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

Connected Vehicle Reference Implementation Architecture Update

Stakeholder’s Webinar
November & December 2013
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
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
  - Walt Fehr
  - Carl Andersen
  - David Binkley, Ron Ice, Tom Lusco
  - Jim Marousek, Chris Karaffa
  - Dawn LaFrance-Linden, Scott Smith
## CVRIA Update Webinar – Agenda

<table>
<thead>
<tr>
<th>Topic</th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome &amp; Background/Overview</td>
<td>2:00</td>
<td>2:10</td>
</tr>
<tr>
<td>Introduce Applications of the Day</td>
<td>2:10</td>
<td>2:15</td>
</tr>
<tr>
<td>CVRIA Applications (see table)</td>
<td>2:15</td>
<td>3:00</td>
</tr>
<tr>
<td>Interface Selection / Standardization Planning</td>
<td>3:00</td>
<td>3:15</td>
</tr>
<tr>
<td>Pertinent Policy Issues</td>
<td>3:15</td>
<td>3:30</td>
</tr>
<tr>
<td>Q&amp;A</td>
<td>3:30</td>
<td>4:00</td>
</tr>
</tbody>
</table>

(All Times Eastern)
CVRIA Update Webinar – Applications to be Reviewed

<table>
<thead>
<tr>
<th>Applications for Webinar</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>V2I</strong></td>
<td>Nov 6, 2013</td>
</tr>
<tr>
<td>• Red Light Violation Warning</td>
<td></td>
</tr>
<tr>
<td>• Curve Speed Warning</td>
<td></td>
</tr>
<tr>
<td>• Speed Harmonization (SPD-HARM)</td>
<td></td>
</tr>
<tr>
<td><strong>Signal Applications</strong></td>
<td>Nov 12</td>
</tr>
<tr>
<td>• Intelligent Traffic Signal System</td>
<td></td>
</tr>
<tr>
<td>• Emergency Vehicle Priority</td>
<td></td>
</tr>
<tr>
<td>• Eco-Approach and Departure</td>
<td></td>
</tr>
<tr>
<td><strong>Road Weather</strong></td>
<td>Nov 19</td>
</tr>
<tr>
<td>• Weather Responsive Traffic Management</td>
<td></td>
</tr>
<tr>
<td>• Enhanced Maintenance Decision Support</td>
<td></td>
</tr>
</tbody>
</table>
### CVRIA Update Webinar – Topics, continued

<table>
<thead>
<tr>
<th>Topics</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freight &amp; Fleet Operations</strong></td>
<td></td>
</tr>
<tr>
<td>• Smart Roadside Initiative</td>
<td>Nov 26</td>
</tr>
<tr>
<td>• Freight Advanced Traveler Information Systems (FRATIS)</td>
<td></td>
</tr>
<tr>
<td><strong>Support Applications</strong></td>
<td>Dec 3</td>
</tr>
<tr>
<td>• Data Distribution</td>
<td></td>
</tr>
<tr>
<td>• Communications Support</td>
<td></td>
</tr>
<tr>
<td>• Core Authorization</td>
<td></td>
</tr>
<tr>
<td><strong>Transit Applications</strong></td>
<td>Dec 10</td>
</tr>
<tr>
<td>• Pedestrian &amp; Turning Vehicle Crash Warning</td>
<td></td>
</tr>
<tr>
<td>• Integrated Multi-modal Payment</td>
<td></td>
</tr>
<tr>
<td><strong>R.E.S.C.U.M.E.</strong></td>
<td>Dec 17</td>
</tr>
<tr>
<td>• Incident Scene Pre-Arrival Staging Guidance for Emergency Responders</td>
<td></td>
</tr>
<tr>
<td>• Incident Scene Work Zone Alerts for Drivers &amp; Workers</td>
<td></td>
</tr>
</tbody>
</table>

(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 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 2

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

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

<table>
<thead>
<tr>
<th>SE Michigan Test Bed 2014</th>
<th>Future Connected Vehicle Projects</th>
</tr>
</thead>
</table>
| ▪ Provide platform for interoperability between vendors, operators and solution providers by developing V2I data exchanges  
  □ Field and Back-Office functions | ▪ CVRIA ‘Mini-Tool’ allows developers to use the CVRIA Visio Drawings |
| ▪ Developing Architecture Views using CVRIA:  
  □ Physical (What)  
    ▪ Multi-layer diagrams  
  □ Enterprise (Who)  
  □ Communications | ▪ 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.

The CVRIA will identify and define interfaces within the connected vehicle environment (CVE).

Interfaces will be prioritized based on criteria established and validated prior to their identification.

Interfaces will then be evaluated against existing standards to identify gaps or inadequacies.

The standards prioritization will be applied to those gaps to develop the standards plan.
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 the San Francisco Bay Area, February 2014
Poll Question 3

- 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

Dawn LaFrance-Linden
USDOT / Research and Innovative Technology Administration / Volpe National Transportation Systems Center
November 2013
When we say “Policy”… Issue Areas Include

- 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?
For each application:

- Identify information flows
  - Primarily from physical view
  - Some enterprise
- Look for policy issues
Policy Process (2/2)

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

<table>
<thead>
<tr>
<th>From (Flow)</th>
<th>To (Flow)</th>
<th>Certification</th>
<th>Communications</th>
<th>Identity Governance</th>
<th>SafeGov</th>
<th>IP</th>
<th>Interoperability</th>
<th>Privacy</th>
<th>Resilience</th>
<th>Security</th>
<th>Social Equity</th>
<th>INC-ZONE</th>
<th>RVI</th>
<th>PEDM</th>
<th>SPAT</th>
<th>PTVCW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Information Device</td>
<td>Roadside Equipment</td>
<td>T001</td>
<td>T002</td>
<td>A031</td>
<td>A010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1477</td>
<td>1533</td>
<td>790</td>
<td>891</td>
</tr>
<tr>
<td>Personal Information Device</td>
<td>Pedestrians</td>
<td>A033</td>
<td>A034</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>792</td>
<td>833</td>
</tr>
</tbody>
</table>

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

### Application Specific Issues

- **Governance**: Setting the appropriate speed
  - Inconsistency among jurisdictions today
  - Ability to gather data on actual driver speeds.

- **Resiliency**: Multiple data sources
  - Most of the CSW application can be implemented without connected vehicle technology
  - What happens when the radar and OBE differ on their measurements of vehicle speed?

- **Resiliency**: What happens if map data is not available?

### Universal Issues

- **Interoperability** between roadside equipment (RSE) and onboard equipment (OBE)
- **Communications**
  - When is DSRC really needed?
- **Security** of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE
- **Dependence** on reliable map and roadway geometry information
- **Social Equity**
  - Safety impacts on non-connected vehicles
- **Use of data**
  - Privacy (movement tracking)
  - Enforcement
  - Liability
Red Light Violation Warning (RLVW)
### Red Light Violation Warning (RLVW)

<table>
<thead>
<tr>
<th>Application Specific Issues</th>
<th>Universal Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Governance</strong>: How does the signal respond to a hazardous situation (e.g., driver is approaching at high speed, unable to stop for the red - should the cross-street green be delayed?)</td>
<td><strong>Interoperability</strong> between roadside equipment (RSE) and onboard equipment (OBE)</td>
</tr>
<tr>
<td><strong>Data governance</strong>: Who has access to the data and for what purposes? For example: Law enforcement, insurance companies, etc.</td>
<td><strong>Communications</strong></td>
</tr>
<tr>
<td><strong>Liability</strong>: If a vehicle with right-of-way ignores the warning that another vehicle is likely to run the red light, does the vehicle’s driver bear any liability for the accident?</td>
<td>- When is DSRC really needed?</td>
</tr>
<tr>
<td></td>
<td><strong>Security</strong> of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE</td>
</tr>
<tr>
<td></td>
<td><strong>Dependence</strong> on reliable map and roadway geometry information</td>
</tr>
<tr>
<td></td>
<td><strong>Social Equity</strong></td>
</tr>
<tr>
<td></td>
<td>- Safety impacts on non-connected vehicles</td>
</tr>
<tr>
<td></td>
<td><strong>Use of data</strong></td>
</tr>
<tr>
<td></td>
<td>- Privacy (movement tracking)</td>
</tr>
<tr>
<td></td>
<td>- Enforcement</td>
</tr>
<tr>
<td></td>
<td>- Liability</td>
</tr>
</tbody>
</table>
Speed Harmonization (SH)
**Speed Harmonization (SH)**

<table>
<thead>
<tr>
<th>Application Specific Issues</th>
<th>Universal Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Governance:</strong> How is the correct speed determined? When is speed harmonization indicated? Is compliance voluntary or mandatory?</td>
<td><strong>Interoperability</strong> between roadside equipment (RSE) and onboard equipment (OBE)</td>
</tr>
<tr>
<td><strong>Credentialing:</strong> How are Traffic Operations Personnel trained? What actions are they permitted with respect to SH?</td>
<td><strong>Communications</strong></td>
</tr>
<tr>
<td><strong>Social Equity:</strong> Are drivers more likely to comply with speed harmonization requests received through CV system vs. more traditional approaches? What percentage of vehicles need to harmonize speed in order for this traffic management technique to be effective?</td>
<td>- When is DSRC really needed?</td>
</tr>
<tr>
<td><strong>Liability:</strong> Does a driver bear any liability if involved in an accident caused wholly, or in part, by adhering to SH directions?</td>
<td>- <strong>Security</strong> of links between external data sources (Maps and RSE) and vehicle OBE; security of links to RSE</td>
</tr>
<tr>
<td></td>
<td>- <strong>Dependence</strong> on reliable map and roadway geometry information</td>
</tr>
<tr>
<td></td>
<td>- <strong>Social Equity</strong></td>
</tr>
<tr>
<td></td>
<td>- Safety impacts on non-connected vehicles</td>
</tr>
<tr>
<td></td>
<td>- <strong>Use of data</strong></td>
</tr>
<tr>
<td></td>
<td>- Privacy (movement tracking)</td>
</tr>
<tr>
<td></td>
<td>- Enforcement</td>
</tr>
<tr>
<td></td>
<td>- Liability</td>
</tr>
</tbody>
</table>
Conclusion

- 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 4

- Do you plan to visit the CVRIA website and add comments by the end of December?
  - Yes
  - No
  - Unsure
Poll Question 5

- Do you plan to attend any subsequent CVRIA webinars?
  - Signal Applications on Thursday 11/14
  - 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
This concludes today’s webinar.

Check out the T3 site and the CVRIA website 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