OVERVIEW OF ROADSIDE UNIT (RSU) STANDARD
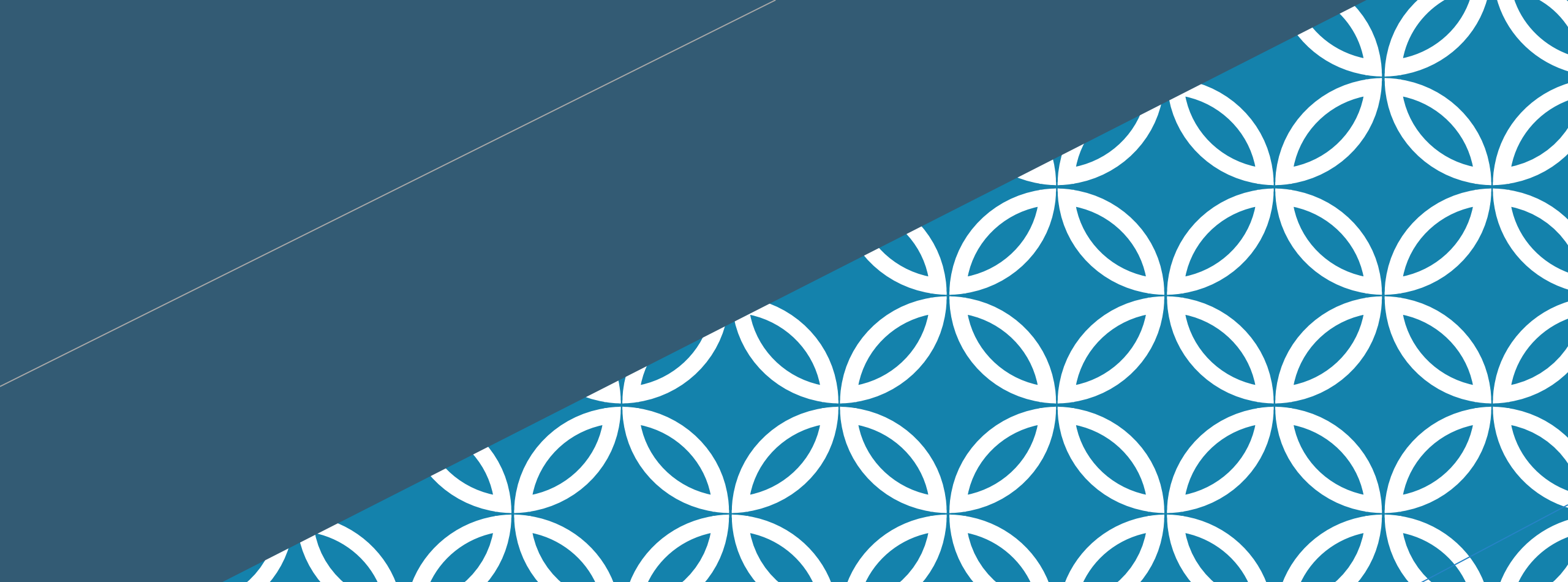
By

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Institute of Transportation Engineers (ITE)

DEVELOPMENT OF THE RSU STANDARD

Goal: Facilitate V2X interoperability by defining the common RSU functionality in a standard.

- A consensus-driven standard following an open, ANSI (American National Standards Institute) process.
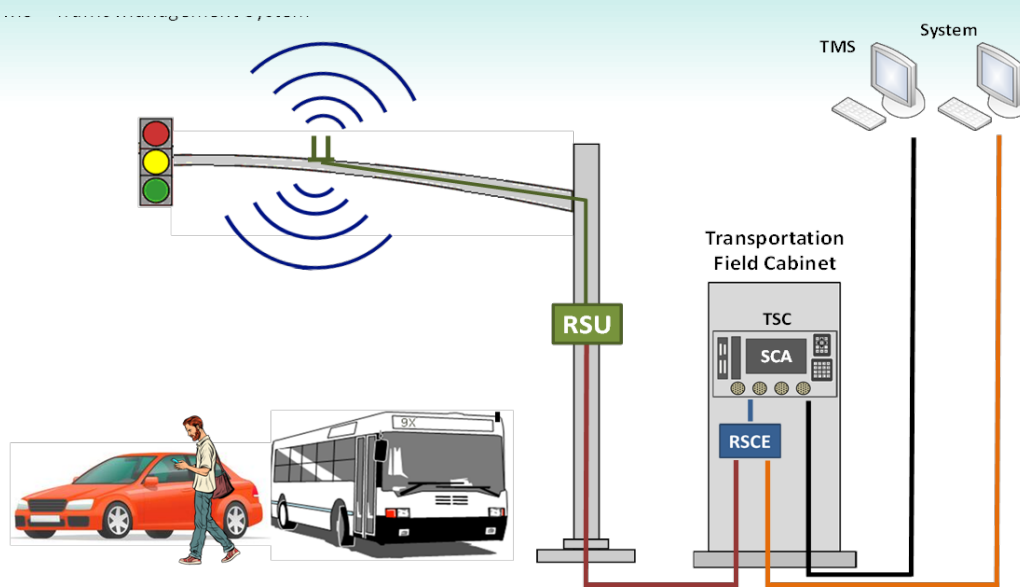
Funded by USDOT

Project was awarded to ITE in September 2019

Project Term: Sept 2019 – Sept 2021

WHAT IS AN RSU?

Roadside Unit

Wireless communications device within a "connected vehicle" system

- Vehicle to Infrastructure
- Talks to the 'on-board unit" – vehicle, pedestrian, etc.
- Transfers information to/from the roadside equipment (controller) and back-office

HISTORY OF THE RSU STANDARD

Dedicated Short Range Communication (DSRC) RSUs

Operate in the 5.9GHz spectrum

- Designated by FCC in 1999 for transportation safety
- The "safety spectrum"

HISTORY OF THE RSU STANDARD

DSRC RSU Specifications developed by USDOT to define the minimum performance requirements

- Basic Safety Pilot in Michigan
- V4.0 release in 2013 to improve security (SNMP v3, physical protection)
- V4.1 release in 2016 for the 2016 versions of the SAE and IEEE standards, improve security, and provided a basic MIB
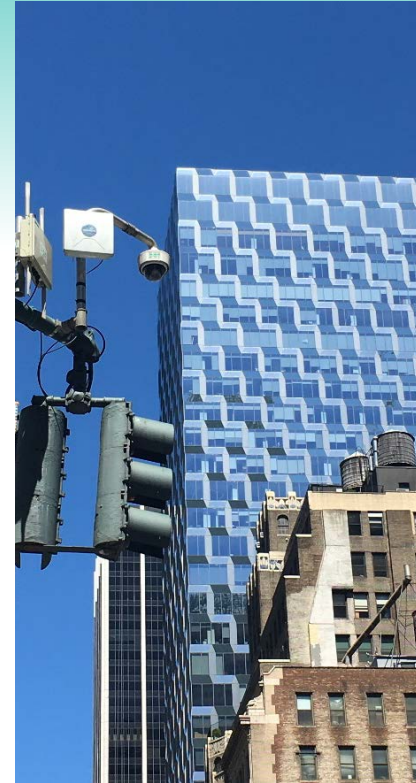
HISTORY OF THE RSU STANDARD

DSRC RSU Specifications Document specifies the following requirements for RSUs:

- Hardware requirements (environmental, physical)
- Functional and behavioral requirements
- Performance requirements

Focused on DSRC communications

Defined a Management Information Base (MIB) for the communications interface

NEED FOR INTEROPERABILITY

V2X technology has developed rapidly

Functionalities defined in the RSU 4.1 Specification had to evolve to meet current interoperability needs.

- Reflect deployment experiences
  - CV Pilot programs
  - Signal Phase and Timing (SPaT) Challenge projects
- Reflect changes in standards referenced
  - Support additional communications platform
    - Cellular Vehicle-to-Everything (C-V2X)
  - Security Credentials Management System (SCMS) evolution
  - Updates / Revisions (e.g., IEEE 1609.x family of standards)

HIGH-LEVEL FUNCTIONS OF THE RSU

Transmit wireless messages to travelers (via the OBU and MU)

Receive wireless messages from travelers (via the OBU and MU)

Provide trusted messages (security)

Support applications

Some examples of Applications Supported by an RSU include:

- Curve Speed Warning (CSW)
- Motorist Advisories and Warnings (MAW)
- Incident Scene Work Zone Alerts (INC-ZONE)
- Intelligent Traffic Signal System (I-SIG)
- BSM Pre-Processing

DEVELOPMENT PROCESS

Incorporates industry experience

Uses a systems engineering (SE) process

Large multidisciplinary group of stakeholders and in accordance with the ANSI development process

- Identify functional elements of a proposed operation based on stakeholder needs
- Establish a high level system design
- Establish boundaries, interfaces and constraints

DEVELOPMENT OF THE RSU STANDARD

Sponsored by **USDOT, the Standards Development Organizations (SDOs)** involved include:

- Institute of Transportation Engineers (ITE)

- American Association of State Highway Transportation Officials (AASHTO)

- Institute of Electrical and Electronic Engineers (IEEE)

- National Electrical Manufacturers Association (NEMA)

- SAE International

INTERFACES OF AN RSU

RSU – Roadside Unit
RSCE – Roadside Cabinet Electronics
TSC – Traffic Signal Controller
SCA – Signal Control Application
TMS – Traffic Management System

RSU Connection
RSCE TSC Connection
TMS Network
Back-Office Network
Antenna Connection

Back-Office System

TMS

Transportation Field Cabinet

RSU

TSC

SCA
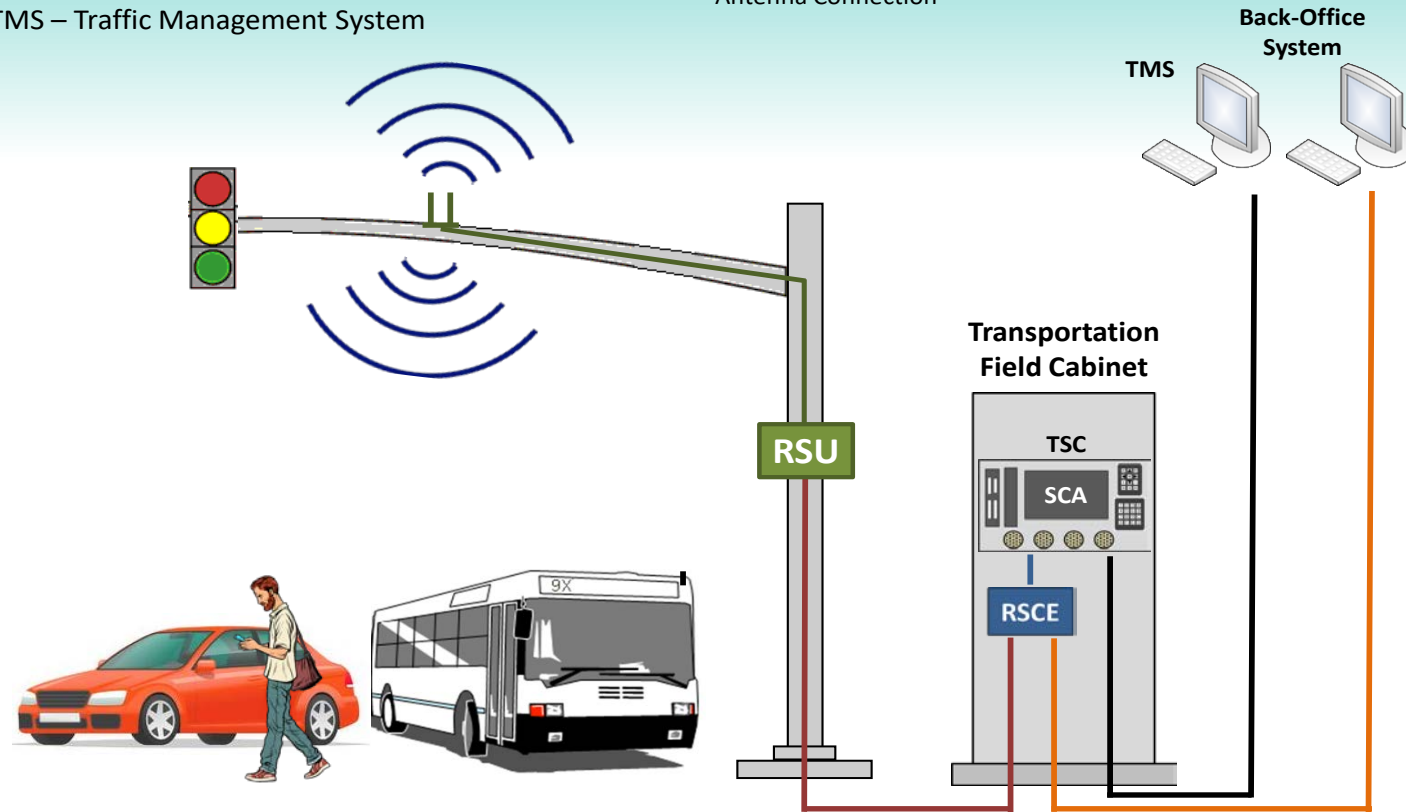
RSCE

INTERFACES OF AN RSU

RSU – Roadside Unit
RSCE – Roadside Cabinet Electronics

RSU Connection
Back-Office Network
Antenna Connection

Back-Office System

RSU

Cabinet

RSCE
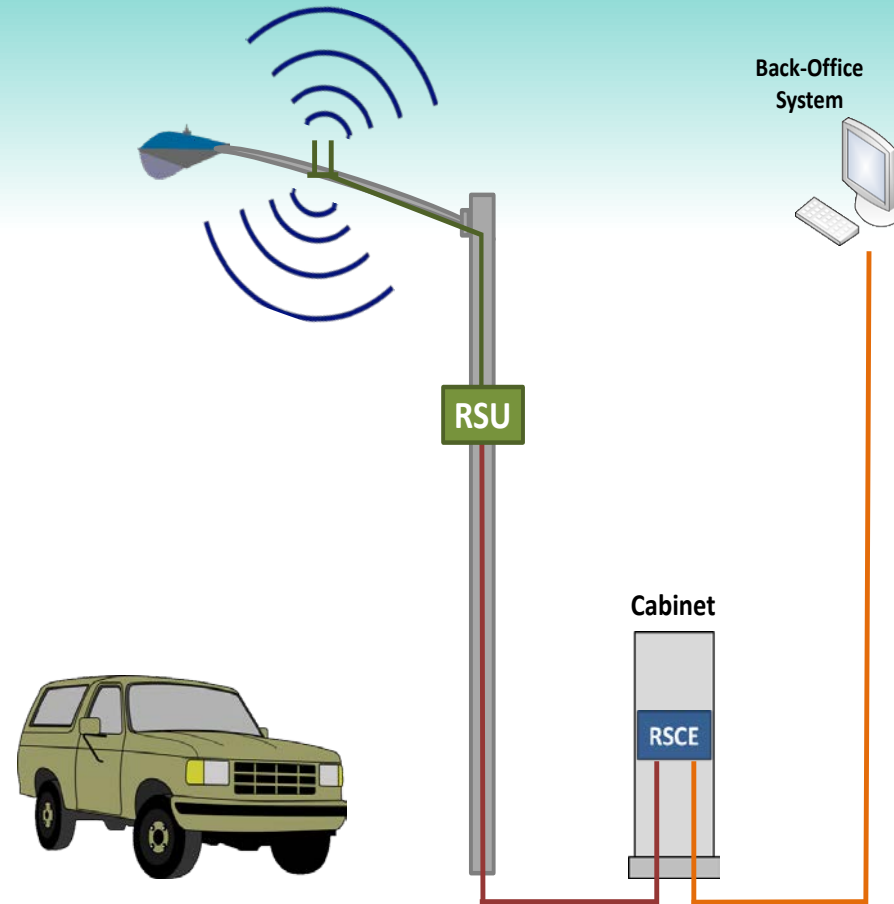
SYSTEMS ENGINEERING PROCESS

Concept of
Operations

System
Requirements

High-Level
Design
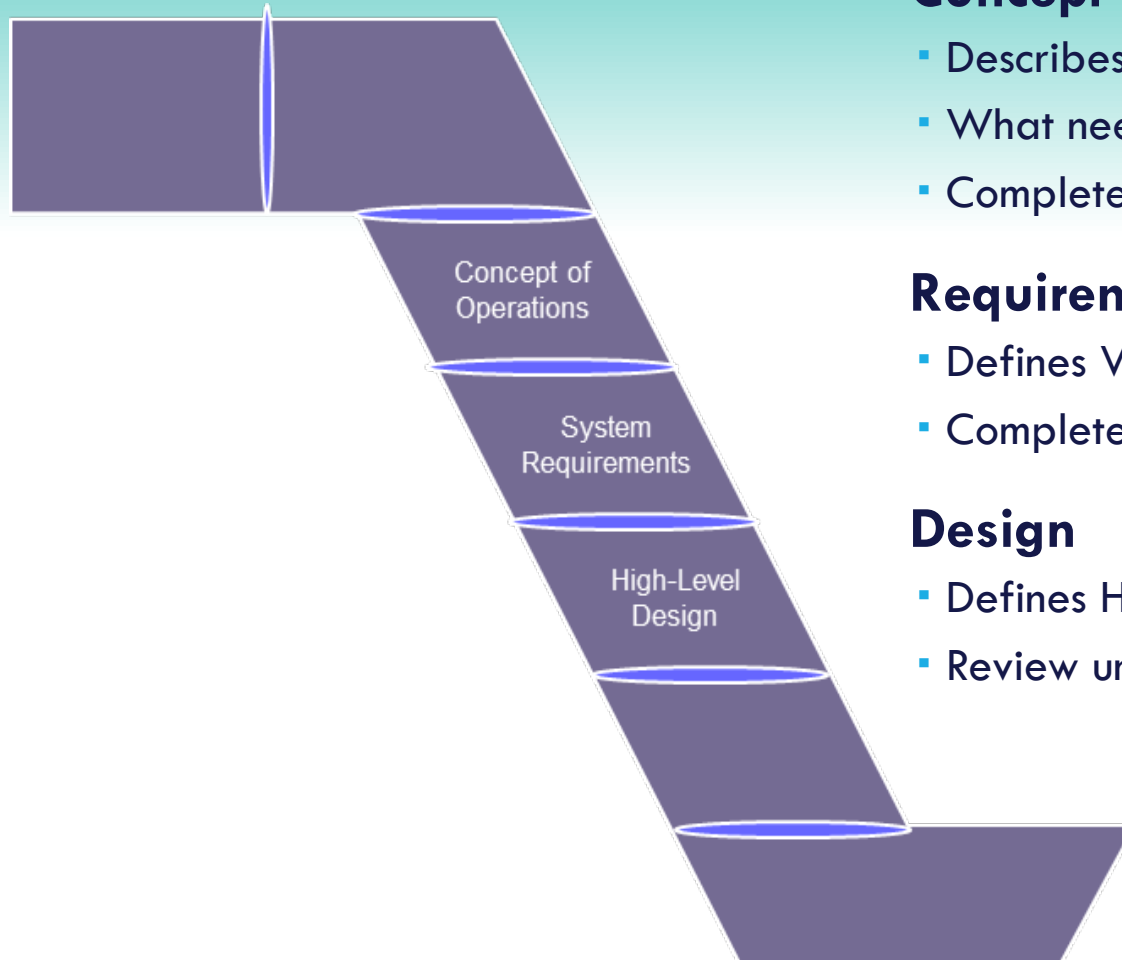
Concept of Operations

- Describes the current situation
- What needs the RSU addresses
- Completed July 2020

Requirements

- Defines WHAT RSU is to do
- Completed Nov 2020

Design

- Defines HOW RSU is to be built
- Review underway

SYSTEMS ENGINEERING PROCESS

Final RSU Standard

- Fully balloted and approved RSU Standard
- February – September 2021

Develop Reference Implementation

- Build RSU per the Standard
- March – August 2020

Project will be complete: September 2021

QUESTIONS?

AGENDA

- **Overview of Available NTCIP Standards**

- **Standards Development / Updated Process & Timeline**

- **Role of SDOs & Voting Members**

- **CAV (RSU and CI) Standards in the Pipeline**

WHAT IS NTCIP?

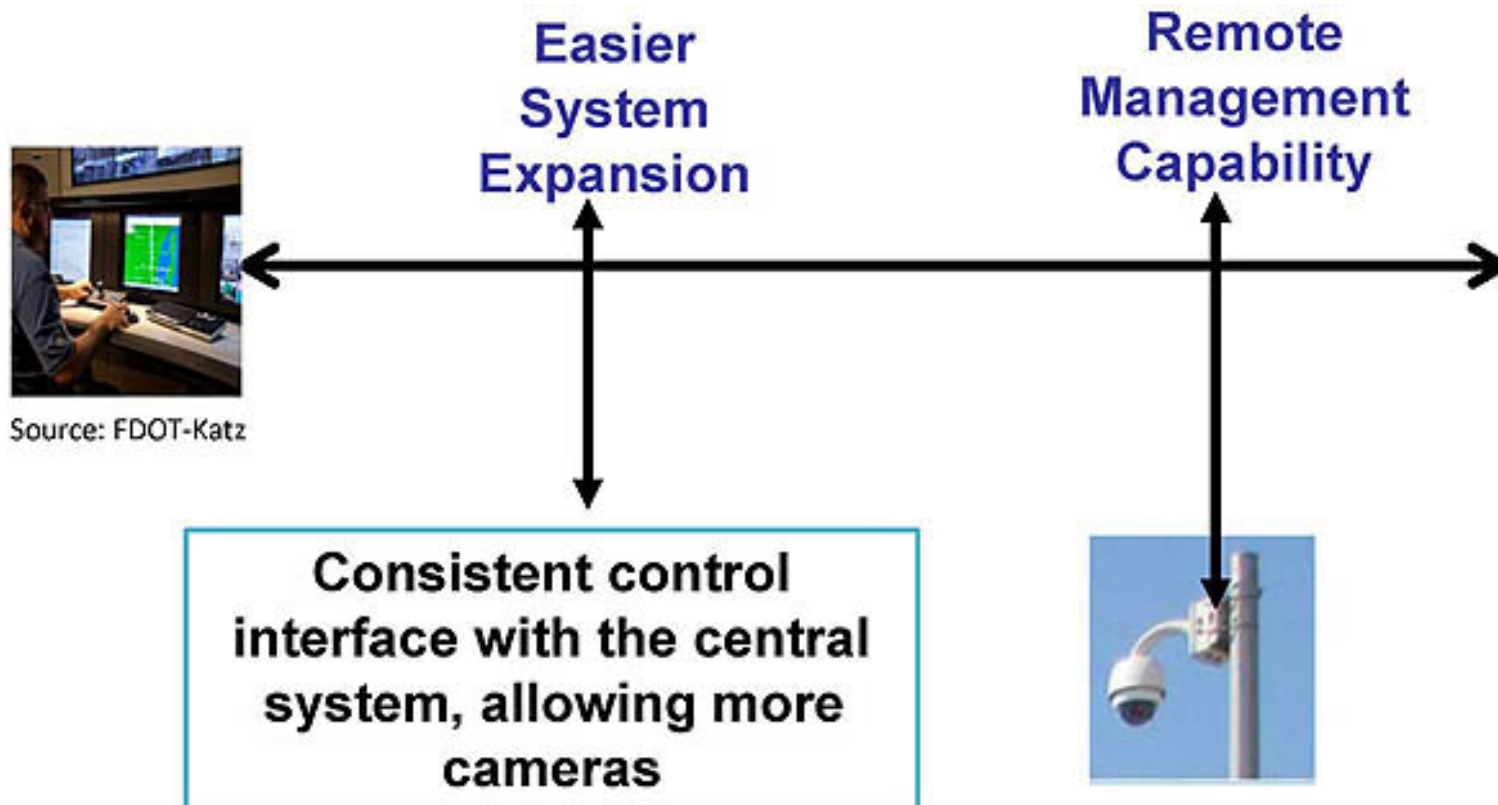- **National Transportation Communications for ITS Protocol (NTCIP)**

- **The NTCIP is a family of open standards, defining common communications protocols and data definitions.**

- **NTCIP is a joint effort of the:**
  - **American Association of State and Highway Transportation Officials (AASHTO)**
  - **Institute of Transportation Engineers (ITE)**
  - **National Electrical Manufacturer's Association (NEMA)**

WHAT IS NTCIP?

- **Developed to address proprietary communications protocols**
  - **Without competition agencies were locked into a vendor**
    - **Limited Innovations**
    - **Little advantageous Pricing**
- **Addresses Center-to-Field (C2F) Interfaces**
- **Addresses Center-to-Center (C2C) Interfaces**

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NTCIP CONCEPTS AND BENEFITS

- **Facilitates ITS deployments**
- **Eliminates need for proprietary solutions**

Easier System Expansion

Remote Management Capability

Source: FDOT-Katz

Consistent control interface with the central system, allowing more cameras
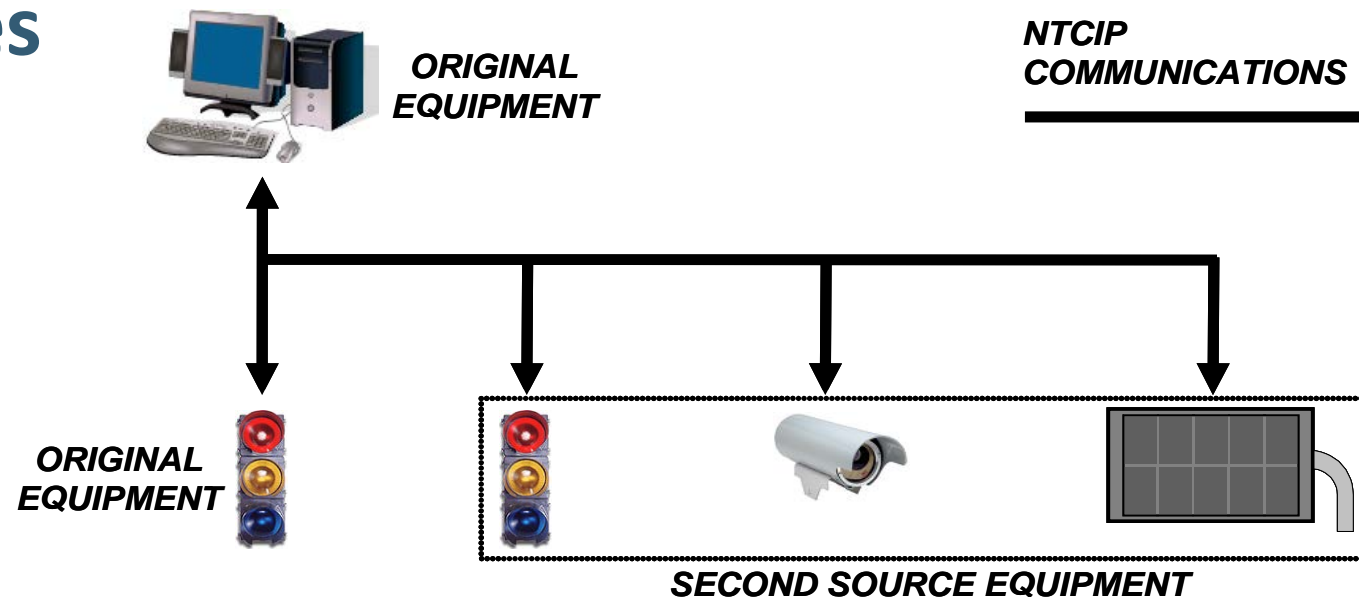
NTCIP CONCEPTS AND BENEFITS

- **Provides a choice of manufacturer**
  - **Supports interoperability of manufacturer's equipment when specifications are based on the NTCIP**
  - **Choice of vendors has been established for many devices**
- **Phased procurement and deployment**
  - **Faster deployment has been demonstrated**
- **Reduced (lifetime) cost of devices and central software**

NTCIP CONCEPTS AND BENEFITS

- **Different types of devices can communicate on a single communications network**

- **Enables interagency coordination and sharing of devices**

ORIGINAL
EQUIPMENT

NTCIP
COMMUNICATIONS

ORIGINAL
EQUIPMENT

SECOND SOURCE EQUIPMENT

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NTCIP CONCEPTS AND BENEFITS

- **Hundreds of NTCIP deployment in the United States**
  - **US – usage is NOT mandatory**
    - **Agencies require NTCIP because of the benefits**
- **NTCIP has been broadly adopted (17+ Countries)**

1200 SERIES INFORMATION LEVEL STANDARDS

Standard Number	Version	Device
NTCIP 1201	v03	Global Objects (GO)
NTCIP 1202	v03A	Actuated Signal Controller (ASC)
NTCIP 1203	v03	Dynamic Message Signs (DMS)
NTCIP 1204	v03	Environmental Sensor Station (ESS)
NTCIP 1205	V01 + Amend. 1	Closed Circuit Television Camera (CCTV)
NTCIP 1206	2005	Data Collection (DCM)
NTCIP 1207	V02	Ramp Meters (RM)
NTCIP 1208	2005	Video Switch (VS)
NTCIP 1209	V02	Transportation Sensor Systems (TSS)
NTCIP 1210	V01	Field Management Station (FMS)
NTCIP 1211	V02	Signal Control and Prioritization (SCP)
NTCIP 1213	V02	Electrical and Lighting Management Systems (ELMS)
NTCIP 1218	V01	Roadside Units (RSU)

STANDARDS DEVELOPMENT

- **Standards Development Process**

- **Timeline**

- **SDO and Voting Member Roles**

STANDARDS DEVELOPMENT PROCESS

Step	Process	Timeline
1	Submit request to initiate standards activity	
2	Joint Committee (JC) votes to form Working Group (WG)	
3	JC forms a Working Group	
4	WG develops Working Group Draft for informal review	May take 6-12 months
5	WG prepares User Comment Draft	
6	JC votes on distribution of User Comment Draft	
7	JC distributes User Comment Draft through SDOs and receives comments	
8	WG resolves user comments	
9	WG decides to submit a "resolved" version as a Recommended Standard	
10	WG prepares a Draft Recommended Standard	
11	JC votes on submission of Recommended Standard to SDOs	
12	JC forwards Recommended Standard to SDOs	
13	SDOs approve the Recommended Standard and thereby create the Standard	May take 2-3 months
14	SDOs maintain the Standard	

UPCOMING STANDARDIZATION PROJECTS

- **Roadside Units (RSU)**

- **Connected Intersections (CI)**

- **ISSA**

ROADSIDE UNIT (RSU) STANDARDIZATION

- ## Background/Motivation

  - The USDOT has made significant previous investments in defining the user needs, requirements and design elements of RSUs through the RSU Specification 4.1 and the development of NTCIP 1218 Object Definitions for Roadside Units (RSUs).

  - This Roadside Unit (RSU) Standardization Project supports interoperability for state and local infrastructure owner/operators and provides the ability to connect to mobile devices including automotive original equipment manufacturer (OEM) vehicles and other users of RSU messages to support a variety of applications related to transportation safety and mobility.

ROADSIDE UNIT (RSU) STANDARDIZATION

- ## Goals/Participants

  - This document was developed by engaging with stakeholders representing the industry at large including but not limited to IOOs, OEMs, RSU manufacturers and the end users of data and services and was supported by the USDOT ITS Joint Program Office (JPO).

  - Several associations - such as AASHTO, ITE, NEMA and SAE International – are involved in ensuring balanced and effective stakeholder representation and adherence to standards development process as Standards Development Organizations (SDOs).

- ## Current Project Status

  - The Concept of Operations and Functional Requirements have been delivered.

  - Currently finishing the Design Details Document (Design Details Walkthrough Workshop to be held Dec. 1-3).

PROJECT STATUS

- Sept. 18, 2019 - Roadside Unit (RSU) Standardization Project Begins

- July 12, 2020 – FINAL ConOps Submitted

- August 25 – August 28 Requirements Walkthrough

- October 12 - Final Requirements Document

- Deliver Initial Design - November 2020

- **<u>Design walkthrough - December 1-3, 12:00 to 5:30pm 2020</u>**

- Deliver updated draft design - December 2020

- Deliver first draft standard for working group ballot – March, 2021

- Balloting by working group to be completed by May 2021

- **<u>SDO Balloting period complete by August 2021</u>**

- Publish Standard - September 2021

CONNECTED INTERSECTIONS (CI) GUIDANCE

- ## Background/Motivation

  - **Development of implementation guide to address the ambiguities and gaps identified by early deployers and provides guidance to generate messages and develop applications for signalized intersections that are truly interoperable across the United States, especially for automated transportation systems.**

  - **This document focuses on harmonizing the existing SPaT message, using the USDOT-sponsored Cooperative Automated Transportation Clarifications for Consistent Implementations (CCIs) To Ensure National Interoperability Connected Signalized Intersections as a starting point.**

CONNECTED INTERSECTIONS (CI) STANDARDIZATION

- ## Goals/Participants
  - This document is being developed with the combined effort of stakeholders representing the industry at large including but not limited to IOOs, Automotive Original Equipment Manufacturers (OEMs), Fleet and Truck operators, safety advocacy groups, multimodal partners and end users of data and services
  - Several associations - AASHTO, IEEE, ITE, NEMA, IEEE and SAE International - are involved in ensuring balanced and effective stakeholder representation and adherence to Standards Development Process as Standards Development Organizations (SDO). Several modal agencies within USDOT were also engaged so that safety, fleet, trucking and pedestrian interests are safeguarded as well as in providing resources as needed to help implementation within two years.

PROJECT SCHEDULE

Draft Requirements Document – Distribute by Nov 23.
- Submit written comments by December 4 using spreadsheet

Requirements Walkthrough
- December 7 – 10, 11:00 – 5:30 PM EST

Draft Final Requirements Document - January 15, 2021

Final Requirements Document Draft Implementation Guidance Document (Complete April 2021)

Validation (to be determined April – June 2021)

Publish Final Implementation Guidance Document (Complete September 2021)

Next CI Committee Meeting
- December 21, 2020, 3:00 – 5:00 PM EST

ISSA

- ## Background/Motivation
    - **ITE is proposing guidance for NTCIP standard updates that provide greater security within the Intelligent Transportation Systems (ITS) infrastructure, given the growing concerns associated with cybersecurity attacks and the increased connection of previously stand-alone equipment to communications networks.**
    - **The current ITS infrastructure standards alone do not adequately address security and it is critical that a strategy for implementing security functionality within the ITS infrastructure is addressed.**

- ## Goals/Participants
    - **Enhance security through the use of SNMPv3 or other NTCIP appropriate security mechanisms, and develop a way forward (plan/long-term roadmap) for implementing SNMPv3 within the NTCIP family of standards.**

CLOSING

QUESTIONS ?

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