

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

***Connected Vehicle Reference
Implementation Architecture***

Stakeholder Workshop – Standards Plan
Day 1: February 19, 2014



Workshop Overview

The Connected Vehicle Reference Implementation Architecture (CVRIA) is used to identify a framework for integrating connected vehicle technologies and identify interfaces for standardization.

The objectives of this workshop are to obtain stakeholder feedback to assist in USDOT in developing a Standards Plan for Connected Vehicle (CV) interfaces.

Topics for Discussion

- The CVRIA (purpose, scope, applications, assumptions, viewpoints)
- Status and next steps for the CVRIA
- Purpose and scope of the Standards Plan
- Approach for developing the Standards Plan
 - Candidate Connected Vehicle (CV) Interfaces
 - Mapping Standards to Interfaces
 - Performance requirements for CV applications and interfaces
 - CV Standards (established, evolving, new and emerging)
 - Standards Gaps

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

Workshop Agenda – 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)

Opening Remarks & Introductions

USDOT ITS JPO

- **Steve Sill**

- Program Manager, Vehicle Safety Technology, ITS Architecture and Standards

- **Walt Fehr**

- Program Manager, Systems Engineering

- **Suzanne Sloan**

- Transportation Technology Policy Analyst, Technology Innovation and Policy Division (Volpe)

Introductions - Continued

USDOT ITS JPO – Contract Support, Standards

- **Chris Karaffa**
 - Systems Engineer, USDOT ITS JPO Contract Support

- **Scott Andrews**
 - Communications & Standards Engineer, USDOT ITS JPO Contract Support

- **James Misener**
 - Communications & Standards Engineer, USDOT ITS JPO Contract Support

- **Ken Vaughn**
 - Transportation Engineer, USDOT ITS JPO Contract Support

- **Kelli Lafferty**
 - Technical Support, USDOT ITS JPO Contract Support

Introductions - Continued

USDOT ITS JPO – Contract Support, Architecture

- **David Binkley**
 - Systems Engineer, National ITS Architecture Team

- **Tom Lusco**
 - Systems Engineer, National ITS Architecture Team

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Background – Program Goals & Objectives

- The USDOT ITS-JPO is developing a plan to guide our 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.
- As part of this effort, ITS-JPO is developing the CVRIA, a reference architecture that will support ongoing and future implementation of CV technologies.
- The CVRIA will be used to identify likely interfaces in a large-scale CV implementation, which will be candidates for standardization. These candidate interfaces will then be used to identify candidate standards that may be used to implement those interfaces.



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Goals & Objectives of Workshop

- During the workshop, we are asking for your feedback to assist us in:
 - Validating the interfaces identified and defined as part of the analysis
 - Validating the association of standards to the CVRIA interfaces
 - Identifying standards gaps
 - Identifying challenges and opportunities associated with current, new, and emerging standards

- The workshop will focus on discussion of:
 - The CV applications captured in the CVRIA;
 - The interfaces identified and defined in the CVRIA;
 - A crosswalk between candidate interfaces and standards; and
 - Standards gap analysis and emerging standards needs;



Providing Input

- Limited Q&A during the presentation portion
- Open discussion during breakout sessions
 - Day 1 Breakout will address:
 - The CVRIA (applications, assumptions, viewpoints)
 - Candidate CV interfaces
 - The mapping of standards to interfaces
 - Day 2 Breakout will address:
 - Performance requirements for CV applications/interfaces
 - Established, new, and emerging standards
 - Applicability of existing standards
 - Standards gaps



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USDOT

Intelligent Transportation Systems – Joint Program Office

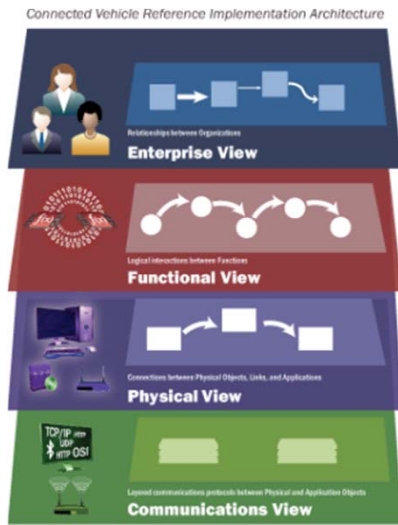
Connected Vehicle Reference Implementation Architecture (CVRIA) Interface Standardization Workshop

CVRIA Background, Status, Definitions

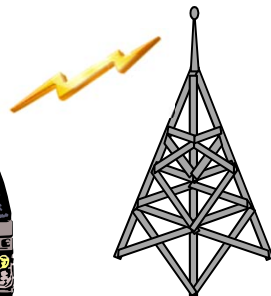
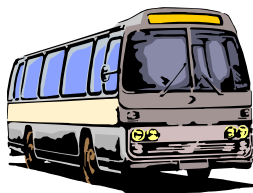
February 19, 2014



Architecture & Standardization Plan



Candidate Interfaces



The CVRIA provides a reference for applications and systems as well as identifying candidate interfaces within the architecture.

But...

how do we implement those interfaces?

Standardization is a critical component of implementation. The standardization plan will provide a strategy for ensuring that there are sufficient standards to support implementation and ensure interoperability.

Adopt

Adapt

or

Create

Connected Vehicle Reference Implementation Architecture (CVRIA)

Basis is the National ITS Architecture and Core System Architecture

Requirements derived from a series of CV-related concepts of operations developed by the USDOT through 2012

CVRIA Development Project

USDOT project now underway:

- *Develop connected vehicle reference implementation architecture*
- *Systematically document and prioritize interfaces, available standards, and standards gaps*
- *Tactically engage key stakeholders for input and communication*
- *Identify policy and institutional issues*
- *Consider potential harmonization benefits/opportunities*

Interface Architecture

Enhance the National ITS Architecture, providing users with a framework for implementation

Standards Development Strategy & Plan

Define a roadmap to help USDOT meet its CV standardization objectives

Policy Options

Provide input to analysis to produce a policy foundation for architecture, standards, and certification



- This session:
 - Discuss the Architecture
 - Prepare for discussions on interfaces and standardization
- Topics:
 - Background
 - Status
 - Definitions



**CONNECTED VEHICLE REFERENCE
IMPLEMENTATION ARCHITECTURE**

CVRIA Background



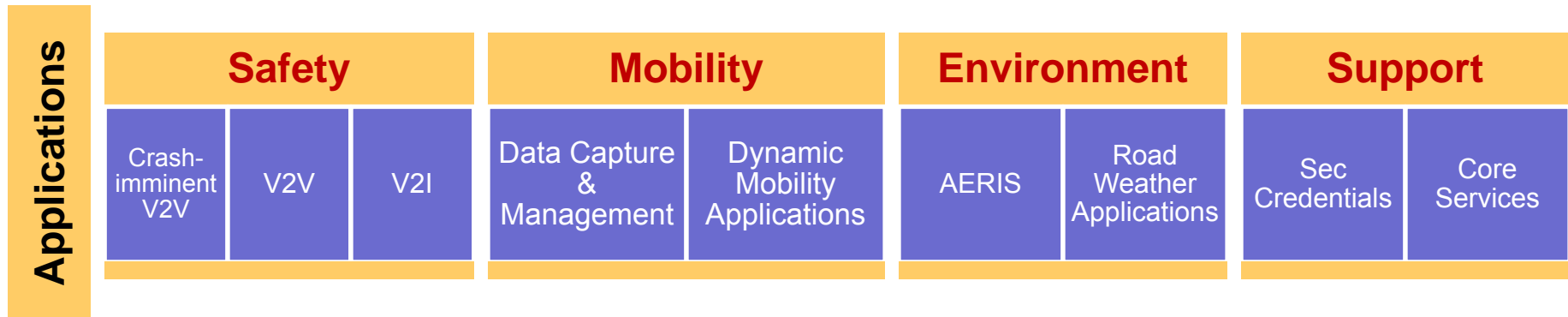
CVRIA Background

Landscape: safety, mobility, environmental applications with common supporting infrastructure

- Purpose – establish 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 – Incorporate CVRIA concepts into
 - National ITS Architecture
 - Regional ITS architectures/plans
 - Future transportation projects

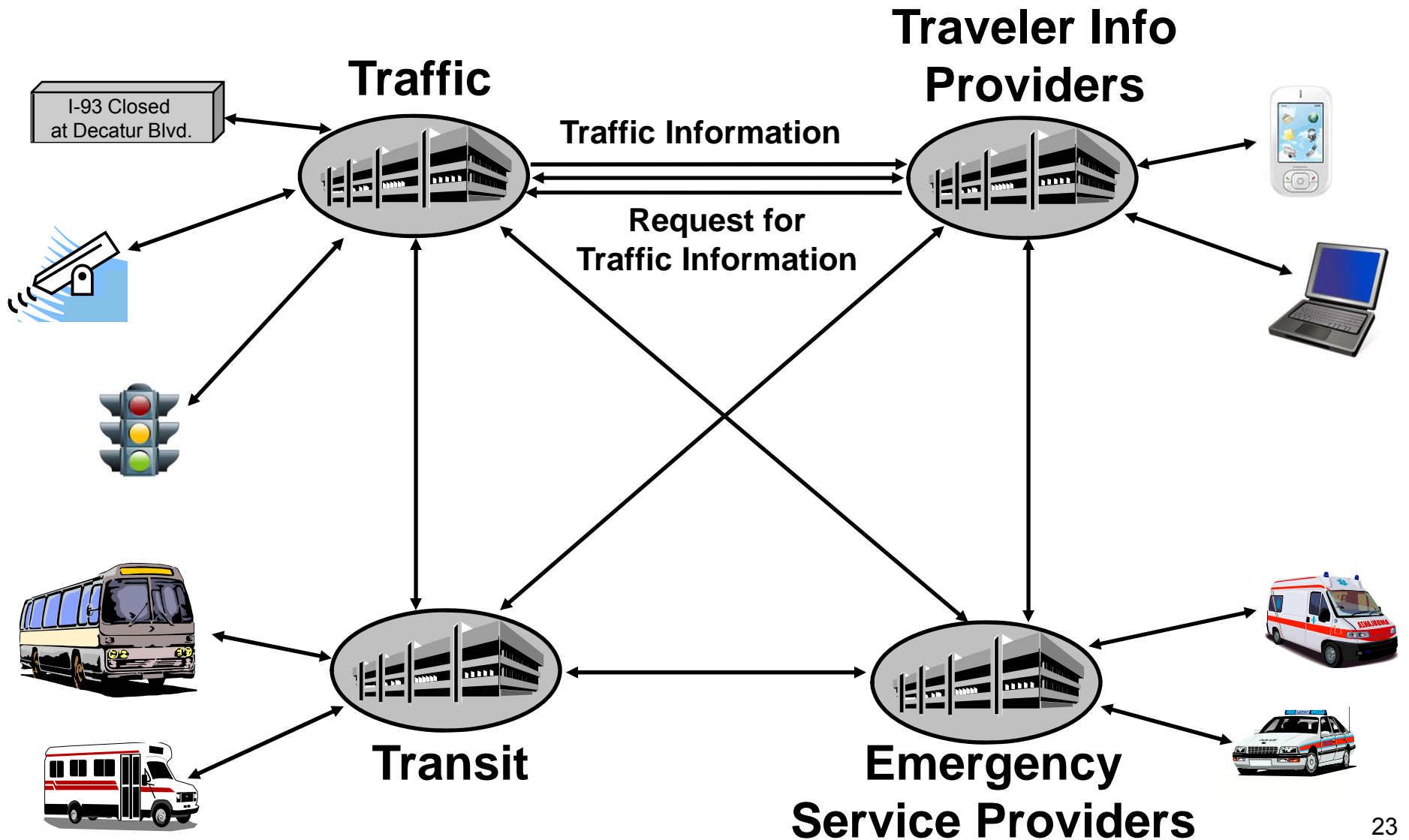


CVRIA Background and Purpose

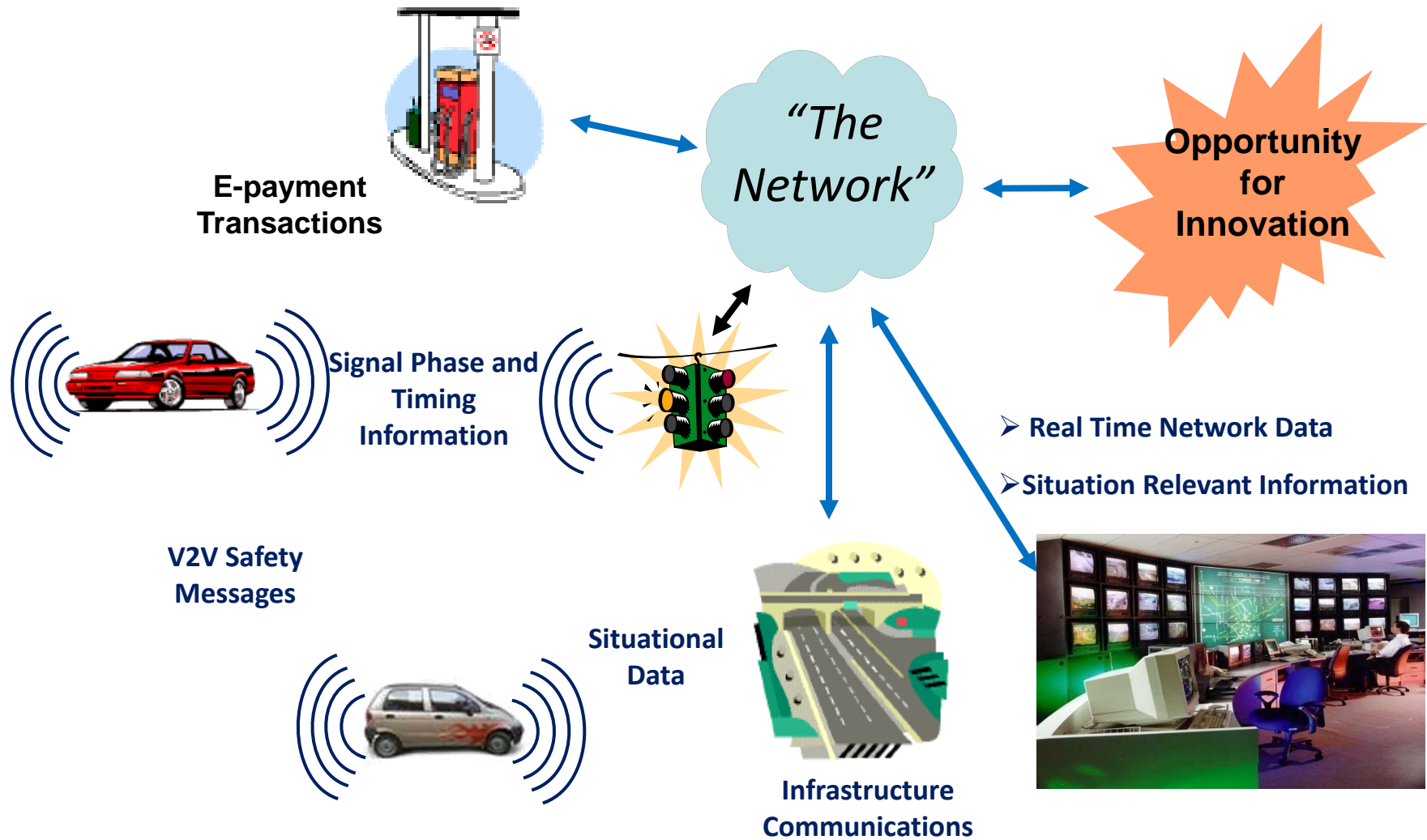


- With so many applications exposing so many opportunities for integration an architecture is needed to put the elements together
- Identifies:
 - Organizations
 - Users
 - Systems operated
 - Functions performed
 - Information exchanged
 - Communications protocols required

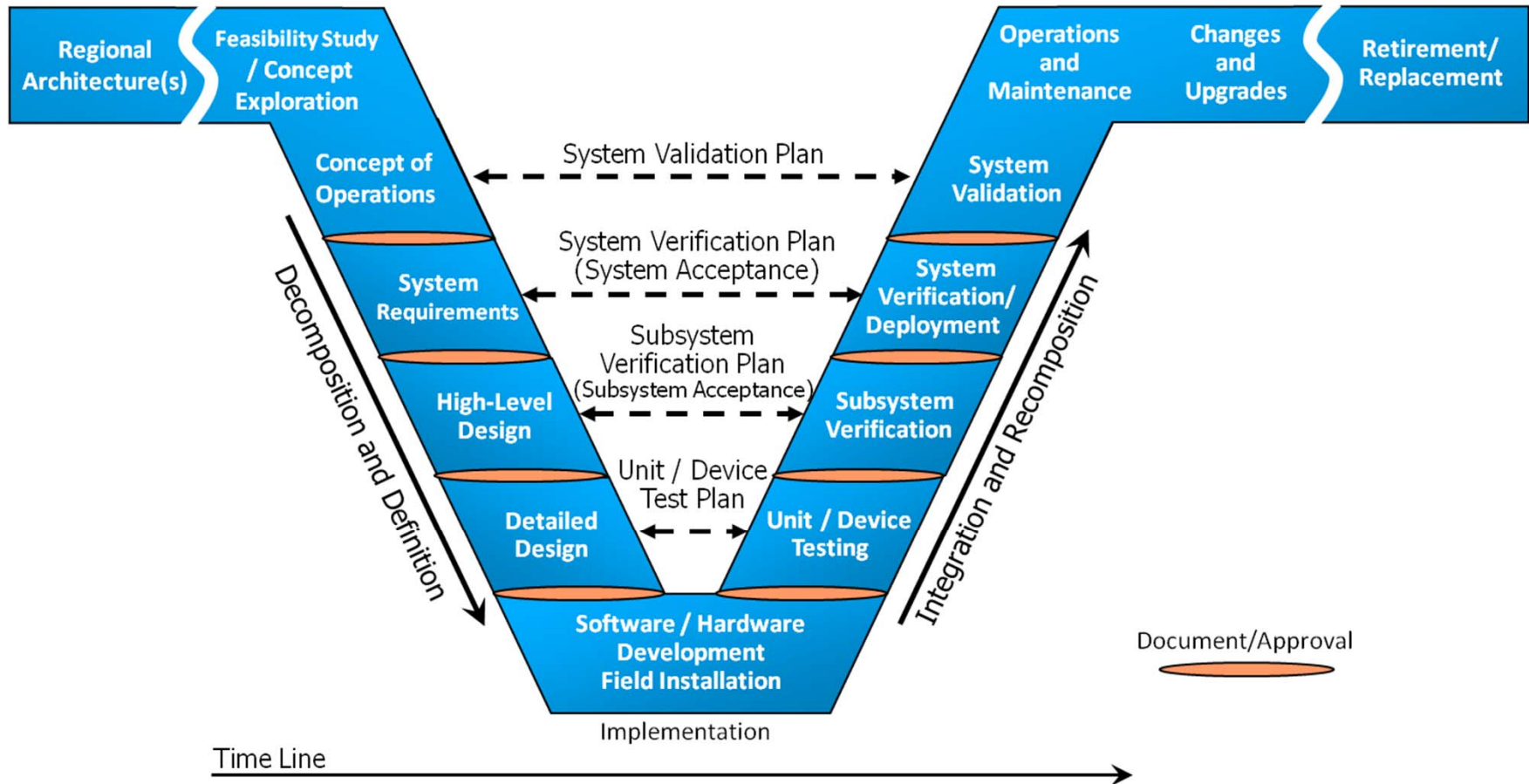
ITS Architectures are a Framework for Integration



Connectivity drives the benefits



A Systems Architecture for ITS Is Part of an Overall Systems Engineering Approach



CVRIA Leverages the National ITS Architecture Framework

- <http://www.its.dot.gov/arch/index.htm>

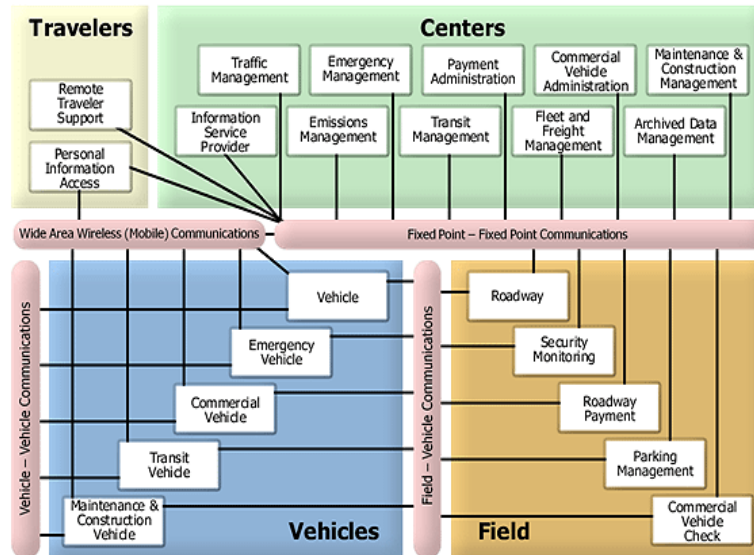


Image Source: USDOT

- Basis for FHWA Rule 940 Compliant ITS Deployment
- CVRIA enriches and expands upon connected vehicle interfaces & definitions
 - Broadcast and peer-to-peer data exchanges
 - Enable Big Data
 - Multiple wireless communication media

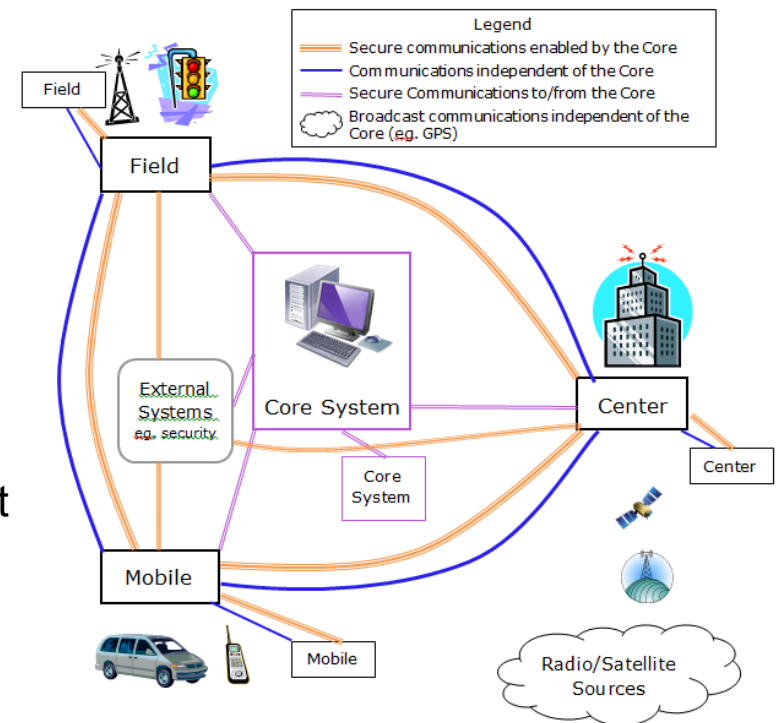
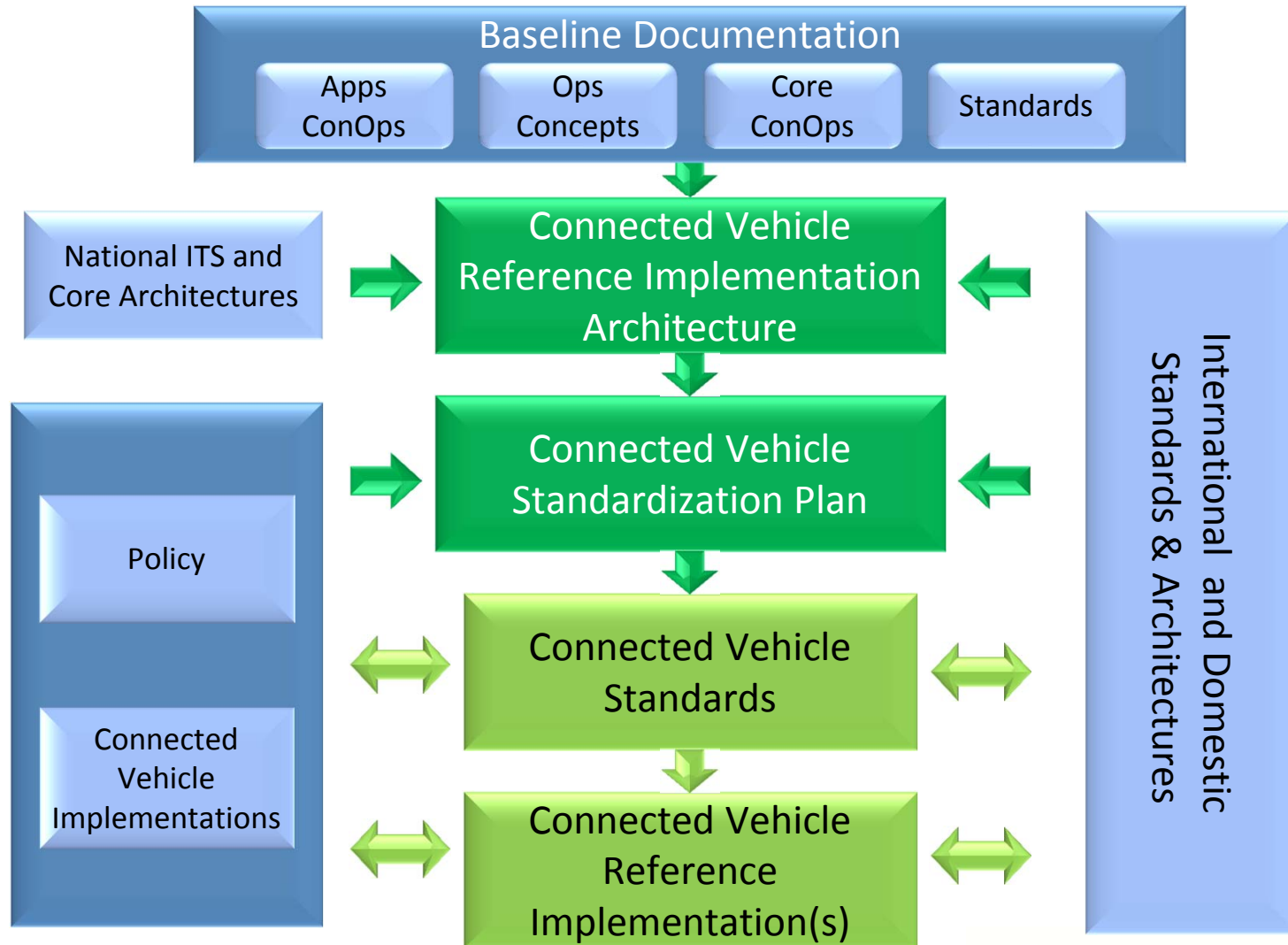


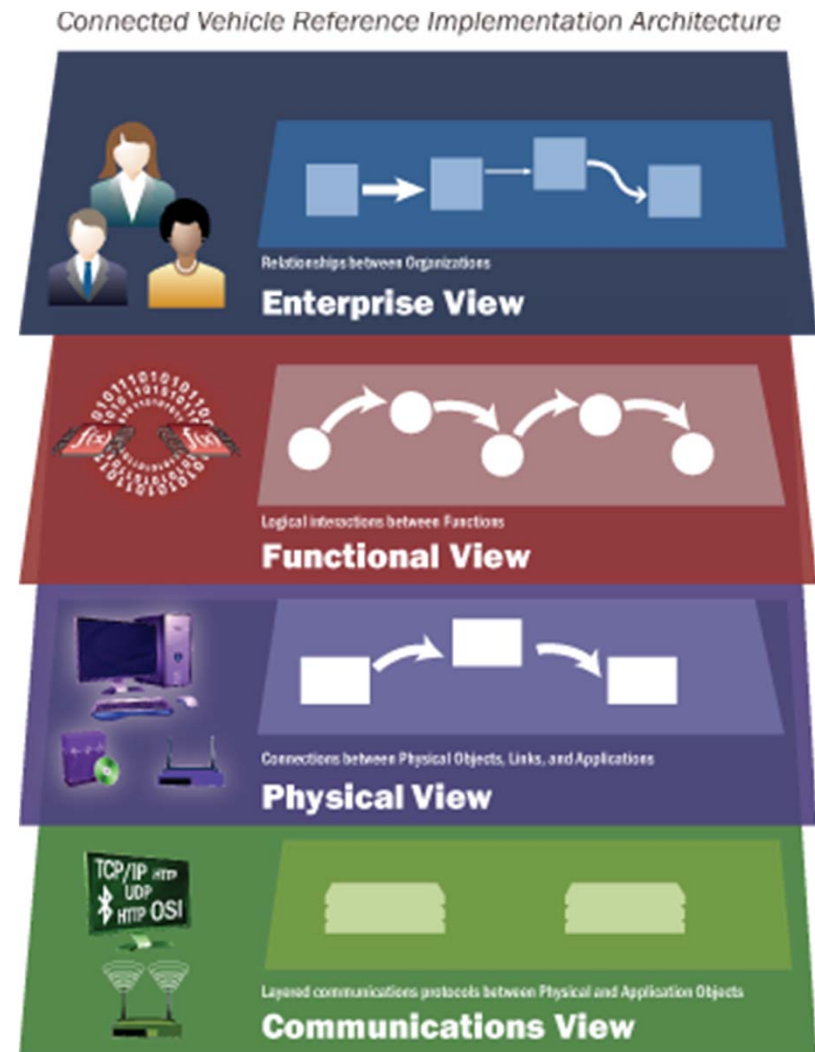
Image Source: USDOT

CVRIA Development Approach



CVRIA Includes Multiple Views

- [Enterprise](#) - Describes the relationships between organizations and the roles those organizations play within the connected vehicle environment
- [Functional](#) - Describes abstract functional elements (processes) and their logical interactions (data flows) that satisfy the system requirements
- [Physical](#) - Describes physical objects (systems and devices) and their application objects as well as the high-level interfaces between those physical objects
 - Interfaces provide potential standardization points
- [Communications](#) - Describes the layered sets of communications protocols that are required to support communications among the physical objects that participate in the connected vehicle environment

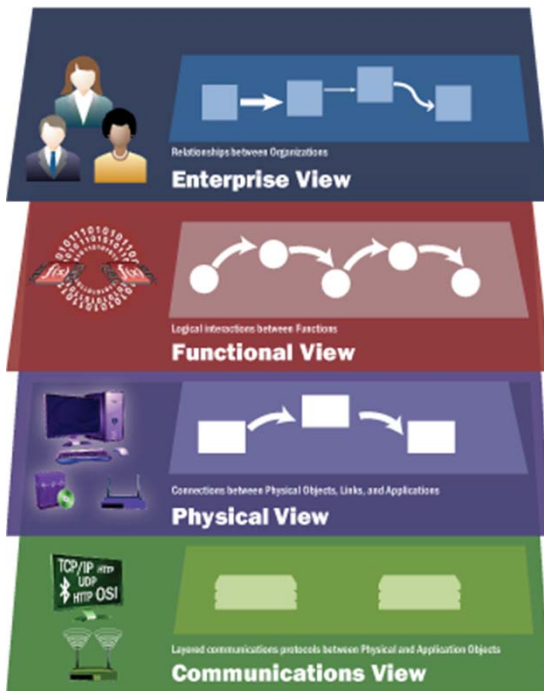


CVRIA Website Links Views to Applications

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

Applications	Safety			Mobility		Environment		Support	
	Crash-imminent V2V	V2V	V2I	Data Capture & Management	Dynamic Mobility Applications	AERIS	Road Weather Applications	Sec Credentials	Core Services

Connected Vehicle Reference Implementation Architecture



CVRIA CONNECTED VEHICLE REFERENCE IMPLEMENTATION ARCHITECTURE

Enterprise Functional **Physical** Requirements

Physical

The physical diagram can be viewed in SVG or PNG format and the current format is SVG.
[SVG Diagram](#)
[PNG Diagram](#)

```

graph LR
    TMC[Traffic Management Center] -- "right-of-way request" --> IRE[ITS Roadway Equipment]
    IRE -- "notification" --> TMC
    TMC -- "signal control commands" --> IRE
    IRE -- "signal priority service request" --> RE[Roadside Equipment]
    RE -- "intersection status" --> IRE
    
```



**CONNECTED VEHICLE REFERENCE
IMPLEMENTATION ARCHITECTURE**



CVRIA Status



CVRIA Status

- Website Created
 - Populated with Architecture Content for all 4 views
 - For all Connected vehicle applications
 - minus Security Credentials Management System (SCMS); to be completed as policy is defined
 - [Contact Us](#) and [Comment on Page](#) links provided for stakeholders to give feedback, either general ideas or specific needs for improvement
 - Standards tab to be updated with results of the standardization planning activity
- Resources Include
 - Presentation materials from previous stakeholder workshops and recent CVRIA webinars
 - Databases
 - Mini-Tool → a downloadable Visio file that allows project developers to create customized versions of the CVRIA physical and enterprise view drawings
 - Allows projects to be defined in same 'language' and format



CVRIA Next Steps

- Currently
 - Gathering feedback from this workshop and website
 - Incorporating inputs
 - Adding security considerations for physical objects and flows
 - Updating tools
- Ongoing
 - Maintain CVRIA
 - Monitor usage in Test Beds, Demos, Early Deployments
 - Updating architecture, tools as needed
- Later
 - Merge / Incorporate CVRIA into National ITS Architecture





**CONNECTED VEHICLE REFERENCE
IMPLEMENTATION ARCHITECTURE**

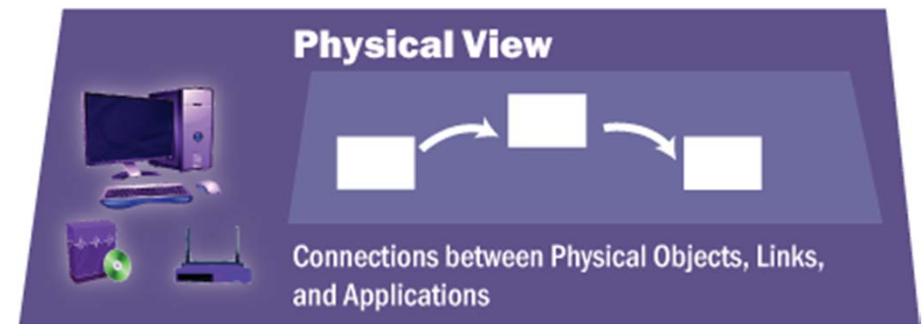


CVRIA Definitions

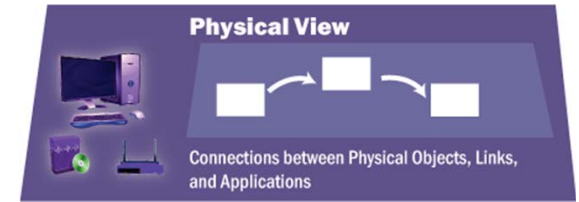


CVRIA Terminology

- Architecture Concepts and Terms that will be needed to discuss Interfaces and Standards
- Interfaces pull directly from the Physical and Communications Views

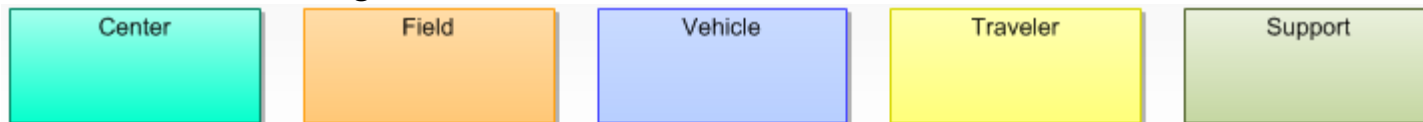


CVRIA Physical View



- Depicted as a set of integrated [Physical Objects](#) that interact and exchange information to support the connected vehicle applications.

- Color coded on diagrams to show 5 classes

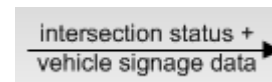


- Physical Objects include [Application Objects](#) that define more specifically the functionality and interfaces that are required to support a particular connected vehicle application.

- White boxes inside the larger physical objects

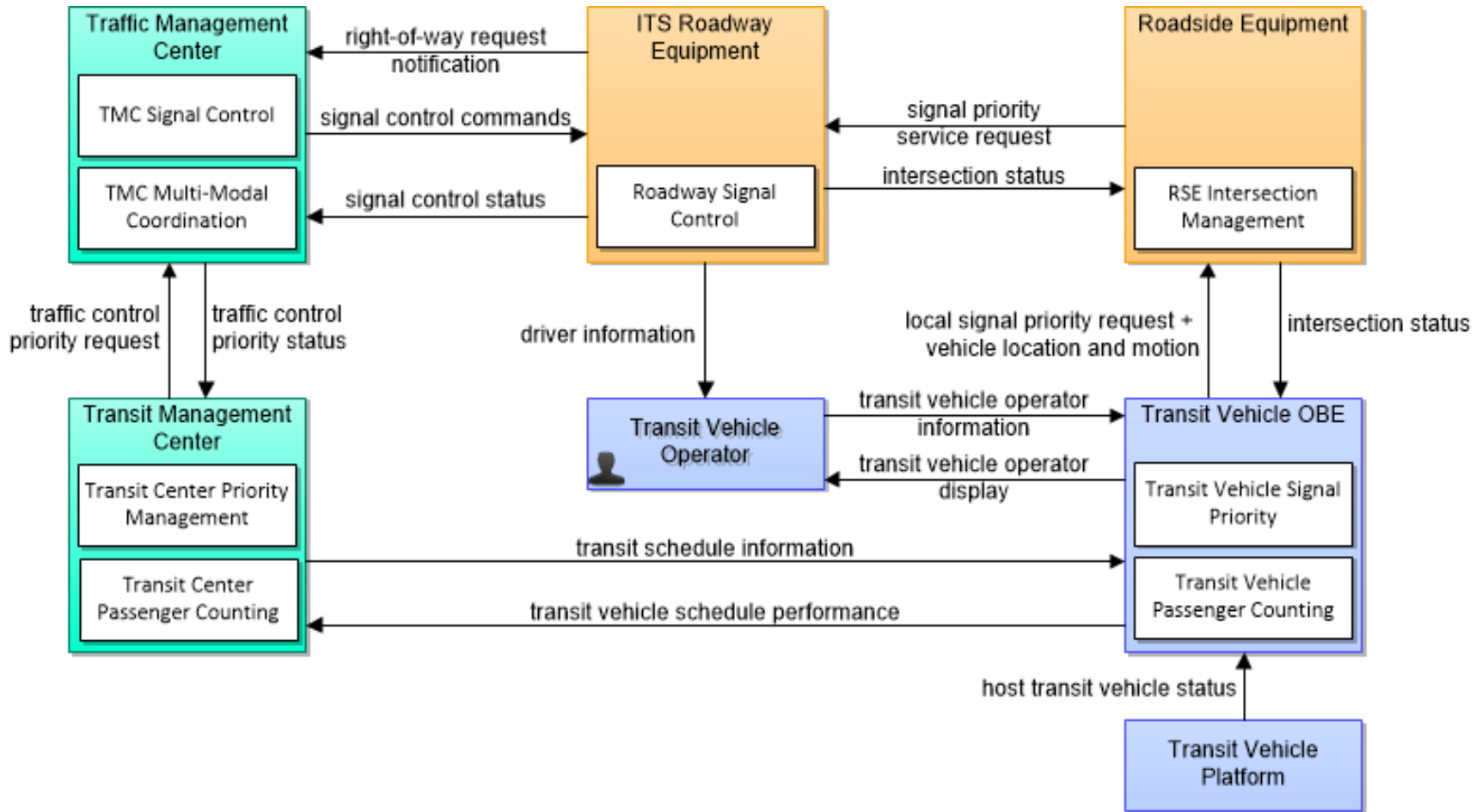
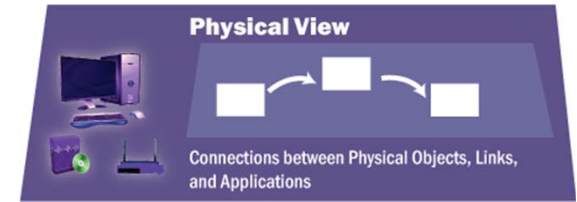


- [Information Flows](#) depict the exchange of information that occurs between Physical Objects and Application Objects.



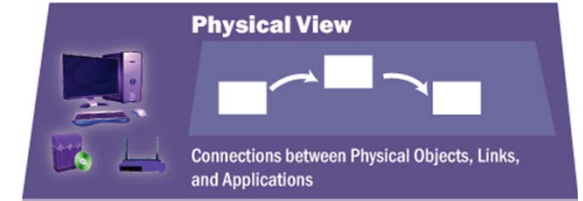
- Information exchanges are identified by [Triples](#) that include the source and destination Physical Objects and the Information Flow that is exchanged.

Physical View, example



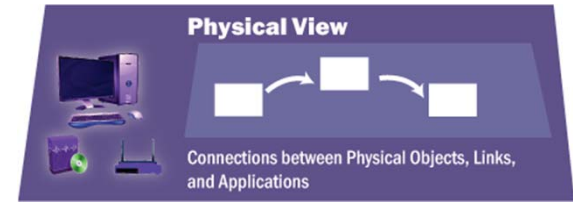
Transit Signal Priority			
2	Physical	Nov 3, 2013	NAT

Physical View, information flows



- Clicking on a link on one of the diagrams opens the definition and associated information for that 'Triple'
 - Definition – for the flow, its source, and its destination
 - Included In – Applications and Application Objects
 - Communications Diagrams – showing protocols and associated standards by type of link
 - Security considerations – to be defined

Physical View, communications diagrams



Roadside Equipment --> Transit Vehicle OBE: intersection status

Link Type: Short Range

Definition	Included In	Communication Diagrams	Security
------------	-------------	------------------------	----------

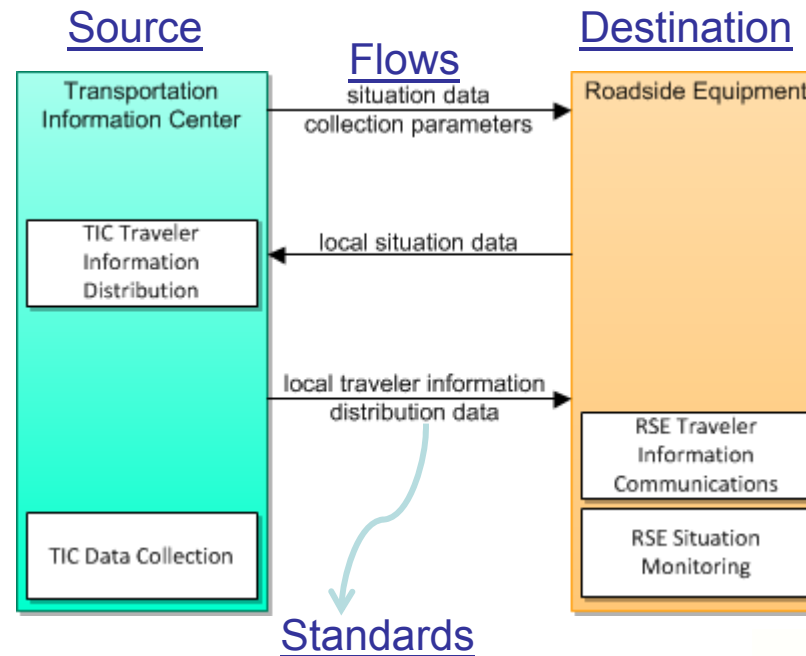
DSRC-5.9-GHz-UDP (Vehicle-to-Vehicle, Vehicle-to- Infrastructure). This template describes a set of standards applicable to broadcast, frequent (non-contant), medium latency vehicle- to-vehicle and vehicle-to-infrastructure communications using the User Datagram Protocol (UDP) over Internet Protocol version 6 (IPv6) over the 5.9GHz spectrum.

DSRC 5.9 GHz - UDP (Vehicle to Vehicle, Vehicle to Infrastructure)		
intersection status -->		
Roadside Equipment		Transit Vehicle OBE
Information Layer		Information Layer
SAE J2735		SAE J2735
Encoding Layer		Encoding Layer
ISO ASN.1 DER		ISO ASN.1 DER
Application Layer		Application Layer
Undefined (Sockets)		Undefined (Sockets)
Transport Layer		Transport Layer
IETF UDP, IETF IPv6		IETF UDP, IETF IPv6
Link Layer	Security Layer IEEE 1609.2	Link Layer
IEEE 802.2, IEEE 1609.4		IEEE 802.2, IEEE 1609.4
Physical Layer		Physical Layer
IEEE 802.11p (5.9Ghz wireless)		IEEE 802.11p (5.9Ghz wireless)

CVRIA Communications View



- Describes the communications protocols necessary to provide interoperability between Physical Objects in the Physical View
- Each triple from the Physical View has been mapped to:
 - one or more data dictionary standards, i.e. information layer standard
 - one or more standards profiles, defined to identify the communications protocols necessary to transport data described by an information flow



CVRIA Communications View, example



Center to Field (RSE)		
local situation data -->		
Roadside Equipment		Transportation Information Center
Information Layer SAE J2735		Information Layer SAE J2735
Encoding Layer ISO ASN.1 DER		Encoding Layer ISO ASN.1 DER
Application Layer Undefined (Sockets)		Application Layer Undefined (Sockets)
Transport Layer IETF UDP, IETF IPv6	Security Layer IEEE 1609.2	Transport Layer IETF UDP, IETF IPv6
Link Layer IEEE 802.2		Link Layer IEEE 802.2
Physical Layer Backhaul PHY*		Physical Layer Backhaul PHY*

* An Internet connection or private network connection that is routable between the RSE and center.

Communications View



- Types of Links included and combined to create the different communications profiles:
 - Short Range Wireless
 - Wide Area Wireless
 - Fixed Point
- Some physical interfaces in CVRIA may have alternative ways of communicating
 - Physical View / Communications Diagrams will show the alternatives as well
 - E.g., Vehicle to Center may go through an RSE or directly via wide-area-wireless
- Communications view supports designers and implementers relate their system elements to specific standards and see the commonalities among interfaces.
- Not all layers on all interfaces have standards associated with them – will show as “UNDEFINED” and is the subject of the standardization task next.

- This session:
 - ✓ Discuss the Architecture
 - ✓ Prepare for discussions on interfaces and standardization
- Topics:
 - ✓ Background
 - ✓ Status
 - ✓ Definitions

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Interface Identification – Overview

- **CVRIA has hundreds of information flows**
 - Described in the physical view as “triples”, which include *Source*, *Destination*, and *Flow* (Data)
 - We simplify by introducing the concept of *interfaces*, which group these triples. Thus, any given interface may carry many different triples
 - e.g., The DSRC interface carries dozens of different messages (flows)

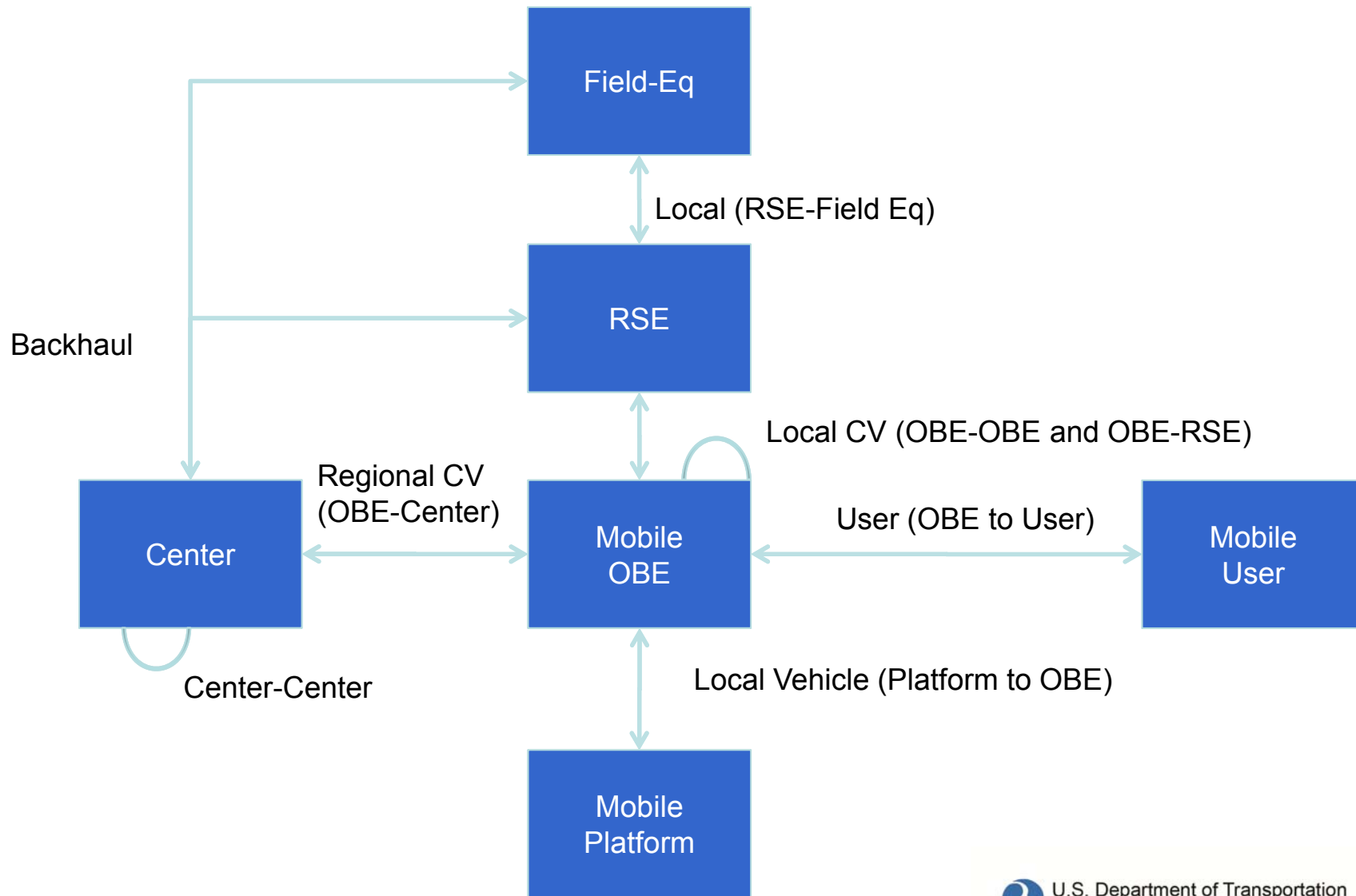
- **To define interfaces and associated standards, we narrow down CVRIA to basic interfaces between high level CVRIA objects**
 - Identify key characteristics of the interface
 - Identify data that passes through the interface
 - Identify connected vehicle applications that use the interface

Basic Connected Vehicle Architecture Objects (Elements)

- Center Objects
- Field Objects
 - Various types of roadway equipment
- Connected Vehicle Field Objects
- Mobile Platform Objects
 - Various types of vehicle platforms
- Mobile Connected Vehicle Objects
 - On board connected vehicle equipment and mobile CV devices
- Users



Basic Connected Vehicle Architecture And Top Level Interfaces



Top Level Interfaces Identified

- **Cluster Objects (source, destination) to identify core interfaces**

- User Interface (only addressed OBE to user, assumed, ITS Field to drivers, and center to center operators were contained within those objects)
- Local-Vehicle (i.e. in-vehicle)
- Local Connected Vehicle (DSRC)
- Regional Connected Vehicle (WWNA/LTE)
- Backhaul (RSE/field to center)
- Center to Center
- Local-Equipment (RSE to Field Equipment)

Field Equipment:

- Border Inspection Equip
- Comm'l Vehicle Check Equip
- ITS Roadway Equip
- Electric Veh Charging Station
- Intermodal Terminal
- Field Support Equip
- Wayside Equip

- **Identify interface attributes and supporting standards for each flow within each core interface**

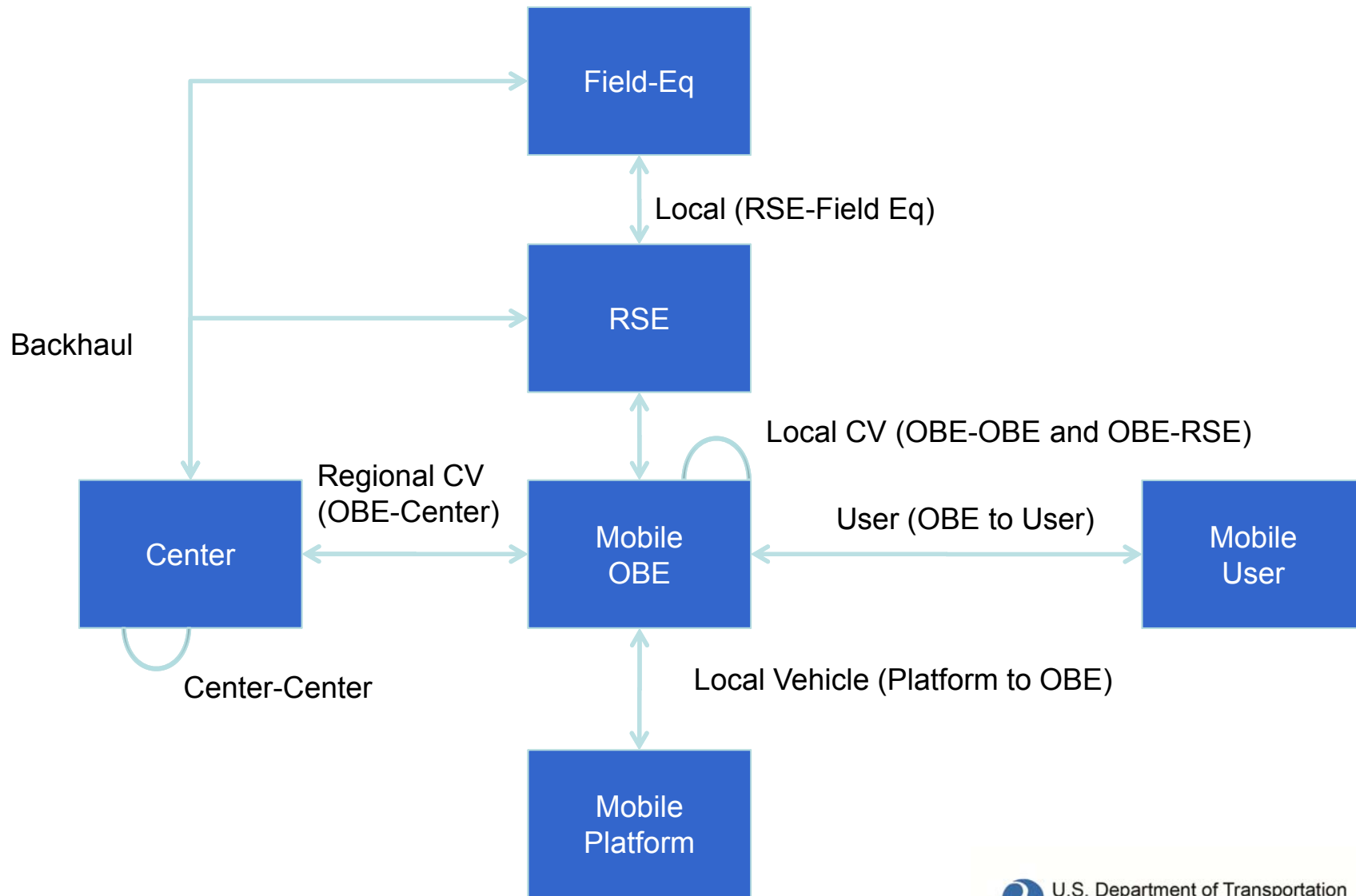
- Attributes (see below)
- Standards based on OSI layers



Interface Attributes

- **Directionality**
 - Unidirectional
 - Bidirectional
- **Immediacy**
 - Now
 - Recent
 - Historical
 - Static
- **Proximity**
 - Adjacent
 - Local
 - Regional
 - National
- **Reliability**
 - Unconfirmed
 - Confirmed
- **Flow**
 - Non-Transactional
 - Transactional
- **Capacity**
 - Now
 - Recent
 - Historical
 - Static
- **Trackability**
 - Trackable
 - Non-Trackable
- **Mobility**
 - Stationary
 - Fixed
- **Authenticity**
 - Verifiable
 - Non-Verifiable
- **Confidentiality**
 - Plain
 - Encrypted
- **Privacy**
 - Identifiable
 - Anonymous
- **Cardinality**
 - One-to-One
 - One-to-Many
 - One-to-Any

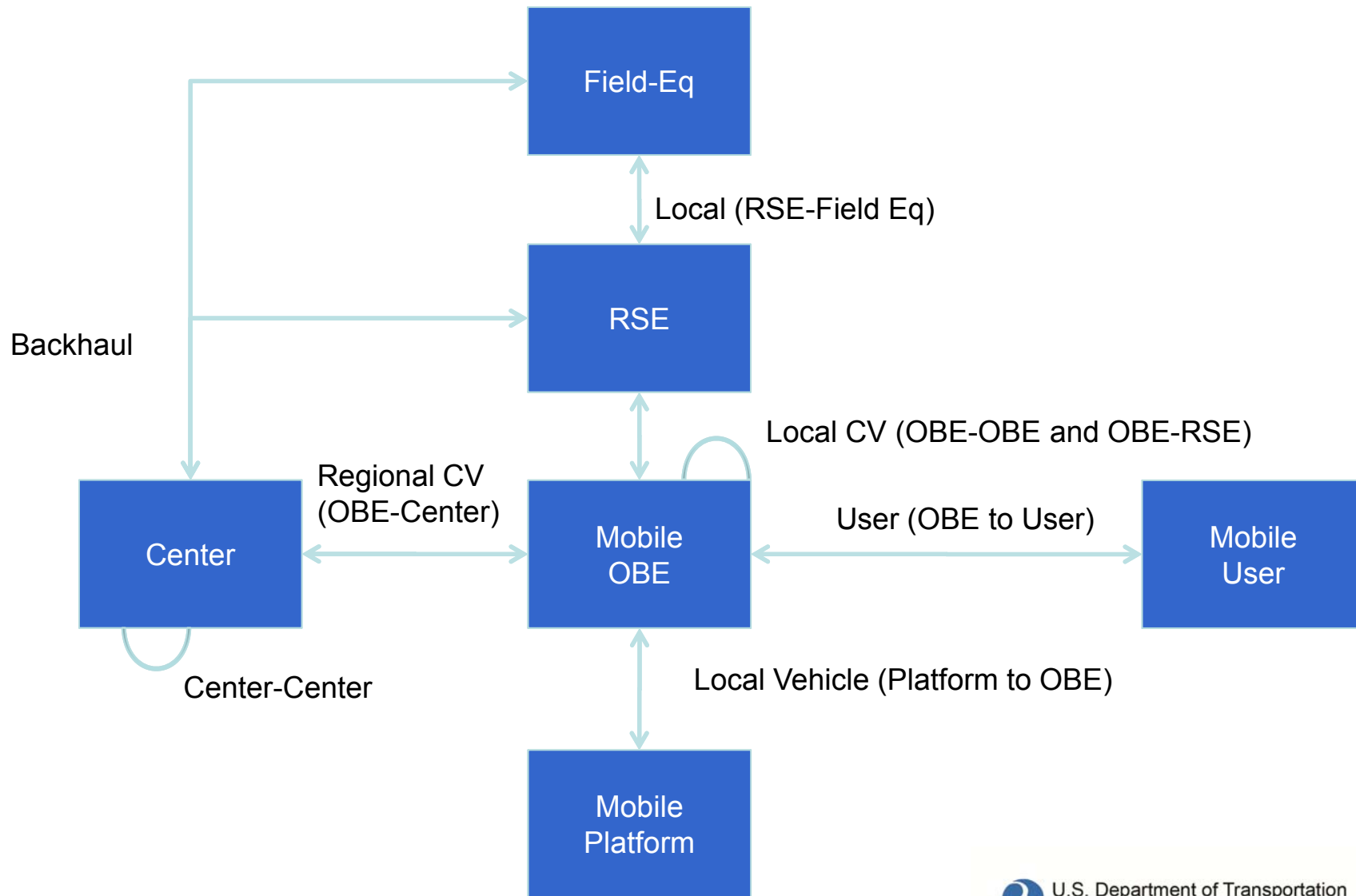
Basic Connected Vehicle Architecture And Top Level Interfaces



CVRIA Mobile Platform Objects

- Mobile Platform (maintained as 6 platforms since the interfaces are different for each type)
 - Commercial Vehicle
 - Emergency Vehicle
 - Freight Equipment
 - Maintenance and Construction Vehicle
 - Transit Vehicle
 - Light Vehicle

Basic Connected Vehicle Architecture And Top Level Interfaces

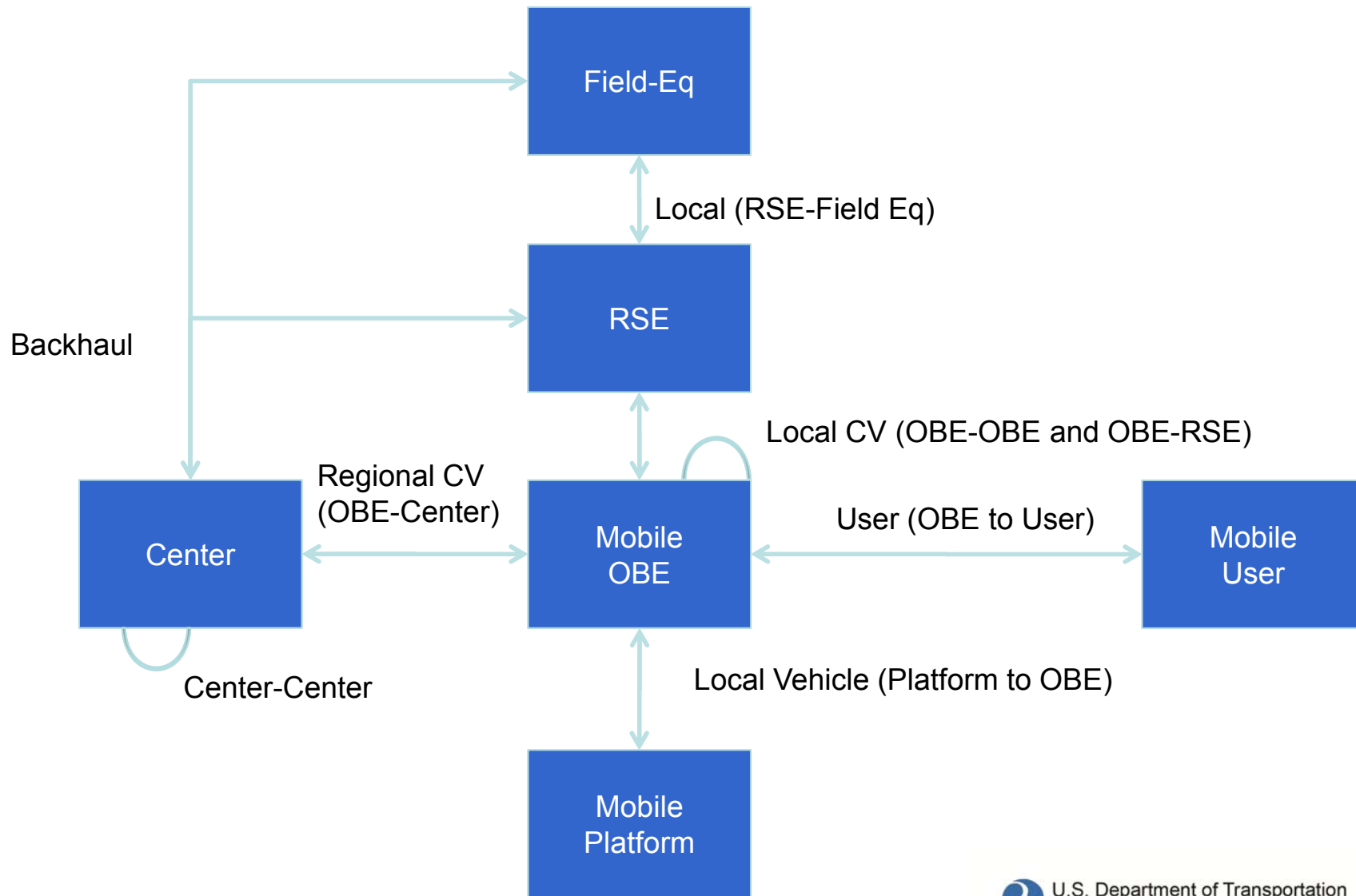


CVRIA Mobile OBE Objects

- Mobile OBE
 - Commercial Vehicle OBE
 - Emergency Vehicle OBE
 - Freight Equipment OBE (New)
 - Maintenance and Construction Vehicle (OBE)
 - Transit Vehicle (OBE)
 - Light Vehicle OBE
 - Personal Info Device



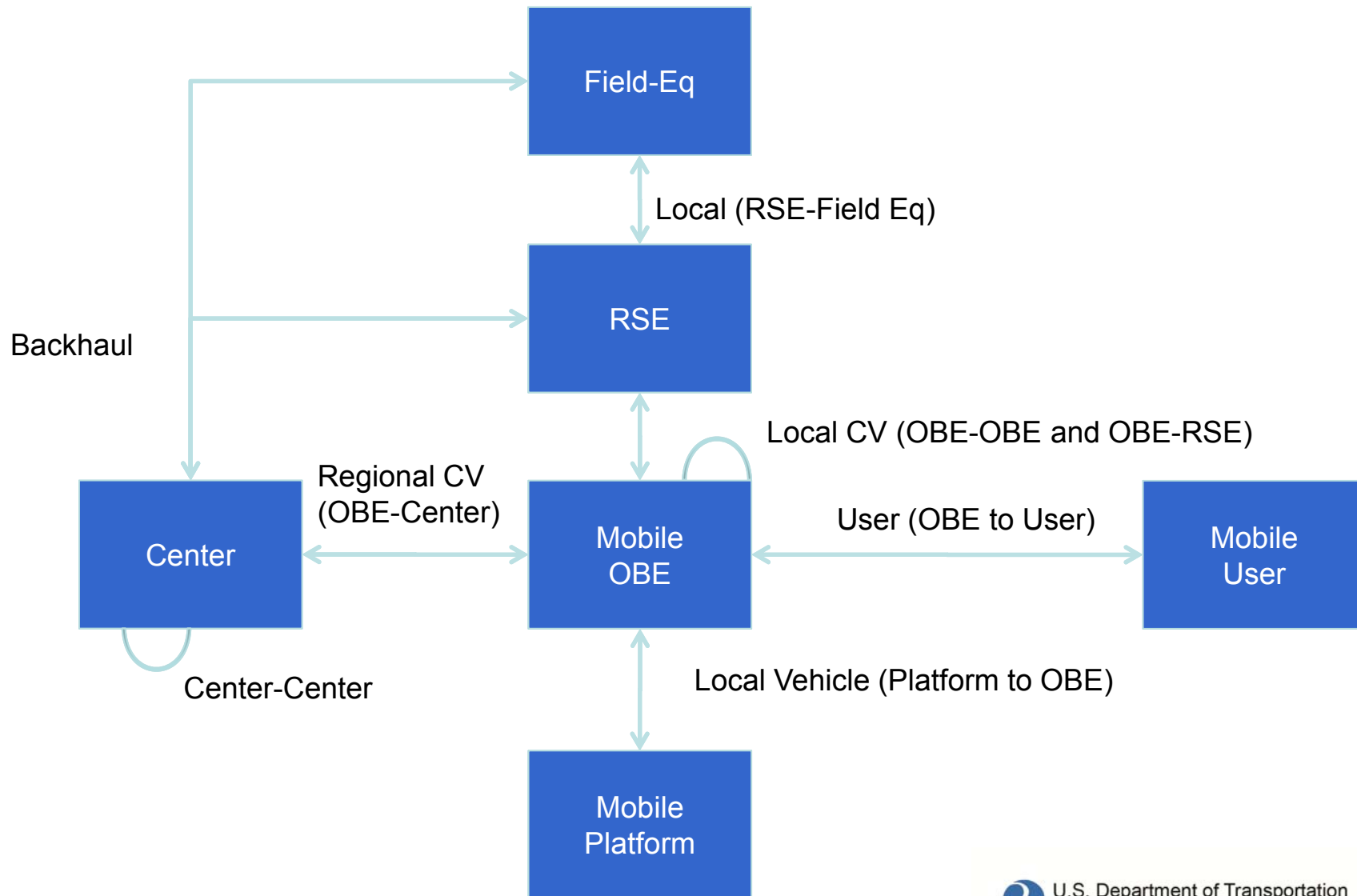
Basic Connected Vehicle Architecture And Top Level Interfaces



CVRIA Users

- Mobile User
 - Commercial Vehicle Operator
 - Emergency Vehicle Operator
 - Emergency Vehicle User (note differentiation with operator)
 - Freight Equipment (no users in CVRIA)
 - Maintenance and Construction Vehicle Operator
 - Maintenance and Construction Vehicle User (note differentiation with operator)
 - Transit Vehicle Operator
 - Transit Vehicle User (passenger)
 - Light Vehicle User/Operator
 - Vulnerable Road User (pedestrian/cyclist)

Basic Connected Vehicle Architecture And Top Level Interfaces

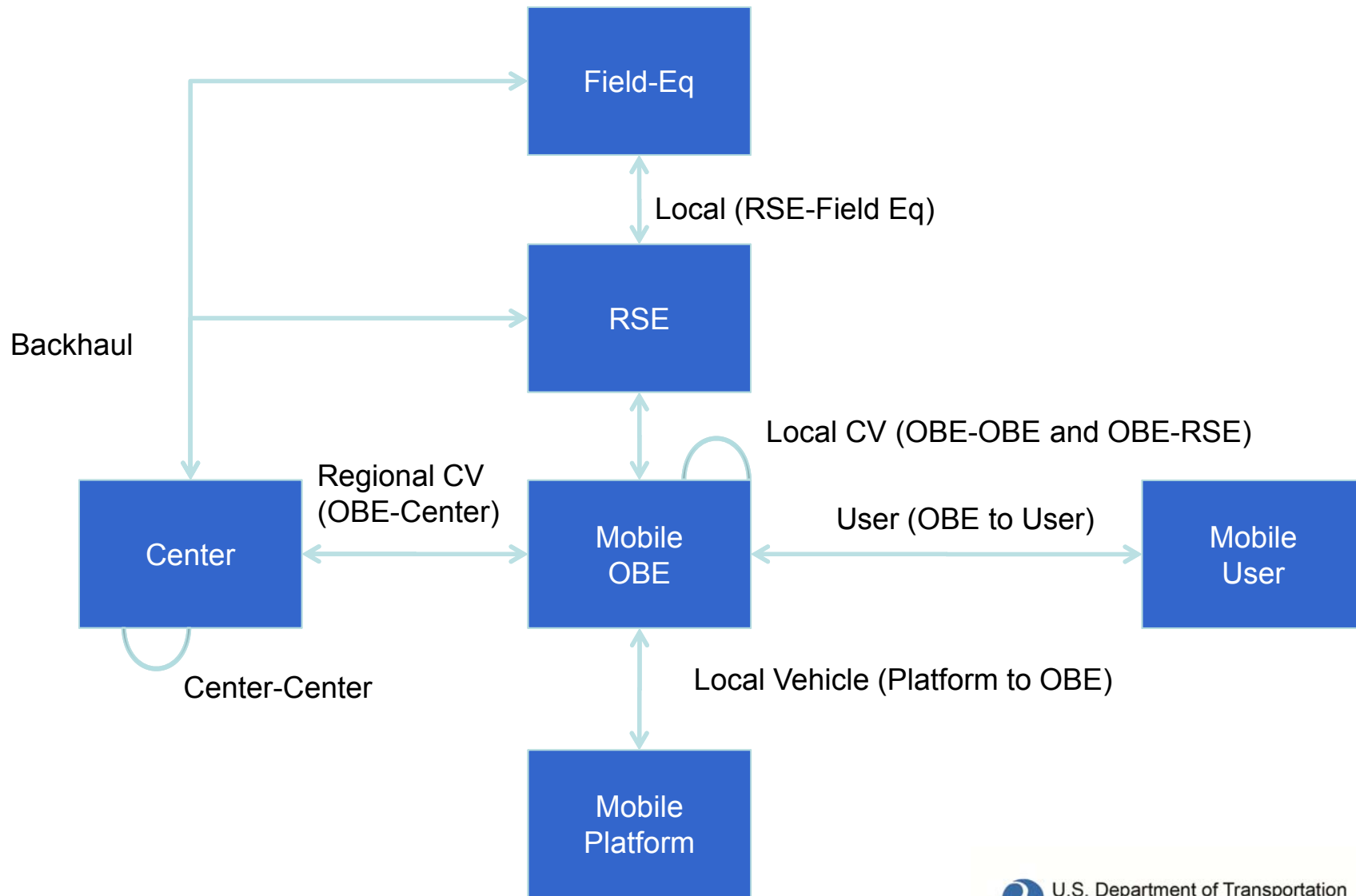


CVRIA Field Equipment Objects

- Field Equipment
 - Border Inspection System
 - Commercial Vehicle Check Equipment
 - Electric Charging Station
 - Field Support Equipment
 - Intermodal Terminal
 - ITS Roadway Equipment (includes 'traditional' ITS devices)
 - ITS Roadway Payment Equipment
 - Parking Management System
 - Wayside Equipment (rail)



Basic Connected Vehicle Architecture And Top Level Interfaces

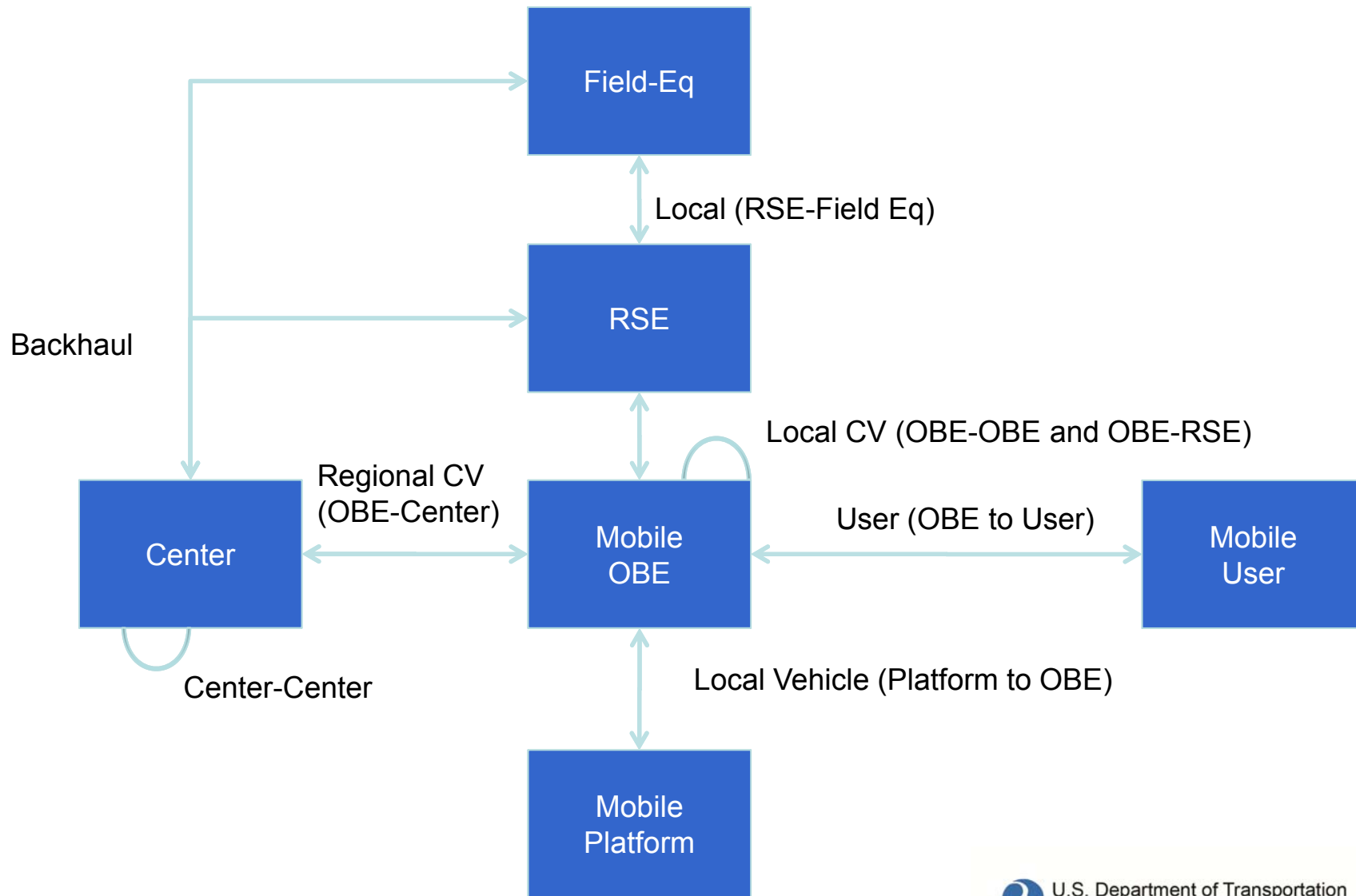


CVRIA Connected Vehicle Field Equipment Objects

- Roadside Equipment (RSE)
 - DSRC Transceiver and optional processing equipment



Basic Connected Vehicle Architecture And Top Level Interfaces



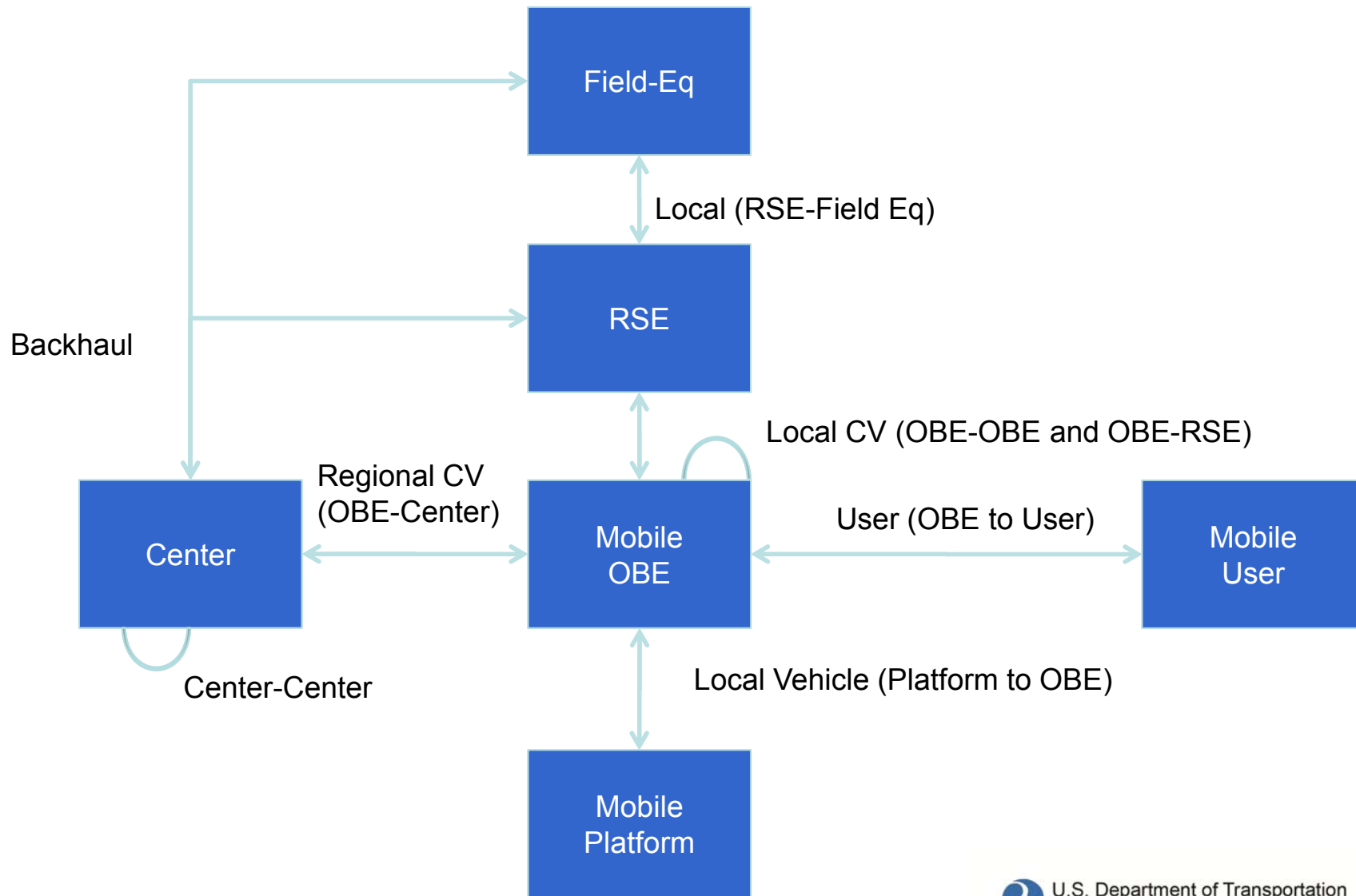
CVRIA Center Objects

▪ Center

- Archived Data Center
- Care Facility
- Center (general)
- Commercial Vehicle Administration Center
- Emergency Management Center
- Enforcement Center
- Fleet and Freight Management Center
- Maintenance and Construction Management Center
- Map Update System
- Security Credentials Management System (SCMS)
- Payment Administration Center
- Traffic Management Center
- Transit Management Center
- Transportation Information Center



Basic Connected Vehicle Architecture And Top Level Interfaces



CVRIA Objects Not Considered

- **ITS elements not necessarily unique to Connected Vehicles**
 - Payment Device
 - Traveler Card
 - Public Info Device (Kiosk)
 - Special Needs Registry
 - Financial Center
- **External to CVRIA**
 - Social Media
 - Emergency Telecomm System
 - Public Health System
 - Event Promoters
 - Traveler (overlaps many other users)
- **Redundant with other more general objects**
 - Maintenance & Construction Systems Admin Systems
 - Payment Administrator
 - Center Operators (absorb into centers)



Read-Ahead Package – Table 1 – Interfaces

Interface ID	Interface Name	Endpoint 1*	Endpoint 2*	Interface Description	Characteristics
I-1	Local Connected Vehicle	Mobile Connected Vehicle Equipment	Mobile Connected Vehicle Equipment	Mobile Connected Vehicle Equipment to Mobile Connected Vehicle Equipment Wireless Interface (e.g. V2V)	Mobile, short range, medium data rate, broadcast and unicast, low latency
			Connected Vehicle Field Equipment (RSE)	Mobile Connected Vehicle Equipment to Roadside Wireless Interface (e.g V2I)	
I-2	Regional Connected Vehicle	Mobile Connected Vehicle Equipment	Center	Mobile Connected Vehicle Equipment to Center Wireless Interface (e.g. V2C)	Mobile, long range medium data rate, point to point (Unicast)
I-3	Local Field Equipment	Field Equipment	Connected Vehicle Field Equipment	Roadside Connected Vehicle Equipment to Roadside ITS Equipment	Fixed, short range, low/medium data rate, point to point (unicast)
I-4	Local Vehicle Internal	Mobile Connected Vehicle Equipment	Vehicle Systems	Internal Interface Between Vehicle Systems and Mobile Connected Vehicle Equipment	Fixed, very short range (in vehicle), medium data rate
I-5	User	Mobile User	Mobile Connected Vehicle Equipment or Vehicle Systems	Interface Between Users and Mobile Connected Vehicle Equipment	Graphical, auditory and haptic human/machine interfaces
I-6	Backhaul	Field Equipment, Connected Vehicle Field Equipment (RSE)	Center	Fixed or Wireless Interface from Roadside Connected Vehicle Equipment and Roadside ITS Equipment to Centers	Fixed, long range, medium/high data rate, point to point (unicast)
I-7	Center to Center	Center	Center	Interfaces Between Centers	Fixed, long range, medium/high data rate, point to point, may include web services



Read-Ahead Package –

Table 2 – Mapping Interfaces to Standards

Interface ID	Interface Name	Expected Technologies	OSI Layer/Standard							Comment
			Physical	Link	Network	Transport	Session	Presentation	Application	
I-1	Local Connected Vehicle	DSRC	IEEE 802.11p/1609.4		IPv6	TCP/UDP	None	None	HTTP, FTP, Proprietary, SAE J2735/SAE J2945	Session management undefined (for session integrity across RSE encounters); SAE message sets incomplete
					IEEE 1609.3				IEEE 1609.2	Security management, and privacy issues remain to be addressed
I-2	Regional Connected Vehicle	LTE Cellular	3GPP 36.201	See Note 1 Below	IPv4/6	TCP/UDP	Unknown	None	Various	
I-3	Local Field Equipment	NTCIP/ITS Cabinet	NTCIP 21xx or ITS Cabinet Standard		NTCIP 22xx*		None	NTCIP 2301 or ISO 15784-2***	NTCIP 12xx	Application layer does not necessarily support CV applications
I-4	Local Vehicle	CAN Bus	ISO11519-2/ISO 11898	CAN 2.0	None	None	None	None	Proprietary	CAN message sets typically vehicle/maker specific
I-5	User	Visual	See Note 2 Below	N/A	N/A	N/A	N/A	N/A	Symbology	OSI Layers typically not used for UI. Few UI Standards Exist, May need top level (application) standards (See Note 2 Below)
		Auditory							Earcons	
		Haptic							N/A	
I-6	Backhaul	NTCIP	NTCIP 21xx		NTCIP 22xx*		None	NTCIP 2301 or ISO 15784-2***	NTCIP 12xx	Application layer does not necessarily support CV applications
		LTE	3GPP 36.201	See Note 1 Below						
		WiMAX	802.16							
I-7	Center to Center	Fiber	10/100/100 OBASE	FDDI	IPv4/6	TCP/UDP	None	None	Various	Data and services interfaces generally not uniformly defined; Various NTCIP C2C standards exist.
		Wireline	ITU-T G.992.x**	ATM/ PPP						

Read-Ahead Package – Table 3 – Standards

Standard	SDO	Status	OSI Layers Addressed							Interfaces Implemented						
			Phys	Link	Net	Trans	Sess	Prsnt	App	I-1	I-2	I-3	I-4	I-5**	I-6	I-7
802.11/802.11p	IEEE 802	Released	X								A					
1609.x	IEEE	Released, being revised, working to harmonize with ISO		X	X	X					A					
SAE J2735	SAE	Released, being extensively revised, working to harmonize with ISO							X	X	A					
SAE J2945	SAE	In development							X	X	A					
NTCIP	NTCIP	Released, need to be revised for Connected Vehicles	X	X	X	X				X			A		A	A
Ethernet (802.2, 802.3)	IEEE 802	Released	X	X									A		A	A
CAN	ISO/Bosch	Released	X	X									A			
IPv4/6	ITFE	Released			X						A	A	A		A	A
FDDI				X											A	A
ISDN				X											A	A
ADSL			X												A	A
100BASE***			X												A	A
1000BASE***			X												A	A
TCP/UDP	ITFE	Released				X					A	A	A		A	A
GSM/LTE	3GPP	Released	X	X	X*							A			A	
HTTP	ITFE/W3	Released					X				B	B			B	B
FTP	ITFE/W3	Released					X				B	B			B	B
XML	W3	Released							X		B	B			B	B
UDDI	W3/OASIS	Released							X		B	B			B	B
SOAP	W3	Released							X		B	B			B	B
WSDL	W3	Released							X		B	B			B	B

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

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Breakout Session #1 – Overview

- Two groups, two rooms

- Open discussion

- Session #1 – Focus On:
 - Applications
 - Candidate CV interfaces within the applications
 - Standards applied to interfaces

- More detailed discussion topics provided at the breakout

PLEASE MOVE TO YOUR BREAKOUT SESSION NOW



Breakout Session #1 – Topics

- **Applications –**

What applications are most important to you? Can you describe how the application is done today? Is it captured in the CVRIA? Is it identical, similar? What are the major differences, if any?

- **Interfaces –**

Do the candidate interfaces in the CVRIA support your application(s)? Are there any additional interfaces you'd need? Are there any interfaces identified that you do not or would not need? Do you define the interfaces with the same attributes as the candidate interfaces captured in the CVRIA?

- **Standards Mapping –**

What standards apply to the interfaces between entities or actors in the application(s) you describe? How well do those standards fit?



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

***Connected Vehicle Reference
Implementation Architecture***

Stakeholder Workshop – Standards Plan
Day 2: February 20, 2014



Workshop Agenda – 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)

Workshop Agenda – 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)

Breakout Session #2 – Overview

- Two groups, two rooms
- Open discussion
- Session #2 – Focus On:
 - Performance requirements for CV applications/interfaces
 - Established, new, and emerging standards
 - Applicability of existing standards
 - Standards gaps
- More detailed discussion topics provided at the breakout

PLEASE MOVE TO YOUR BREAKOUT SESSION NOW



Breakout Session #2 – Topics

- **Performance Requirements –**

How well are the performance requirements for applications and interfaces defined? What are some implementation risks associated with performance requirements for the interfaces? Where should requirements definition efforts be focused?

- **Standards Gaps –**

How well do existing standards address known interfaces? What are the critical standards gaps? What are the risks to implementation, operations, maintenance?

- **New & Emerging Standards –**

What are the new and emerging standards that show the most promise for implementing CV applications? What are the risks associated with the emerging technologies? Where should standards development efforts be focused?

Workshop Agenda – Day 2

- 9:00 – 9:15:** Open Discussion, Recap of Day 1
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Contact Information

For other questions on CVRIA or the connected vehicle program:

Steve.Sill@dot.gov – 202-366-1603

Walt.Fehr@dot.gov – 202-366-0278

Workshop Agenda – Day 2

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