



W E L C O M E

RITA Intelligent Transportation Systems
Joint Program Office

Welcome



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

The screenshot shows the RITA website header with the logo and navigation menu. The main content area is titled "ITS Professional Capacity Building Program" and includes sections for "Welcome to ITS Professional Capacity Building", "ITS Technical Assistance", "News", and "Scheduled T3 Webinars".

ITS Professional Capacity Building

The ITS Professional Capacity Building (PCB) Program provides comprehensive, accessible, and flexible ITS learning for the transportation industry. By using the program, public agencies can build and sustain a capable and technically proficient ITS workforce, and transportation professionals can develop their knowledge, skills, and abilities while furthering their career paths.

The plan, [ITS Professional Capacity Building: Setting Strategic Direction 2010-2014](#), describes the strategy the ITS PCB Program is pursuing to create a 21st century learning environment and build an ITS profession that leads the world in the innovative use of ITS technologies.

ITS Technical Assistance

The ITS PCB Program offers technical assistance resources to State and local transportation agencies, and to FHWA Field Offices.

- [ITS Peer-to-Peer Program](#) helps resolve ITS challenges by speaking to your peers.
- The ITS Help Line provides [technical support by e-mail](#) or telephone 866-367-7487.

Scheduled T3 Webinars

Register now for these upcoming T3 webinars:

Date	Time	Topic
June 23, 2011	1:00 PM – 2:30 PM ET	2011 Enhancements to the ITS Knowledge Resources Websites: Improving Access to Information on ITS Benefits, Costs, Lessons Learned and Deployment
June 29, 2011	1:00 PM – 2:30 PM ET	Open Payments, Mobile Payments and Personal Identification Verification (PIV) Acceptance – Overview of Innovations in Public Transit Payment Systems

[View T3 webinar archives](#)

WWW.PCB.ITS.DOT.GOV/STANDARDSTRAINING





A321a

Understanding User Needs for Traffic Management Systems Based on TMDD v3.0 Standard





Target Audience

- Engineering and Planning Staff
- Emergency Management
- Public Safety
- Traffic Management Center (TMC) Operation Staff
- System Developers
- Public and Private Sectors





Instructor



Raman K Patel, Ph.D., P.E.

President

RK Patel Associates, Inc.

New York, NY, USA

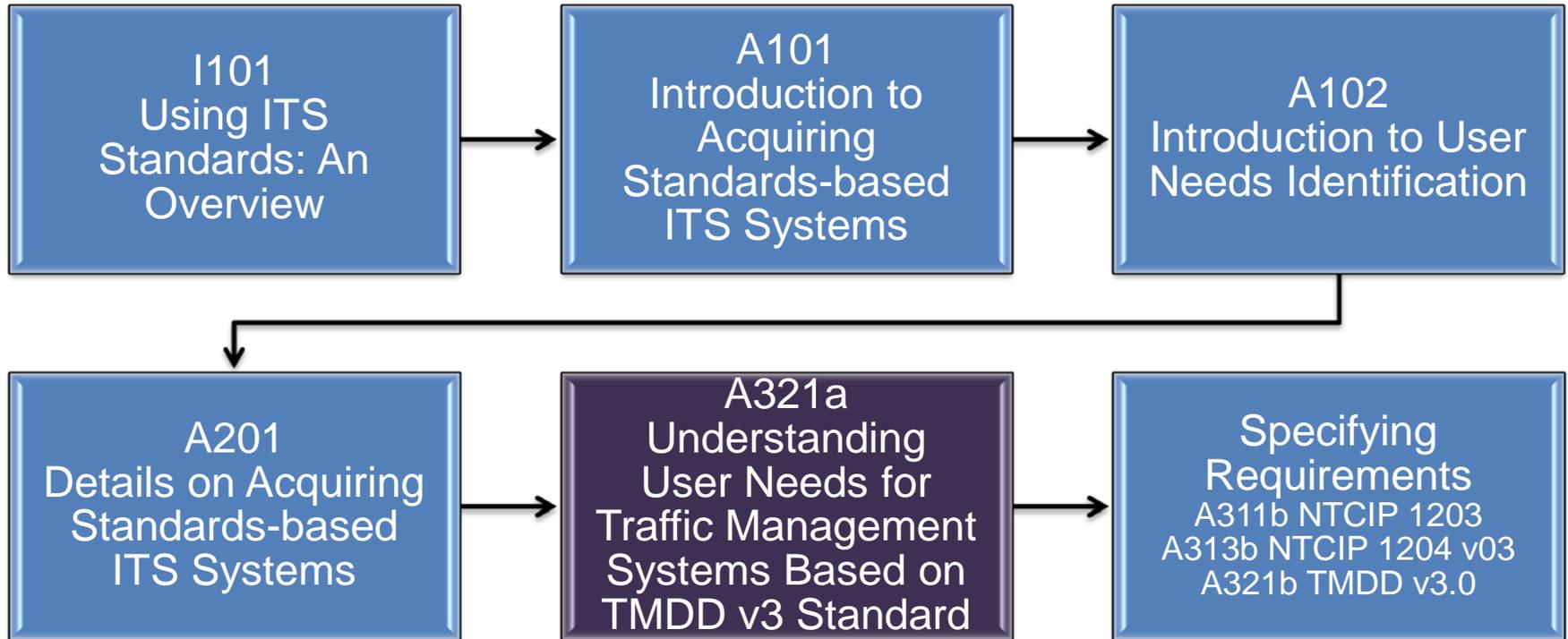


RITA

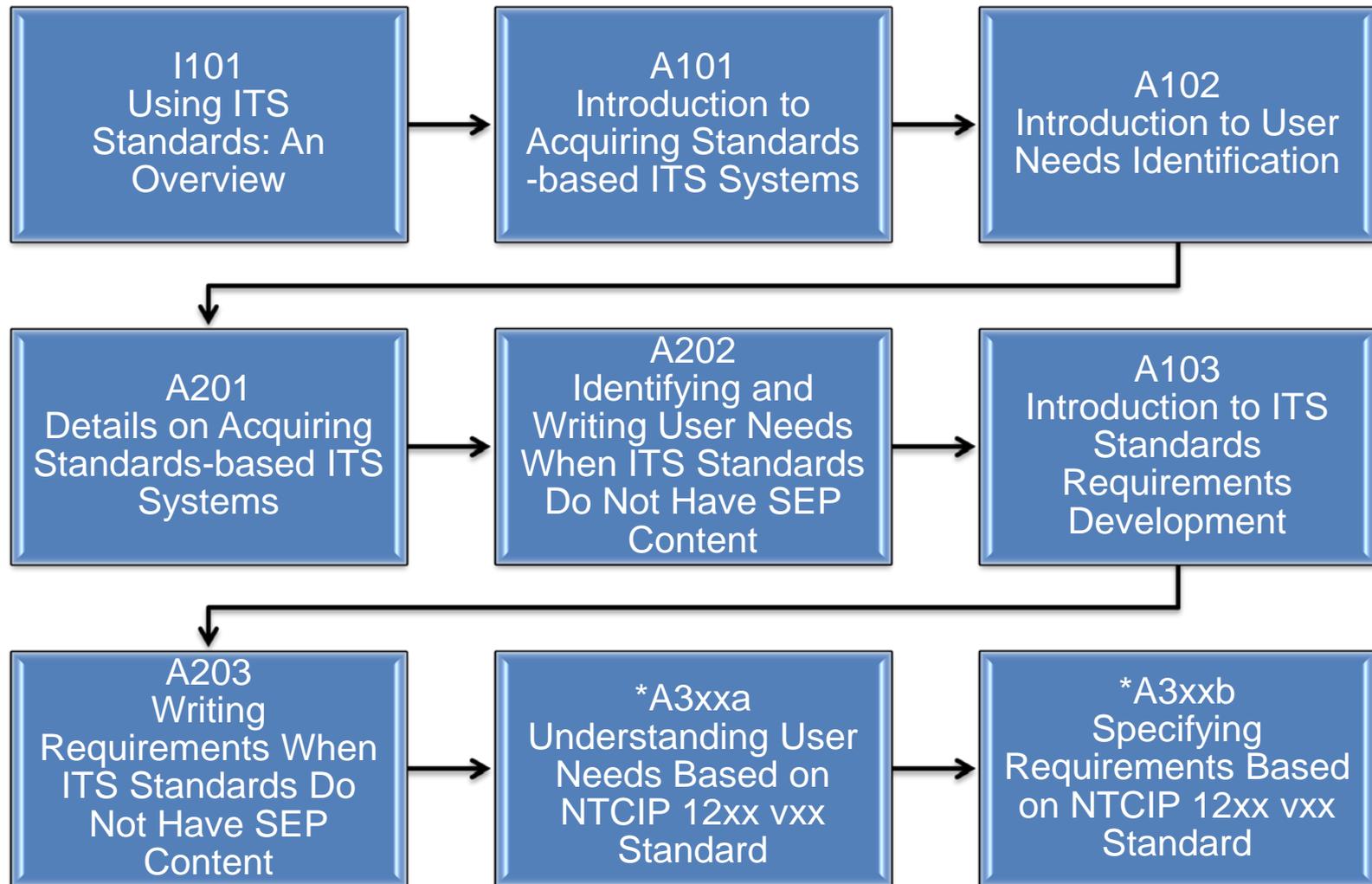
U.S. Department of Transportation
Research and Innovative Technology Administration



Curriculum Path (SEP)



Curriculum Path (Non-SEP)





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





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. Describe what problem TMDD is addressing
2. Identify regional operational and planning needs (specific to TMDD) for common system interface to support interagency communications





Learning Objectives (cont.)

3. Discuss the TMDD v3.0 standard structure and the content
4. Understand the role of NRTM and learn how to use it to select user needs and link them to requirements
5. Identify a requirement of institutional arrangement for implementing a system interface



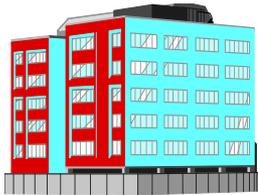
What is the Traffic Management Data Dictionary (TMDD)?

- Provides high level definitions of user needs, requirements and data concepts
- Used in ***System Interface*** specification
- Supports Center-to-Center (C2C) communications needs



Centers

External Center (EC)



A center that uses services provided by another center

Owner Center (OC)



A center (TMC) that provides information and has direct control of field devices

Center-to-Center
Communications
(C2C)



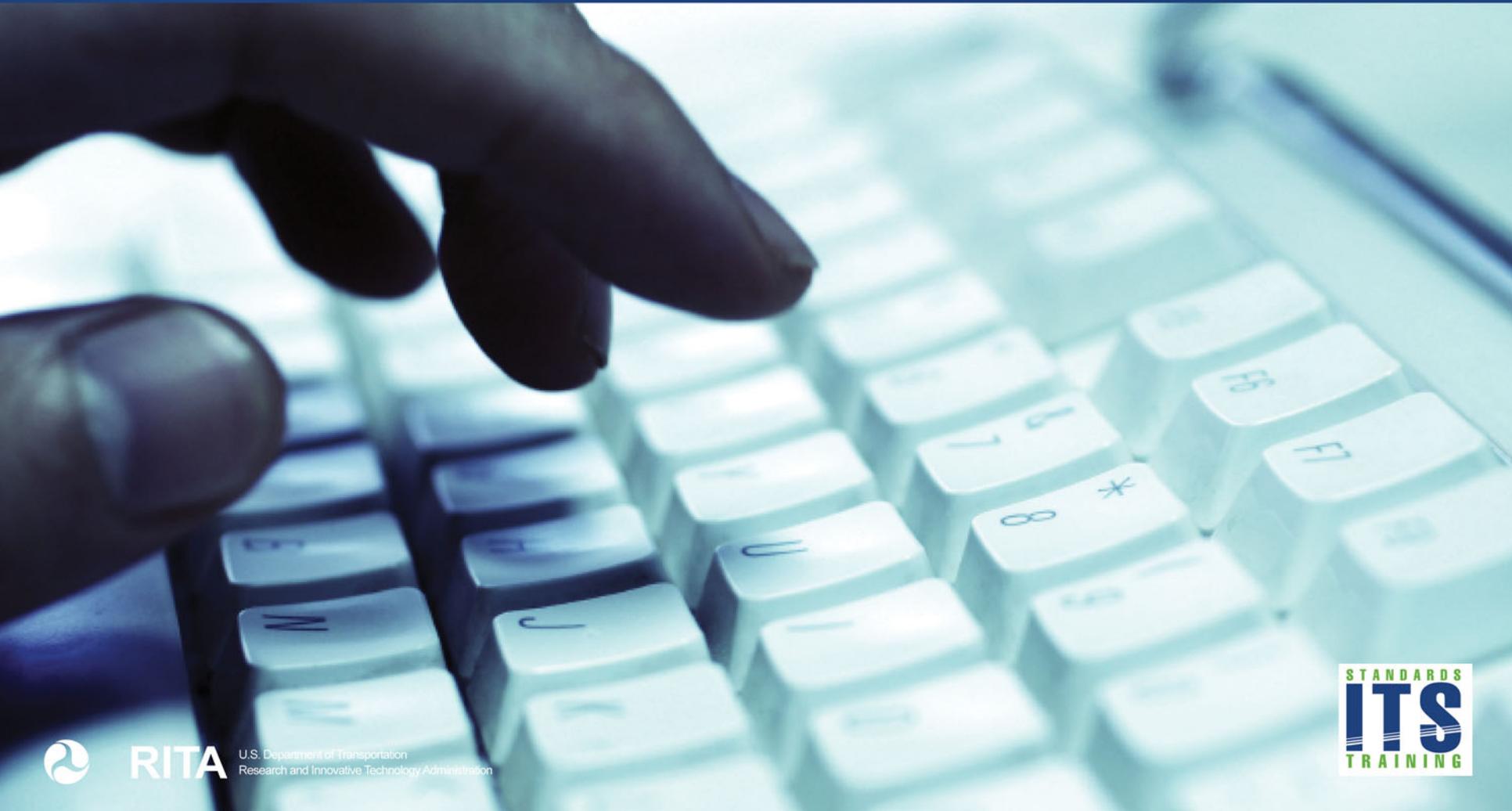
Interoperability

“The ability of two or more systems or components to exchange information and to use the information that has been exchanged”

-IEEE Std 610



ACTIVITY



RITA

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



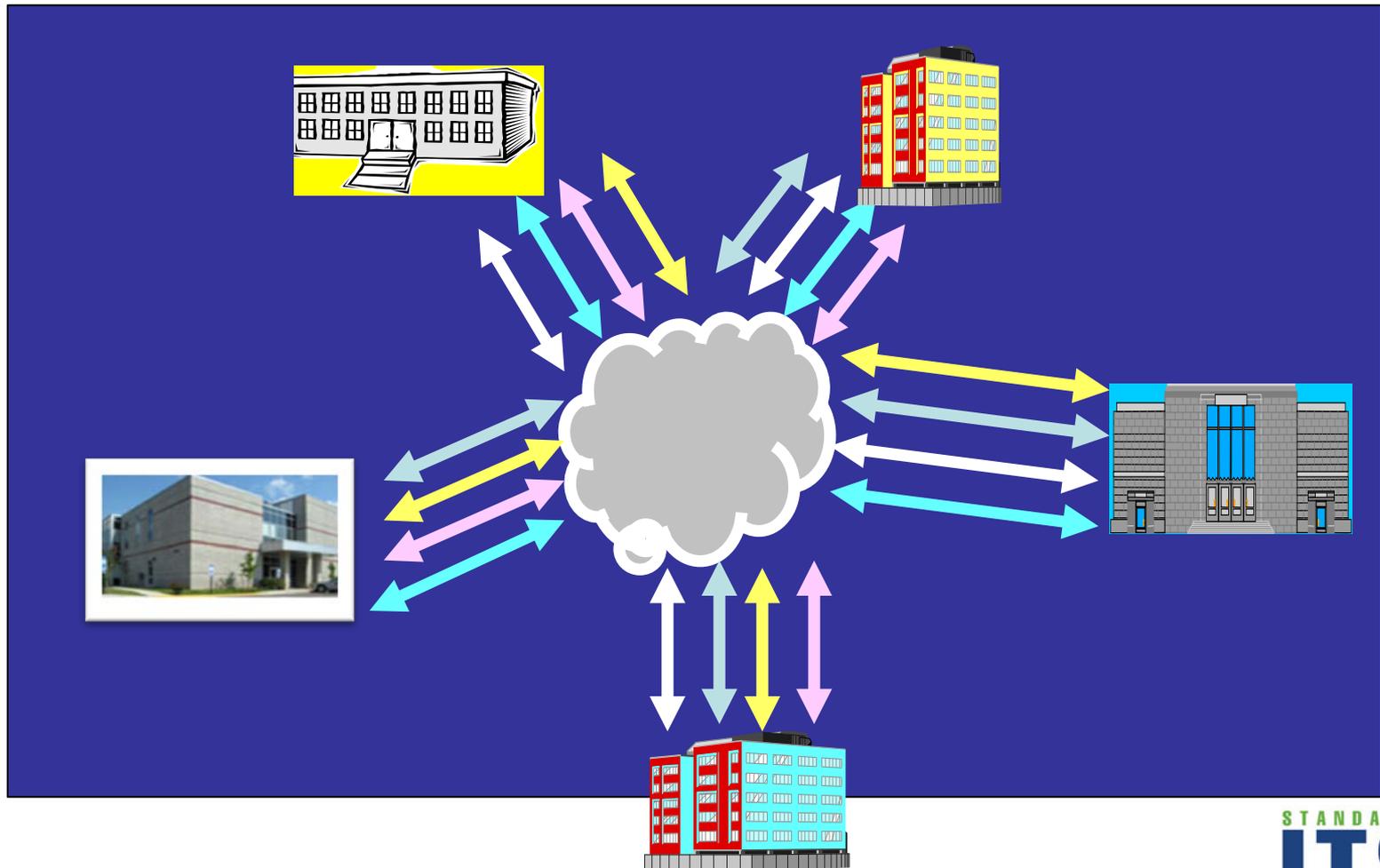
Why do centers desire to communicate with each other?

Type your response in the chat pod



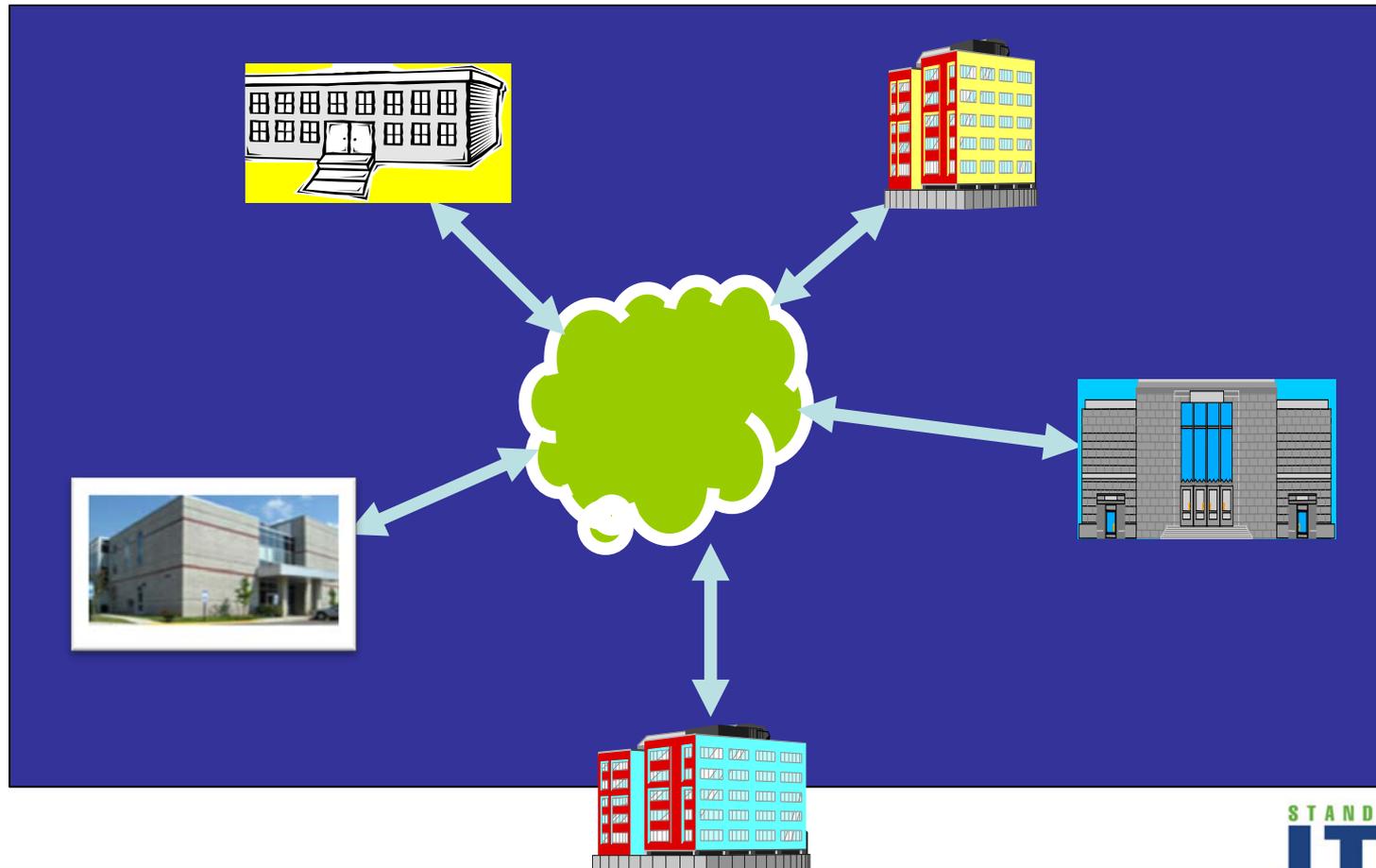
Before Standardization

Each Center Requires Multiple Proprietary Interfaces



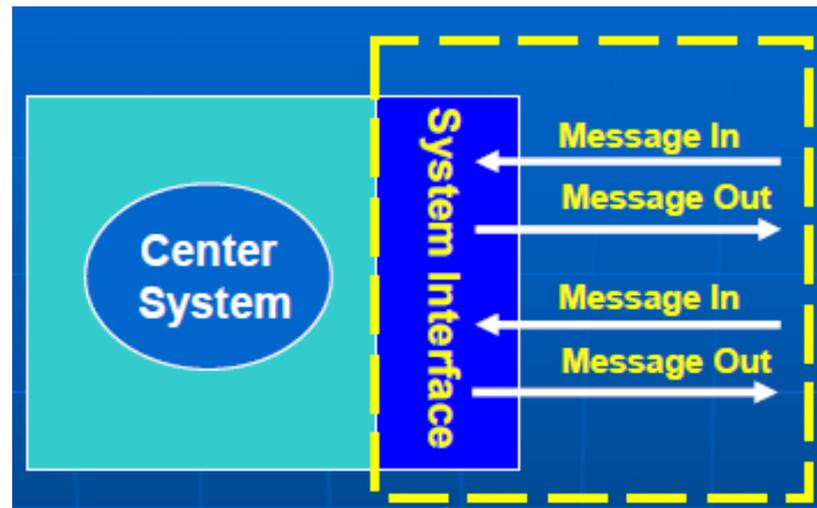
After Standardization

Each Center Requires One Standard-based Interface



What is a System Interface?

“a system interface is a shared boundary across which information is passed”



System Interface Implementation

Shared Boundary

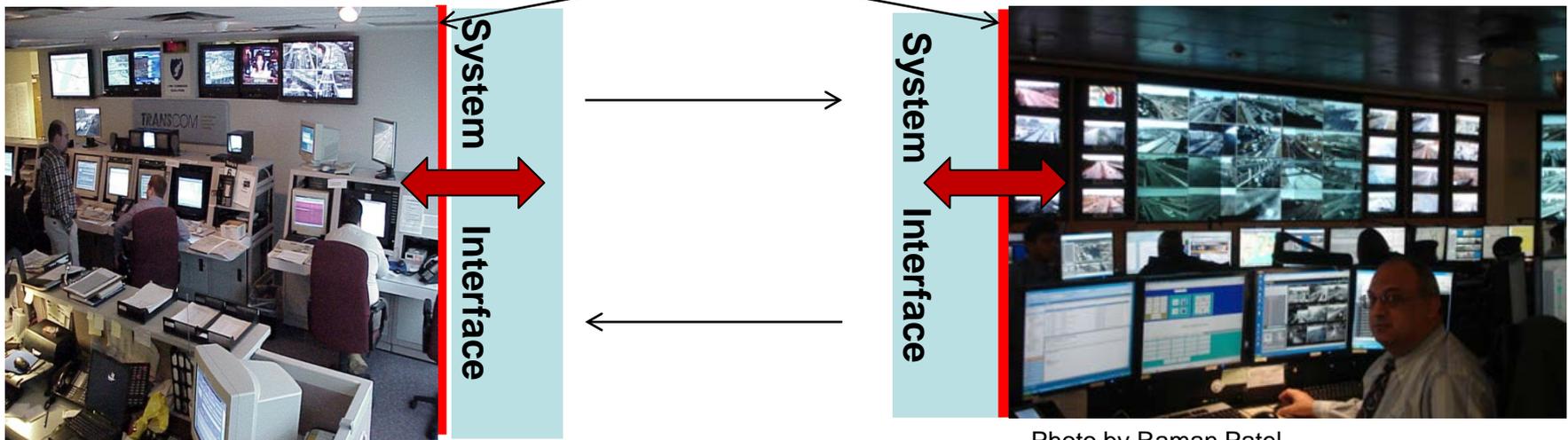


Photo by TRANSCOM

Photo by Raman Patel

SI Uses:

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

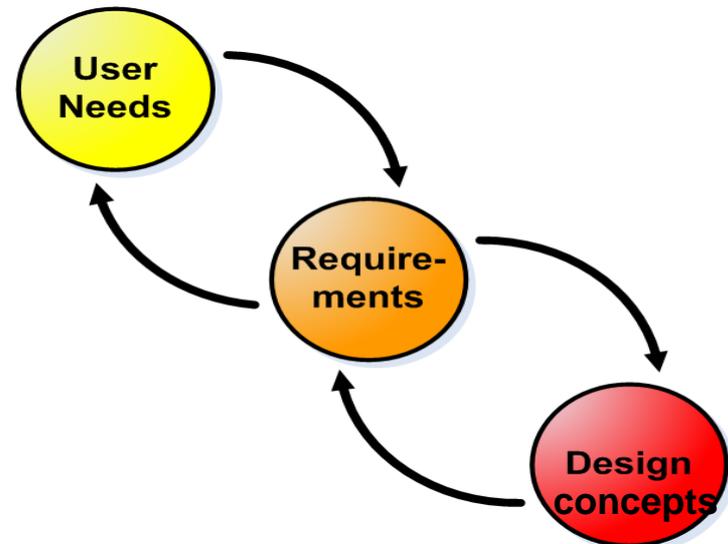
Procuring System Interface

Specification Components Supplied by TMDD v3 standard

Description of what the system interface must do to support operations

Written in “*shall*” language, specific requirements to satisfy user needs

Use of only standard-supplied design data concepts to fulfill the allocated requirements





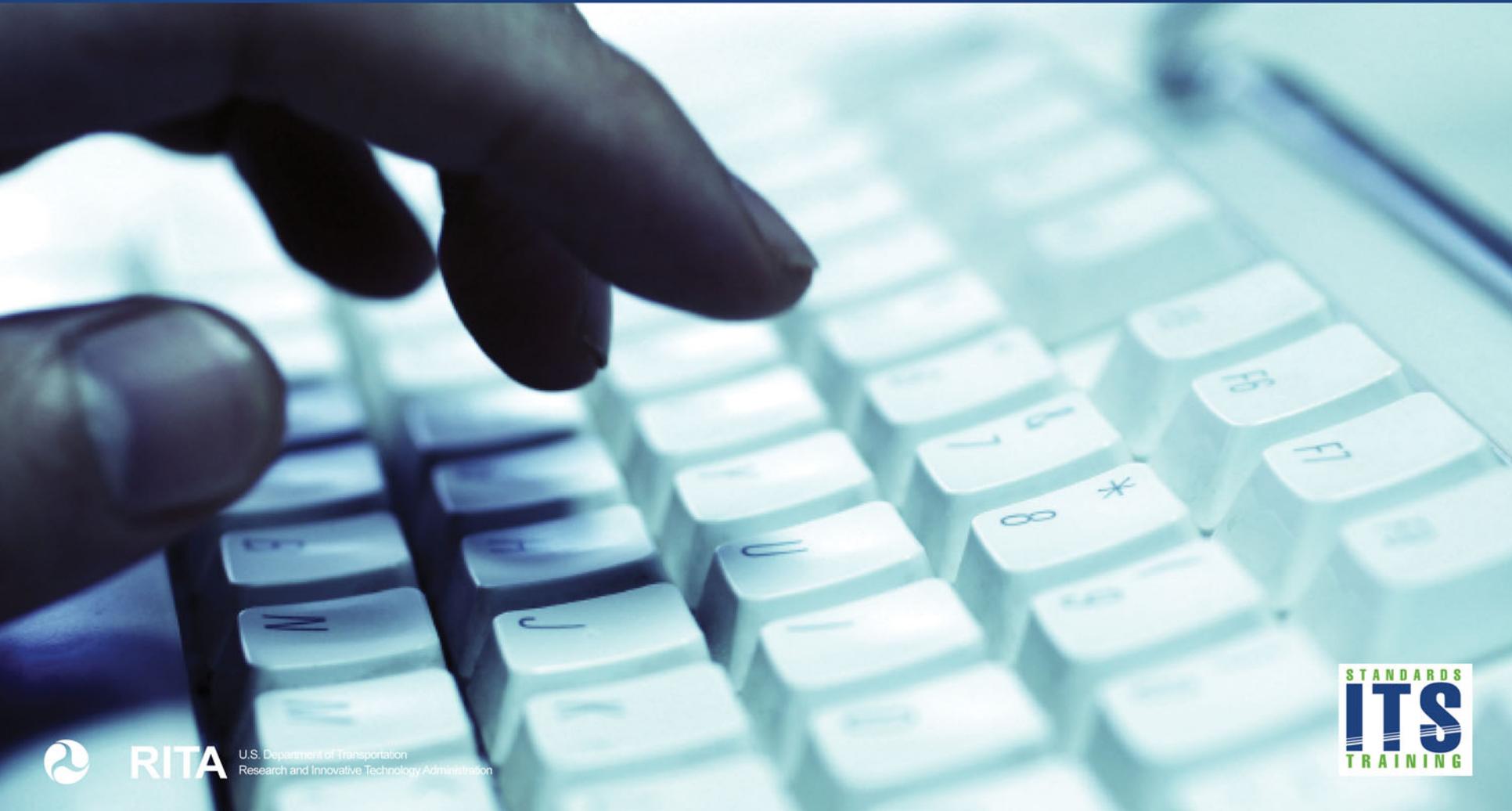
Summary of Learning Objective 1

What Problem is TMDD Addressing?

- Recognizes a need for a *system interface* to exchange information among centers
- **System Interface** design uses ONLY standardized “*building materials*”
- Same set of user needs, requirements, and data concepts is to be included in specification to achieve interoperability among centers



ACTIVITY



RITA

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



What operational needs will a TMC have for information from another center?

Type your response in the chat pod



Operational Environment

Categories of User Needs

Connection Management

Support Authentication-Restrictions

Provide Information on Organization

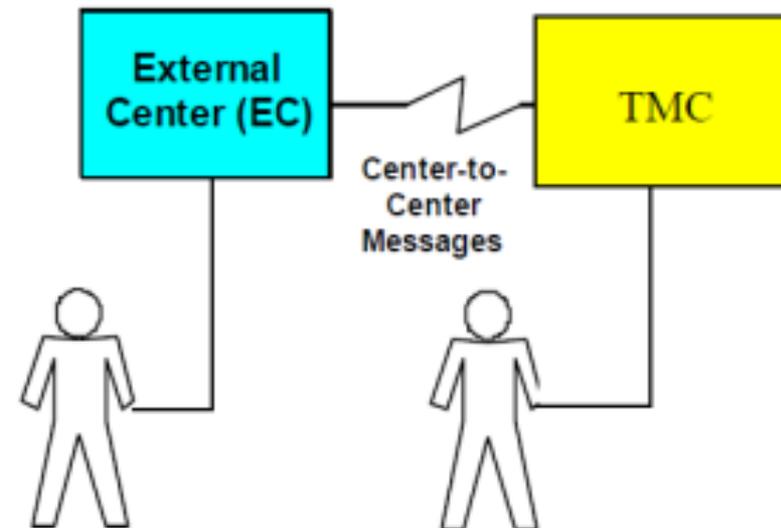
Share Event Information

Provide Roadway Network

Provide Control of Devices

Share Data for Archiving

Accept Null Values



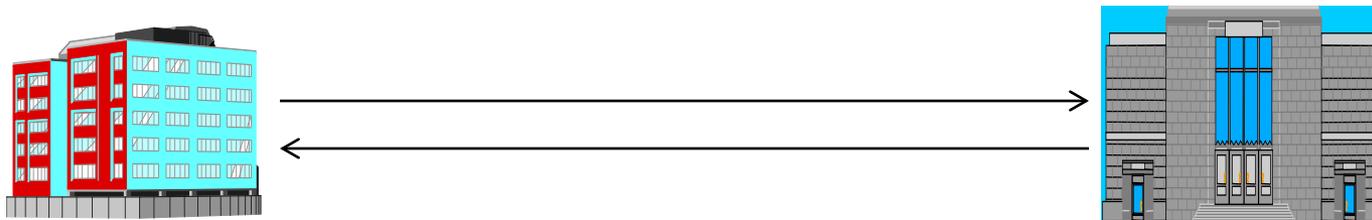
Example

2.3.1 Need for Connection Management

2.3.1.1 Verify Connection Active

Centers need to verify that a connection with another center is alive or active.

2.3.1.2 Need to Support Requests



2.3.1.3 Need to Support Subscriptions

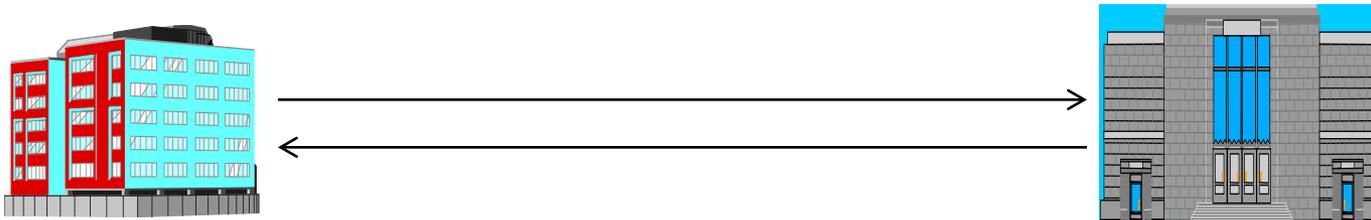
2.3.1.4 Need to Support Error Handling

Example

2.3.4 Need to Share Event Information

2.3.4.6 Need for Current Event Information

External centers need to obtain current event information from owner centers such as a description, location, severity, and status of the event.



2.3.4.7 Need for Planned Event Information

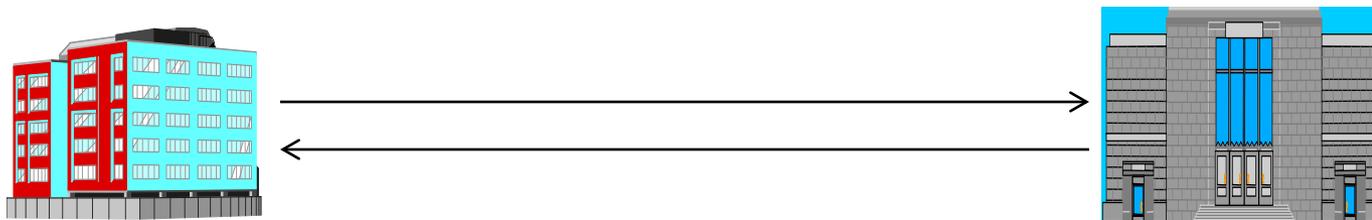
.....need to obtain planning information.....

Example

2.3.6.4 Need to Share DMS Status and Control

2.3.6.4.4 Need to Display a Message on a Remote DMS

Centers need to request that a specific message be displayed on a DMS controlled by another center.



Example

2.3.7 Need to Share Data for Archiving

2.3.7.1 Need for Traffic Monitoring Data

Centers exchange traffic monitoring data, such as volume, occupancy, and speed for archival purposes.

Data collection for planning and research needs



Monitoring traffic volumes on another agency's roadway

Illustration

How centers share and use current information

Transit



Traffic



Verified current event and route condition information is sent to external center

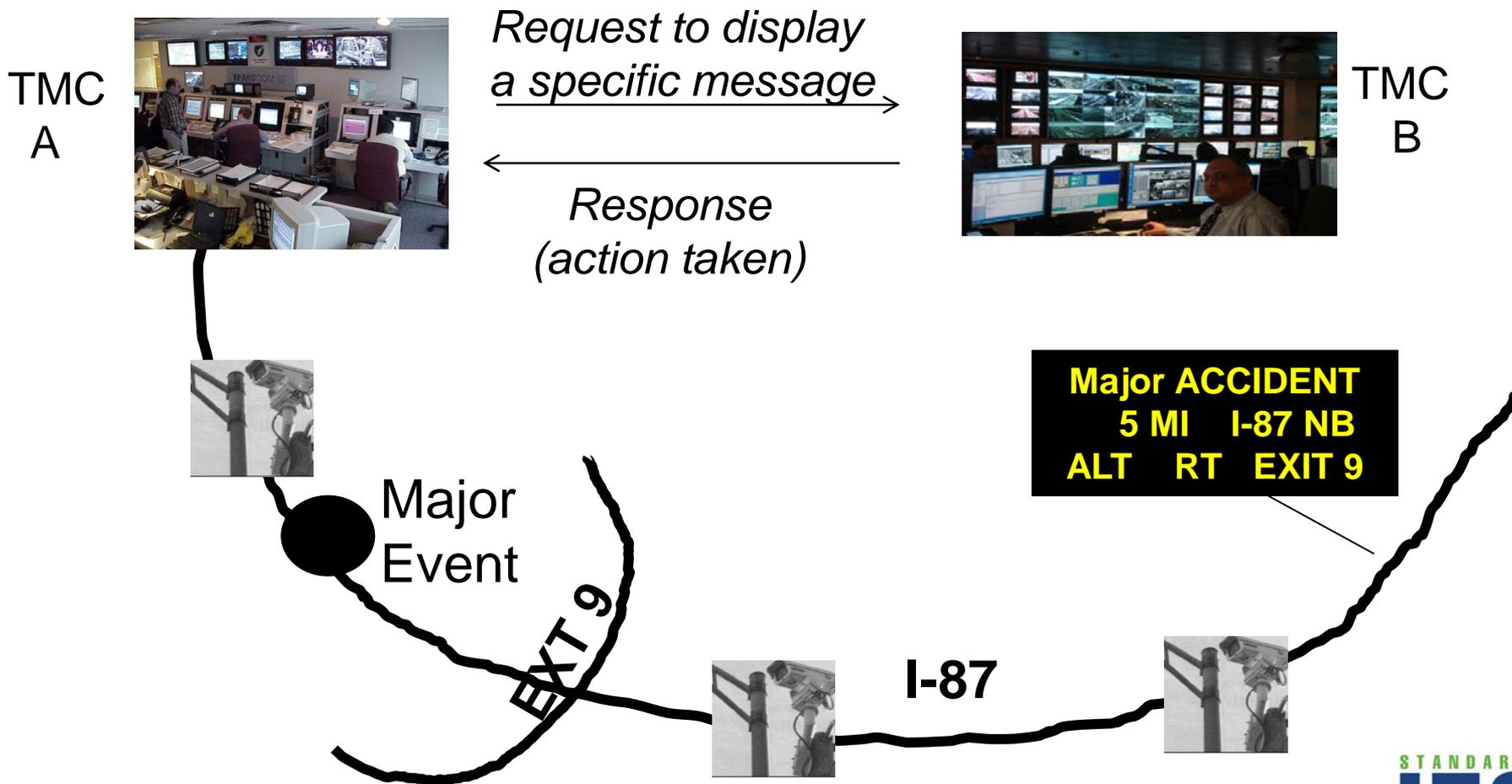


Bus driver is then informed accordingly



Illustration

How centers share field devices?





Summary of Learning Objective 2

Operational Needs

1. Reviewed operational and planning needs to support interagency communications



Summary

Operational Needs (cont.)

2. User needs categories:

- 2.3.1 Connection management
- 2.3.2 Support Authentication-Restrictions
- 2.3.3 Provide information on organizations
- 2.3.4 Share event information
- 2.3.5 Provide roadway network data
- 2.3.6 Provide control of devices
- 2.3.7 Share data for archiving
- 2.3.8 Accept null values



Volume I

Concept of Operations and Requirements

What is to be done?

- Section 1 Document Introduction
- Section 2 User Needs
- Section 3 Requirements
- Section 4 Traceability to National ITS Architecture
- Section 5 NRTM (pages 174-295)



Volume II-Design Content

How is it to be done?

Section 1 Document Introduction

Section 2 TMDD Dialogs and Messages

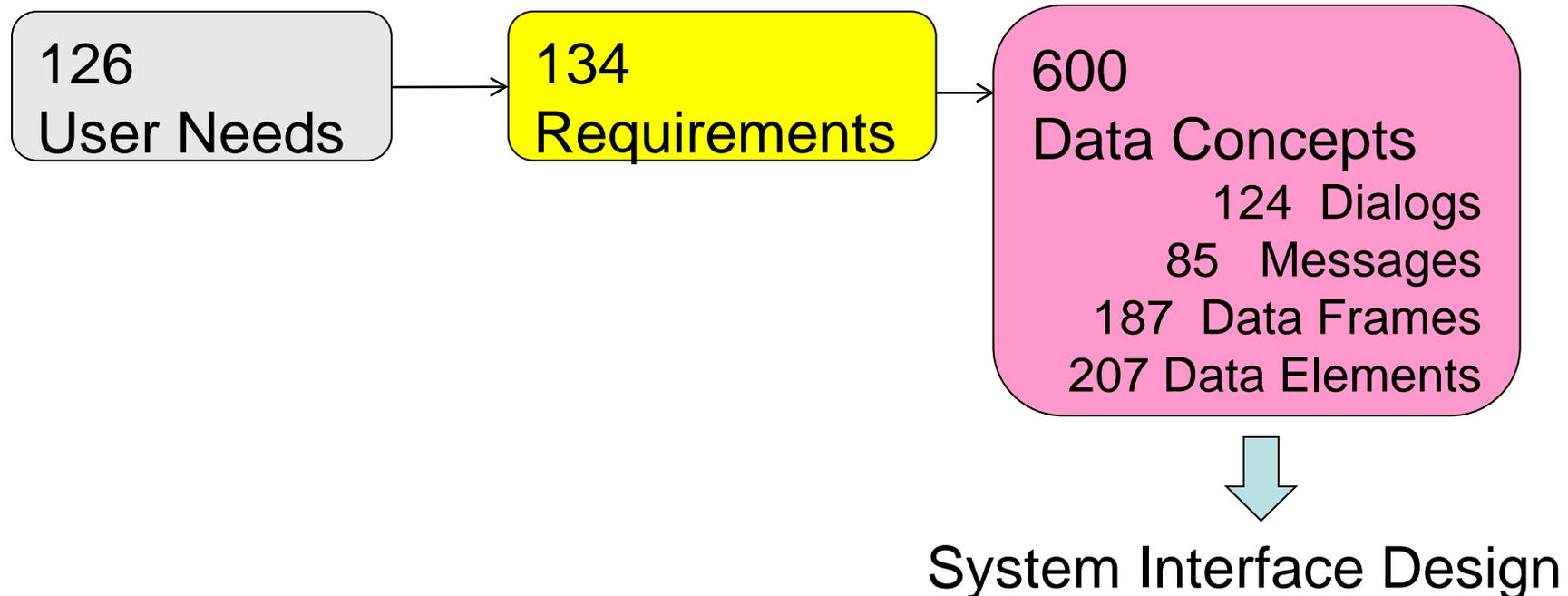
Section 3 TMDD ISO 14817 ASN.1 and
XML Data Concepts Definitions

Section 4 Requirement Traceability
Matrix (RTM) (pages 58-635)

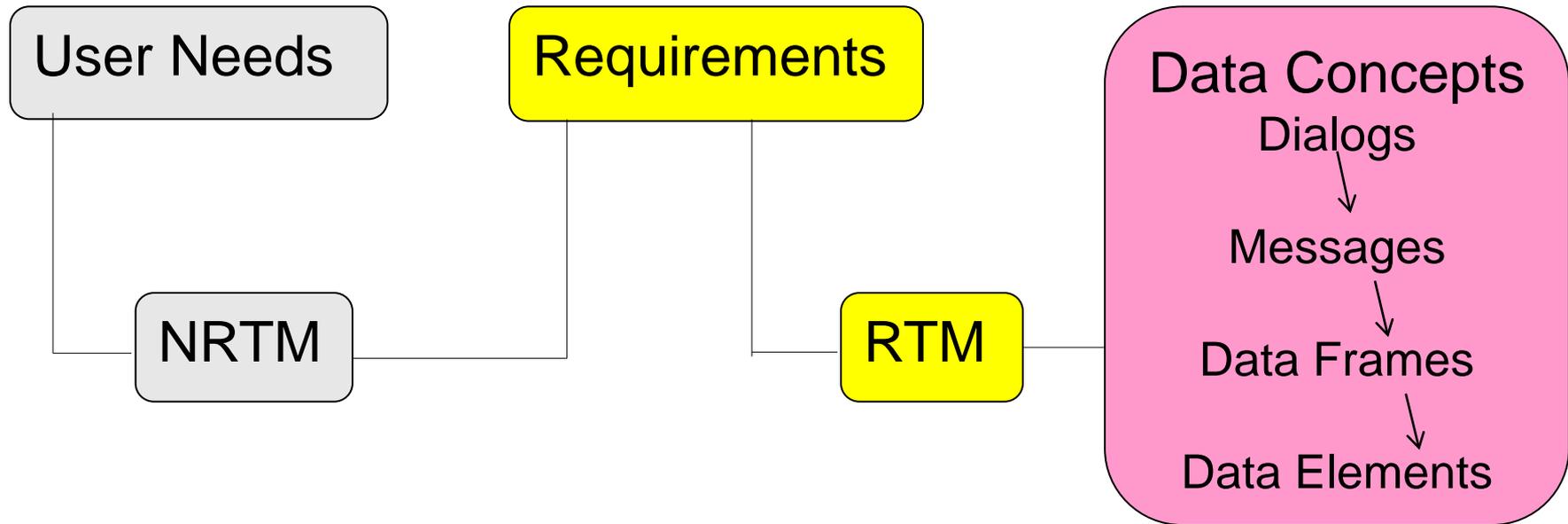
ASN.1 and XML are Data Encoding Formats



Availability of Standardized Definitions by TMDD v3.0 standard



Understanding Relationship through NRTM and RTM



Volume I
TMDD v3.0 standard

Volume II
TMDD v3.0 standard



Summary of Learning Objective 3

TMDD Structure

- Provides NRTM for:
 - Mapping operational needs to user needs definitions
 - Tracing requirements to user needs
 - With the NRTM, the relationships between user needs and requirements is standardized



Summary

TMDD Structure (cont.)

- Provides RTM for:
 - Tracing requirements to data concepts
 - Relationship between requirements and data concepts (design) is standardized
- TMDD promotes “*Off-the-shelf interoperability*”

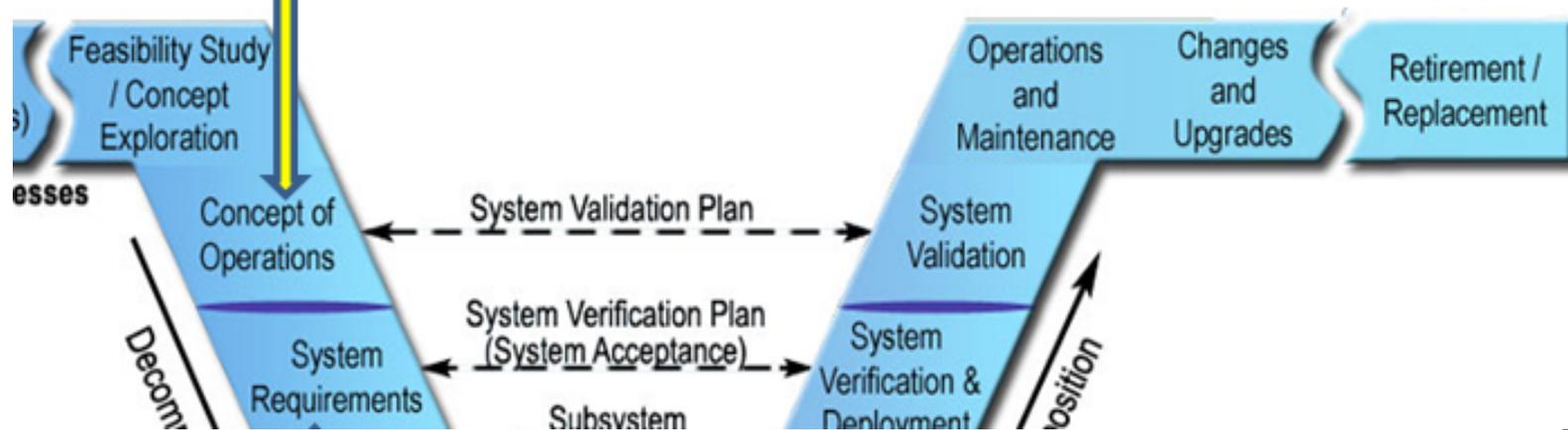


Where are User Needs located on “V”?

NRTM

STEP-2: Using the NRTM (pages 174-295 in the TMDD Standard Volume I, Section 5), select the user needs that address your operational needs. The user need description provided in the ConOps (pages 9-33 in TMDD Standard Volume 1) will help to better understand the intent and capability of the user needs.

Needs are located at ConOps stages of the V diagram; Requirements follow



Parts of NRTM

What needs to be done

Details-specifics

User Needs

Requirements

UN ID	User Need	UN Selected	Req. ID	Req.	Conformance	Support	Other Req.

NRTM Structure has 8 Columns with Multiple Rows

NRTM Content

- Using the UN ID number (e.g. 2.3.6.4.5), the corresponding text from the standard allows you to determine if this UN is desired in your project.

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		M	YES	

For **Mandatory (M)** requirements stated in the standard, project must select **YES** only.

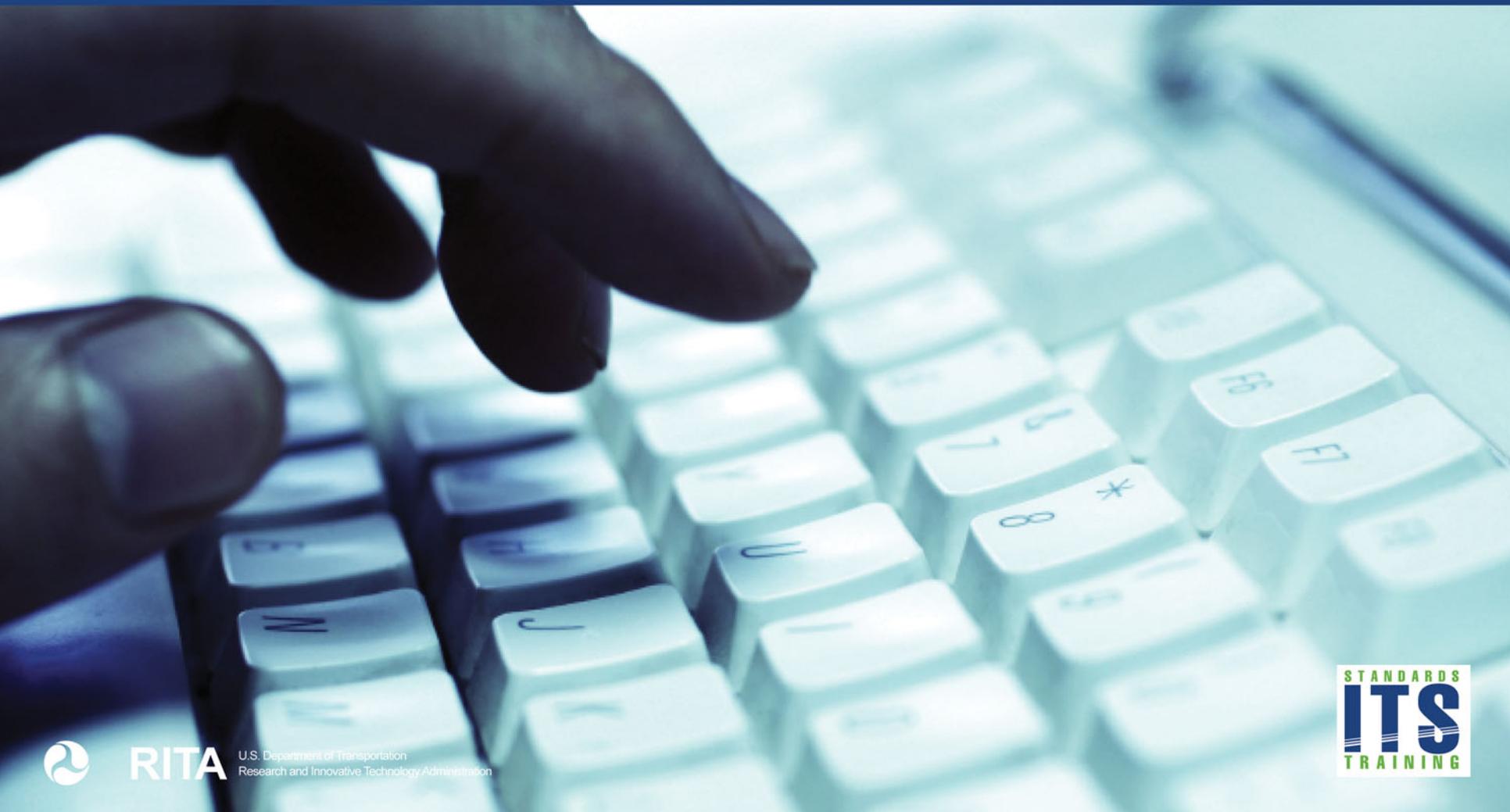
For **Optional requirements (O)**, project decides if the requirement will be used.



NRTM Role

- With NRTM:
 - Requirements are traced to user needs (at least one)
 - Work is monitored at each stage of the system life cycle process (*Are we addressing user need?*)
 - Final check to validate user needs is made (*Did we build the right system?*)

ACTIVITY



RITA

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

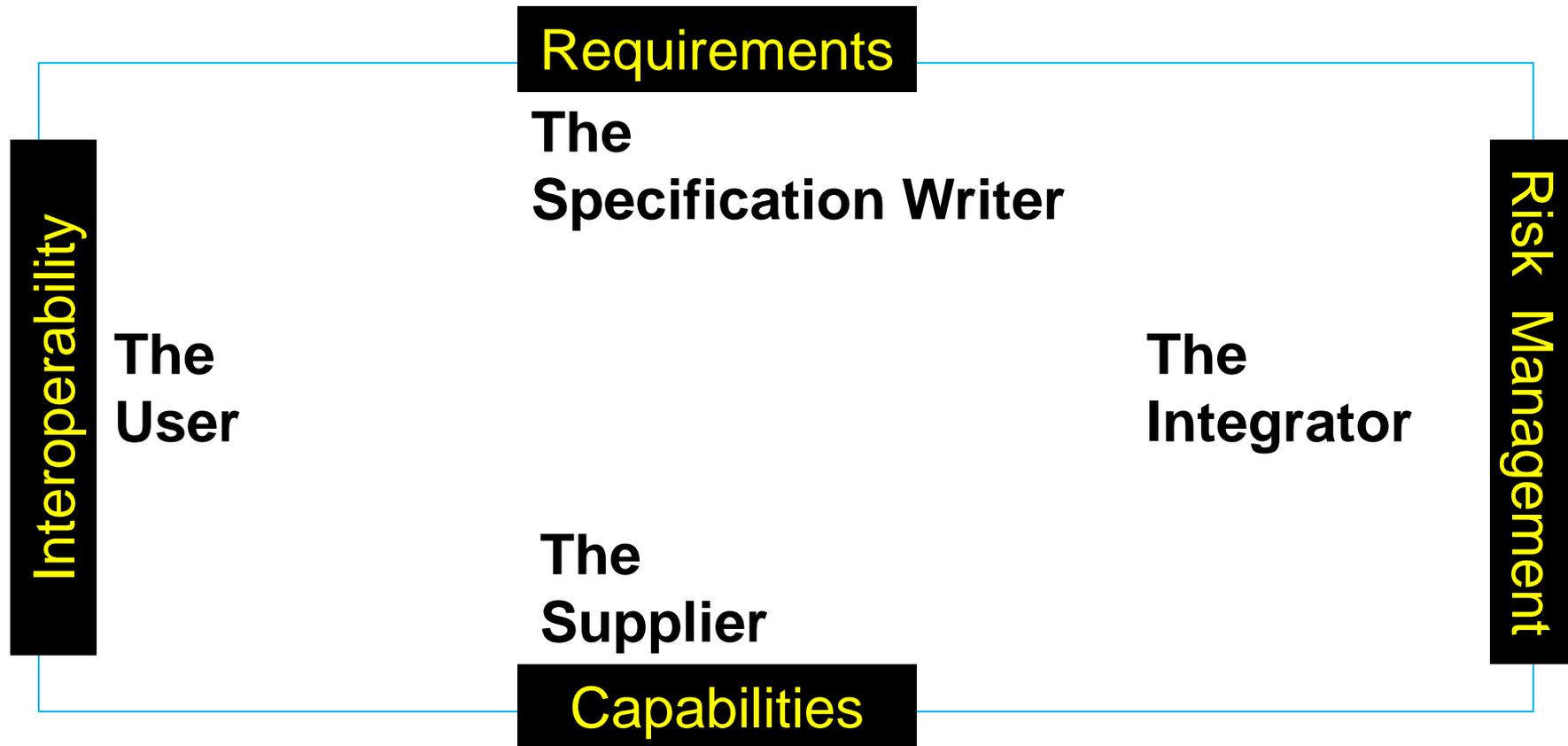


Who do you think benefits from use of NRTM?

Type your response in the chat pod

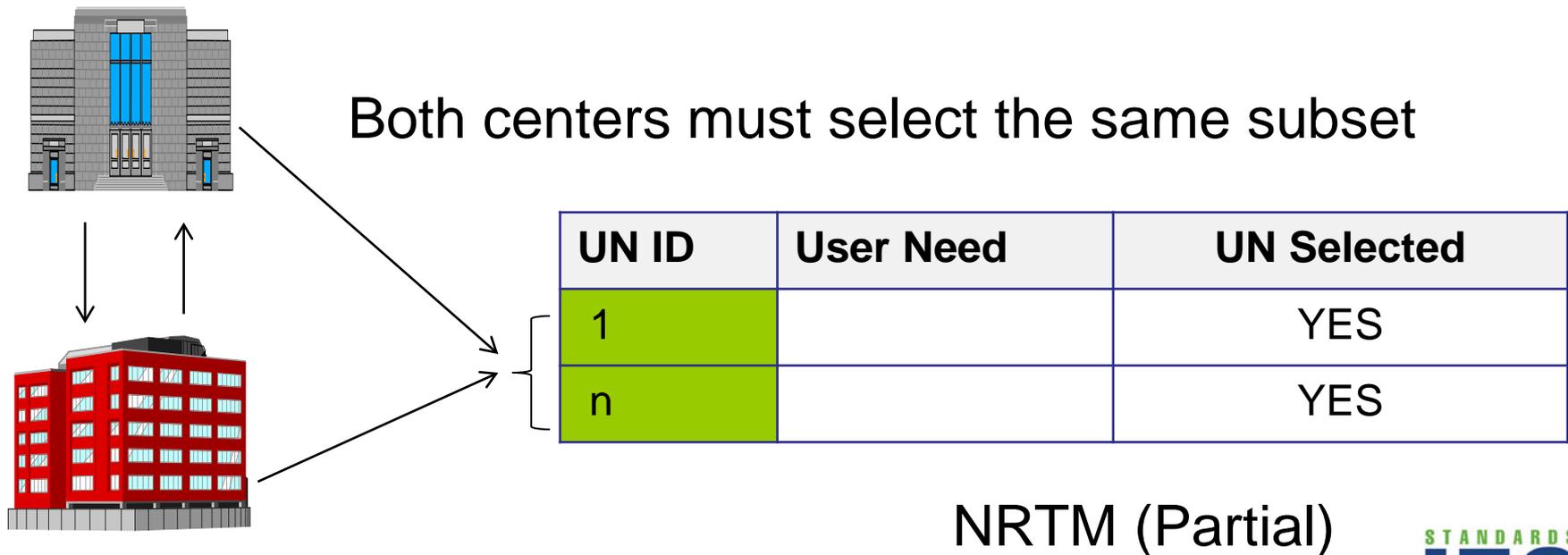


Beneficiaries of NRTM



Ensuring Interoperability

- User needs are a first step towards achieving C2C interoperability



Understanding Mandatory User Needs

To conform to the standard, Mandatory user needs must be selected-YES

UN ID	User Need	UN Selected
2.3.1.1	<i>Verify Connection Active</i>	YES
2.3.1.2	<i>Request Needs to Support</i>	YES
2.3.1.4	<i>Need to Support Error Handling</i>	YES
2.3.5.1.1	<i>Need for Node Inventory</i>	YES
2.3.5.1.2	<i>Need for Link Inventory</i>	YES
2.3.8	<i>Need to Accept Null Values</i>	YES

Ref. page 174, Volume I, Table 4, 4th Column UN Selected



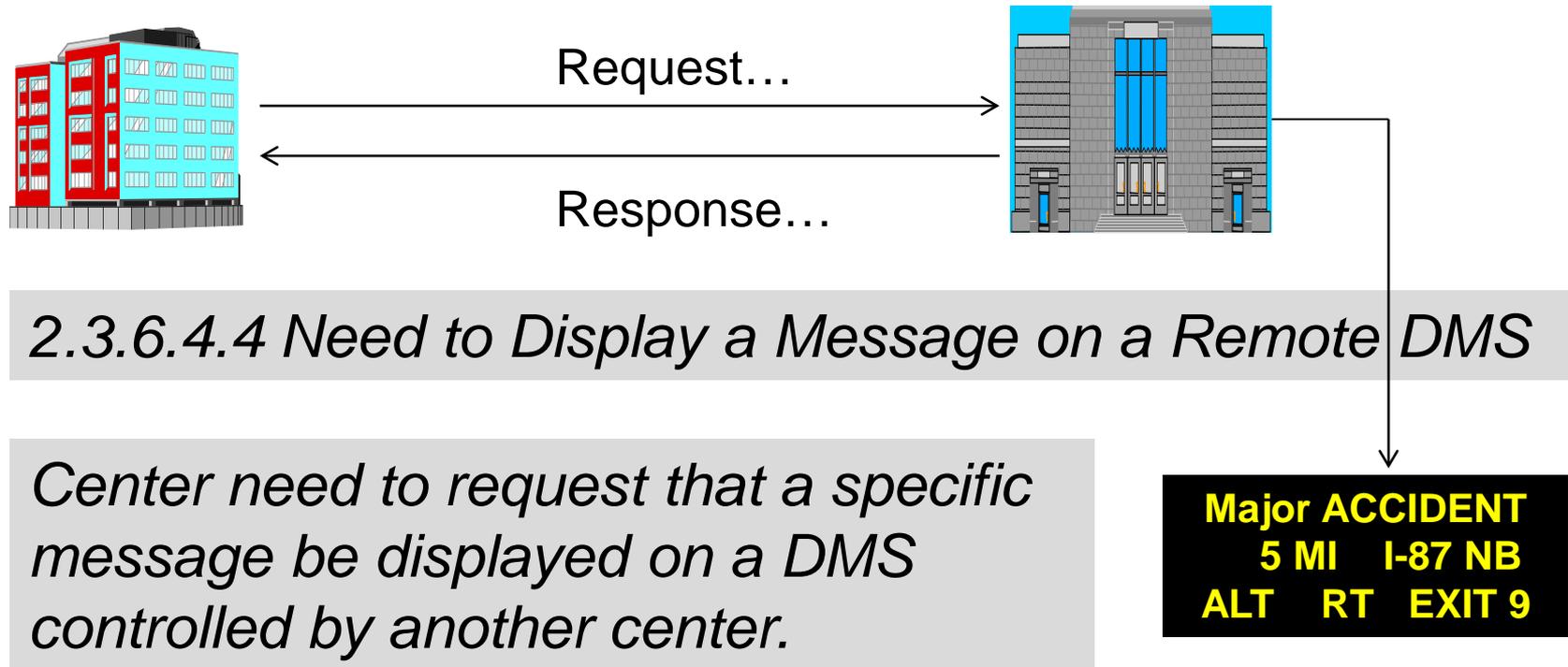
Understanding Optional User Needs

Select optional needs based on the project's operational needs

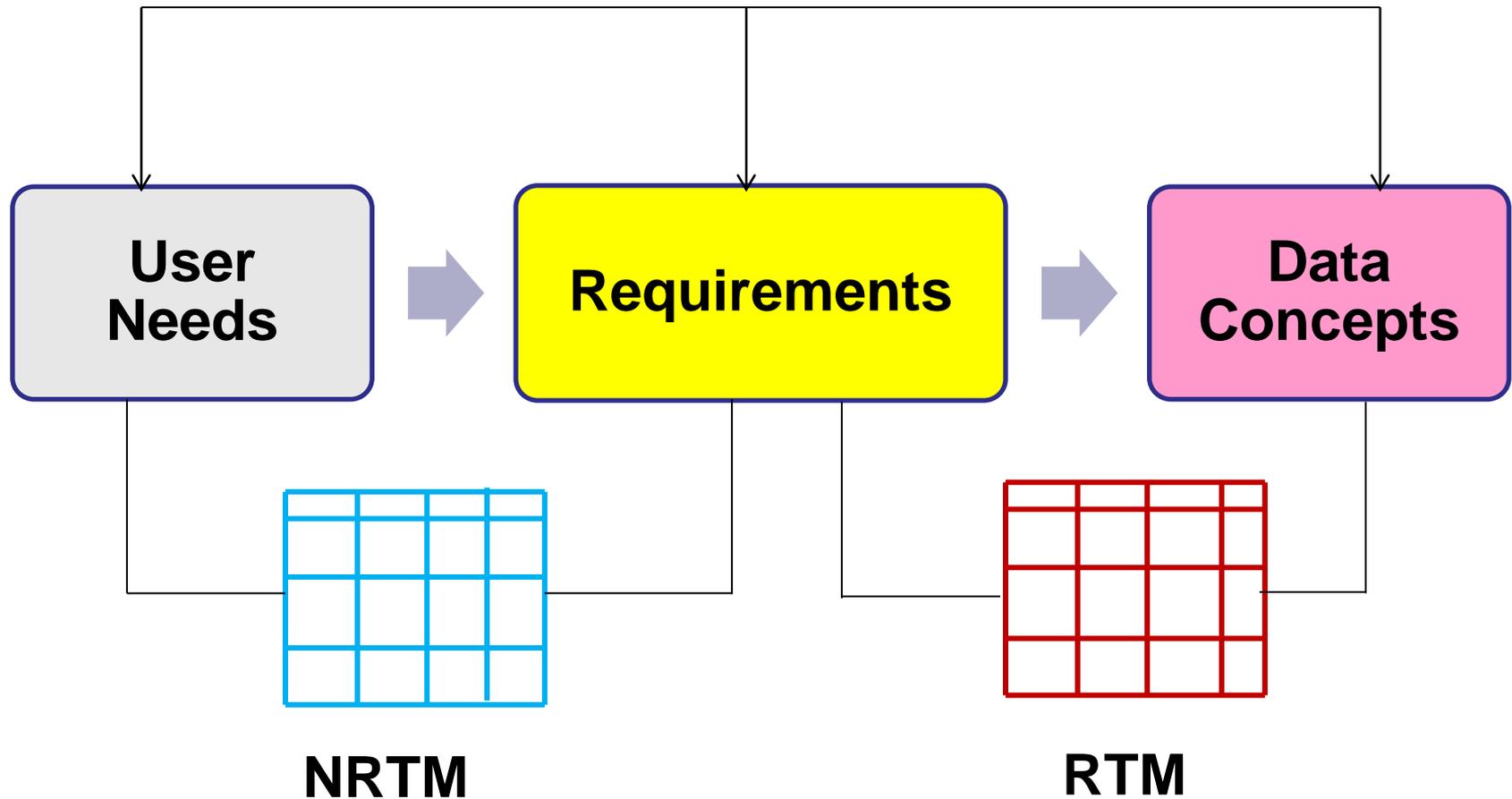
UN ID	User Need	UN Selected
2.3.1.3	<i>Need to Support Subscriptions</i>	Yes
2.3.4.2	<i>Need to Correlate an Event with Another Event</i>	Yes
2.3.4.5	<i>Need to Provide Multilingual Event Descriptions</i>	Yes
2.3.4.6	<i>Need for Current Event Information</i>	Yes
2.3.6.1.3	<i>Need to Share Detector Status</i>	Yes

Example

Centers must select same set of user needs for interoperability



Preparing Project NRTM



Preparing a Project NRTM

Step 1 Section 2 Volume I Page 22

Match project's operational need to User Need ID number and corresponding text description. This action determines if this UN is desired in your system

Example

2.3.6.4.5 Need to Verify DMS Control Status

The center that sends a request to display a specific message on a DMS operated by another center needs to confirm if the message was displayed. Possible statuses include that the message request was implemented, was queued, or was rejected.

DMS supports congestion (traffic) management



Preparing a Project NRTM (cont.)

Step 2

User Need Part

Write UN ID, UN
and Select YES

Step 3 Requirements Part

Go to Section 5, Volume I,
page 174, Table 4 to read
allocated requirements

UN ID	User Need	UN Selected	REQ. ID	REQ.	Conformance	Support	Other req.
2.3.6.4.5	<i>Need to Verify DMS Control Status</i>	Yes	3.3.6.1.4.2		M	Yes	

Project NRTM (Partially Populated)

Step 4 Find 2.3.6.4.5 on page 224
Read ten listed Req. in 4th column

10 requirements are allocated to a user need

UN ID	User Need	UN Selected	Req. ID	Requirement	Conformance	Support	Other Req.
2.3.6.4.5	Need to Verify DMS Control Status	YES	3.3.6.1.4.2		M	Yes	
			3.3.6.1.4.2.1		M	Yes	
			3.3.6.1.4.2.2.1		O	Yes	
			3.3.6.1.4.2.2.2		O	Yes	
			3.3.6.1.4.2.2.3		O	Yes	
			3.3.6.1.4.2.2.4		O	Yes	
			3.3.6.1.5.1		M	Yes	
			3.3.6.1.5.2		M	Yes	
			3.3.6.1.5.3		M	Yes	
			3.3.6.5.4		M	Yes	



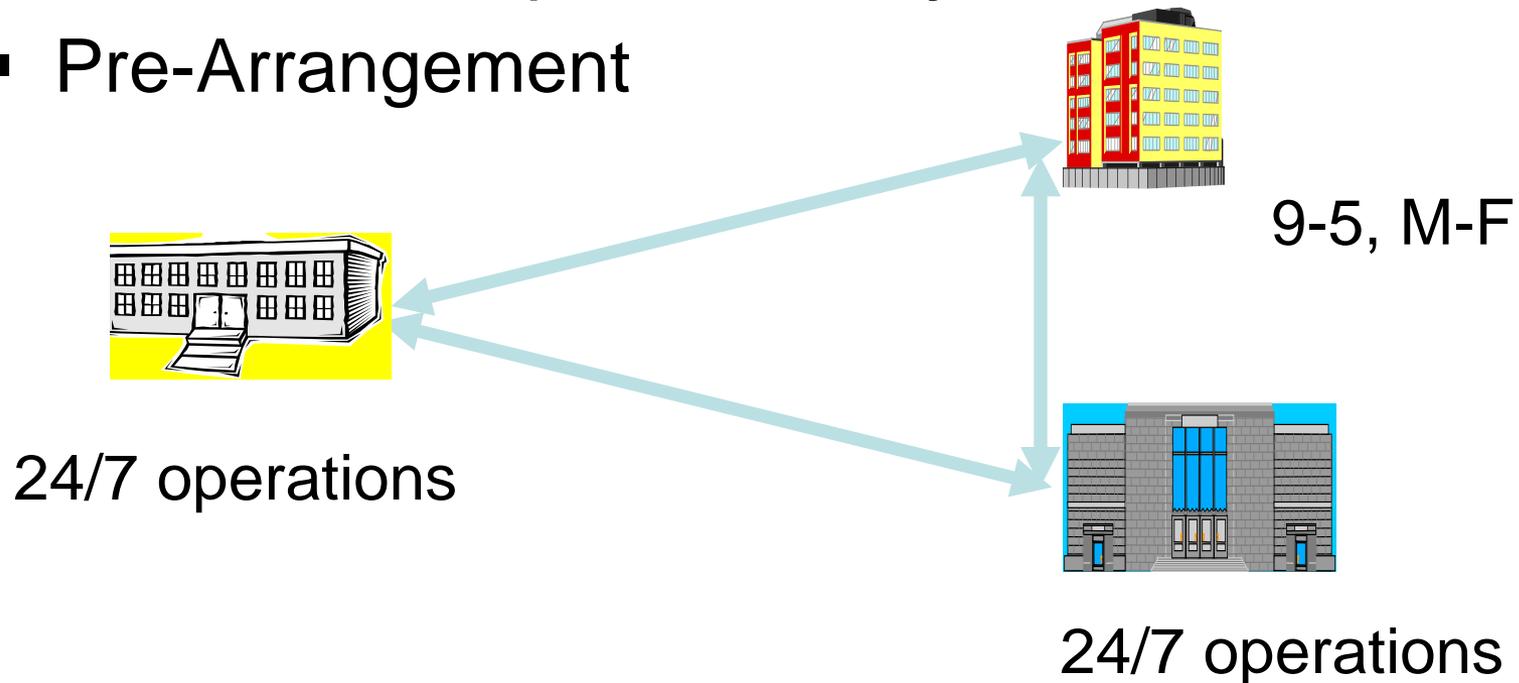
Summary of Learning Objective 4

- User needs are located at ConOps stage on “V” diagram
- Using NRTM Operational Needs are mapped to user needs in Section 2, Volume I
- NRTM traces requirements to at least one user need
- Mandatory UN must be selected YES
- Optional UN, if selected YES, associated requirements are Mandatory

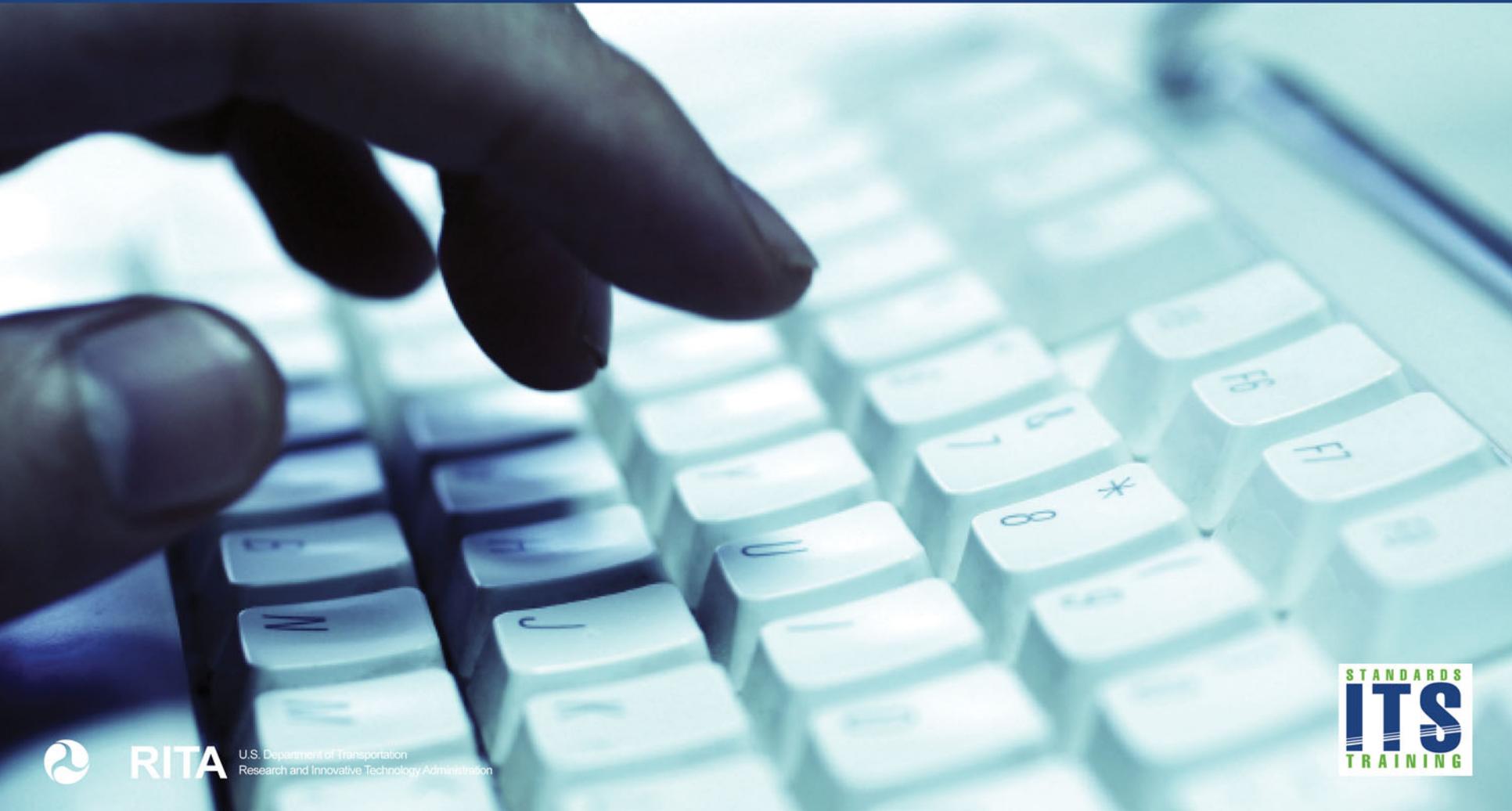


Pre-Arrangement

- How do we implement a *System Interface*?
- Pre-Arrangement



ACTIVITY



RITA

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



Name some pre-arrangements before a system interface is implemented

Type your response in the chat pod



Types of Agreements

Memorandum of Understanding (MOU)

Example: Florida DOT District Four

Purpose: ThisMOU..... provides the framework to promote a collaborative effort topromote coordinated decision-making and information sharing in planning, design, deployment, operations,.....
.... Maximize communications between and among the network of traffic management centers

Source: www.smartsunguide.com/pdf/MOU.doc



Types of Agreements

Operational Agreement Covers:

- Networks (system admin.)
- Authentication, Security
- Standard Operating Procedures (SOPs) for:
 - Current conditions on road networks
 - Sharing devices (DMS, CCTV,...)
 - Sharing event Information (Traffic Incidents, emergency..)
 - Sharing data (Archiving)



Example: Agreement



Sacramento Area Council of Governments

7 Formal Agreements

The Sacramento Region ITS Partnership Memorandum of Understanding for Participation in the Regional ITS Deployment Strategy, although not a binding agreement, provides a framework for cooperation between key STARNET stakeholders, especially for sharing of regional funds.

Source: <http://www.fhwa.dot.gov/cadiv/segb/files/starnet/starnetstake.htm>

Example

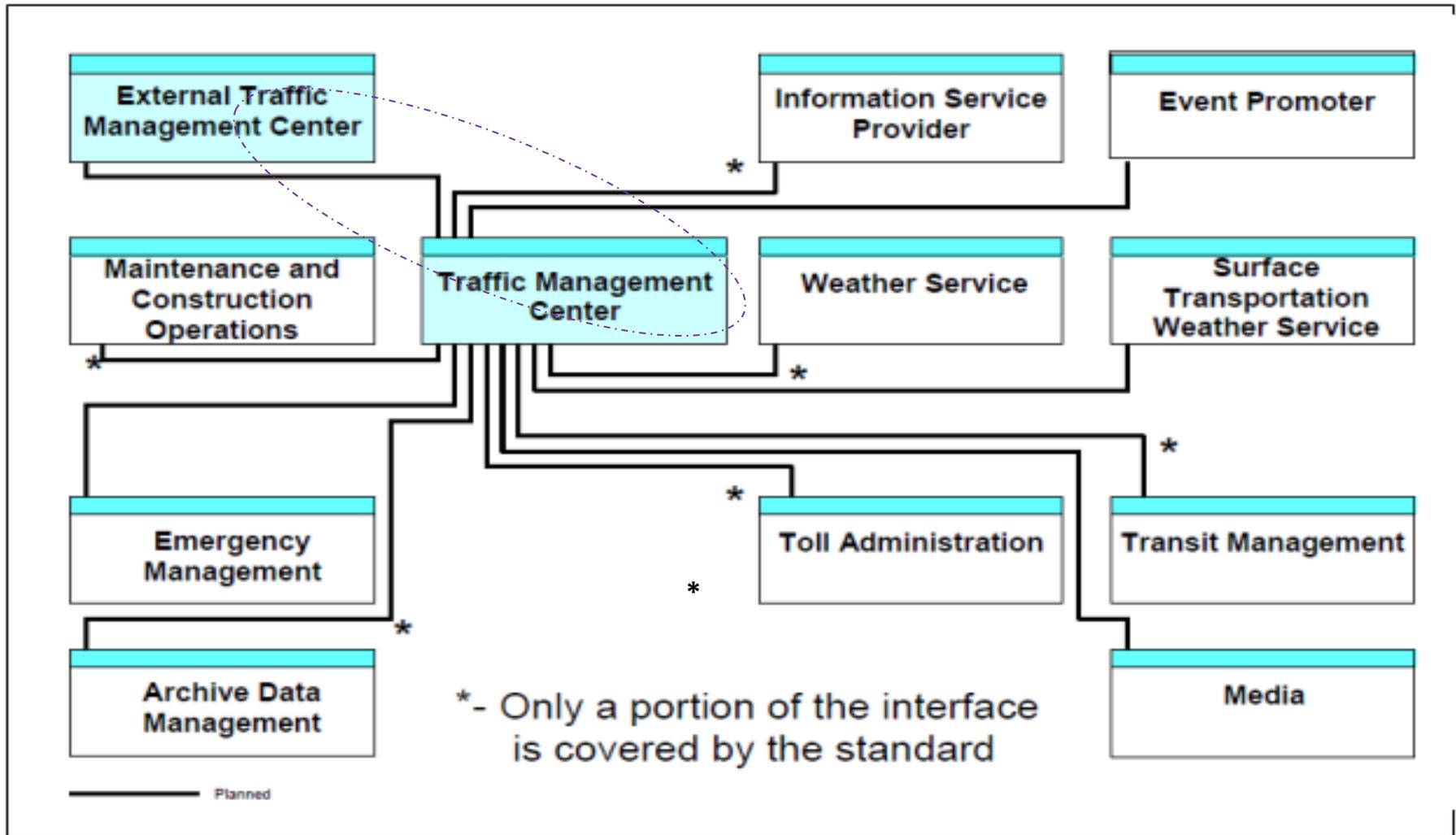
Puget Sound Regional Council

4.6	Incident Management.....	38
4.7	Data Archiving	39
4.8	ITS Backbone	40
4.9	Regional Multi-Modal Traveler Information Center (RMTIC)	41
4.9.1	<i>RMTIC Concept</i>	41
4.9.2	<i>RMTIC Information</i>	41
4.10	Local Link to CVISN	41
4.11	Railroad Operations Coordination.....	42
5	Agreements Between Organizations	44
5.1	Existing, Planned and Potential Agreements	44
5.2	Elements of an Agreement.....	48

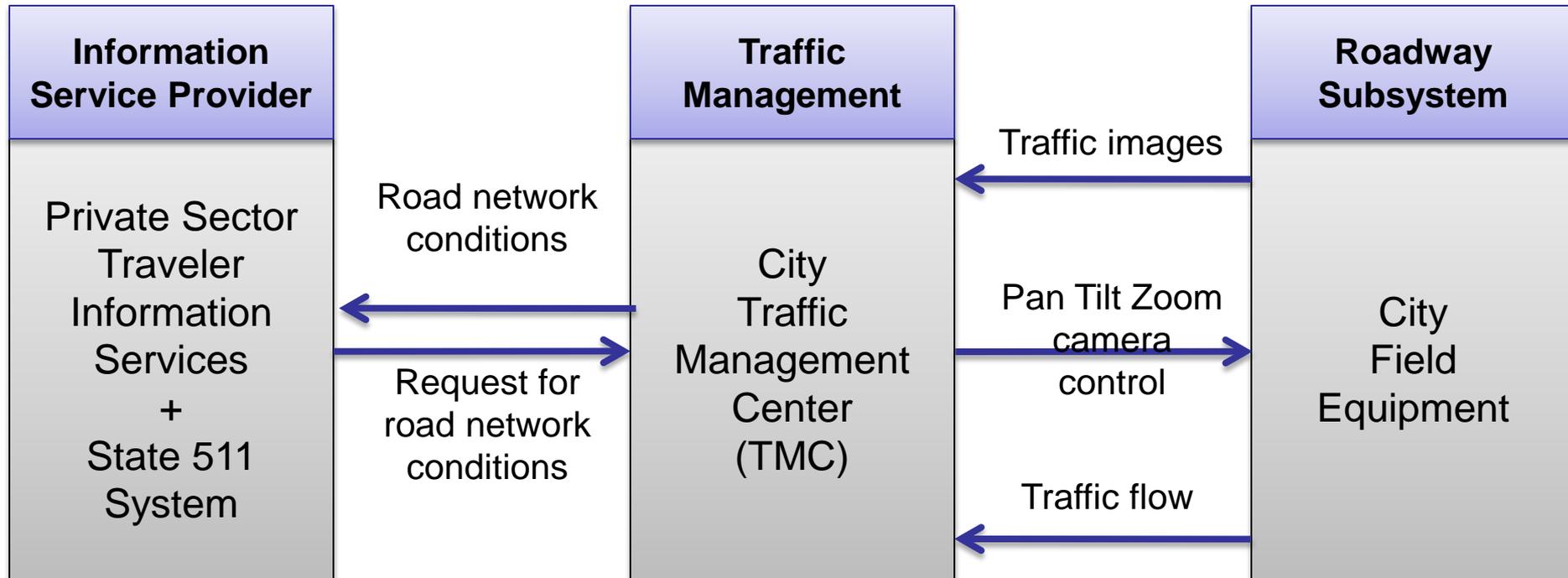
Source: psrc.org/assets/543/regarch.pdf



TMDD's Relationships to Architecture



Example of TMDD's Support



**Center to Center
C2C**

**Center to Field
C2F**

Related C2C Standards

SI Implementation Requires:

1. TMDD v3 standard:
 - User Needs, Requirements and ISO 14817 Based Data Concepts
 - Centers must have a common specification
2. Application Protocol:
 - NTCIP 2306 C2C XML or NTCIP 2304 C2C DATEX
 - Centers must select one as a common protocol for Interoperability



CASE STUDY



RITA

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





Case Study

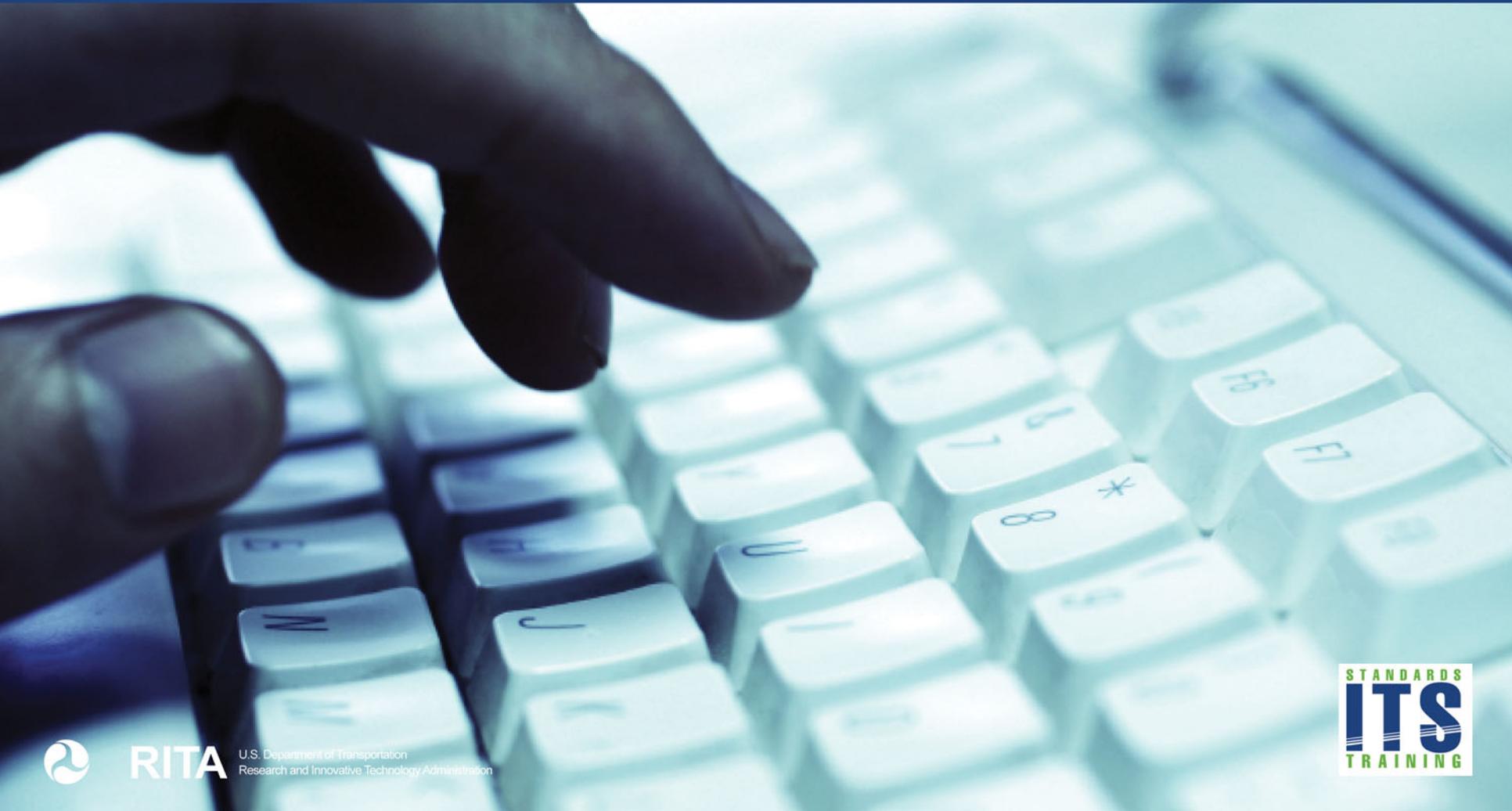
TMC-A has 24/7 traffic management operations, which includes 50 traffic signals, 7 DMSs, and 15 CCTV cameras, and has received approval from FHWA to develop an ITS project to add a system interface capability to exchange information with the adjoining TMC B.

Both TMCs have agreed to coordinate traffic management in the region and share event information and field devices.

A system interface is to be procured soon. **What Next?**



ACTIVITY



RITA

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





Please type in response in the chat room

1. The project will be guided by the SEP to develop the system interface desired by the TMCs.
2. The TMDD v3.0 standard will be used to develop the system interface for both TMCs.
3. In this case study the Owning Center is TMC A and the External Center is TMC B





Please type in response in the chat room

4. Which tool will you use to map the operational need? **NRTM**
5. How do we go about preparing project user needs?
Prepare Project NRTM
6. Both TMCs must prepare a **specification** common with same set of user needs, requirements and data concepts to achieve off-the-shelf interoperability.





Case Study Exercise

7. The overall ***Operational Need*** driving this development can be stated as traffic (congestion) management
8. The standardized user needs definitions can be found in TMDD v3.0 standard, Volume I Section 2
9. Information exchange related user needs are: roadway network, event sharing, device sharing and data archiving. Additional four are related to network authentication management etc.



Case Study Exercise (Cont.)

10. What pre-arrangement should TMCs have in place for implementation of the SI?

MOU-SOPs-Agreement

11. **NTCIP 2306-C2C XML** is selected as a common protocol to support the system interface.





What did we learned today?

- TMDD addresses the need for system interface capability for C2C “*information exchange*” [LO #1]
- Supports eight categories of operational needs [LO #2]
- Standardized definitions are available for use in a specification: [LO #3]
 - Volume I contains *User Needs and Requirements and NRTM*
 - Volume II contains *design concepts and RTM*





What did we learned today? (cont.)

- Learned how to prepare a project NRTM [LO#4]
- Required pre-arrangement to implement a system interface [LO#5]
- The Case Study examination confirmed key concepts
- Prepared for the A321b module on the requirements





Next Steps:

Module A321b

Specifying Requirements for Traffic Management Systems Based on TMDD v3 Standard

- Requirements and their link to Data Concepts through RTM will be discussed in details to complete preparation of a system interface specification





Where to Find More Information

- TMDD v3 standard and TMDD Guide:
<http://www.ite.org/standards/distribution.asp>
- NTCIP Guide: www.ntcip.org/library
- Systems Engineering Guidebook for ITS
FHWA-Caltrans, v3.0 2009:
<http://www.fhwa.dot.gov/cadiv/segb/files/segbversion3.pdf>
- Systems Engineering for Intelligent Transportation
Systems, FHWA , 2007:
<http://ops.fhwa.dot.gov/publications/seitsguide/index.htm>



QUESTIONS?



RITA

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

