMDD v3.0 standard files?	References		II	2.0

What Have We Learned?

Learning Objective #1
Continuity with A321a

- **Standard Structure**:
  - Volume I:
    - ConOps/user needs
    - Requirements
    - NRTM
  - Volume II:
    - Data Concepts
    - RTM



What Have We Learned? (cont.)

Learning Objective #1
Continuity with A321a

- **TMDD Capabilities:**
  - Enables interoperability among centers
  - Serves traffic management domain:
    - We can exchange event information
    - Share ITS field devices
    - Share roadway information
    - Data gathering

What Have We Learned? (cont.)

Learning Objective #2

Using NRTM:

- NRTM traces requirements to user needs:
  - Learned to map operational needs to user needs listed in the standard
  - Learned how to prepare a **project NRTM**

What Have We Learned? (cont.)

Learning Objective #3

Using RTM:

- Learned how RTM traces requirements to data concepts
  - Data concepts are the building blocks for system interface design
  - How to prepare a project RTM

What Have We Learned? (cont.)

Learning Objective #3,4

- Project NRTM and RTM are required
- Interoperability is dependent on specification that uses same data concepts, requirements, and user needs
- Agencies desiring interoperability must select a common protocol (e.g., NTCIP 2306 XML)

What Have We Learned? (cont.)

Learning Objective #5

- How to extend the standard using rules

Learning Objective #6

- TMDD v3.0 Guide helps in system interface specification preparation and implementation

Recommended References

1. A321b Student Supplement
2. TMDD v3.0 Guide, July 2011
   http://www.ite.org/standards/distribution.asp
3. The NTCIP Guide v04, October 2008
   http://www.ntcip.org/library/standards/default.asp?documents=yes&qreport=no&standard=9001
4. Systems Engineering Guidebook for ITS

   FHWA-Caltrans, v3.0 2009

   http://www.fhwa.dot.gov/cadiv/segb/files/segbversion3.pdf
5. Systems Engineering for Intelligent Transportation Systems, FHWA, 2007

   http://ops.fhwa.dot.gov/publications/seitsguide/index.htm

TMDD Sequence

- Modules A321a +A321b +T321 will complete the curriculum path for the TMDD v3.0 standard
- T321: Applying Your Test Plan to the TMDD Standard
  - Proposed for second-year PCB program
  - Module will cover:
    - Test plans, test design specifications, test cases, and test procedures

QUESTIONS?

RITA U.S. Department of Transportation
Research and Innovative Technology Administration

STANDARDS ITS TRAINING

Questions to Consider

1. Which matrix standardizes relationships between requirements and design concepts?
2. What are the minimum conditions to achieve interoperability using TMDD v3.0 standard?