RITA Research and Innovative Technology Administration

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

Connected Vehicle Reference Implementation Architecture

Stakeholder's Workshop

San Jose, CA

April 30 – May 1, 2013

CVRIA Stakeholder Workshop Purpose

- Connected Vehicle Reference Implementation Architecture (CVRIA):
  - Identify a framework for integrating connected vehicle technologies and identify interfaces for standardization
- This workshop is to:
  - Discuss and solicit feedback on preliminary (draft) architecture views
  - Discuss policy analysis and standardization planning
  - Gain feedback from stakeholders manufacturing, developing, deploying, operating, or maintaining connected vehicle technologies and applications

CVRIA Stakeholder Workshop – Agenda

Topic – Day 2	Start	End
Welcome & Recap	8:30	8:45
Architecture View Discussions (Breakout Groups) (will include a 15 minute break)	8:45	11:30
Lunch	11:30	12:45
Report from Breakout Discussions	12:45	1:00
Connected Vehicle Policy Discussion	1:00	2:30
Break	2:30	2:45
Standardization Planning	2:45	3:30
Next Steps Discussion	3:30	4:00

CVRIA Breakout Group Discussion, Continued

- Pick-up where you left off…
  - Room 1: IMA, RSZW, Drayage, T-CONNECT, Eco-Lane Mgt, Road Weather
  - Room 2: IMA, Road Weather, Eco-Lane Mgt, T-CONNECT, Drayage, RSZW
- Take breaks, Take notes, we'll reconvene after lunch to discuss our findings

CVRIA Breakout Group Discussions

Room 1 Findings	Room 2 Findings

CVRIA Next Steps to Complete the Architecture

- May
  - Collect comments from workshop and website
  - Apply inputs to rest of architecture
- June – August
  - Complete Views
  - Continue stakeholder feedback
  - Complete Web/Documentation;
  - Identify interface candidates
- Ongoing
  - Incorporate feedback from Standardization plan workshop
  - Maintain CVRIA

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Connected Vehicle Reference Implementation Architecture

and

Connected Vehicle Policy

Suzanne Sloan
Transportation Technology Policy Analyst
USDOT / Research and Innovative Technology Administration / Volpe National Transportation Systems Center

May 1, 2013

CVRIA and Policy

- **Two levels of policy analysis for Connected Vehicle Environment:**
  - Broad analysis of universal policies that may apply across the Connected Vehicle environment
  - Analysis on specific elements or links among Connected Vehicle environment components to discover if more tailored policies or different policies are needed to ensure proper functionality

Broad Policy Research and Analysis

Has been underway since 2011 on critical issues such as:

- **Roles**
  - Government: Federal, State and local operating agencies
  - Private sector
- **Security, Privacy, and Communications**
  - What are the options? How is it provided? Who pays?
  - What levels of security and privacy are required? By whom?
- **Assurances of Interoperability**
  - Development of standards; International Harmonization
- **Funding/Financing**
  - Sustainable resources for operations and maintenance
  - Identifying and capturing value from the Connected Vehicle assets
  - Partnerships to leverage value into sustainable funding

Connected Vehicle Policy: Detailed Research

- **Focuses on specific elements and interchanges/interfaces of the Connected Vehicle environment**
- **Connected Vehicle Reference Implementation Architecture (CVRIA) is a tool**
  - Shows how all elements of the connected vehicle environment:
    - Work together
    - Where they interface with each other
    - What links exchange data
- **CVRIA analysis**
  - Illustrates risks in a more concrete, detailed manner
  - Provides an opportunity to ask questions about specific interfaces / interactions
  - Helps to identify the types of resources that might be needed by deployers

Plan for Policy Analysis

1. **STEP 1 – DEVELOP AN ANALYSIS PLAN**
2. **STEP 2 – PERFORM ANALYSIS**
3. **STEP 3 – DEVELOP POLICY OPTIONS**

STEP 1: DEVELOP AN ANALYSIS PLAN

1. **Identify the questions that elicit risks, concerns, opportunities**
2. **Identify actions/priorities desired for interfaces:**
    i. **Control / Open (standards)**
    ii. **Access / Credentials**
    iii. **Privacy Levels**
    iv. **Security Levels**
    v. **Others?**

Detailed Policy Research (continued)

- **Questions about specific interfaces / interactions**
  - Where is SECURITY needed, and why?
  - Where is PRIVACY of greatest importance?
  - Are specific types of COMMUNICATIONS (i.e., DSRC) needed and, if so, why?
  - Where are STANDARDS needed?
  - Are policies needed to achieve INTEROPERABILITY?
  - WHO is responsible for GOVERNANCE?
  - WHAT PERSONNEL might require CREDENTIALING?
  - Are there any SYSTEM POLICIES that must be uniform across the Connected Vehicle Environment? (i.e., use of a uniform time stamp with safety applications)

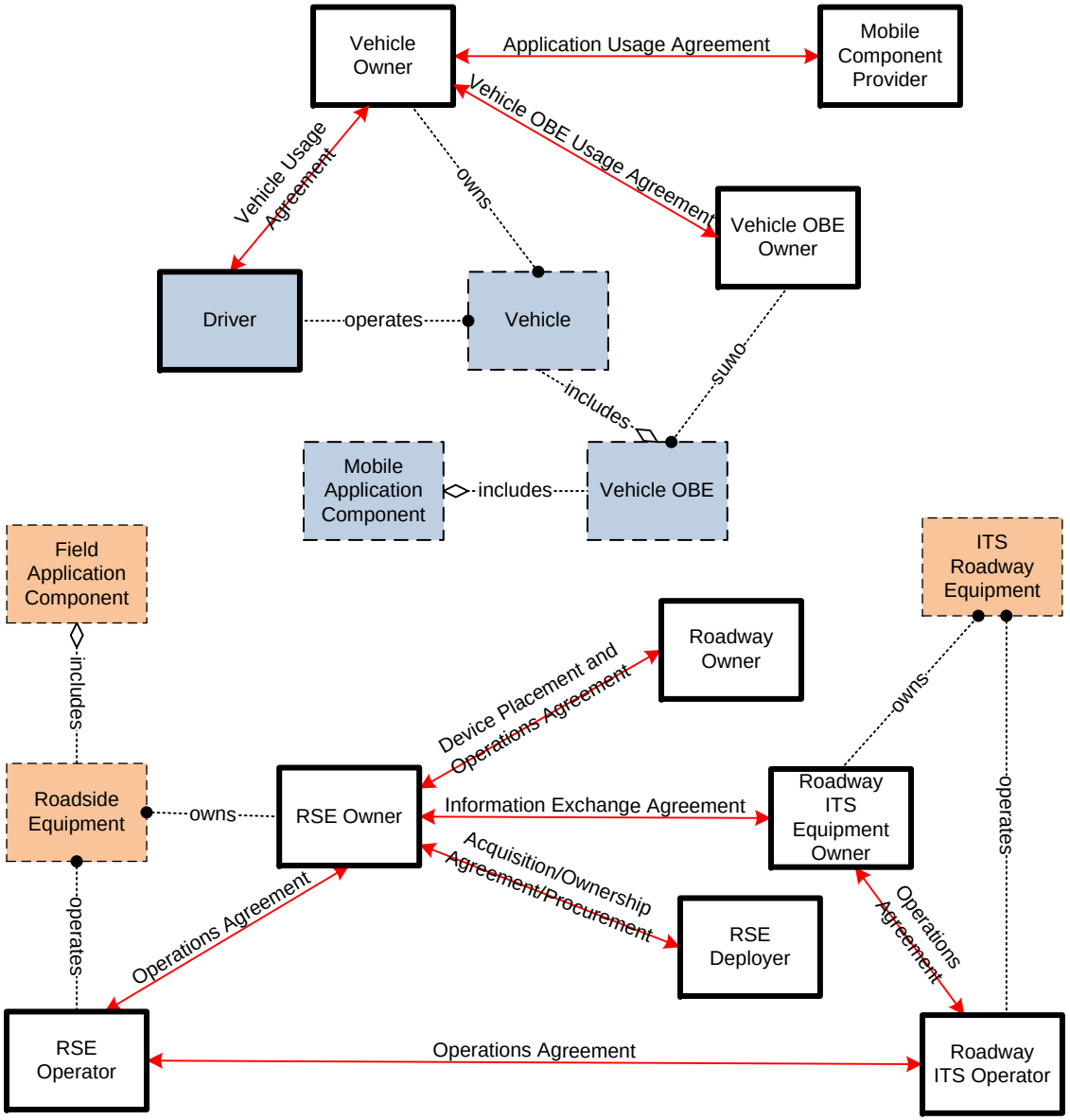
STEP 2: PERFORM ANALYSIS

1. **Analyze the viewpoints and collect/organize information into a database**
   - Enterprise viewpoint may reveal where partners need to work together and where agreements will specify policies for data sharing, usage, privacy, etc.
   - Functional and physical viewpoints may reveal links where specific policies regarding interfaces are needed (e.g., standards, greater security)
2. **Identify policy needs**
3. **Analyze to determine which needs are universal; which are specific**

Example: Reduced Speed Zone Warning

CVRIA analysis identifies the need for agreements:

- Who is party to the agreement? What are the actions/impacts?
- Does it concern the Federal government? Any restrictions needed on the agreement?
- What system-wide policies are required to ensure overall functionality?
- What are the risks of allowing differing system policies?
- What are the certification requirements?
  - Who sets them? Who enforces? How?
  - What are the impacts on deployers, operators, users?
- What other questions should be asked?

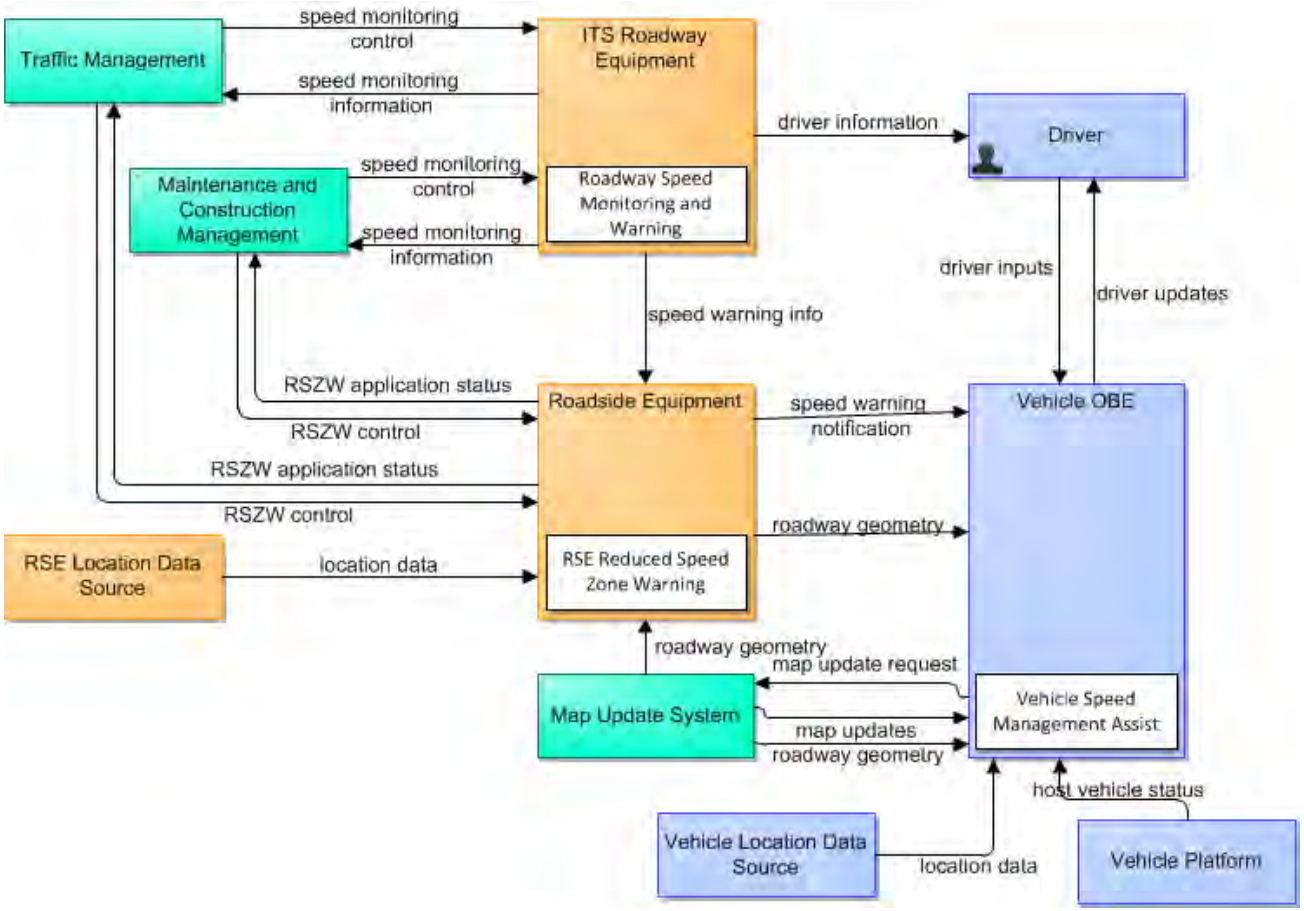


Reduced Speed Zone Warning

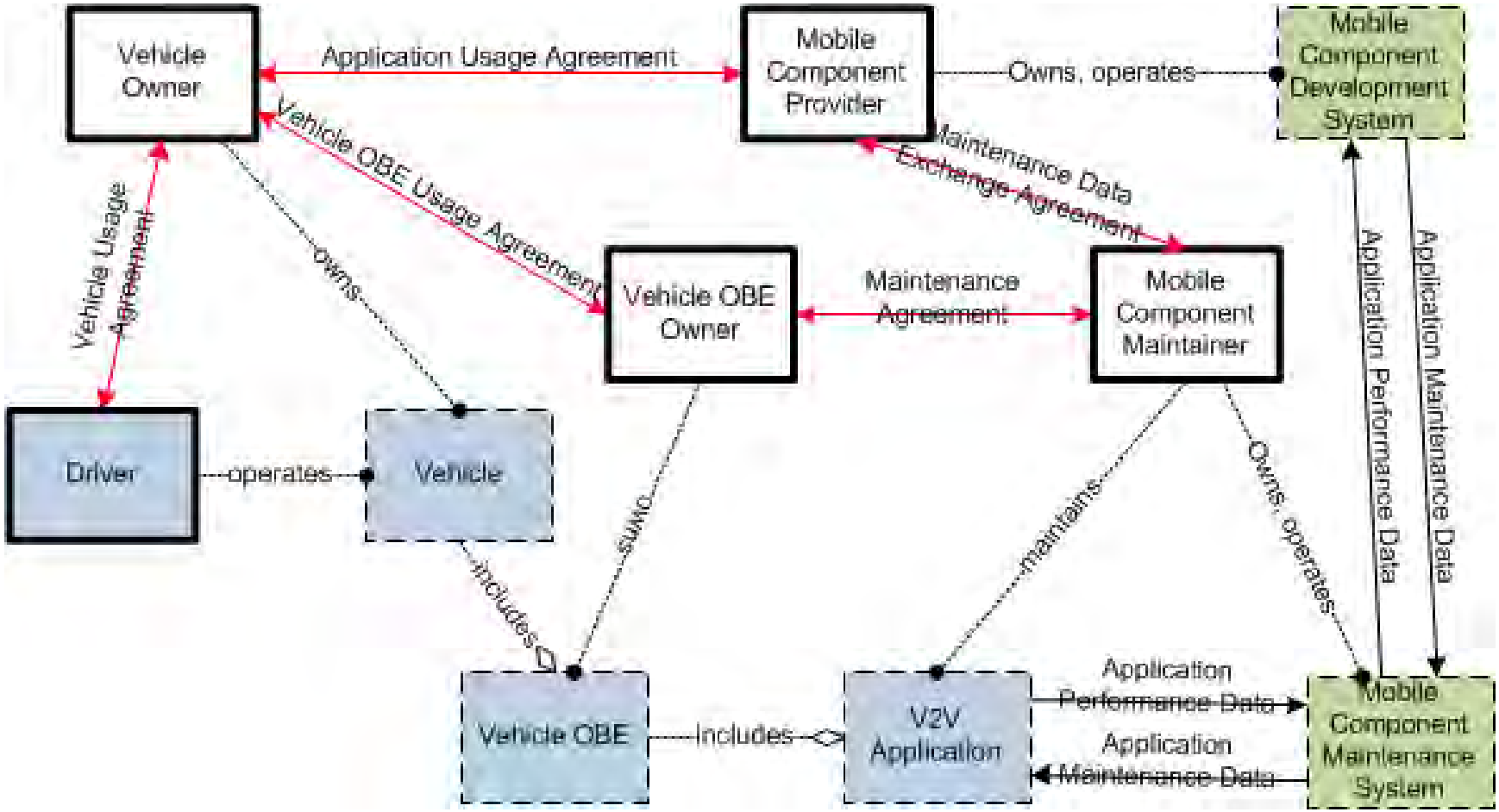
What policies regarding interoperability will ensure that these technologies will communicate over the lifecycle of the equipment? Are standards enough?

Is security or privacy an issue at any of these interfaces?

Is any of the data sensitive enough to require special credentials for personnel to gain access?



Intersection Movement Assist



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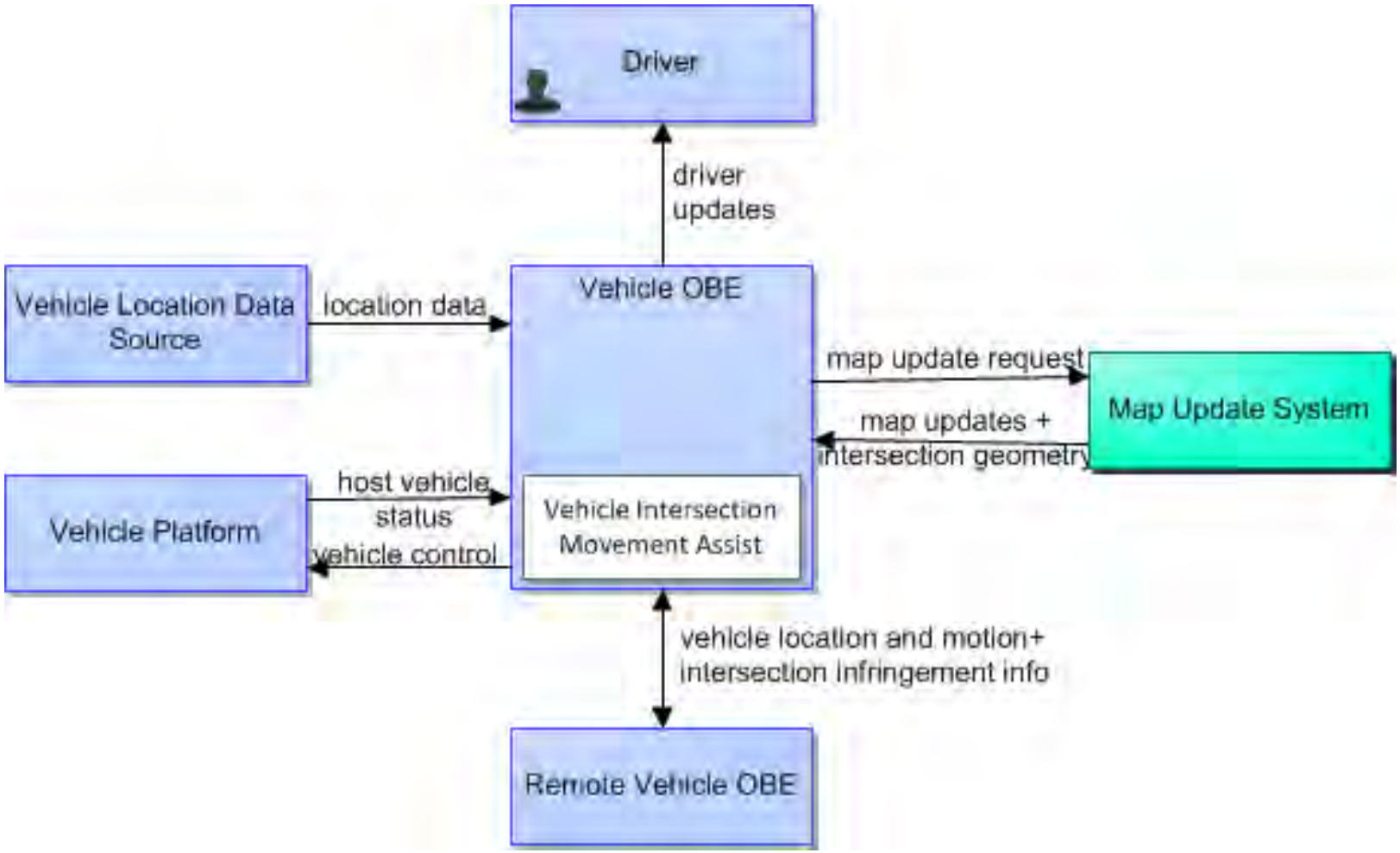
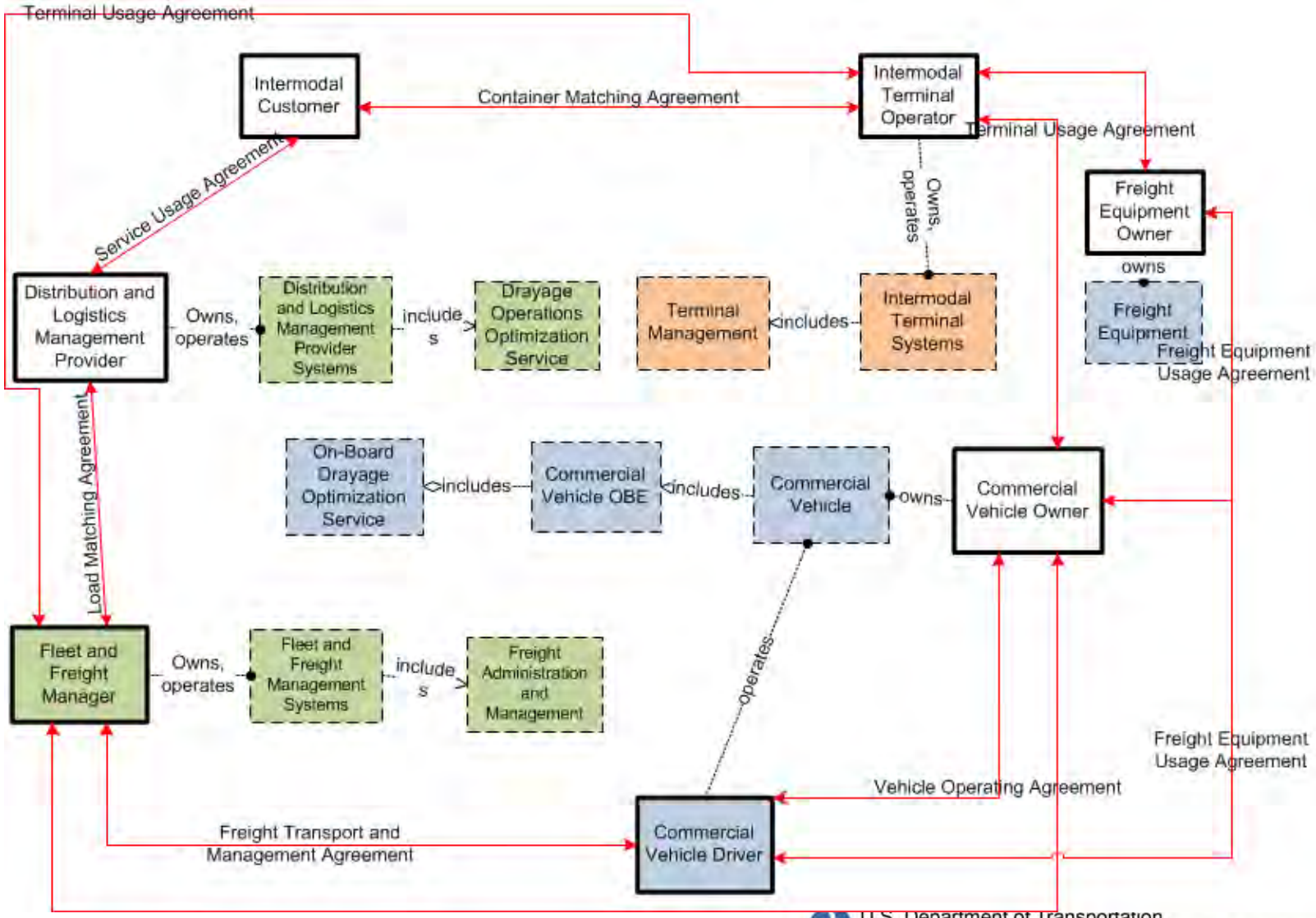
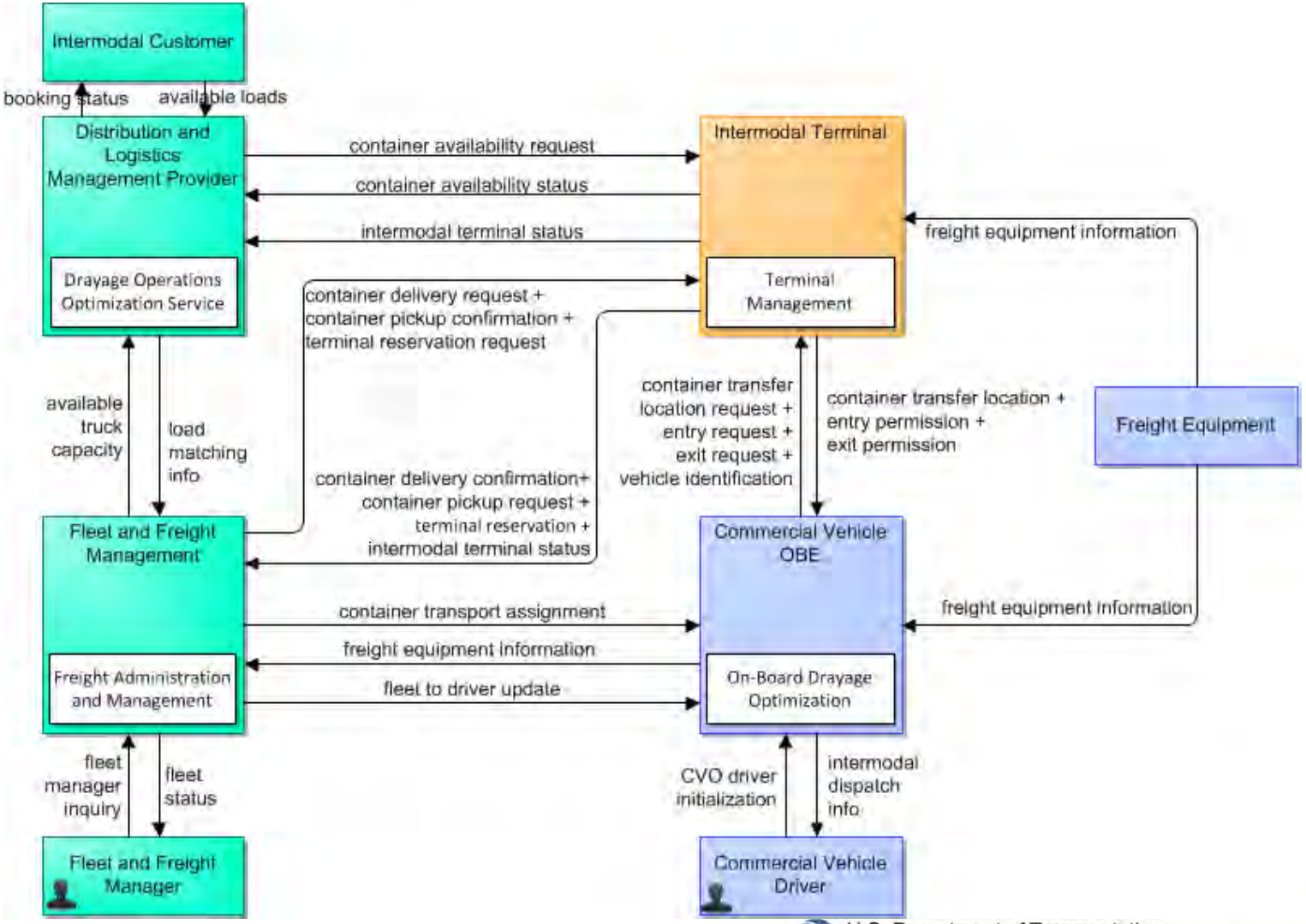


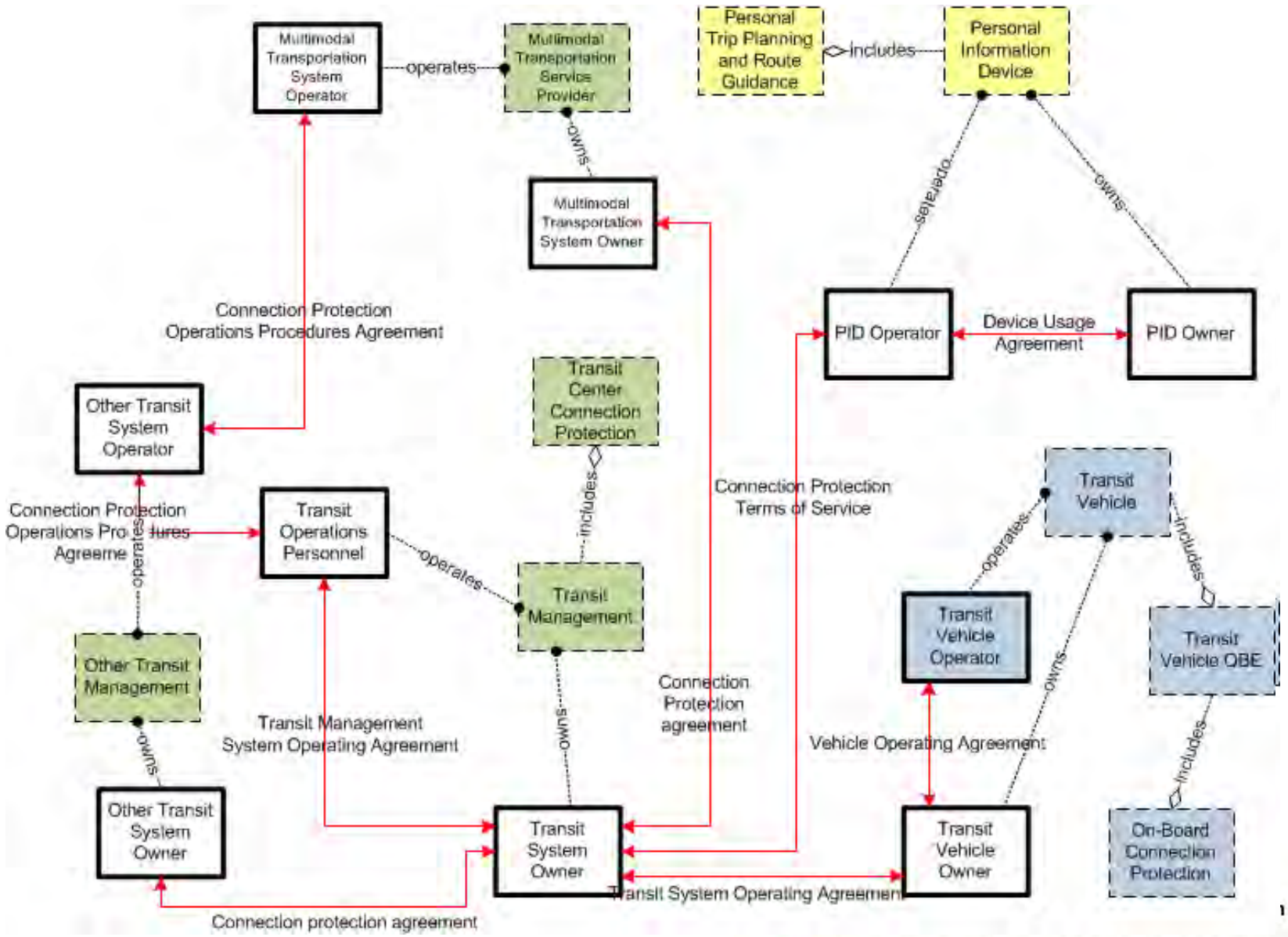
FRATIS Drayage



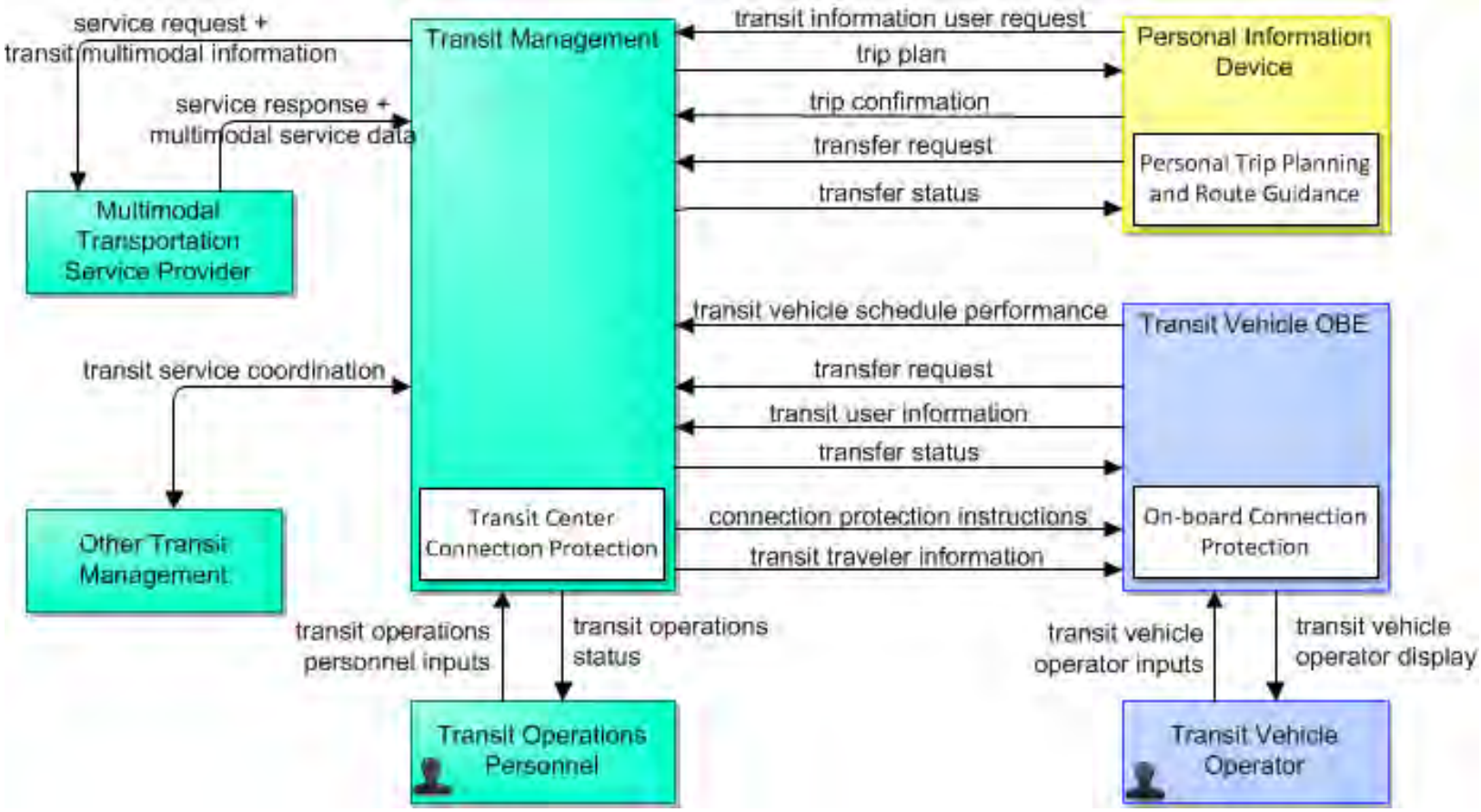
FRATIS Drayage



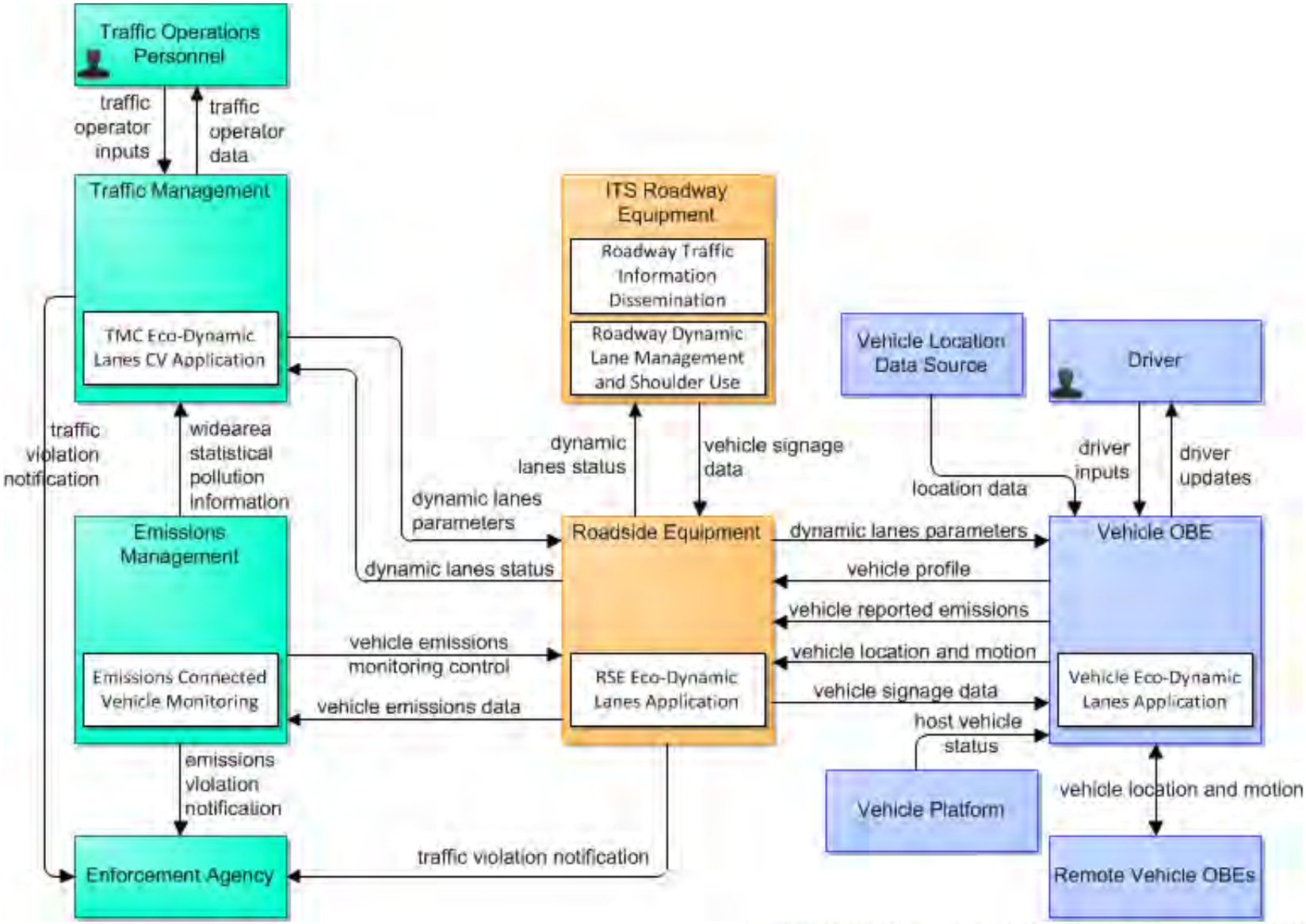
T-CONNECT


Multimodal Transportation System Operator
operates
Multimodal Transportation Service Provider
owns
Multimodal Transportation System Owner
Personal Trip Planning and Route Guidance
includes
Personal Information Device
operates
owns
Connection Protection Operations Procedures Agreement
PID Operator
Device Usage Agreement
PID Owner
Other Transit System Operator
Transit Center Connection Protection
includes
Connection Protection Operations Procedures Agreement
operates
Transit Operations Personnel
operates
Transit Management
Connection Protection Terms of Service
Transit Vehicle
operates
includes
Transit Vehicle Operator
Transit Vehicle OBE
owns
Other Transit Management
owns
Transit Management System Operating Agreement
Connection Protection agreement
Vehicle Operating Agreement
Other Transit System Owner
Transit System Owner
Transit System Operating Agreement
Transit Vehicle Owner
includes
On-Board Connection Protection
Connection protection agreement

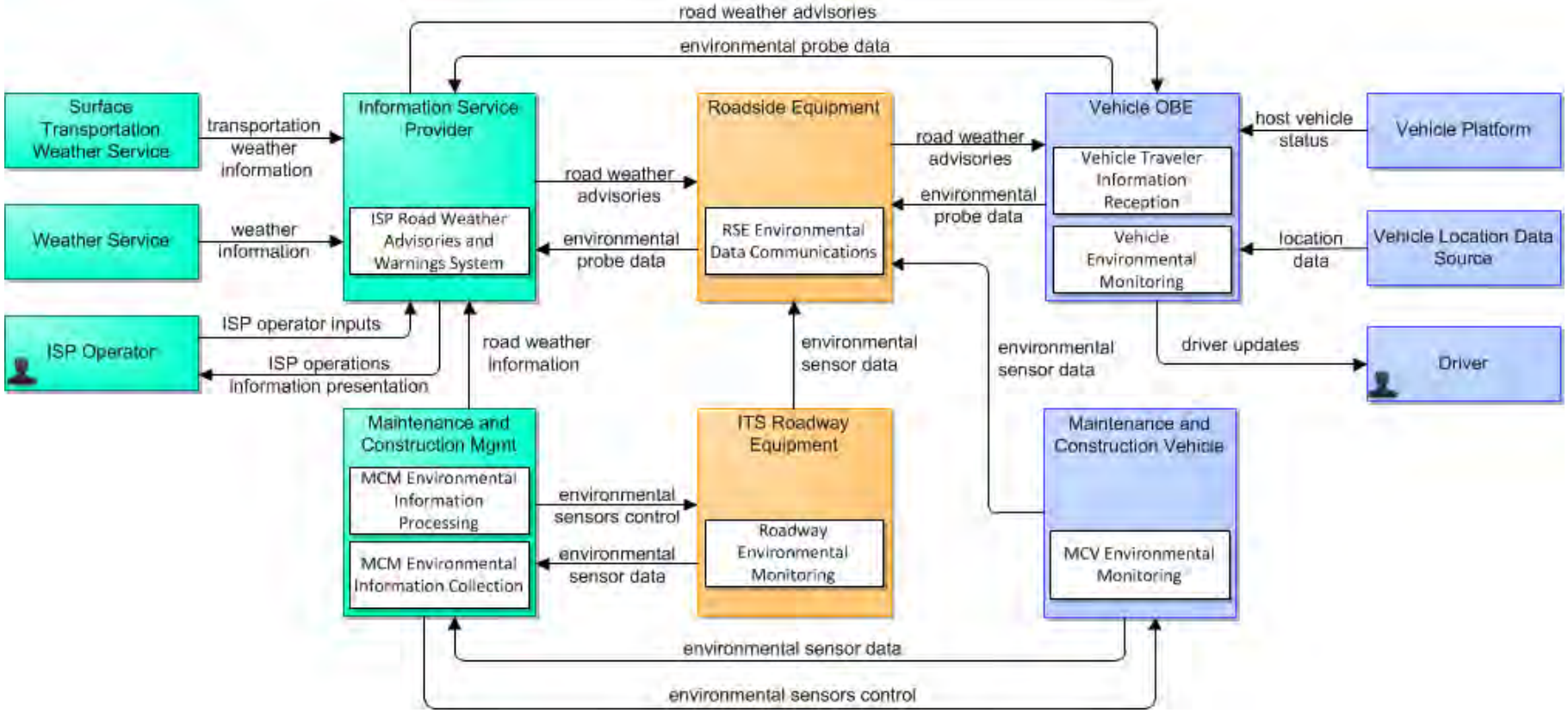
T-CONNECT


service request +
transit multimodal information
service response +
multimodal service data
Multimodal Transportation Service Provider
transit service coordination
Other Transit Management
Transit Management
Transit Center Connection Protection
transit operations personnel inputs
transit operations status
Transit Operations Personnel
transit information user request
trip plan
trip confirmation
transfer request
transfer status
Personal Information Device
Personal Trip Planning and Route Guidance
transit vehicle schedule performance
transfer request
transit user information
transfer status
connection protection instructions
transit traveler information
Transit Vehicle OBE
On-board Connection Protection
transit vehicle operator inputs
transit vehicle operator display
Transit Vehicle Operator

ECO-Lanes


Traffic Operations Personnel
traffic operator inputs
traffic operator data
Traffic Management
TMC Eco-Dynamic Lanes CV Application
ITS Roadway Equipment
Roadway Traffic Information Dissemination
Roadway Dynamic Lane Management and Shoulder Use
Vehicle Location Data Source
Driver
traffic violation notification
widearea statistical pollution information
dynamic lanes status
vehicle signage data
location data
driver inputs
driver updates
dynamic lanes parameters
Emissions Management
Roadside Equipment
dynamic lanes parameters
Vehicle OBE
dynamic lanes status
vehicle profile
vehicle reported emissions
vehicle location and motion
vehicle emissions monitoring control
Emissions Connected Vehicle Monitoring
RSE Eco-Dynamic Lanes Application
vehicle signage data
Vehicle Eco-Dynamic Lanes Application
vehicle emissions data
host vehicle status
emissions violation notification
Vehicle Platform
vehicle location and motion
Enforcement Agency
traffic violation notification
Remote Vehicle OBEs

Weather


road weather advisories
environmental probe data
Surface Transportation Weather Service
transportation weather information
Information Service Provider
ISP Road Weather Advisories and Warnings System
Roadside Equipment
RSE Environmental Data Communications
road weather advisories
environmental probe data
Vehicle OBE
Vehicle Traveler Information Reception
Vehicle Environmental Monitoring
host vehicle status
Vehicle Platform
location data
Vehicle Location Data Source
Weather Service
weather information
ISP Operator
ISP operator inputs
ISP operations information presentation
road weather information
environmental sensor data
environmental sensor data
driver updates
Driver
Maintenance and Construction Mgmt
MCM Environmental Information Processing
MCM Environmental Information Collection
environmental sensors control
environmental sensor data
ITS Roadway Equipment
Roadway Environmental Monitoring
Maintenance and Construction Vehicle
MCV Environmental Monitoring
environmental sensor data
environmental sensors control

STEP 3: DEVELOP POLICY OPTIONS

Policy analysis is expected to identify:

1. **Universal policies**
   - Universal policies address the Connected Vehicle Environment and all of the specific links among the different assets. An example might include security policy.
2. **Where unique sub-policies are needed for certain links.**
   - The same link is typically used by multiple applications. Will policies differ by application? An example might include variations in policy governing use of communications or standards for opt-in applications.
3. **Where exceptions might be desirable, for example:**
   - Basic safety messages are anonymous, but:
     - What if the vehicle is publicly owned (transit, emergency)?
     - What if the vehicle has been reported stolen, or is the subject of an Amber alert?

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

Policy Principles

See April 18, 2012 Discussion Document: Principles for a Connected Vehicle Environment

- **Purpose**
  - Top priority is safety
    - Prevent or mitigate crashes
    - Minimize driver workload and distraction
    - Encompass all road users
    - Can not turn off mandatory safety applications
  - Other uses (mobility, environment) are encouraged
- **Coverage**
  - Extensible to all CV systems and applications
  - Extensible across North America

Policy Principles (continued)

- **User Protections**
  - Privacy
  - Security
- **Implementation and Oversight**
  - Operating organization can be public or private or both
  - Compliance with U.S. DOT CV principles, with stakeholder input
  - Financial sustainability
  - No consumer subscription fees for mandatory safety applications
- **Technical Functionality**
  - Interoperability: comply with national non-proprietary standards
  - System is able to evolve over time, and be backward compatible
  - Secure, fast communications (DSRC)
  - Appropriate use of spectrum

Next Steps

- **When database of viewpoints is available in May, review each viewpoint for policy issues**
- **Create a database of policy issues:**
  - Identify common issues
  - Identify unique issues
  - Analyze to recommend policy options or specific policies with justifications
  - Vet policy recommendations with DOT staff and program managers
  - Vet policy recommendations with stakeholders

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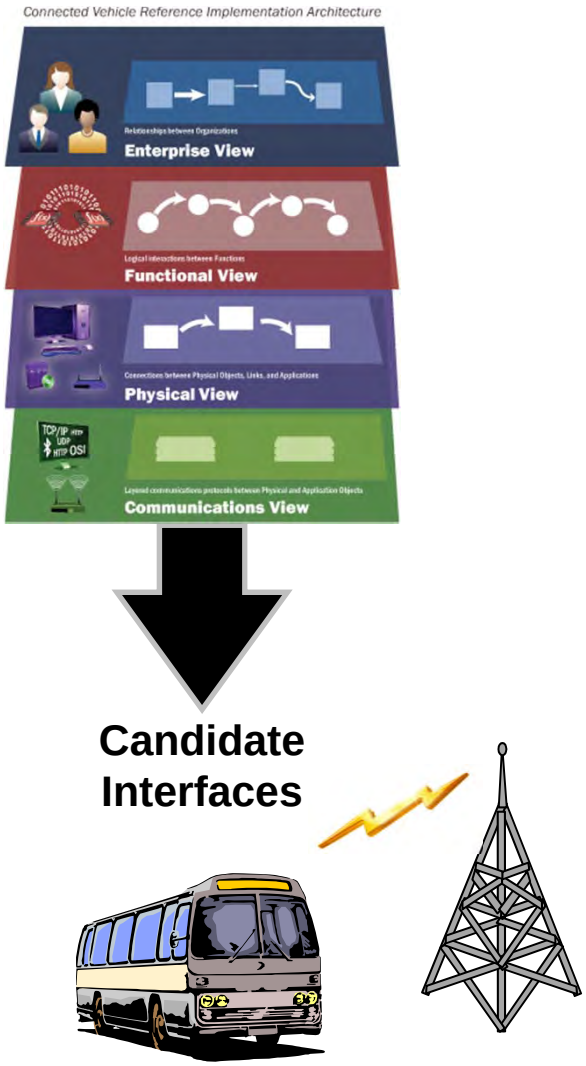
Connected Vehicle Standardization

Chris Karaffa, Booz Allen Hamilton

May 1, 2013

Standardization Plan



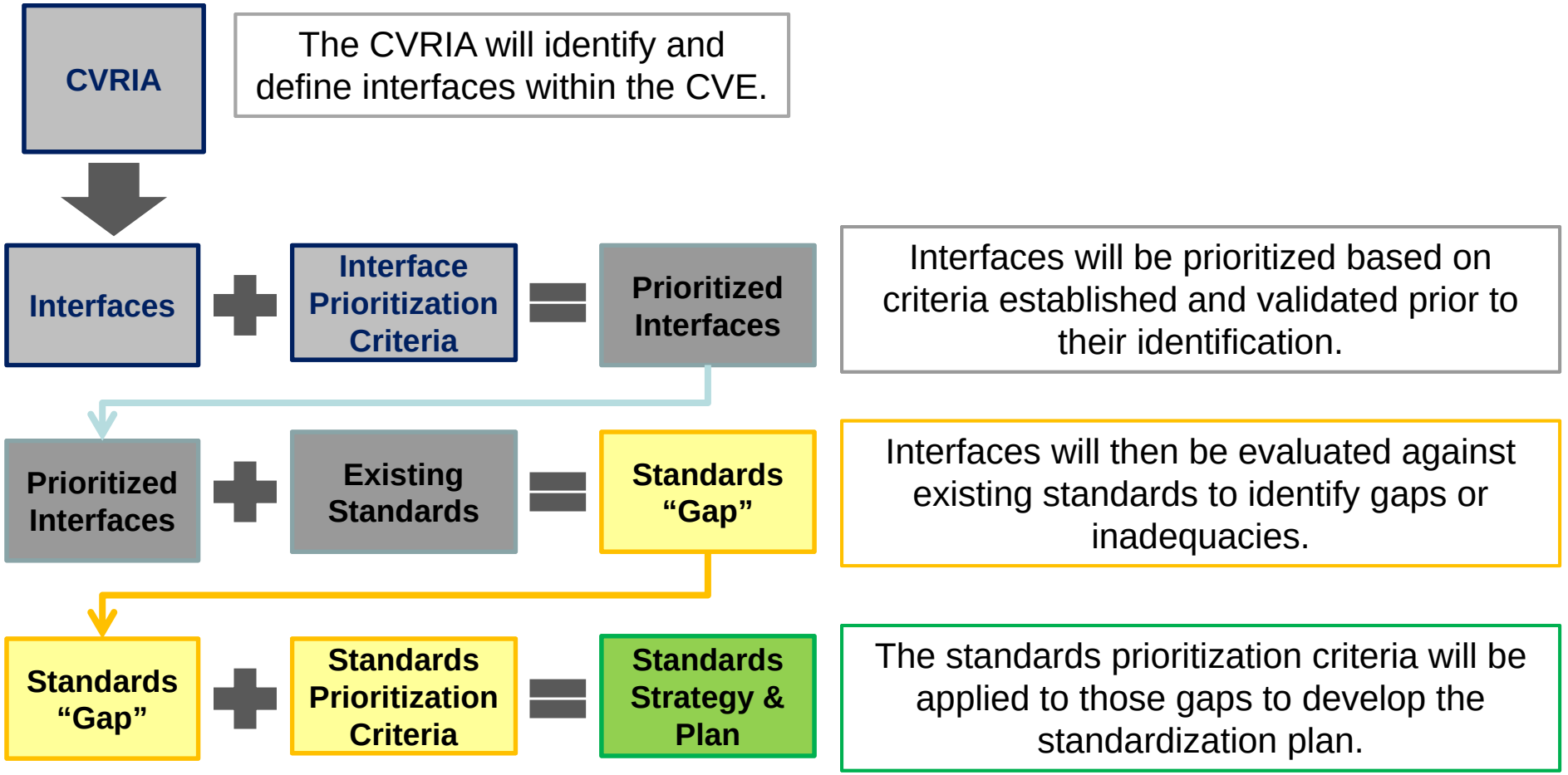
The CVRIA provides a reference for implementing ITS, as well as candidate interfaces within the architecture.

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**

ITS Standards Strategy and Plan



The standardization plan will support activities in the ITS Standards Program Strategic Plan, specifically in cooperative systems standards development and needs identification

Bridging 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"

The standardization plan will guide the ITS JPO in addressing the gap between existing standards and interface requirements.

The plan will be a "living document" that evolves over time.

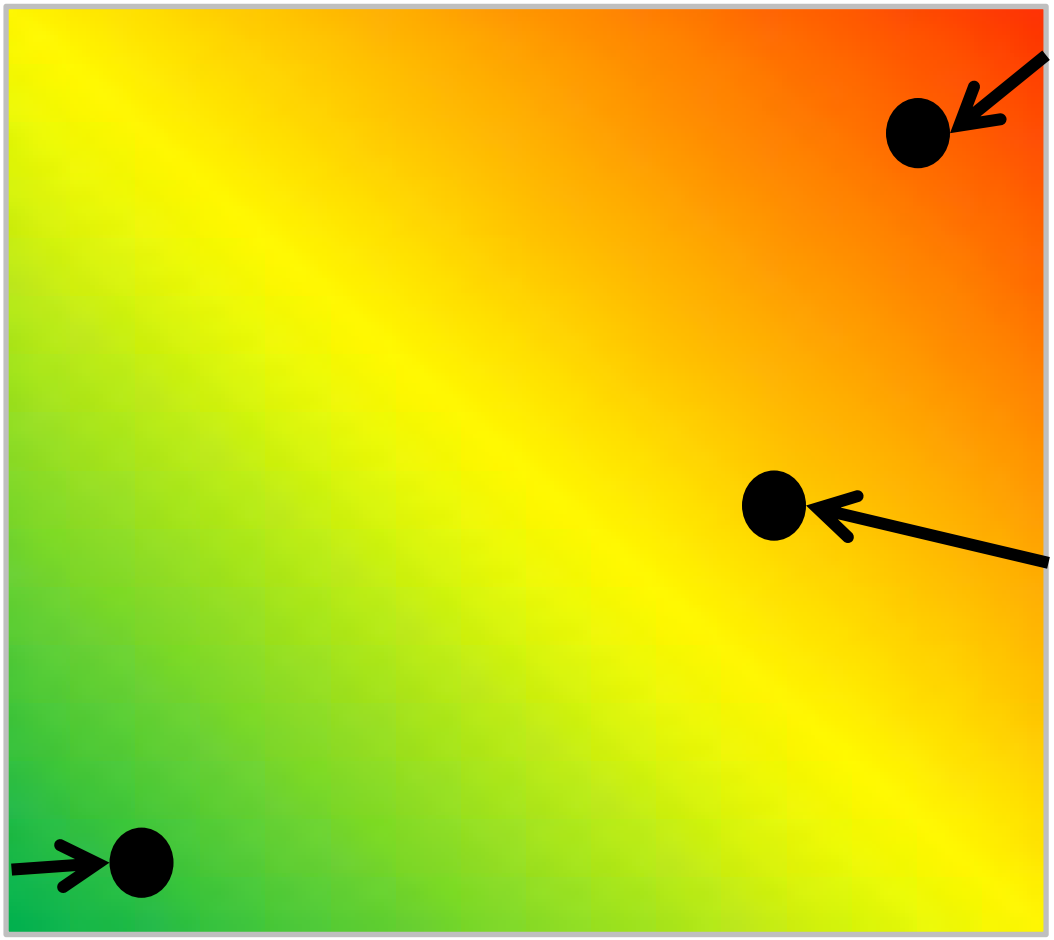
Prioritization Criteria

Criteria Title	Interface Prioritization Criteria Description	Weighting
Application Criticality	Describes the criticality or importance of applications enabled by the candidate interface.	10
Prominence	The number of instances present in CVRIA physical, enterprise, and application viewpoints. Higher value increases priority.	8
Implementation Timeframe	Describes the rate at which candidate interfaces will need to be implemented in the ITS implementation lifecycle. Earlier implementation reflects higher urgency.	6
System of Systems	Describes the role of the candidate interface in integrating or connecting CVE systems to non-CVE systems outside of US DOT/DOT control, such as OEM OBE.	5
Interface Maturity	Describes the maturity of candidate interface definition (i.e., how well are interface requirements defined). Less defined interfaces are lower priority.	3

Criteria Title	Standards Prioritization Criteria Description	Weighting
Interface Priority	Describes the criticality of the candidate interface(s) that may be supported by the standard This value comes directly from the Interface Prioritization.	10
Market Capability	Reflects the evaluation of an appropriate standard to develop naturally without US DOT involvement or influence. Higher score indicates increased confidence that the market will develop an appropriate standard.	8
Development Stage	Describes the progress of SDOs to address a given standard. Applies to standards already under development. Higher values indicate greater progress and higher priority.	6
Current Application Support	Measure of how a given standard supports current operational needs. Higher number reflects greater magnitude (number and criticality) of currently operational applications supported by the standard.	5
Standard Interdependency	A measure of how a given standard is a normative reference in another standard. This is a measure of how dependent *other standards* are on the standard being evaluated--not the dependence of the standard in question on other standards.	3

Scoring will depend largely on expert judgment

Prioritization = Gap x Urgency

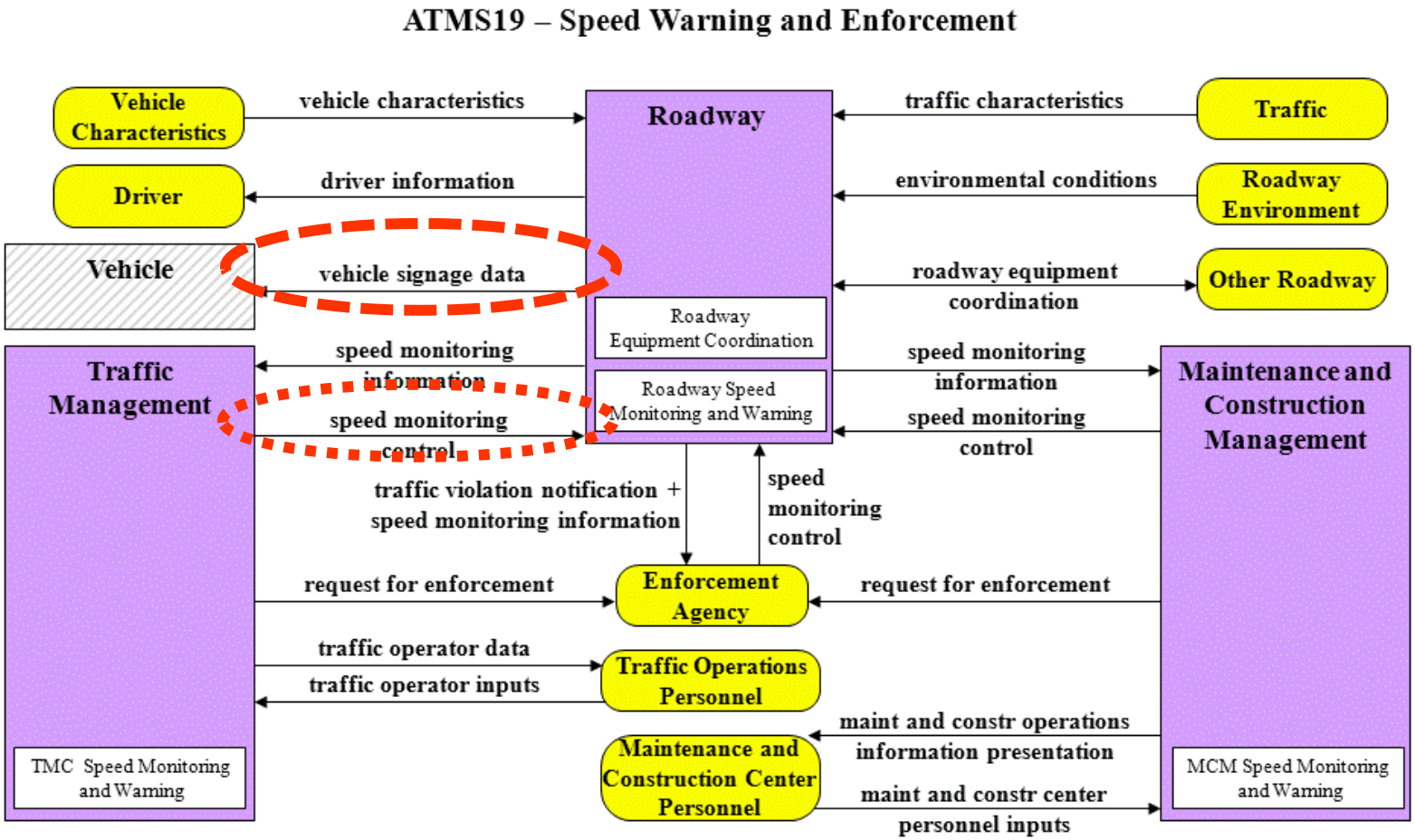


Extremely urgent need for standard; no suitable standards exist.

Urgent need for standard; partially suitable standard exists.

Need not urgent; standards already exist.

Prioritization Process Walkthrough (1 of 3)



Let's look at two interfaces that are included in the *Speed Warning and Enforcement* application:

- **vehicle signage data**
- **speed monitoring and control**

DRAFT

Prioritization Process Walkthrough (2 of 3)

Prioritizing the Interface

	Application Criticality (10)	Prominence (8)	Imp. Timeframe (6)	System of Systems (5)	Interface Maturity (3)	TOTAL SCORE
vehicle signage data	**5**	**5**	**5**	**6**	**9**	**5.53**
speed monitoring and control	**4**	**5**	**5**	**5**	**7**	**4.88**

Prioritizing the Standard

	Interface Priority (10)	Market Capability (8)	Developme nt Stage (6)	Current Application Support (5)	Standard Interdep. (3)	TOTAL SCORE
J2735	**9**	**9**	**10**	**9**	**4**	**8.72**
NTCIP 1209	**5**	**7**	**9**	**6**	**4**	**6.31**

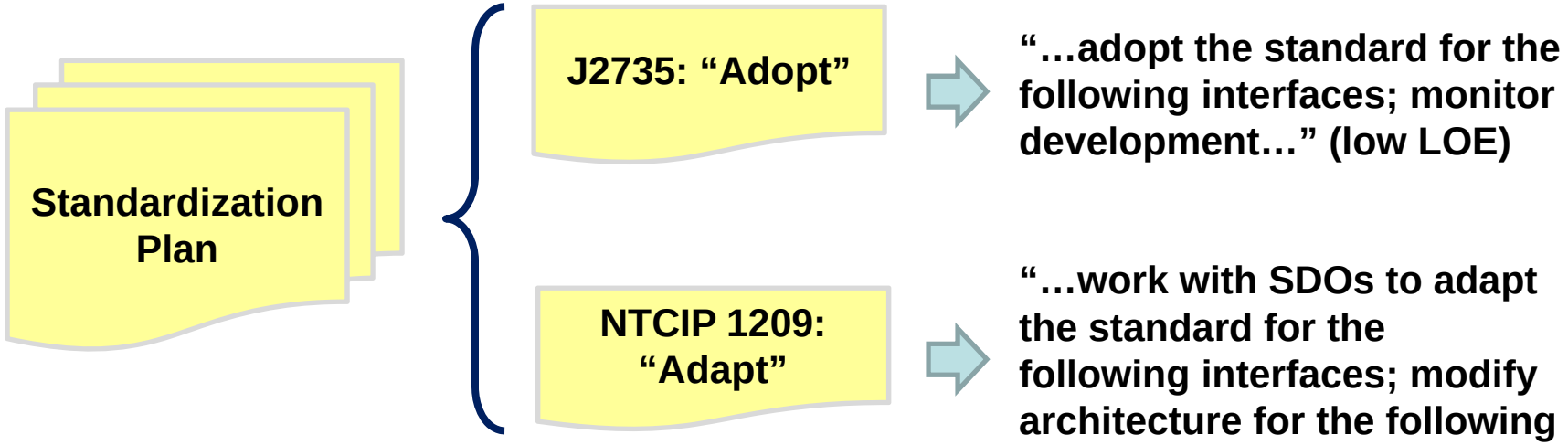
- The “Interface Priority” score will be based on total score of *all* of the interfaces that might reasonably be supported by a given standard.
  - With good correlation between the “vehicle signage data” interface requirements and the J2735 standard, the total score for that interface was factored into the “Interface Priority” score for the J2735 standard.
- If an interface can not be reasonably associated with a standard, then a placeholder “TBD” standard will be used and scored.

Prioritization Process Walkthrough (3 of 3)

The standard prioritization effort:

- ensures that the "right" standards receive attention (comparing apples to apples)
- provides the basis for a basic "adopt, adapt, create" decision
- provides justification for decisions made and documentation that allows meaningful re-evaluation as conditions and change

The prioritization does not imply level of effort associated with each standard.



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Closing Remarks

Steve Sill, JPO

May 1, 2013

CVRIA Stakeholder Engagement Opportunities

- Website established to provide draft material: http://www.iteris.com/cvria/index.htm
- Use the Contact Us page or Comment on Page links to ask questions or provide comments to the team
- Public Workshops
  - San Jose, CA – April 30 – May 1
    - Discussion focused on draft architecture views
  - Detroit, MI – Fall
    - Discussion will focus on inputs to standardization plan

For More Information