

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

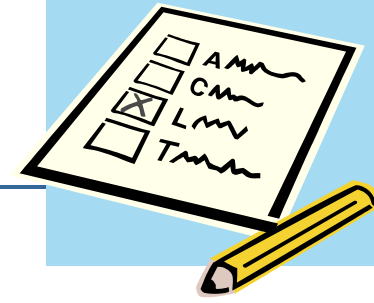
## *Connected Vehicle Reference Implementation Architecture Update*

Stakeholder's Webinar  
November & December 2013



# Poll Question 1

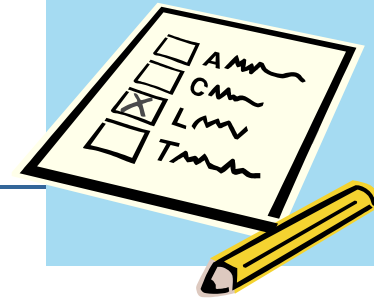
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- **Which of the following best describes your role in Connected Vehicles?**
  - Federal Government
  - State DOT or Metropolitan Planning Organization
  - Local government
  - Car maker / OEM
  - Roadside equipment maker
  - Consultant
  - Academic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

## Poll Question 2

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- **How familiar are you with CVRIA (check all that apply)?**
  - Attended the previous webinar (V2I safety on 11/6)
  - Visited the CVRIA website
  - This is my first experience

# CVRIA Update Webinars

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- 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
  - Walt Fehr
  - Ben McKeever, Marcia Pincus
  - David Binkley, Ron Ice, Tom Lusco
  - Chris Karaffa, Jim Marousek
  - Scott Smith, Dawn LaFrance-Linden

# CVRIA Update Webinar #2 – Agenda

Topic	Start	End
Welcome & Background/Overview	2:00	2:10
Introduce Applications of the Day	2:10	2:15
CVRIA Applications:		
1. Intelligent Traffic Signal System	2:15	2:50
2. Emergency Vehicle Priority	2:50	3:10
3. Eco-Approach and Departure	3:10	3:30
Interface Selection / Standardization Planning	3:30	3:45
Pertinent Policy Issues	3:45	4:00
Q&A	4:00	4:30

(All Times Eastern)

# CVRIA Update Webinar – Applications to be Reviewed

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Applications for Webinar	Date
V2I <ul style="list-style-type: none"><li>• Red Light Violation Warning</li><li>• Curve Speed Warning</li><li>• Speed Harmonization (SPD-HARM)</li></ul>	Nov 6, 2013
Signal Applications <ul style="list-style-type: none"><li>• Intelligent Traffic Signal System</li><li>• Emergency Vehicle Priority</li><li>• Eco-Approach and Departure</li></ul>	Nov 14
Road Weather <ul style="list-style-type: none"><li>• Weather Responsive Traffic Management</li><li>• Enhanced Maintenance Decision Support</li></ul>	Nov 19

# CVRIA Update Webinar – Applications to be Reviewed, continued

Topics	Date
Freight & Fleet Operations <ul style="list-style-type: none"><li>• Smart Roadside Initiative</li><li>• Freight Advanced Traveler Information Systems (FRATIS)</li></ul>	Nov 26
Support Applications <ul style="list-style-type: none"><li>• Data Distribution</li><li>• Communications Support</li><li>• Core Authorization</li></ul>	Dec 3
Transit Applications <ul style="list-style-type: none"><li>• Pedestrian &amp; Turning Vehicle Crash Warning</li><li>• Integrated Multi-modal Payment</li></ul>	Dec 10
R.E.S.C.U.M.E. <ul style="list-style-type: none"><li>• Incident Scene Pre-Arrival Staging Guidance for Emergency Responders</li><li>• Incident Scene Work Zone Alerts for Drivers &amp; Workers</li></ul>	Dec 17

(Dates/Times and Specific Topics Subject to Change)

# Connected Vehicle Reference Implementation Architecture (CVRIA)

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

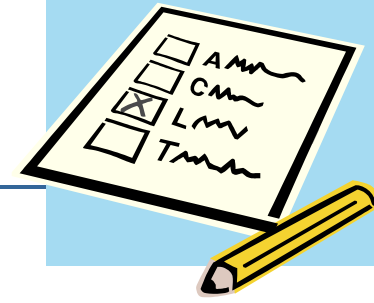
- Purpose of CVRIA is to identify a **framework** for integrating connected vehicle technologies and identify interfaces for standardization
- By...
  - Collecting and aggregating connected vehicle needs/requirements
  - Developing a multi-faceted system architecture
  - Identifying and prioritizing **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 Testbed 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

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



# CVRIA Website Users Guide

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- 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/](http://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**

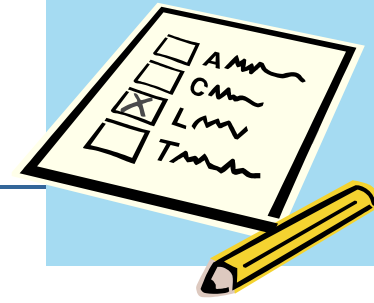
<http://www.standards.its.dot.gov/DevelopmentActivities/CVReference>

Or

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

## Poll Question 4

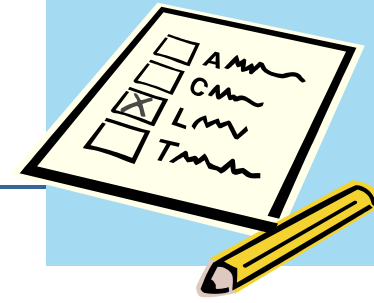
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- **Which of the Architecture Views presented interests you the most?**
  - Communications
  - Enterprise
  - Functional
  - Physical

## Poll Question 5

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- **Of the applications presented today, which is the most familiar to you?**
  - Intelligent Traffic Signal Systems
  - Emergency Vehicle Priority
  - Eco-Approach & Departure
  - It's All New to Me



# 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 Test Bed 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

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- 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***



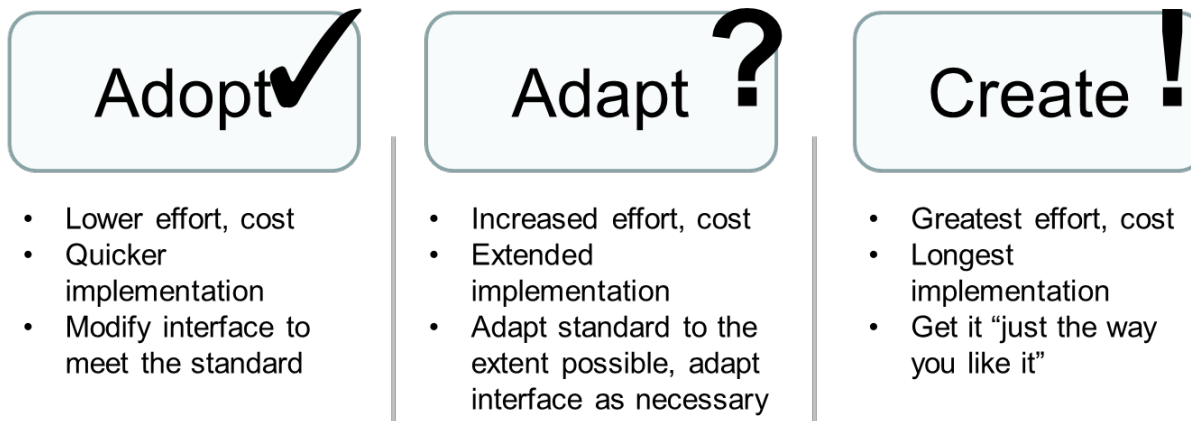
# CVRIA and Standards

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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

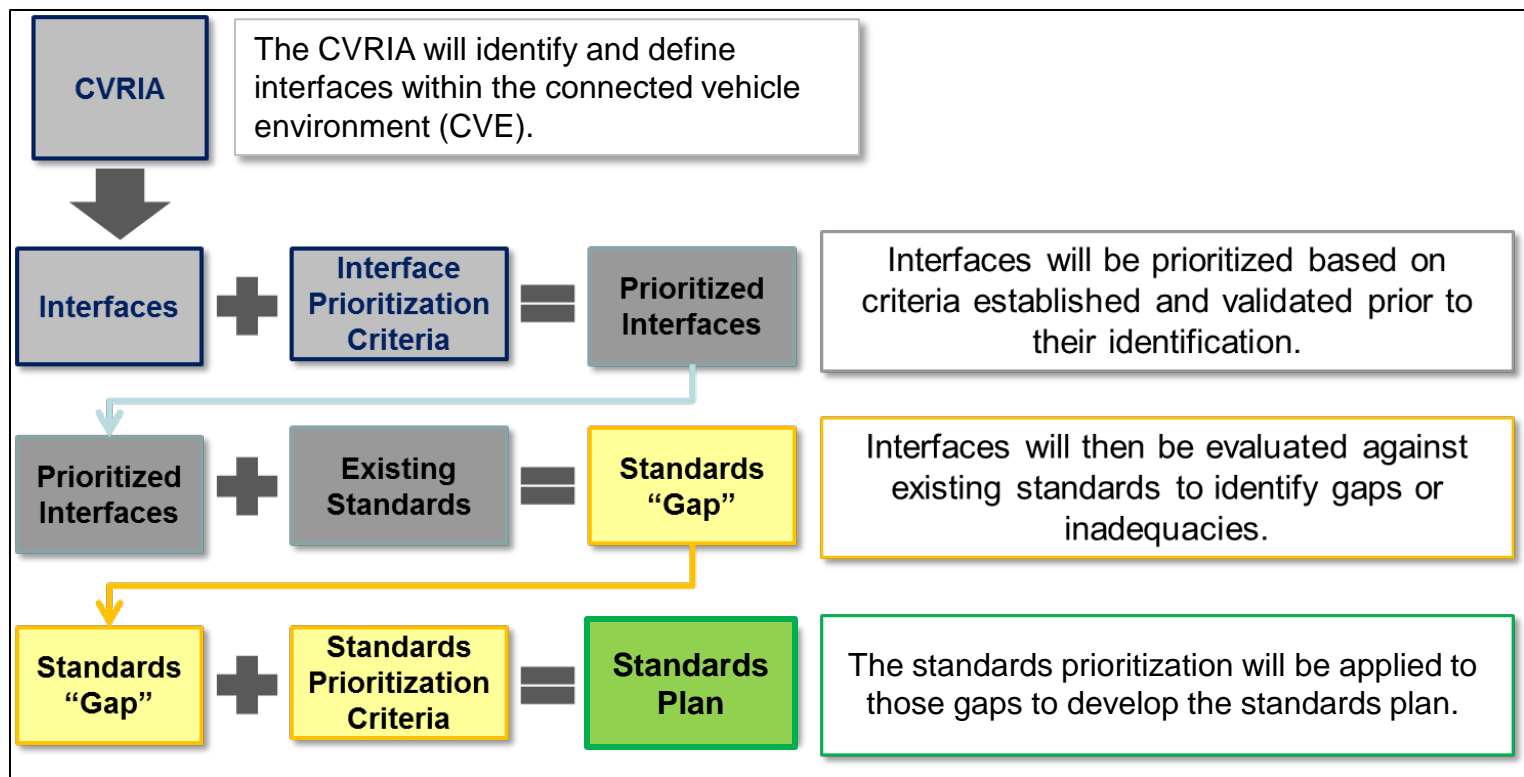
This plan will be a living document that will evolve as ITS technologies, implementation strategies, and policies develop

The plan will help the USDOT bridge the “standards gap”



# Standards Plan Approach

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



# Using Prioritization

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- 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

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- **Currently**

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

- **Feedback**

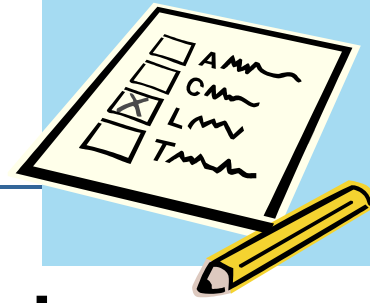
- Feedback on applications or other aspects of the architecture will help us to refine: *interface identification and definition; scoring; interpreting results.*

- **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 6

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- **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

November 2013



# When we say “Policy” ... Issue Areas Include

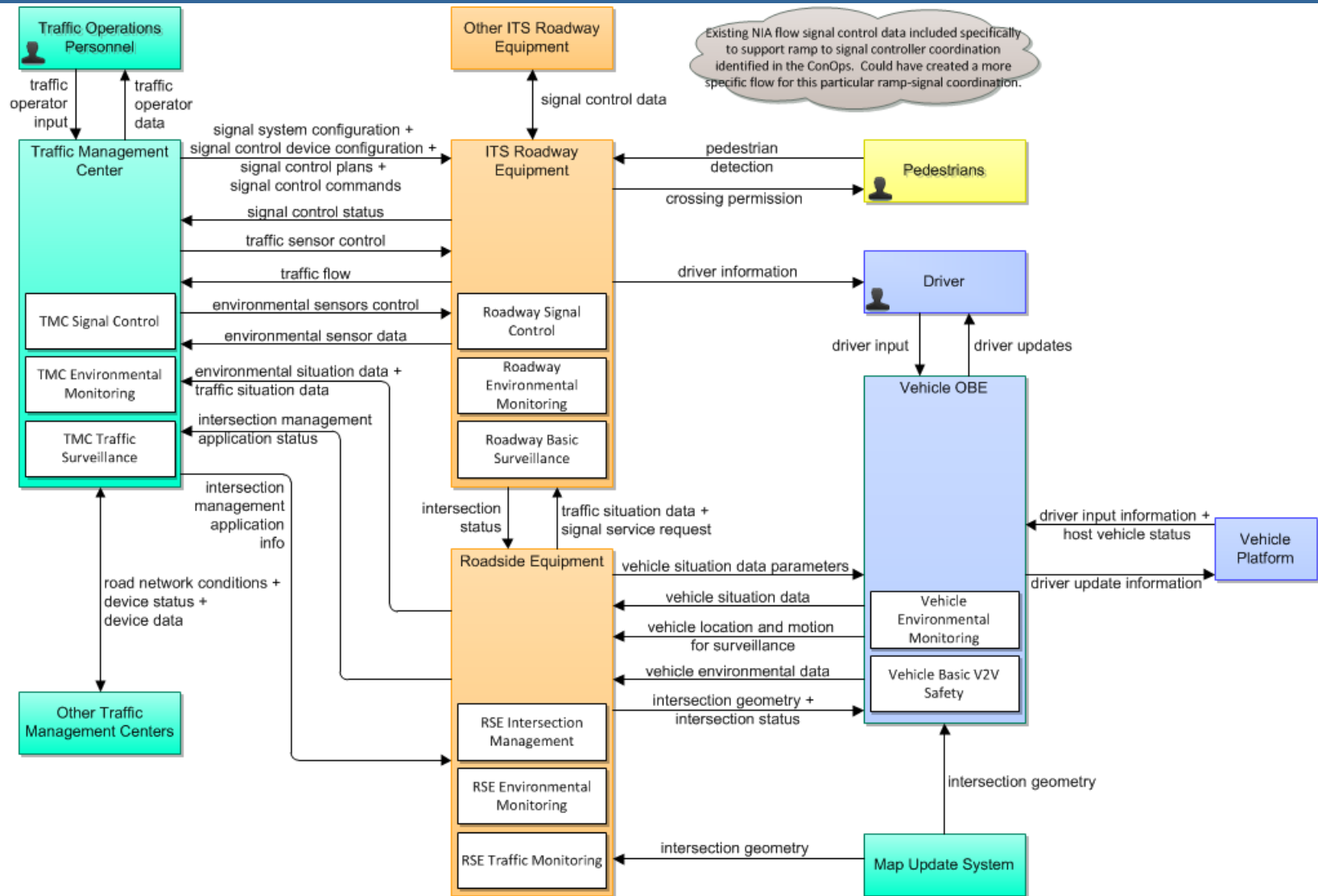
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- **Certification.....what certification is required?**
- **Communications.....what technologies are preferred?**
- **Credentialing.....who has access to CV systems?**
- **Data governance.....who may access the data?**
- **Governance.....what are the roles of the participants?**
- **Intellectual Property.....what are the risks for exposure?**
- **Interoperability.....how is data exchange handled?**
- **Liability.....who is responsible for bad outcomes?**
- **Privacy.....what information to protect?**
- **Resiliency.....what are the failure modes?**
- **Security.....how to we prevent inappropriate usage?**
- **Social equity.....how are benefits distributed?**





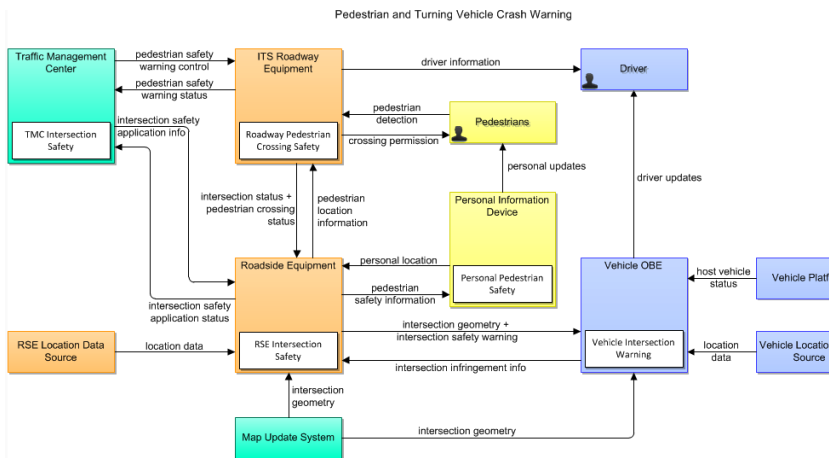
# Intelligent Traffic Signal System



# 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	Community	Credentialed	Data Governance	Gov. Access	IF	Interoperability	Liability	Privacy	Resiliency	Security	Social Equity	Pedestrian and Turning Vehicle Crash Warning	PTVCW
crossing permission	ITS Roadway Equipment	Pedestrians					..		Amy0 05						\$0058 0068 00750	248
driver information	ITS Roadway Equipment	Driver					Amy0 01		Amy0 02	Amy0 02						245
driver updates	Vehicle OBE	Driver	Tim0 01	Tim0 02			..		Amy0 03	Amy0 03						240
host vehicle status	Vehicle Platform	Vehicle OBE	Tim0 01	Tim0 02			..	..	..	..		Andy 015	Tim0 04			239
intersection geometry	Map Update System	Roadside Equipment	Tim0 01	Tim0 02			..			Amy0 05						243
	Map Update System	Vehicle OBE	Tim0 01	Tim0 02			..			Amy0 03						242
	Roadside Equipment	Vehicle OBE	Tim0 01	Tim0 02			..			Amy0 03						249
intersection infringement info	Vehicle OBE	Roadside Equipment					Amy0 31		Amy0 03	Amy0 02						241
intersection safety application info	Traffic Management Center	Roadside Equipment	Tim0 01	Tim0 02			..									796
intersection safety application status	Roadside Equipment	Traffic Management Center	Tim0 01	Tim0 02			Amy0 07									798
intersection safety warning	Roadside Equipment	Vehicle OBE					..		Amy0 03	Amy0 03						250
location data	RSE Location Data Source	Roadside Equipment	Tim0 01	Tim0 02			Amy0 01			Amy0 05				Tim0 04		799
	Vehicle Location Data Source	Vehicle OBE	Tim0 01	Tim0 02			Amy0 04	Amy0 2		Amy0 05		Andy 008		Tim0 04		238
pedestrian crossing status	ITS Roadway Equipment	Roadside Equipment	Tim00	Tim002			..			Amy0 03					\$0058 0068 00750	247
pedestrian detection	Pedestrians	ITS Roadway Equipment					..								\$0058 0068 00750	255
pedestrian location information	Roadside Equipment	ITS Roadway Equipment	Tim0 01	Tim0 02			..								\$0058 0068 00750	251
pedestrian safety information	Roadside Equipment	Personal Information Device	Tim0 01	Tim0 02			..			Amy0 03					\$0058 0068 00750	252
pedestrian safety warning control	Traffic Management Center	ITS Roadway Equipment								Amy0 03						244
pedestrian safety warning status	ITS Roadway Equipment	Traffic Management Center														246
personal location	Personal Information Device	Roadside Equipment	Tim0 01	Tim0 02			Amy0 31			Amy0 10					\$0058 0068 00750	253
personal updates	Personal Information Device	Pedestrians					Amy0 33			Amy0 34					\$0058 0068 00750	254
signal phase and timing	ITS Roadway Equipment	Roadside Equipment	Tim0 01	Tim0 02			..									797

# Policy Process (2/2)

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

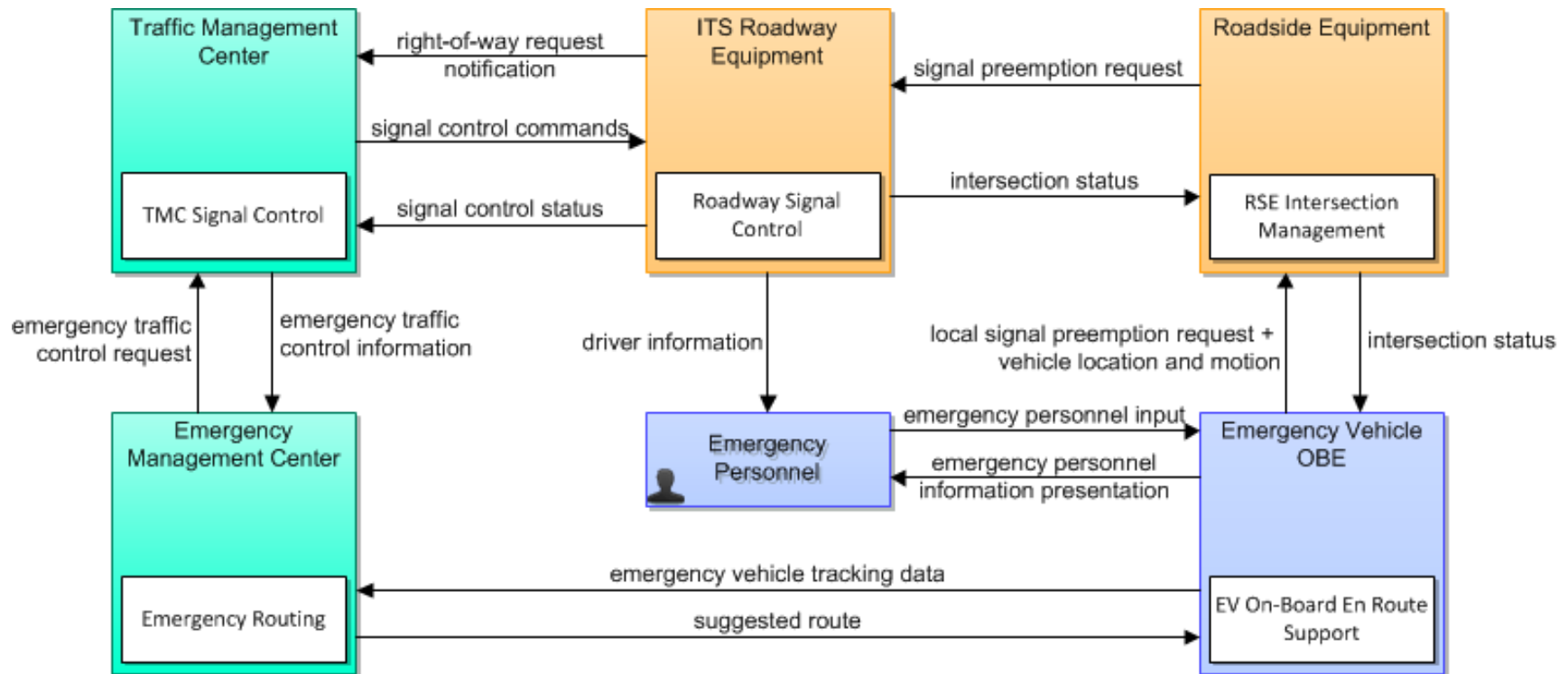
(link to web definition) ↓Flow↓	↓From (flow origin)	↓To (flow destination)	Certification	Communications	Credentialing	Data Governance	Governance	IP	Interoperability	Liability	Privacy	Resiliency	Security	Social Equity	INC-ZONE <small>Incident Scene Work Zone Alerts for Drivers and Workers</small>	RVI <small>Route ID for the Visually Impaired</small>	PEDM <small>Pedestrian Mobility</small>	SPAT <small>Signal Phase and Timing</small>	PTVCW <small>Pedestrian and Turning Vehicle Crash Warning</small>
<a href="#">personal.location</a>	Personal Information Device	Roadside Equipment	T001 S002	T002			A031			A010				S005S0 06S007 S008	1477	1533	790	891	253
<a href="#">personal.updates</a>	Personal Information Device	Pedestrians					A033			A034				S005S0 06S007 S008			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 cann

# Intelligent Traffic Signal System (ISIG)

Application Specific Issues	Universal Issues
<ul style="list-style-type: none"> <li>▪ <b>Governance:</b> <ul style="list-style-type: none"> <li>▫ Development of algorithms</li> </ul> </li> <li>▪ <b>Data Governance:</b> <ul style="list-style-type: none"> <li>▫ Use of data for planning</li> <li>▫ Protection of PII</li> <li>▫ Availability of data from vehicle OBE that goes beyond the Basic Safety Message</li> </ul> </li> <li>▪ <b>Liability:</b> <ul style="list-style-type: none"> <li>▫ System “rewards” higher speeds than are safe (say, due to weather)</li> </ul> </li> <li>▪ <b>Security:</b> <ul style="list-style-type: none"> <li>▫ If some users are privileged (e.g., a blind pedestrian), prevent the privilege from being abused by others.</li> </ul> </li> <li>▪ <b>Social Equity:</b> “Pedestrians” includes           <ul style="list-style-type: none"> <li>▫ Persons with disabilities (visual, mobility)</li> <li>▫ Bicyclists</li> <li>▫ Animal-drawn vehicles</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Interoperability</b> between roadside equipment (RSE) and onboard equipment (OBE)</li> <li>▪ <b>Communications</b> <ul style="list-style-type: none"> <li>▫ When is DSRC really needed?</li> </ul> </li> <li>▪ <b>Security</b> of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE</li> <li>▪ <b>Dependence</b> on reliable map and roadway geometry information</li> <li>▪ <b>Social Equity</b> <ul style="list-style-type: none"> <li>▫ Safety and mobility impacts on non-connected vehicles</li> <li>▫ Safety and mobility impacts on other road users</li> </ul> </li> <li>▪ <b>Use of data</b> <ul style="list-style-type: none"> <li>▫ Privacy (movement tracking)</li> <li>▫ Enforcement</li> <li>▫ Liability</li> </ul> </li> </ul>

# Emergency Vehicle Priority (EVP)

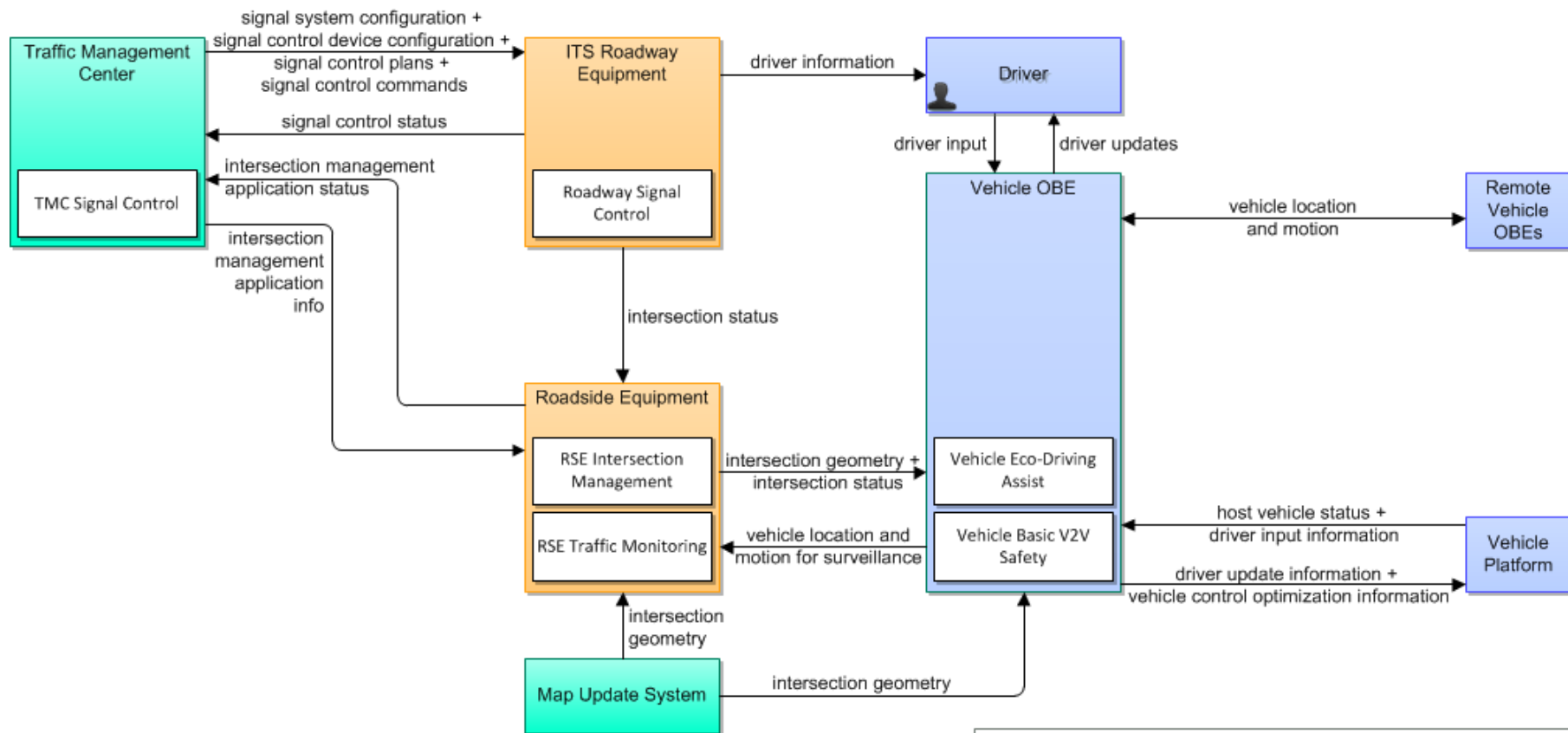


Emergency Vehicle Preemption			
1	Physical	Oct 5, 2013	NAT

# Emergency Vehicle Priority (EVP)

Application Specific Issues	Universal Issues
<ul style="list-style-type: none"> <li>▪ <b>Governance:</b> <ul style="list-style-type: none"> <li>▫ Who gets priority (volunteer firefighter?)</li> <li>▫ Competing requests for priority</li> </ul> </li> <li>▪ <b>Security:</b> Prevent requests for priority from unauthorized vehicles</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Interoperability</b> between roadside equipment (RSE) and onboard equipment (OBE)</li> <li>▪ <b>Communications</b> <ul style="list-style-type: none"> <li>▫ When is DSRC really needed?</li> </ul> </li> <li>▪ <b>Security</b> of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE</li> <li>▪ <b>Dependence</b> on reliable map and roadway geometry information</li> <li>▪ <b>Social Equity</b> <ul style="list-style-type: none"> <li>▫ Safety and mobility impacts on non-connected vehicles</li> <li>▫ Safety and mobility impacts on other road users</li> </ul> </li> <li>▪ <b>Use of data</b> <ul style="list-style-type: none"> <li>▫ Privacy (movement tracking)</li> <li>▫ Enforcement</li> <li>▫ Liability</li> </ul> </li> </ul>

# Eco-Approach and Departure at Signalized Intersections



Eco-Approach and Departure at Signalized Intersections			
3	Physical	Oct 23, 2013	NAT

# Eco Approach and Departure at Signalized Intersections

Application Specific Issues	Universal Issues
<ul style="list-style-type: none"> <li>▪ <b>Governance:</b> What support should be given for algorithms to determine the correct advisory speed. It is not a trivial problem.               <ul style="list-style-type: none"> <li>▫ Is there a need for standards, similar to standards for the lengths of various components of a traffic signal cycle?</li> </ul> </li> <li>▪ <b>Governance:</b> Are the recommended speeds advisory or mandatory? Might drivers deliberately ignore a system-optimal recommendation, perceiving that it is not optimal for them?</li> <li>▪ <b>Data governance:</b> Who has access to the data and for what purposes? For example: Law enforcement, insurance companies, etc.</li> <li>▪ <b>Liability:</b> If the system offers dangerous advice, and a crash results, who is liable?</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Interoperability</b> between roadside equipment (RSE) and onboard equipment (OBE)</li> <li>▪ <b>Communications</b> <ul style="list-style-type: none"> <li>▫ When is DSRC really needed?</li> </ul> </li> <li>▪ <b>Security</b> of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE</li> <li>▪ <b>Dependence</b> on reliable map and roadway geometry information</li> <li>▪ <b>Social Equity</b> <ul style="list-style-type: none"> <li>▫ Safety and mobility impacts on non-connected vehicles</li> <li>▫ Safety and mobility impacts on other road users</li> </ul> </li> <li>▪ <b>Use of data</b> <ul style="list-style-type: none"> <li>▫ Privacy (movement tracking)</li> <li>▫ Enforcement</li> <li>▫ Liability</li> </ul> </li> </ul>



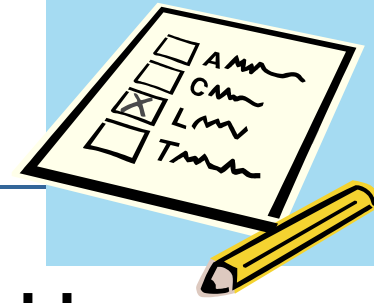
# Conclusion

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- **Why perform this analysis? Government role is to:**
  - Encourage use of connected vehicle technologies to provide public benefit
  - Discourage misuse that would create harm to the public
  
- **Tools that are available to the government:**
  - Resources and guidance
  - Regulation and policies
    - Provide a stable environment for others to use/deploy in
    - Build public trust in the system
    - Discourage misuse

# Poll Question 7

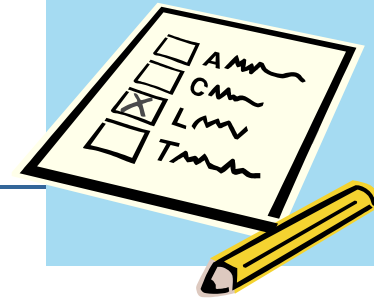
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- **Do you plan to visit the CVRIA website and add comments by the end of December?**
  - Yes
  - No
  - Unsure

## Poll Question 8

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- **Do you plan to attend any subsequent CVRIA webinars? (check all that apply)**
  - ❑ Road Weather on Tuesday 11/19
  - ❑ Freight and fleet operations on Tuesday 11/26
  - ❑ Support applications on Tuesday 12/3
  - ❑ Transit and non-motorized user applications on Tuesday 12/10
  - ❑ Public Safety on Tuesday 12/17
  - ❑ None

**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](mailto:CVRIAcomments@iteris.com)
- For other questions on CVRIA or the connected vehicle program:
  - [Steve.Sill@dot.gov](mailto:Steve.Sill@dot.gov) – 202-366-1603
  - [Walt.Fehr@dot.gov](mailto:Walt.Fehr@dot.gov) – 202-366-0278

