Intelligent Transportation Systems (ITS) Joint Program Office (JPO)

Connected Vehicle Reference Implementation Architecture Update

Stakeholder's Webinar

November & December 2013

Transit Applications

Mobility

- Signals
  - (ECO) Transit Signal Priority
- Traveler Information
  - Advanced Traveler Information Systems
- Other Transit
  - Dynamic Ridesharing
  - Dynamic Transit Operations
  - **Integrated Multi-Modal Electronic Payment**
  - Intermittent Bus Lanes
  - Route ID for the Visually Impaired
  - Smart Park and Ride System
  - Transit Connection Protection
  - Transit Stop Request

Safety

- Vehicle to Infrastructure (V2I) Safety for Transit.
  - Curve Speed Warning
  - **Pedestrian in Signalized Crosswalk Warning**
  - Transit Vehicle at Station/Stop Warnings
- Vehicle to Vehicle (V2V) Safety for Transit
  - Forward Collision Warning
  - Vehicle Turning Right in Front of a Transit Vehicle

Poll Question 1

- **Which of the following best describes your role in Connected Vehicles?**
  - Federal Government
  - State DOT or Metropolitan Planning Organization
  - Local government
  - Car maker / OEM
  - Roadside equipment maker
  - Consultant
  - Academic
  - Other

Poll Question 2

- **How familiar are you with CVRIA (check all that apply)?**
  - ❑ Attended one of the previous webinars
  - ❑ Visited the CVRIA website
  - ❑ This is my first experience

CVRIA Update Webinars

- These webinars are meant to:
  - Familiarize attendees with the Connected Vehicle Reference Implementation Architecture (CVRIA) so that they will be equipped to provide feedback on the architecture
  - Provide an update on the development of the CVRIA
  - Review portions of the CVRIA Website
  - Discuss standardization planning and policy analysis
- Today's Speakers
  - Jeff Spencer
  - David Binkley, Ron Ice, Tom Lusco
  - Chris Karaffa, Jim Marousek
  - Scott Smith

CVRIA Update Webinar #6 – Agenda

Topic	Start	End
Welcome & Background/Overview	2:00	2:10
Introduce Applications of the Day	2:10	2:20
CVRIA Applications	2:20	3:15
Interface Selection / Standardization Planning	3:15	3:30
Pertinent Policy Issues	3:30	3:45
Q&A	3:45	4:00

(All Times Eastern)

CVRIA Update Webinar – Applications to be Reviewed

Applications for Webinar	Date
V2I • Red Light Violation Warning • Curve Speed Warning • Speed Harmonization (SPD-HARM)	Nov 6, 2013
Signal Applications • Intelligent Traffic Signal System • Emergency Vehicle Priority • Eco-Approach and Departure	Nov 14
Road Weather • Weather Responsive Traffic Management • Enhanced Maintenance Decision Support	Nov 19

CVRIA Update Webinar – Applications to be Reviewed, continued

Topics	Date
Freight & Fleet Operations • Smart Roadside Initiative • Freight Advanced Traveler Information Systems (FRATIS)	Nov 26
Support Applications • Data Distribution • Communications Support • Core Authorization	Dec 3
Transit Applications • **Pedestrian in Signalized Crosswalk Warning** • **Integrated Multi-modal Payment**	**Dec 10**
R.E.S.C.U.M.E. • Incident Scene Pre-Arrival Staging Guidance for Emergency Responders • Incident Scene Work Zone Alerts for Drivers & Workers	Dec 17

(Dates/Times and Specific Topics Subject to Change)

Connected Vehicle Reference Implementation Architecture (CVRIA)

Landscape: Safety, Mobility, Environmental Applications with common supporting infrastructure

- Purpose of CVRIA is to identify a framework for integrating connected vehicle technologies and identify interfaces for standardization
- By...
  - Collecting and aggregating connected vehicle needs/requirements
  - Developing a multi-faceted system architecture
  - Identifying and prioritizing candidate interfaces for standardization
  - Conducting policy analysis around the architecture
- Near term uses – Define interfaces/functions/standards to support early deployments, e.g. SE Michigan 2014
- Longer term – the National ITS Architecture will incorporate CVRIA to support use of connected vehicle in
  - regional ITS architectures/plans
  - future transportation projects
- So, we need your help:
  - Are we capturing the connected vehicle applications adequately?
  - Are we including all of the necessary interfaces?
  - We'll show you how to provide feedback via the website?

Poll Question 3

- With what area of the connected vehicle program are you or your stakeholders primarily interested?
  - Safety
  - Mobility
  - Environment
  - Support

CVRIA Website Users Guide

- This site uses Scalable Vector Graphics (SVGs) to produce diagrams that are crisp and support hyperlinks from the graphical elements to the detailed descriptions
  - Different web browsers support SVGs in different ways (some not at all). Try viewing the site with browsers like Firefox, Chrome, Safari for best results.
  - As an alternative to SVGs all graphics are also available Portable Network Graphics (PNG) format. You may have to click on the PNG option to see it.
- This site is still under construction, many pages are updated on a fairly regular basis. Make sure you are looking at the latest version of a web page by clicking “Refresh” or “Reload” within your browser.

Web Tour Road Map

Start here

JPO / Stds / Activities / CVRIA

Start / Home www.iteris.com/cvria/

What's the overall layout?

Architecture Viewpoints Tab

Let's focus on an application

Applications Tab

How do I learn about an app?

Physical Tab (objects, flows, comm)

Enterprise Tab (4 phases)

Functional & Requirements Tabs

What about standards?

Standards Tab

What else is here?

Resources / Glossary

How do I provide feedback?

Comment on Page

Let's Begin the Tour

Go To Website

http://www.standards.its.dot.gov/DevelopmentActivities/CVReference

Or

http://www.iteris.com/cvria/index.html

At conclusion of webtour Skip to Use of CVRIA Slides

Poll Question 4

- **Which of the Architecture Views presented interests you the most?**
  - Communications
  - Enterprise
  - Functional
  - Physical

Uses of CVRIA

Now that you've completed the 'tour' of the website, let's talk about some ways that CVRIA can be used...

SE Michigan 2014

- Provide platform for interoperability between vendors, operators and solution providers by developing V2I data exchanges
  - Field and Back-Office functions
- Developing Architecture Views using CVRIA:
  - Physical (What)
    - Multi-layer diagrams
  - Enterprise (Who)
  - Communications

Future Connected Vehicle Projects

- CVRIA 'Mini-Tool' allows developers to use the CVRIA Visio Drawings
- Customize physical view drawings to describe future projects using same 'language' and format
- Supports multi-layer approach
  - Layer 0 – high-level objects and interconnections
  - Layer 1 – project specific physical, application objects
  - Layer 2 – application level (just like the application drawings on CVRIA website)

Connected Vehicle projects can be defined as collections of applications from CVRIA and use the same 'language', interfaces, standards

CVRIA Next Steps

- November / December
  - Gathering feedback from webinars and website
  - Incorporate inputs
  - Update tools
- Ongoing
  - Maintain CVRIA
- 2014 / 2015
  - Monitor usage in Test Beds, Demos, Early Deployments
    - Updating architecture, tools as needed
  - Merge / Incorporate CVRIA into Nat'l ITS Arch

Intelligent Transportation Systems (ITS)
Joint Program Office (JPO)

Connected Vehicle Reference Implementation Architecture:

Standards Development Strategy and Plan

CVRIA and Standards

The USDOT's Intelligent Transportation Systems (ITS) Joint Program Office (JPO) is developing a standards plan to guide ITS standards-related efforts and activities in support of the USDOT ITS connected vehicle research program, and to support broad deployment of connected vehicle (CV) technologies

This plan will be a living document that will evolve as ITS technologies, implementation strategies, and policies develop

The plan will help the USDOT bridge the "standards gap"

Adopt ✓

- Lower effort, cost
- Quicker implementation
- Modify interface to meet the standard

Adapt ?

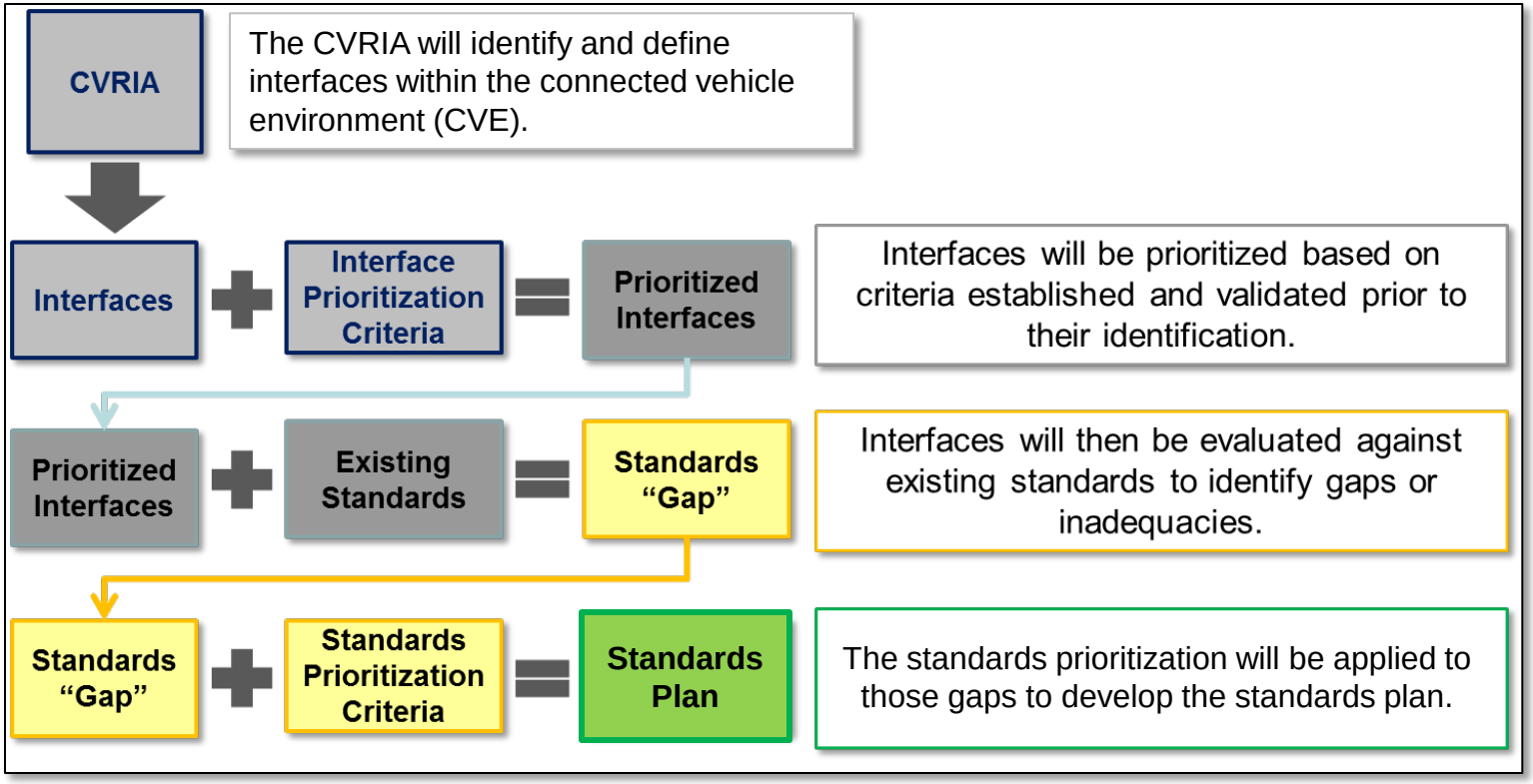
- Increased effort, cost
- Extended implementation
- Adapt standard to the extent possible, adapt interface as necessary

Create !

- Greatest effort, cost
- Longest implementation
- Get it "just the way you like it"

Standards Plan Approach

Once interfaces are identified and defined, they must be prioritized and associated with standards, which will then be prioritized



Using Prioritization

- Scoring process and criteria are not absolute
- They are one factor, among many, in determining how to allocate resources to support standardization activities

- They may be adapted to evolving goals and objectives

Next Steps

- **Currently**
  - The CVRIA viewpoints/database are being analyzed now to identify and define interfaces within the architecture.

- **Feedback**
  - Feedback on applications or other aspects of the architecture will help us to refine: *interface identification and definition; scoring; interpreting results.*

- **Second Public Workshop**
  - Presentation of findings and results of interface and standards prioritization
  - First opportunity to share results of the interface and standards analyses
  - Tentatively planned for the San Francisco Bay Area, February 19-20, 2014

Poll Question 5

- **Are these views clear and stable enough to start interface analysis for standards?**
  - Yes
  - No
  - Unsure

Intelligent Transportation Systems (ITS)
Joint Program Office (JPO)

Connected Vehicle Reference Implementation Architecture

and

Connected Vehicle Policy

Scott Smith
USDOT / Research and Innovative Technology Administration /
Volpe National Transportation Systems Center

December 2013

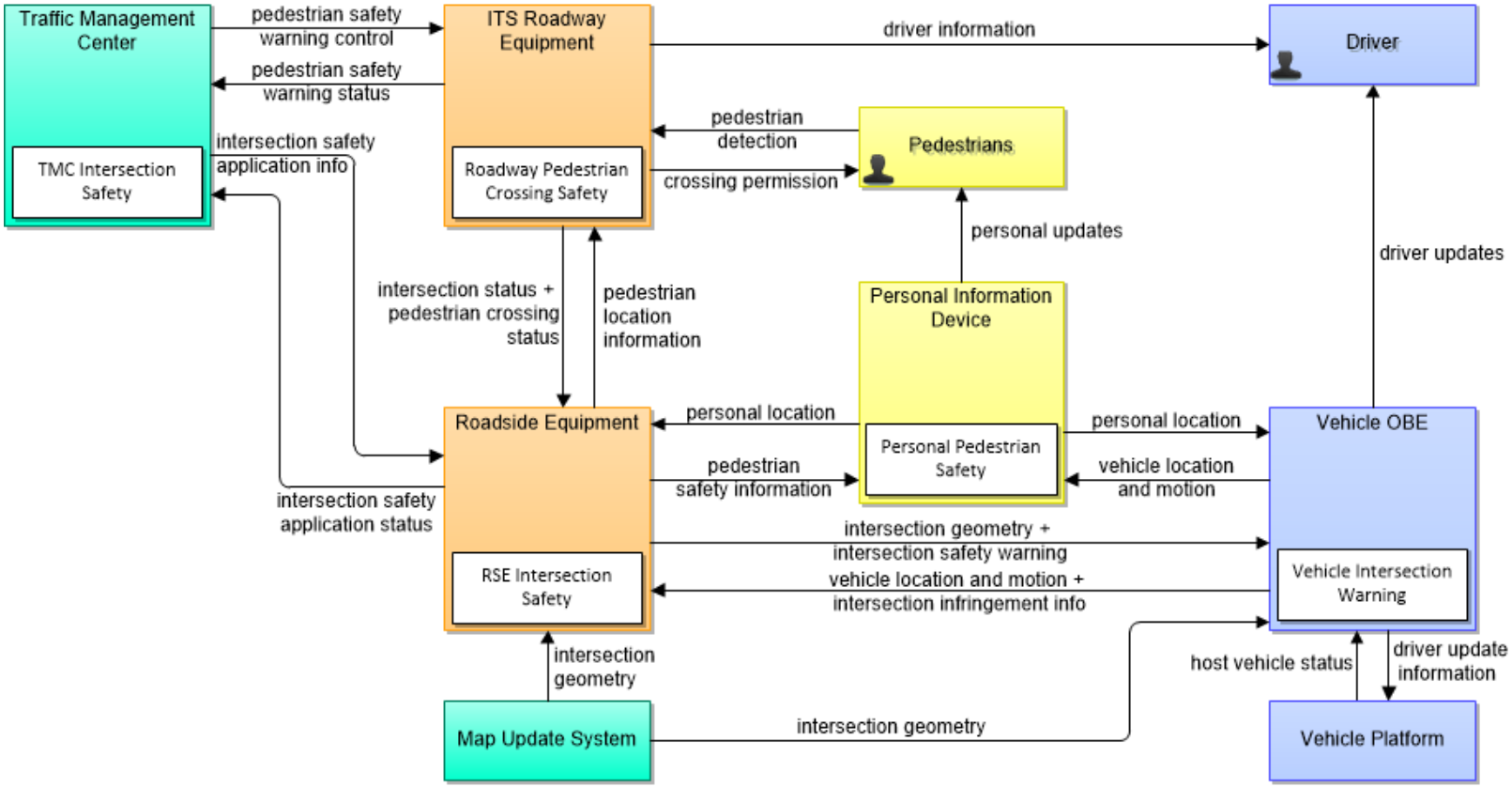
When we say "Policy"… Issue Areas Include (1/2)

- **Certification……what certification is required?**
- **Communications……what technologies are preferred?**
  - ***When is DSRC necessary or desirable?***
- **Credentialing……who has access to CV systems?**
  - ***Who may have access to on-board or roadside equipment for maintenance. What training / certification is needed?***
- **Data governance……who may access the data?**
  - ***Privacy (movement tracking) concerns***
  - ***Use of data for enforcement***
  - ***Use of data to establish liability***
- **Governance……what are the roles of the participants?**
  - ***Who runs the various systems***
  - ***How to avoid road user distraction (driver or pedestrian)***

Policy Issue Areas (2/2)

- **Intellectual Property……..what are the risks for exposure?**
- **Interoperability……how is data exchange handled?**
  - ***Between onboard, roadside, and personal DSRC equipment, which may come from a variety of manufacturers***
- **Liability……who is responsible for bad outcomes?**
- **Privacy……what information to protect?**
- **Resiliency……what are the failure modes?**
  - ***Dependence on reliable map and roadway geometry information***
- **Security……how to we prevent inappropriate usage?**
  - ***OBE and external data sources (RSE, maps)***
  - ***Security of links to RSE***
- **Social equity……...how are benefits distributed?**
  - ***Safety/mobility impacts on non-connected vehicles***
  - ***Safety/mobility impacts on other road users***

Pedestrian in Signalized Crosswalk Warning

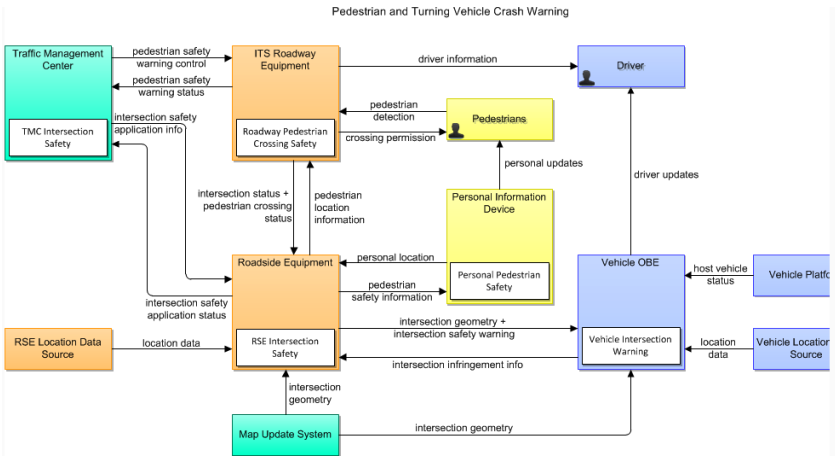


Pedestrian in Signalized Crosswalk Warning			
3	Physical	Dec 4, 2013	NAT

Policy Process (1/2)

For each application:

- **Identify information flows**
  - **Primarily from physical view**
  - **Some enterprise**
- **Look for policy issues**



(link to web definition) ↓Flow↓	↓From (flow origin)	↓To (flow destination)	Certification	Communications	Credentialing	DataGovernance	Governance	IT	Interoperability	Liability	Privacy	Resiliency	Security	Sociality	Pedestrian and Turning Vehicle Crash Warning 2 PTVCW
crossing permission	ITS Roadway Equipment	Pedestrians					--			Amy005				$005$006$007$0	248
driver information	ITS Roadway Equipment	Driver					Amy001		Amy002	Amy002					245
driver updates	Vehicle OBE	Driver	Tim001	Tim002			--		Amy003	Amy003					240
host vehicle status	Vehicle Platform	Vehicle OBE	Tim001	Tim002			--	--	--	--		Andy013	Tim004		239
intersection geometry	Map Update System	Roadside Equipment	Tim001	Tim002			--			Amy005					243
	Map Update System	Vehicle OBE	Tim001	Tim002			--			Amy003 Amy0					242
	Roadside Equipment	Vehicle OBE	Tim001	Tim002			--			Amy003 Amy0					249
intersection infringement info	Vehicle OBE	Roadside Equipment					Amy031		Amy003	Amy002 Amy0					241
intersection safety application info	Traffic Management Center	Roadside Equipment	Tim001	Tim002			--								796
intersection safety application status	Roadside Equipment	Traffic Management	Tim001	Tim002			Amy007								798
intersection safety warning	Roadside Equipment	Vehicle OBE					--		Amy003	Amy003					250
location data	RSE Location Data Source	Roadside Equipment	Tim001	Tim002			Amy001			Amy005			Tim004		799
	Vehicle Location Data Source	Vehicle OBE	Tim001	Tim002			Amy004	Amy02		Amy005		Andy008	Tim004		238
pedestrian crossing status	ITS Roadway Equipment	Roadside Equipment	Tim00	Tim002			--			Amy003 Amy0				$005$006$007$0	247
pedestrian detection	Pedestrians	ITS Roadway Equipment					--							$005$006$007$0	255
pedestrian location information	Roadside Equipment	ITS Roadway Equipment	Tim001	Tim002			--							$005$006$007$0	251
pedestrian safety information	Roadside Equipment	Personal Information	Tim001 $002	Tim002			--			Amy003 Amy0				$005$006$007$0	252
pedestrian safety warning control	Traffic Management Center	ITS Roadway Equipment								Amy003 Amy0					244
pedestrian safety warning status	ITS Roadway Equipment	Traffic Management													246
personal location	Personal Information Device	Roadside Equipment	Tim001 $002	Tim002			Amy031			Amy010				$005$006$007$0	253
personal updates	Personal Information Device	Pedestrians					Amy033			Amy034				$005$006$007$0	254
signal phase and timing	ITS Roadway Equipment	Roadside Equipment	Tim001	Tim002			--								797

Policy Process (2/2)

- **Write brief summaries of each issue**
- **One information flow may apply to multiple applications**

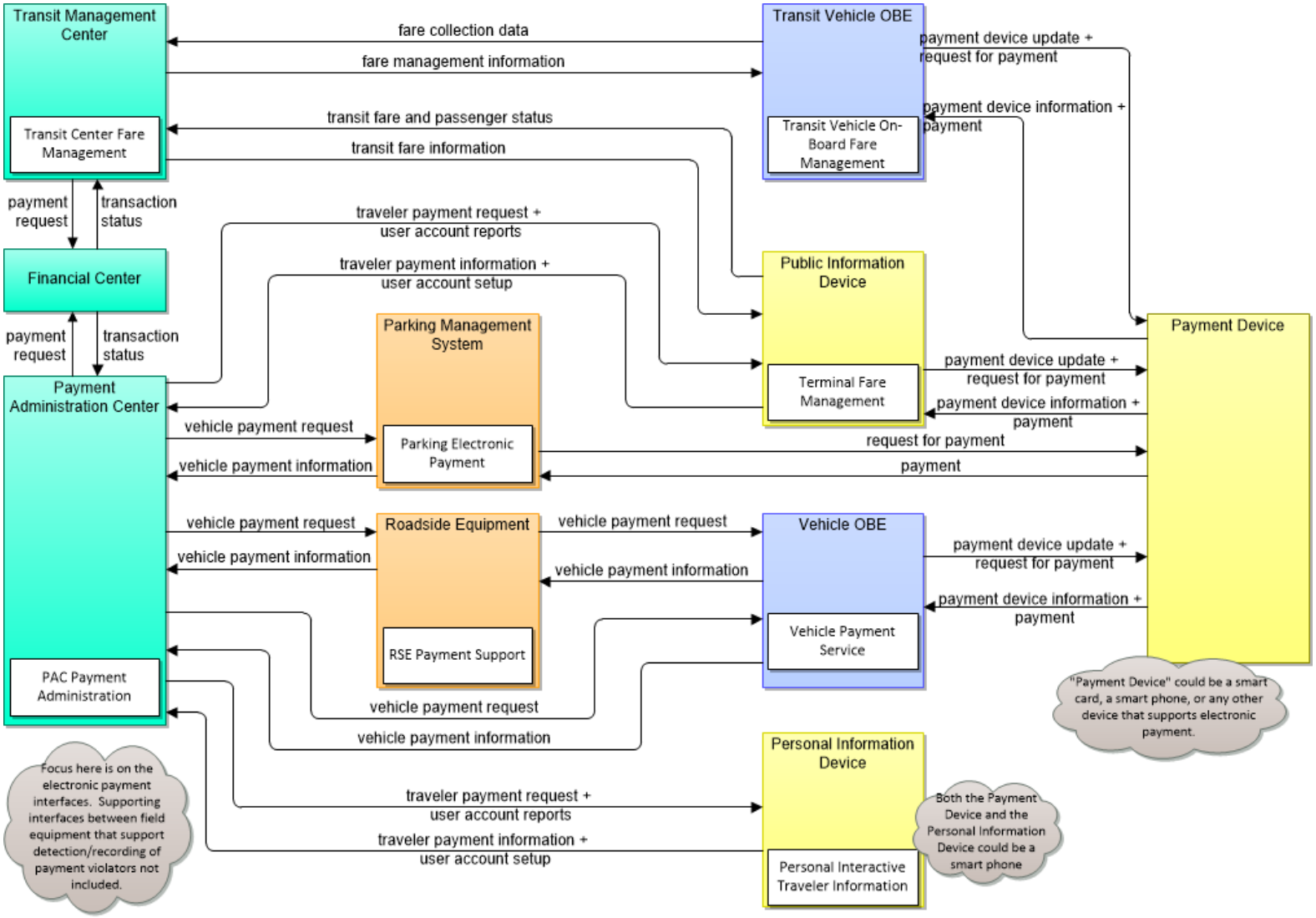
(link to web definition) ↓Flow↓	↓From (flow origin)	↓To (flow destination)	Certification	Communications	Credentialing	DataGovernance	Governance	IP	Interoperability	Liability	Privacy	Resiliency	Security	SocialEquity	Incident Scene Work Zone Alerts for Drivers and Workers	Route ID for the Visually Impaired	Pedestrian Mobility	Signal Phase and Timing	Pedestrian and Turning Vehicle Crash Warning
															INC-ZONE	RVI	PEDM	SPAT	PTVCW
personal location	Personal Information Device	Roadside Equipment	T001 S002	T002			A031			A010				S005S006S007S008	1477	1533	790	891	253
personal updates	Personal Information Device	Pedestrians					A033			A034				S005S006S007S008			792	893	254

Spreadsheet	PO	PolicyArea	IssueTitle	IssueSummary
A031	143	Governance	**Prevailing Data Source**	In cases where two or more sources provide location or other critical data, which source is s
A033	144	Governance	**Pedestrian Traffic Laws**	Is pedestrian required to respond to alerts and warnings?
A010	156	Liability	**Liability for faulty data**	Who is liable if TMC, RSE, or PID provides incorrect data to vehicles? ...and if vehicle OBE se
A034	167	Liability	**Pedestrian Traffic Laws**	Is pedestrian liable for own injuries if s/he fails to respond appropriately to alerts & warnin
T001	181	Certification	**Ensure OBE or RSE Credential is valid**	Anytime data is exchanged with an OBE or and RSE, the device must be trusted by the syste
T002	182	Communications	**Data Exchange between RSEs, OBEs and other system objects**	The choice of communication in this application is critical to its safe operation and effective
S002	196	Communications	**Need for reliable real-time communications with PID for safety**	For a safety application using a personal information device (PID) held by a pedestrian or bi
S005	199	Social Equity	**Will the application protect all non-motorized users who have**	In the definitions of the Physical Objects, "Pedestrians" are defined as follows: *"Pedestria*
S006	200	Social Equity	**Will the application protect all types of pedestrians, including**	A person with a mobility impairment may walk exceptionally slowly, or may be using a whe
S007	201	Social Equity	**Will the application protect all types of pedestrians, including those with visual impairments?**	
S008	202	Social Equity	**Affordability of Personal Information Devices.**	Unlike the case with motor vehicles, where certain equipment can be mandated, one canno

Pedestrian in Signalized Crosswalk Warning

Application Specific Issues	Most Relevant Universal Issues
▪ **Certification and Interoperability** ▫ What requirements apply to personal information devices (PIDs) ▪ **Communications** ▫ Size, weight and power constraints on PIDs ▫ Do PIDs communicate with vehicle OBEs or only RSEs? ▪ **Social equity** ▫ In CVRIA, “pedestrians” includes all non-motorized users, such as bicyclists and animal-drawn vehicles. What applications will improve safety for them? ▫ What applications protect non-motorized road users, including pedestrians, who are not in signalized crosswalks? ▫ Will the applications protect pedestrians with visual or mobility impairments? ▫ Affordability of PIDs	▪ **Communications** ▫ When is DSRC really needed? ▪ **Data Governance** ▫ Privacy (movement tracking) ▫ Enforcement ▫ Liability ▪ **Interoperability** between roadside equipment (RSE) and onboard equipment (OBE) ▪ **Privacy** What information (e.g., driver PII) is considered highly sensitive? ▪ **Security** of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE ▪ **Social Equity** ▫ Safety and mobility impacts on non-connected vehicles ▫ Safety and mobility impacts on other road users

Integrated Multi-modal Payment



Integrated Multi-Modal Electronic Payment			
3	Physical	Dec 4, 2013	NAT

Integrated Multimodal Fare Payment

Application Specific Issues	Most Relevant Universal Issues
▪ **Credentialing.** Employees with access to sensitive personal travel and financial information need to be properly screened and trained. ▪ **Data Governance** ▫ Who owns the personal/financial information? ▪ **Governance** ▫ Who will finance and run a multi-agency system? ▪ **Interoperability** ▫ How much benefit from inter-agency interoperability? ▫ Should specific fare media be encouraged for specific applications? ▪ **Resiliency** ▫ Protection from hacking / theft ▫ Policies for system and fare media failures ▪ **Security** ▫ Meet financial industry standards for security of payment information ▪ **Social Equity** ▫ Ensuring that smaller service providers (e.g., a small parking lot) have access to the system ▫ Ensure that all have access to fare media	▪ **Communications** ▫ When is DSRC really needed? (other frequency bands are currently being used) ▪ **Security** of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE ▪ **Data Governance** ▫ Privacy (movement tracking) ▫ Enforcement ▫ Liability

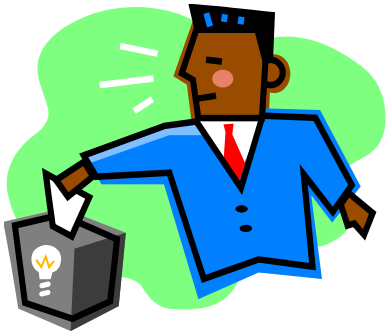
Poll Question 6

- **Do you plan to visit the CVRIA website and add comments by the end of December?**
  - Yes
  - No
  - Unsure

Intelligent Transportation Systems (ITS)
Joint Program Office (JPO)

Connected Vehicle Reference Implementation Architecture Update

Q&A + Final Thoughts

THANK YOU

- This concludes today's webinar.
- Check out the T3 site and the CVRIA website (http://www.iteris.com/cvria/) for the next webinar or to view archives of previous webinars.
- Keep those comments coming!
  - CVRIAcomments@iteris.com
- For other questions on CVRIA or the connected vehicle program:
  - Steve.Sill@dot.gov – 202-366-1603
  - Walt.Fehr@dot.gov – 202-366-0278