WELCOME

RITA Intelligent Transportation Systems
Joint Program Office

Welcome

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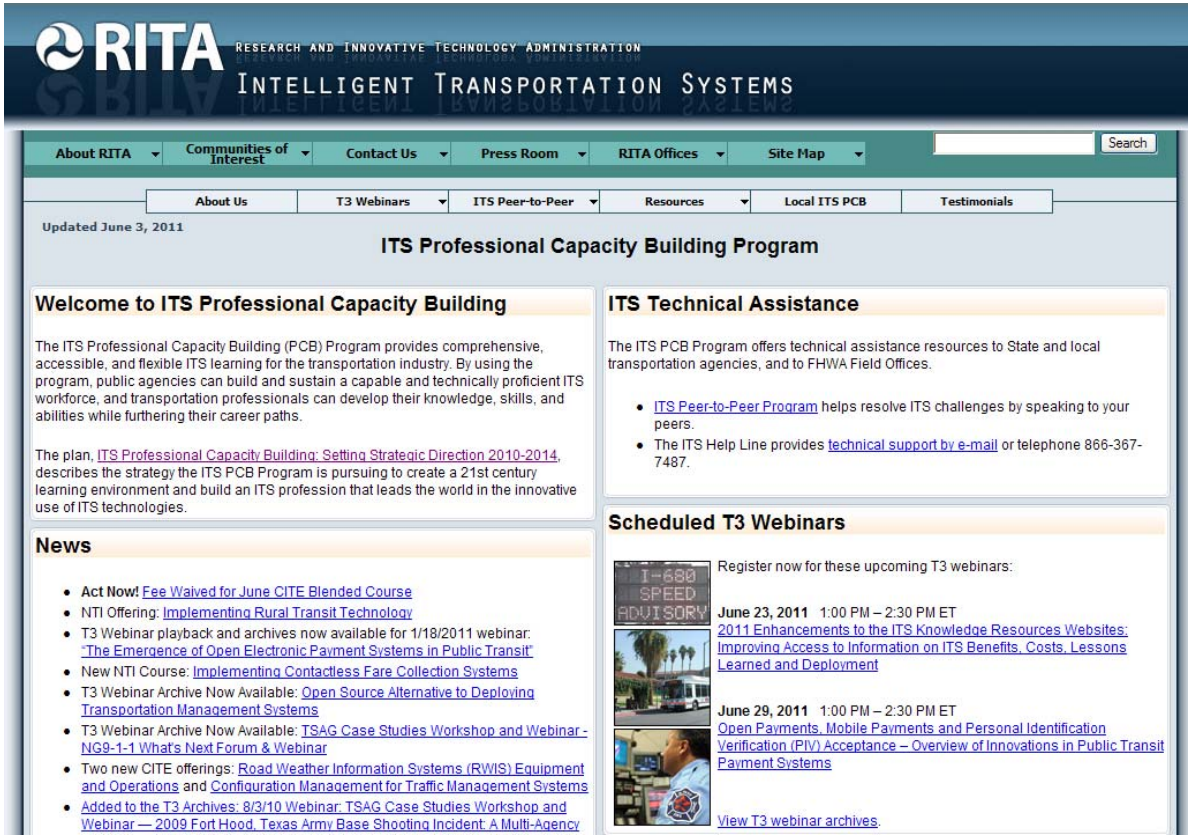

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A102
Introduction to User Needs Identification

Target Audience

- Project managers
- Decision makers
- Operators
- Transportation management center (TMC) staff
- Stakeholders

Instructor

Tomas Guerra

President

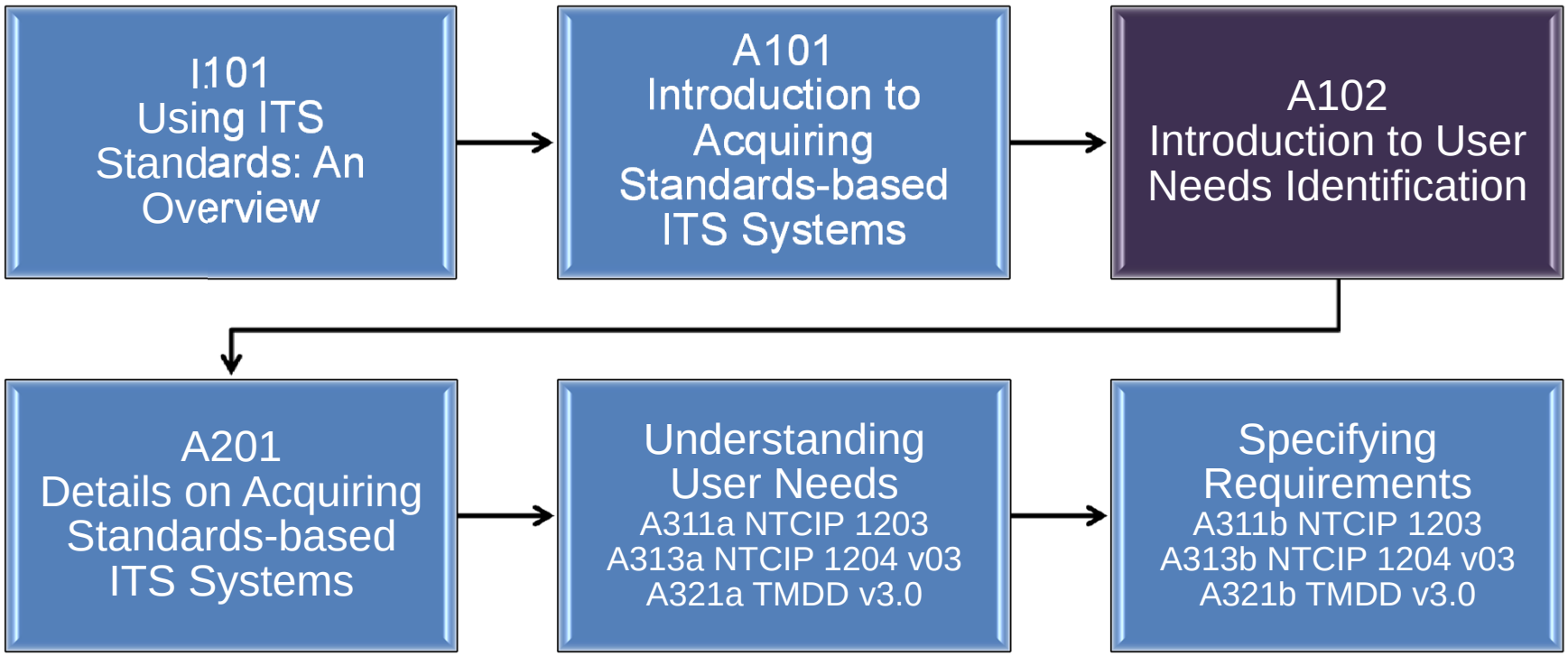
OZ Engineering, LLC

Phoenix, AZ, USA

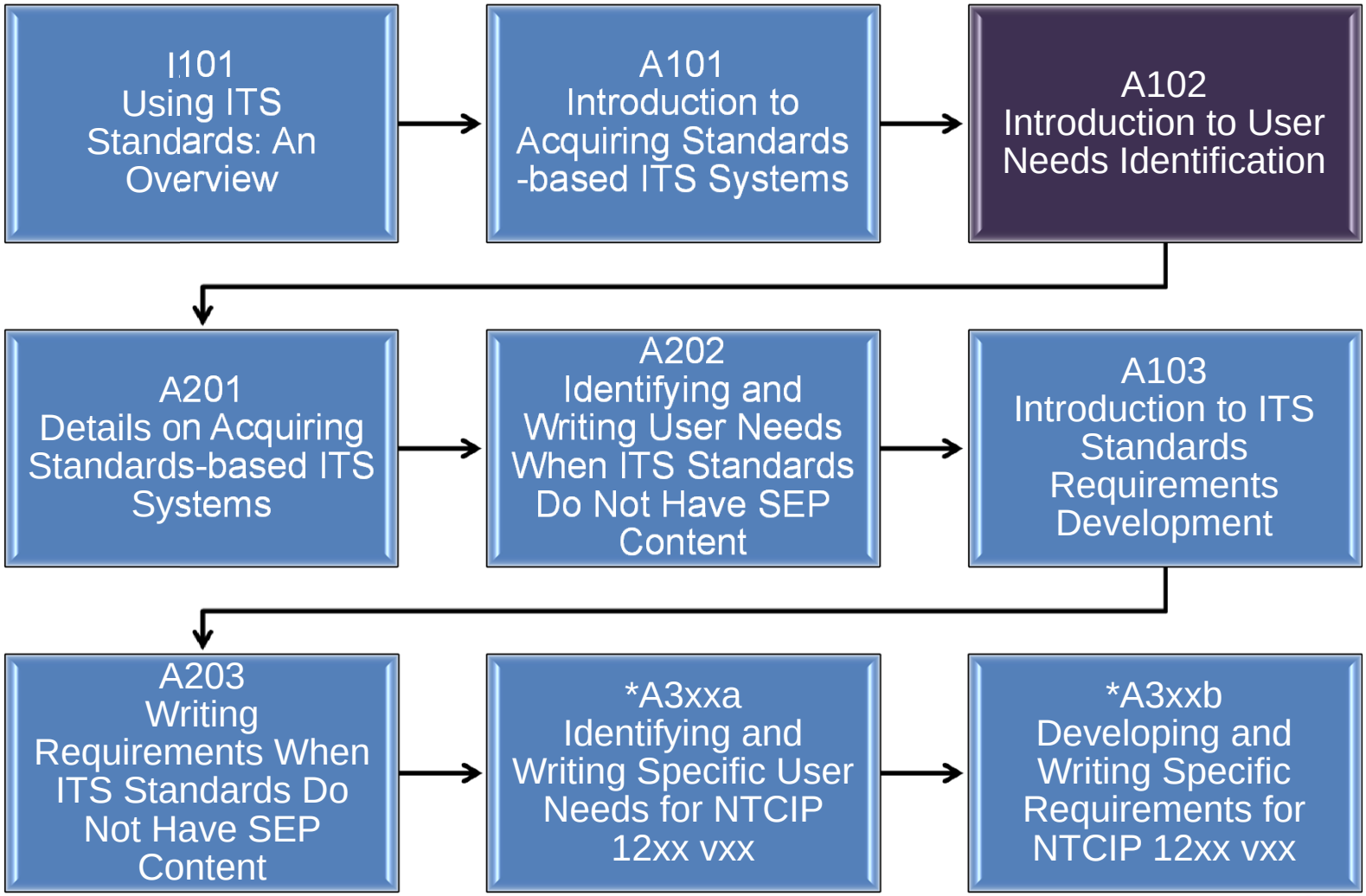
Recommended Prerequisites

- I101 Using ITS Standards: An Overview
- A101 Introduction to Acquiring Standards-based ITS Systems
- Basic knowledge of the following is helpful
  - Intelligent Transportation Systems
  - Government procurement processes
  - Systems Engineering Process (SEP)

Curriculum Path (SEP)



Curriculum Path (Non-SEP)



Learning Objectives

1. Identify user needs
2. Identify standards that have gone through the Systems Engineering Process (SEP)
3. Select user needs for standards that have been through SEP

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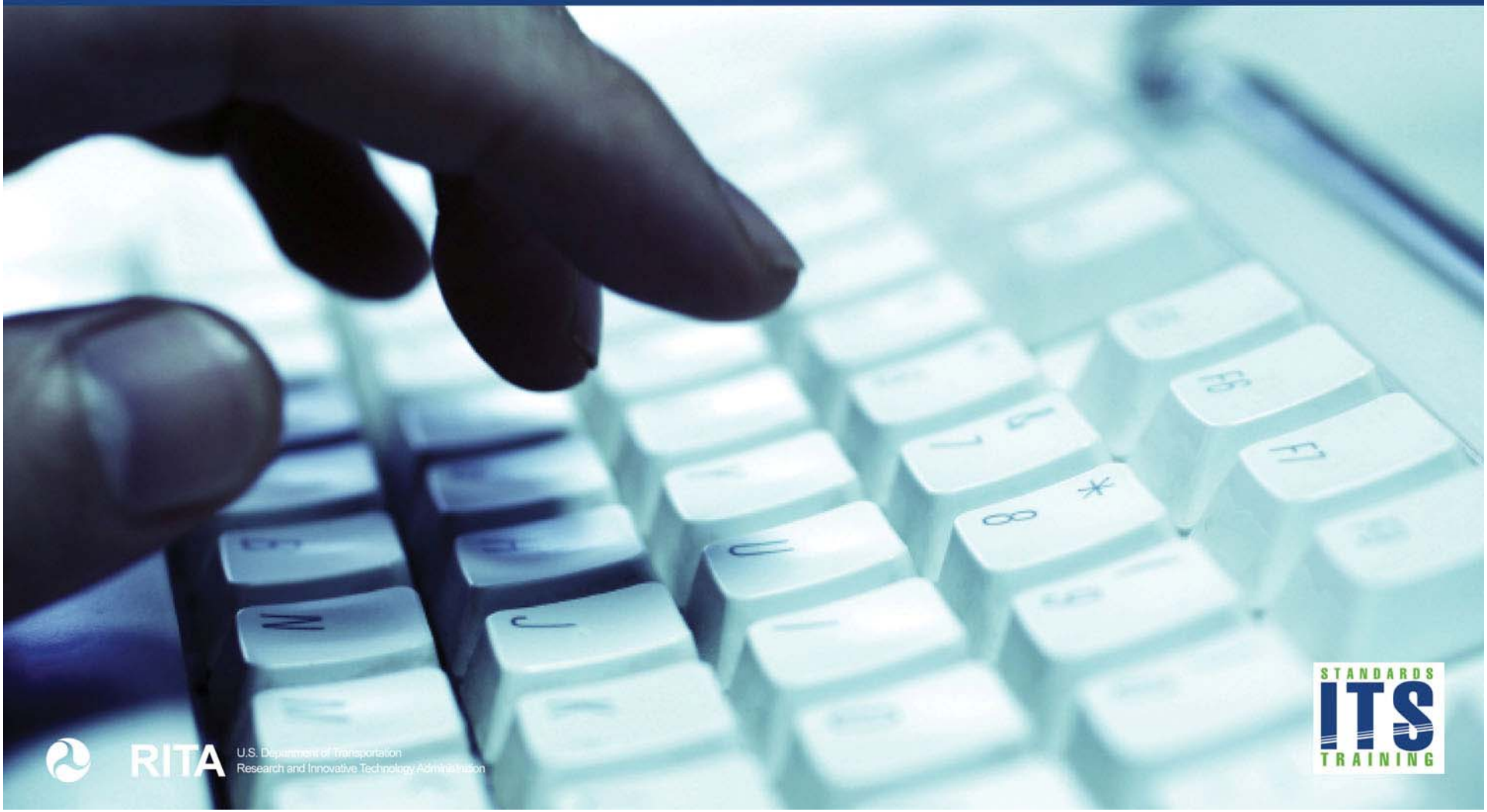
STANDARDS ITS TRAINING

Did you follow the SEP?

- Yes
- No

ACTIVITY



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STANDARDS ITS TRAINING

Do You Know What a User Need is?

- Provide an example in the chat pod

What is a User Need?

- Describes the major capability provided by a system
  - A system should not be procured or built without first knowing what it is expected to do.
  - User needs help to assess/validate if a system does what the user wants it to do.

From IEEE Std 1362-1998 Guide for Information Technology System Definition Concept of Operations Document

"A user requirement for a system that a user believes would solve a problem experienced by the user."

"The user's set of qualitative and quantitative requirements in a particular problem domain."

Who Establishes a User Need?

- A stakeholder – anyone who has a stake in the implementation, operation, and maintenance of a system.
- Typically a team made up of individuals, for example:
  - System purchaser, Project Manager
  - Planning and Design
  - TMC Operator, Field Maintenance, Operational Support
  - Other regional partners, sponsors
  - Politicians, regulators, the public

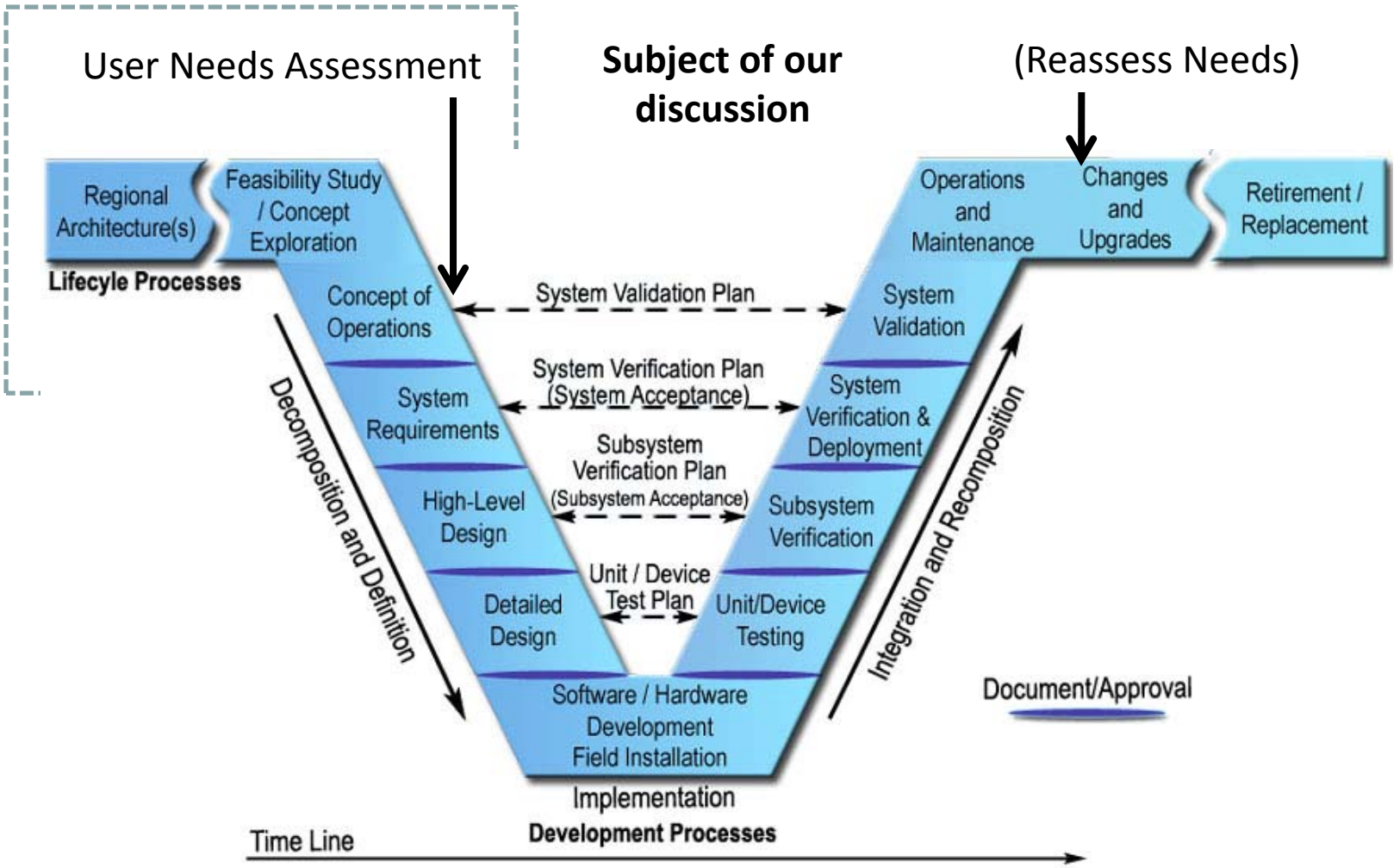
From Where are User Needs Derived?

- Regional architecture
- Case studies (lessons learned)
- Existing systems (Concept of Operations/Project Concept)
- User needs workshops and interviews
- Standards with SEP content

Why Focus on User Needs?

- User needs are critical to assess/validate whether a system does what the user wants it to do.
- User needs tend to remain stable over time
  - If needs changed frequently it would be impossible to build a system interface to satisfy those needs.
  - This inherent stability in user needs bounds the scope of the system interface.

Systems Engineering Process-SEP



*Source: V diagram adopted from U.S. Department of Transportation, Systems Engineering for ITS,*U.S. Department of Transportation. January 2007

Well-Written User Needs

1. **Uniquely Identifiable**: Each need must be uniquely identified (i.e., each need shall be assigned a unique number and title).
2. **Major Desired Capability (MDC)**: Each need shall express a major desired capability in the system, regardless of whether the capability exists in the current system or situation or is a gap.
3. **Solution Free**: Each need shall be solution free, thus giving designers flexibility and latitude to produce the best feasible solution.
4. **Capture Rationale**: Each need shall capture the rationale or intent as to why the capability is needed in the system.

UN ID#	UN Title	User Need	Remark

Real-World User Need Example

- City of Minneapolis
  TMC Upgrade & ITS Enhancements

  December 8, 2008

No.	Gaps and Deficiencies	Needs	Operational Scenarios
12	Stakeholders agreed that there is an operational gap in signal coordination between Minneapolis and neighboring jurisdictional areas.	Procure and deploy a traffic control system that has the capability to monitor and implement signal coordination for the arterials that cross the neighboring jurisdictional boundaries.	
13	Stakeholders agreed that there is a gap in sharing cameras to monitor real-time traffic among agencies.	Improve the capability to share surveillance cameras between the City and related stakeholders.	2, 3, 4
14	Stakeholders agreed that there is a gap in coordinating the dissemination of traveler and incident information to the public.	Improve the capability and partnership with related stakeholders to exchange, report and disseminate traveler information and incident information to the public.	2, 3, 4, 5, 6, 11, 12

Poorly Written User Needs

- Not a capability the system must have (wants versus needs).
  - Ask the question of each need – if I removed it, would the system be missing some important capability?
- Not solution free (for example, indicating a specific vendor or technology solution).
- Vague (makes it difficult to assess/validate if a system does what the user wants it to do).

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Poorly-Written User Needs (Examples)

- **8.4.5** The system needs to manage Lane Control Signals (LCS)
  - Note: There are no LCS deployed in the region.

Which of the following criteria is violated?

1. Uniquely Identifiable
2. Major Desired Capability
3. Solution Free
4. Capture Rationale

Poorly Written User Needs (Examples)

- **12.7** The Dynamic Message Sign (DMS) needs to be NTCIP-compliant so that it may be procured from various vendors.

Which of the following criteria is violated?

1. Uniquely Identifiable
2. Major Desired Capability
3. Solution Free
4. Capture Rationale

ITS Standards with SEP Content (as of Oct-27-2010)

C2F Device Standards (Recommended, pending SDOs approvals)

1. National Transportation Communications for ITS Protocol (NTCIP) 1203 Dynamic Message Signs (DMS) v2.0
2. NTCIP 1204 Environmental Sensor Systems (ESS) v3.0
3. NTCIP 1209 Transportation Sensor Systems (TSS)
4. NTCIP 1210 Field Master Stations (FMS), Part I SSM (v1.46)
5. NTCIP 1211 Signal Control and Prioritization (SCP) v2.0
6. NTCIP 1213 Electrical and Lighting Management Systems (ELMS) v2.0

C2C Standards Approved by SDOs

7. Traffic Management Data Dictionary (TMDD) v3.0
8. NTCIP 2306 C2C XML

Structure of Standards with SEP Content (C2C)

- Concept of Operations/User Needs section
- Requirements section
- Design section(s)
- Needs to Requirements Traceability Matrix (NRTM)
  - In C2F Protocol Requirements List (PRL)
- Requirements Traceability Matrix (RTM)

Example

TMDD v3.0 Standard

- This standard, containing SEP content, defines information flows between a TMC and other centers.
- Covers exchange of field device information (DMS, CCTV, etc.)
- Covers exchange of road condition information (e.g., incident information)
- User needs are defined and listed by functions
- Each user need is traced to ensuing requirements (NRTM)
- Traces each requirement to design content (RTM)
- Works well with modern XML communication protocol
- See TMDD v3.0 guide for user needs discussion

TMDD v3.0

Where do I find it?

http://www.ite.org/standards/tmdd/

Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC) v3.0

Title	Order Now
Volume I	
Volume II	

TMDD Volume I - Table of Contents

TMDD Volume I - Table of Contents

Example of TMDD User Need(s)

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. Messages may be either freeform text messages, in MULTI-string format, or from a library associated with the DMS.

When a control request is received, the center that controls the DMS needs to make a determination if the message will be implemented, queued, or rejected. Then, the center that controls the DMS needs to send a response to the center that originated the request describing the status (action taken) on the control request.

Needs to Requirements Traceability Matrix (NRTM)

UN ID	User Need	UN Selected	Requirement ID	Requirement	Conformance	Support	Other Requirements
2.3.6.4.4	Need to Display a Message on a Remote DMS	Yes / No	3.3.6.1.4.1	Contents of Device Control Request Header	M	Yes	
			3.3.6.1.4.1.1	Required Device Control Request Header Content	M	Yes	
			3.3.6.1.4.1.2.1	Operator Identifier	O	Yes / No	
			3.3.6.1.4.1.2.2	Request Priority	O	Yes / No	
			3.3.6.1.4.1.2.3	Request Expiration Date and Time	O	Yes / No	
			3.3.6.1.4.1.2.4	Event Identifier	O	Yes / No	
			3.3.6.1.4.1.2.5	Event Response Plan	O	Yes / No	
			3.3.6.1.4.1.2.6	External Center Organization	O	Yes / No	
			3.3.6.1.4.1.2.7	Request Date and Time Information	O	Yes / No	
			3.3.6.1.4.2	Contents of Device Control Request Response	M	Yes	
			3.3.6.1.4.2.1	Required Device Control Response Content	M	Yes	
			3.3.6.1.4.2.2.1	Operator Identifier	O	Yes / No	
			3.3.6.1.4.2.2.2	Operator Lock Identifier	O	Yes / No	
			3.3.6.1.4.2.2.3	Owner Center Organization	O	Yes / No	
			3.3.6.1.4.2.2.4	Operator Last Revised Date and Time	O	Yes / No	
			3.3.6.5.3.1	Send DMS Control Response Upon Request	M	Yes	
			3.3.6.5.3.2	Contents of DMS Control Request	M	Yes	
			3.3.6.5.3.2.1	Required DMS Control Request Content	M	Yes	
			3.3.6.5.3.2.2.1	Beacon Control	O	Yes / No	
			3.3.6.5.3.3	Contents of DMS Control Response	M	Yes	

TMDD v3.0

Additional training available:

Module A321a: Understanding User Needs for Traffic Management Systems Based on TMDD V3 Standard

This module will provide participants with information on how to identify the appropriate use of the TMDD V3 standard and acquire a Traffic Management system based on what the user is seeking to accomplish with support from tools and resources such as Needs to Requirements Traceability Matrix (NRTM) in following a systems engineering process.

NTCIP 1203 Example

Overview of NTCIP 1203 DMS

- Specifies the logical interface between DMS and the host systems that control them ("central" systems)

Organization of NTCIP 1203 DMS

- Concept of Operations
- Functional Requirements
  - Includes Protocol Requirements List (PRL) - same as NRTM
- Dialogs Specifications
- Management Information Base
- Mark-Up Language for Transportation Information (MULTI)
- Requirements Traceability Matrix

NTCIP 1203 DMS

- Where do I find it?

  www.ntcip.org/library/documents/

1203	Device Data Dictionary	NTCIP Object Definitions for Dynamic Message Signs (DMS)	

9002	Information Report	NTCIP VDOT Case Study on VMS	
9003	Information Report	NTCIP WashDOT Case Study on VMS	

NTCIP 1203 DMS

- Document Status
  - v01 Jointly Approved; v02 Recommended Standard
- Take Note of Multiple Versions
  - "Shopping cart" initiates download of 1203 v01
  - PDF for 1203 v02 Recommended Standard posted at bottom of the page.

Example User Needs from NTCIP 1203 DMS v02

2.5.3.1 Perform Diagnostics

This feature enables the operator to test the operational status of system components. It consists of the following sub-features:

a) Determine Sign Error Conditions (High-Level Diagnostics)

b) Monitor Sign Subsystem Failures (Mid-Level Diagnostics)

2.5.3.1.13 Monitor Fuel Level

This feature enables the operator to monitor the level of fuel within the tank of a generator that is being used to operate the DMS. This feature is typically used in portable signs.

3.3.8 Protocol Requirements List (PRL)

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.3.1	Perform Diagnostics			M	Yes	
2.5.3.1.1	Determine Sign Error Conditions—High-Level Diagnostics			M	Yes	
		3.5.3.1.1.1 (LampTest)	Execute Lamp Testing	Lamp OR Fiber:M	Yes / NA	
		3.5.3.1.1.2 (Pixel Test)	Activate Pixel Testing	Matrix:M	Yes / NA	
		3.5.3.1.1.3 (ClimateTest)	Execute Climate-Control Equipment Testing	O	Yes / No	
		3.5.3.1.2	Provide General DMS Error Status Information	M	Yes	

Project User Needs

- Map your project User Needs to the User Needs provided in existing standards with SEP content.

UN ID#	UN Title	User Need	Remark

VDOT/VTTI Early Deployment

- Virginia DOT, Virginia Tech Transportation Institute, FHWA and Trevilon (2007)
- Demonstrated value of systems engineering
  - Traceability ➔ quick identification of problems
    - Consensus because everyone can see
      - Requirement
      - Need
      - Design
  - Identification of problem ➔ assign action item
  - Assigned action item ➔ resolution of problems
  - Resolution of problem ➔ accepted product
  - Accepted product avoids conflict and legal issues

NTCIP 1203 DMS

Additional training to be available:

Module A311a-Understanding User Needs for DMS Systems Based on NTCIP 1203 Standard

This module will provide participants with information on how to identify the appropriate use of the NTCIP 1203 standard and acquire a Dynamic Message Sign system based on what the user is seeking to accomplish with support from tools and resources such as a Protocol Requirements List (PRL) in following a systems engineering process.

Additional Examples of Standards with SEP Content

NTCIP 1204 ESS v3.0

- Environmental Sensor Station Interface Standard

2.5.2.1.1 Monitor Atmospheric Pressure

A transportation system operator may need to monitor the atmospheric pressure in the vicinity of the ESS.

2.5.2.1.2 Monitor Winds

A transportation system operator may need to monitor the current wind conditions in the vicinity of the ESS.

NTCIP 1209 TSS v02

- Transportation Sensor Systems provide timely and accurate information on traffic flow

2.5.4 Collect Data from TSS

The various sub-features for collecting data from the TSS include:

a) Retrieve In-Progress Sample Data

b) Retrieve Most Recently Completed Sample Data

c) Retrieve Historical Sample Data

NTCIP 1210 FMS Part I SSM v1.46

- Field Master Stations – Object Definition for Signal System Masters which manage a small set of Signal System Locals (SSL) traffic signals.

2.5.1.2.5.1 Configure Traffic Responsive Mode

To operate in an traffic responsive mode, a system owner needs to configure the SSM to assign which system detectors to obtain data from, configure the pattern selection frequency, and to select which traffic-responsive algorithm (Threshold or Signature) to use. Once these selections are made, the SSM directs the SSL to engage the plan that contains these elements.

NTCIP 1211 Signal Control and Prioritization (SCP) v01 vs. v02

- Defines the Management Information Base for Signal Control and Prioritization systems.

2.5.1.1.3 Configure Reservice Period

A management station needs to define the reservice period between when servicing one priority request is completed and when a subsequent priority request is serviced. This feature allows an operator to prevent the Priority Request Server (PRS) from constantly servicing priority requests, therefore disrupting traffic flow. This feature also helps maintain headways to prevent bunching of transit vehicles.

NTCIP 1213 Electrical and Lighting Management Systems (ELMS) v2.0

- ELMS equipment is a telemetry-based remote monitoring and control system for highway lighting.

2.4.1.2.9 Provide Periodic Power Meter Measurement Logging

The management station may need to configure the ELMS device to keep a local log of periodic measurements of the voltage, current, power, and energy.

NTCIP 2306 C2C XML v2.0

- Allows transportation agencies and center managers to specify and implement communications interfaces for transmitting eXtensible Markup Language (XML) between centers.

2.1 Profile Need (PN 2.1) Message Encoding Privacy

Privacy. This profile needs a mechanism to allow messages to be privately transmitted over the Internet and other shared networks.

Standards without SEP Content
(as of Oct-27-2010)

C2F Device Approved Standards

1. NTCIP 1202 Actuated Traffic Signal Controller (ASC)
2. NTCIP 1205 Closed Circuit Television (CCTV)
3. NTCIP 1206 Data Collection
4. NTCIP 1207 Ramp Meters
5. NTCIP 1208 Video Switches
6. NTCIP 1214 Signal Monitor Unit (SMU) Conflict Monitoring

Domain Standards (includes C2C communication protocols)

7. IEEE 1512 Incident Management
8. IEEE 1609.X DSRC
9. SAE J2354 ATIS
10. SAE LRMS Series
11. SAE J2735 DSRC Message Sets
12. ITS Cabinet
13. ITE ITS Advanced Traffic Controller v5.2

Equipment Standards

14. ITS Cabinet v1
15. ATC Controller Standard v5.2b

Extracting User Needs from Standards without SEP Content

- In order to clearly understand what capabilities of a standard you will implement, you want to define user needs for these standards.
- Take Module A202:

  Identifying and Writing User Needs When ITS Standards Do Not Have SEP Content

What did we Learn Today?

1) ___User___ ___Needs___ describe the major capability provided by a system.

2) Criteria for a well-written User Need:

   a) Uniquely ___Identifiable___

   b) Describe Major Desired ___Capability___ (MDC)

   c) Are Solution ___Free___

   d) Capture ___Rationale___ or ___Intent___

3) Identified eight (8) ITS standards that contain ___Systems___ ___Engineering___ ___Process___ (SEP) content

4) How to select User Needs from the ___Concept___ of ___Operations___ section

Conclusion

- Identified User Needs
- Identified standards that have gone through Systems Engineering Process (SEP)
- Selected User Needs for standards that have been through SEP
- Identified standards without SEP content.
  - Identifying and Writing User Needs When ITS Standards Do Not Have SEP Content (Module A202)

Module A201

Next Module:

Details on Acquiring Standards-based ITS Systems

The module will provide guidance on selecting the appropriate standard for acquiring standards based systems that take into account the specifications, processes, and roles of users and staff.

Where to Learn More

- Module Student Supplement
- NTCIP Guide
- TMDD v3 Guide
- IEEE 1512 Implementation Guide

QUESTIONS?

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