

## February 2014 CVRIA Workshop Summary

A second Connected Vehicle Reference Implementation Architecture (CVRIA) workshop was held on 19-20 February, 2014 in San Francisco, CA. The goal of the workshop was to provide stakeholders with an update on the progress made to revise the architecture views to reflect feedback; and to elicit stakeholder input for the interface and standards needs of the broader connected vehicle environment (as described by the CVRIA)— both near term and over the long term. Specifically, this input is being used to assist the USDOT to identify gaps where new or updated standards may be needed, and to prioritize these development efforts.

Over sixty stakeholders attended the workshop including representatives from the automotive industry, state departments of transportation, academia and research and development organizations, equipment manufacturers, and the wireless and information technology industries. Many of these stakeholders came with specific modal (e.g., transit, freight) interests and expertise.

The initial plenary session on the 19<sup>th</sup> focused first on informing the stakeholders on the CVRIA and how to understand and interpret the different “views”. Additional effort was spent describing how the large number of interfaces can be categorized in order to allow for detailed discussion of where gaps in standards may exist. Discussion also focused on the “interface attributes”. These first-day presentations and discussions formed the basis for three specialized breakout group discussions on the second day, with each group examining two types of interfaces from the following list:

- Center-to-Center/Backhaul
- Local Field Equipment/Local Vehicle Internal
- Local Connected Vehicle/Regional Connected Vehicle

The composition of the stakeholder community present at the workshop was heavily weighted toward those with expertise and interest in the application layers; which was expected given the maturity of many lower-layer wide area wireless network applications and standards (e.g., 3GPP/cellular) and the resources already devoted toward Dedicated Short Range Communications (DSRC) standards. While several common topics, such as security, were discussed in the breakouts, the wide range of applications was a noteworthy conversation. Moreover, even in this modest sized group, several stakeholders offered discussion about very specific applications that are not part of the currently envisioned set of CVRIA use cases.

Specific and specialized recommendations from various subject matter experts were provided at the end of the two-day workshop; these are described below. In conclusion, the CVRIA project team gathered, from these discussions, that there is a stated need for widely promulgated and complete data dictionaries, accompanied by a large menu of message sets that can essentially be mixed and matched to address the range of current and prospective Connected Vehicle applications.

## Workshop Agenda

### **DAY 1**

- 9:00 – 9:30: Overview, Agenda, Opening Remarks, & Introductions**
- 9:30 – 10:00: Background – Program Goals & Objectives**
- 10:00 – 10:30: Goals & Objectives of Workshop**
- 10:30 – 10:45: Break**
- 10:45 – 11:30: CVRIA Background, Status, Definitions**
- 11:30 – 12:30: Review of Read-Ahead Package and Q&A**
- 12:30 – 2:00: Lunch**
- 2:00 – 4:00: Breakout Session #1**
- 4:00 – 5:00: Open Discussion/Comment/Q&A**

### **DAY 2**

- 9:00 – 9:15: Open Discussion, Recap of Day 1**
- 9:15 – 10:30: Breakout Session #2**
- 10:30 – 10:45: Break**
- 10:45 – 12:00: Breakout Session #2 (continued)**
- 12:00 – 1:30: Lunch**
- 1:30 – 1:45: Closing Remarks**
- 1:45 – forward: Open Discussion (optional)**

## Notes – Day 1 (19-Feb-2014)

### **General Session**

The first day plenary session provided background and updates on the CVRIA effort and set forth the overall objectives of the workshop. The basis of the workshop objectives was a description of the various interfaces in the CVRIA and the various potential attributes that characterize these interfaces. With this background, workshop participants were expected to provide comment and feedback on how to prioritize the interfaces and attributes as part of the analysis that will, eventually, lead to a proposed Connected Vehicle Standards Development Plan. The first session started with an introductory briefing that outlined the interface view of the CVRIA, and presented examples of:

- Which interfaces were used to support connections between with basic elements of the CVRIA (e.g. field, mobile, center, etc.);
- Which standards were available to support those interfaces; and
- What other standards might be considered.

Key comments and questions from this first session include the following, by topic:

- The participants noted that the CVRIA team may want to consider vehicle interface standards for heavy vehicles and transit first, since these follow established standards. They noted the variation in passenger vehicle conformance to specific standards.
- Participants offered questions about standards for user interfaces. Discussion centered around any need for or willingness to impose minimum standards for user interfaces. Comments included a stated desire for various guidelines for user interfaces both in the US and Japan.
- Participants voiced concern that vehicle data will only be provided by vehicle manufacturers on a case-by-case basis; and that they don't foresee that the CAN bus message sets will be put into an SAE standard. The group suggested that the CVRIA team explore other indirect avenues from OEMs. However, the USDOT representatives noted that a key objective with Connected Vehicle technologies is interoperability—the ability for vehicles to interface with other vehicles.

After the plenary session, the group was provided instructions for breakout sessions. Specifically, the group was asked to consider the way that CVRIA interfaces were identified and defined.

### ***Breakout Session #1: Field-to Center Communications***

The purpose of this first breakout was to elaborate on field-to-center interfaces and communication. The assembled participants discussed applications of interest to them and their industries and noted, when possible, which standards were in use. Further discussions within each group then defined applications that used “centers” and their companion field elements.

In summary, the breakout groups had widely different experiences and perspectives on the key applications of interest to them. Applications ranged from weather, transit, development of a DSRC “stack”, and developing truck components, among others.

Other significant conclusions include the following:

- Connected vehicle applications that utilize the field-to-center interface are developed for and maintained by local agencies, including transit properties. While standards are appreciated as a means to open the competitive field and control cost, customization for local needs is required as well. Moreover, the burgeoning interest in M2M communication (in this case, between field elements and the center) may require use of those standards.
- Public sector applications are by their nature quite diverse, e.g., transit, enforcement, emergency services, weather, rail interface.
- Some important considerations include privacy, level of trust per application (e.g., some mobility applications may not require certificates from every information source).
- Heavy commercial and transit vehicles often used by public agencies have a CAN serial bus J1939 standard and data elements; and with this openness comes lesser burden in developing interfaces.

In summary, the diverse and public-sector-oriented participants were vocal within the field-to-center communications breakout group. They presented a diversity of response, a common thread being that non-standardized use cases may need to fit into the mix. Very solid application suggestions and in some cases, specific standards, were revealed by the audience and can be used going forward.

## Notes – Day 2 (20-Feb-2014)

Day 2 began with three smaller facilitated breakout sessions. Each session was focused on a different set of interface types.

### **Breakout Session #2A** – Center-to-Center/Backhaul - Facilitator: Ken Vaughn

This breakout session focused on issues related to the center-to-center and backhaul links to determine which issues were most critical for this aspect of the connected vehicle program. The breakout session concluded that the following data was not currently supported:

- Number of empty/total bike rack spaces on a transit vehicle
- Data for bus-bus or bus-train transfers
- Freight data
- Parking information, especially for commercial vehicles
- Environmental conditions and indicators such as snow plows being down
- Structures for the aggregation and consolidation of field information such as BSM data

The group concluded that the highest priority applications were:

- Commercial screening
- Parking information
- Fleet operations
- Messages about events that impact traffic flow

Participants felt that traffic condition information was less important as this would be provided by third party providers. The group concluded that implementers of connected vehicle systems will install the necessary bandwidth and that there should be less focus on legacy low-speed links that are common in many backhaul systems today.

Participants felt that backhaul and center-to-center communications needed better security and there needed to be a way to block messages by application or source/destination.

### **Breakout Session #2B** – Local Field Equipment/Local Vehicle Internal – Facilitator: Jim Misener

This breakout focused on what is commonly called “V2I”. The objective was to determine data and connectivity needs, and from these needs standards gaps that may exist. Because the V2I applications hold promise to a large set of stakeholders, discussions about the ensuing standardization possibilities are topical and timely.

## Major Points:

An initial round of applications discussions showed strong recognition of and identification of M2M communications (also referred to as “The Internet of Things”). Moreover:

- The use of Dedicated Short Range Communication (DSRC) has been to date, considered for broadcast wireless communications, participants found this limiting for probe data. Thus, IP-addressable variants of DSRC were discussed as important.
- The “local vehicle internal” messages being “non-standardized and accessible” was viewed as a problem. The stakeholders expressed optimism that a “minimum set” of well-defined data messages could be standardized.
- Participants desired to be shown how to interface the traffic signal controller to DSRC or other wireless communications
- Performance standards are missing.

A key takeaway is that there is high interest in standardizing this particular “local” set of interfaces, largely because they apply to many of the V2I applications. The “field-elements-to-vehicle-internal” aligns well with M2M applications, not just alerts and warning. The group decided that achieving standardization and compliance of “local vehicle internal” data elements and message sets would be important.

### **Breakout Session #2C** – Local Connected Vehicle/Regional Connected Vehicle – Facilitator: Scott Andrews

This breakout session focused on the local and regional connected vehicle interfaces. Specifically, the local vehicle interface is between vehicles in a localized area and between vehicles and the roadside in a localized area. It also addressed the interface between vehicles and centers over regional data links.

The localized interface focused on localized communications on a topic by topic basis, specifically:

- Commercial V2V
- Emergency vehicles
- Maintenance vehicles
- Transit
- Light rail/Bus
- Motorcycles
- V2I

The regional interface discussion focused on a variety of applications mostly dealing with the collection, processing and re-dissemination of vehicle data; for example, collecting data from vehicles and using that data to generate additional messages and directives to other vehicles. Examples included:

- Congestion information broadcast between vehicles using unused parts of BSM
- Mechanisms to provide for relay of information upstream between vehicles
- Probe data/BSMs
- Queue warning and speed harmonization

The discussion then moved into defining the interface attributes. Key discussion points were:

- Structure is needed for regional vs. site specific information
- Mechanism to address capacity and throughput are needed.
- Routing = Priority use of channel (very difficult to determine priorities in advance)
- New versions of LTE have cell broadcast (this is new information from Cisco)
- All messages need to be verifiable ( security applies to all messages--verification can be optional by the receiver, but not the sender)
- Communications capacity is major concern if vehicles plan to use BSMs

There was also an ad hoc discussion about the use of the cellular system for the Regional Interface:

- For Cell Broadcast, LTE and GSM use an opt out rather than opt in – which is in the GSM standard
- Latency with regards to LTE—it needs to be noted that guaranteed delivery not a factor.
- Currently not clear how extensive security is in Cellular. Over-the-air (OTA) security is part of the system, but source authentication is not.

There was extensive discussion about the range of CVRIA applications and the implications that has on the application messages. Since it is unclear which applications will thrive, focusing on lots of application specific messages is probably not very effective or efficient. It was suggested that a better approach might be to identify the core data elements (mostly done in SAE J2735) and then, instead of defining specific message types, define rules and a tagging scheme for creating composite messages. That way a message originator can compile a message with what they have (making the message generation more flexible for different types of vehicles), and the recipient can make use of the parts they need.

This vastly reduced the total number of messages, speeds up the ability to create new applications (since a special message is not required for each application), and fosters a lot more creativity and flexibility.

Lastly, the group discussed Standards Needs and Harmonization, which could be data dictionary. There is work being done to create common repository.

## **Conclusion**

An open discussion of the entire audience followed the Day 2 breakout sessions, in which key takeaways (noted above) from each breakout group were presented by the facilitators.

There was an announcement that a future stakeholder workshop to present the updated CVRIA and a draft Standards Plan would take place sometime in the summer/fall of 2014.

Closing remarks were provided by Steve Sill and Walt Fehr to thank the participants for their attendance and hard work. They noted that the results would provide important input into the next stage of analysis for the CVRIA team.

For other questions on CVRIA or the connected vehicle program:

<http://iteris.com/cvria/>

or

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