



UNITED STATES
DEPARTMENT OF TRANSPORTATION

Core System Stakeholder Analysis

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Agenda

- Introduction
- Case Study Examples
- Why Care and What Next

Introduction

- Connected vehicle environment
 - vehicles communicating with each other and infrastructure
 - V2V safety applications
 - V2I mobility applications

- Enabled by a number of deployed Core Systems
 - Provides trusted secure communications
 - Protects privacy of users
 - Facilitates efficient data collection and distribution

- Purpose of the stakeholder case studies
 - A simpler way to convey the concepts of the Core System
 - Stimulate input from stakeholders
 - To help us understand the institutional challenges of implementing Core Systems



Case Studies

- ☞ Transit Agency
- ☞ Private Trucking/State-based Truck Credentialing and Inspection Agency
- ☞ State DOT/Local DOT
- ☞ Emergency Response/Pre-Emption
 - Private Sector Data Organization – Aggregator, ISP
 - Mobility Services for individual drivers
 - Electronic Tolling/Payment
 - Business – Rental Car Company



State DOT/Local DOT

Existing Capabilities	New Capabilities	Use Case Requirements	
<p>Limited traffic data from point detectors (eg., inductive loops) and CCTV surveillance augmented by localized use of probe vehicles.</p>	<p>Rich traffic data set from continuous output of substantial fraction of vehicles throughout entire road network in addition to the fixed sensors.</p>	Yes	Trusted Communications
<p>Communication with customers via Changeable Message Signs, radio beacons, and traffic messages in the media.</p>	<p>Core System technology allows direct, targeted communication with vehicles regarding incident warnings, travel time, weather warnings, etc., in real-time.</p>	Yes	Privacy
<p>Incident detection via Traffic Management Center controlled cameras, law enforcement input or phone calls by the traveling public.</p>	<p>Incident detection can be accomplished in real-time. Severity of incidents (accident or stranded vehicle?) determined almost instantaneously and appropriate resources dispatched.</p>	Yes	Data Publish-Subscribe
<p>Congestion management through static devices such as ramp meters with predetermined schedules and fixed speed limits.</p>	<p>More flexible tools such as variable speed limits and dynamic traffic signal operations triggered by actual and predicted traffic.</p>	Yes	Data Geocast
		V2V&I	Type of Communications



State DOT/Local DOT cont'd

Stakeholders/Users	Benefits
Operators	<ul style="list-style-type: none">• Less congestion.• New sources of data from mobile sources.• Improved response through better incident detection.• More effective and efficient communication with drivers via targeted in-vehicle messaging.• Lower operating costs from more effective use of resources and less reliance on infrastructure-based data collection.
Traveling Public	<ul style="list-style-type: none">○ Improved safety from individual warnings.○ Reduced travel times.○ Better quality and flow of information, tailored to the needs of drivers in a specific area.



Emergency Response/Pre-Emption

Existing Capabilities	New Capabilities	Use Case Requirements
<p>Current technology transmits optical signal to request preemption therefore requires line-of-sight communication.</p>	<p>Ability to request preemption for an actual path along its intended route.</p> <p>Exact timing of preempt based on actual traffic conditions.</p>	<p>Yes Trusted Communications</p> <p>No Privacy</p> <p>No Data Publish-Subscribe</p> <p>Yes Data Geocast</p> <p>V2I&V Type of Communications</p>
<p>Clear path for emergency vehicles quickly without generating confusion among drivers.</p>	<p>Warning to individual vehicles to clear path.</p>	
<p>Alert emergency management agency / dispatch to accidents and dispatch resources necessary.</p>	<p>Give precise information on location and potential severity of injuries based on actual vehicle speed prior to accident.</p>	
<p>Medical information and crash details communicated to medical and rescue facilities by radio after responders arrive.</p>	<p>Vehicle crash data provides real-time information about the crash: number of victims, potential injuries and need for extraction equipment.</p>	



Emergency Response/Pre-Emption cont'd

Stakeholders/Users	Benefits
Operators	<ul style="list-style-type: none">• More efficient traffic flow• Reduced rate of secondary accidents
First responders	<ul style="list-style-type: none">○ Faster response time○ More effective deployment of resources.



Private Trucking/State-based Truck Credentialing and Inspection Agency

Existing Capabilities	New Capabilities	Use Case Requirements
Speed warning signs with fixed maximum speed suggestion based on assumptions.	Individually calculated maximum curve speed for vehicles based on various factors (weather, road surface, vehicle weight, center of gravity, etc).	Yes Trusted Communications
Freight trucks have to stop for Enforcement Agency inspections.	Wireless roadside inspections will allow monitoring of truck operators and cargo without costly delays.	Yes Privacy
Truck weight checks at state and national borders along with credentialing of operator and cargo.	Virtual weigh stations along the roadside and electronic screening of cargo credentials eliminating redundant manual inspections.	Yes Data Publish-Subscribe
Heavy trucks act as moving bottlenecks that increase stop and go traffic near urban freight facilities.	Traffic signals near freight facilities enable green waves that match heavy truck accelerations to smooth traffic flow in the area.	No Data Geocast
Trucks spend a lot of time at facilities waiting their turn to load and unload on fixed schedules.	Real-time drayage assigns slots based on actual predicted arrival times to reduce waiting and idling.	V2I Type of Communications



Private Trucking/State-based Truck Credentialing and Inspection Agency cont'd

Stakeholders/Users	Benefits
Operators	<ul style="list-style-type: none">• More efficient, lower cost operation.• Reduced risk of accidents.
DOTs & Enforcement Agencies	<ul style="list-style-type: none">○ Reduced resources dedicated to monitoring and inspection.○ Real-time monitoring (particularly of Hazmat and oversize).○ More effective detection of violators.



Transit Agency

Existing Capabilities	New Capabilities	Use Case Requirements	
Multiple redundant hardware on buses support different applications on separate systems.	Integrating previously separate hardware and software components.	Yes	Trusted Communications
Rigid price structures.	Dynamic pricing: time, distance, mode, conditions	No	Privacy
Fixed schedules.	Real-time schedule adjustments for intermodal connections.	Yes	Data Publish-Subscribe
Fixed schedules. Cannot add buses on real-time demand.	Dynamic matching of supply and demand.	No	Data Geocast
Fixed routing. Fixed schedule.	Dynamic routing within a corridor. Allow user requested diversions within predefined corridor.	V2I	Type of Communications
Busses can bunch poorly serving customers.	Dynamic management of bus headways.		
Transit signal priority one intersection ahead.	Strategic signal prioritization to optimize traffic flow in all directions along entire corridor.		



Transit Agency cont'd

Stakeholders/Users	Benefits
Transit operators	<ul style="list-style-type: none">• Lower capital and operating costs.• More efficient asset management. Lower per trip costs.• Attract ridership.• Mainstream more handicapped travelers.
Travelers	<ul style="list-style-type: none">○ More reliable travel times across entire multimodal trip.○ More flexibility in pick up and drop off locations.
Traffic management authority	<ul style="list-style-type: none">▪ More efficient traffic flow, especially in peak conditions.▪ Ubiquitous corridor traffic data.▪ Increased HOV lane usage.



Why Care and What Next

- Stakeholder feedback
- Input to Core System Policy & Institutional Analysis
- Policy Framework
 - Understand the Core System and its interfaces
 - Control & access policies to mitigate risk
 - Standards, Certifications, Legal, Enforcement ...
- Bottom line:

We don't want to preclude business models BUT must protect interoperability and control risks.

That's our tradeoff. We need your help

Questions?

Thank you

Backup Slides

Private Sector Data Organization – Aggregator, ISP

Existing Capabilities	New Capabilities
Data obtained via cellphone applications. Not all of them on the road. Most of the vehicle-generated probe data comes from trucks.	Data obtained from a more numerous and diverse population of vehicles.
Cell location or Lat/Long position data.	Richer and more reliable data set including position, heading, type of vehicle, passengers, road condition, and weather-related data (surface temperatures, headlight & wiper status).

Use Case Requirements	
Yes	Trusted Communications
Yes	Privacy
Yes	Data Publish-Subscribe
No	Data Geocast
V2I	Type of Communications

Private Sector Data Organization cont'd

Stakeholders/Users	Benefits
Data Firms	<ul style="list-style-type: none">• Reliable wide area real-time data in large quantities.• Lower data collection/acquisition costs.• Higher value of more precise data.• Avoid data privacy issues.
Application providers	<ul style="list-style-type: none">○ Trusted sources of large distributed real-time data sets.○ More precise data enables new applications.
Users	<ul style="list-style-type: none">▪ More reliable prediction of traffic conditions.▪ Possibility to gain desired services with no exposure of personal information (because of trusted communications) and less advertising.



Mobility Services for individual drivers

Existing Capabilities	New Capabilities
Fixed speed cruise control. Drivers must manually observe gap, conditions and brake lights. Some applications of Adaptive Cruise Control (ACC) which uses autonomous sensors to maintain gap distance.	Cooperative Adaptive Cruise Control (CACC) or inter-vehicle communication to maintain gap and speed between vehicles. Possibility to form platoons of vehicles when penetration is high. Optimal speed can be derived in TMC and sent to vehicles.
GPS-based route guidance. Real-time information is spotty and infrequently updated if used at all.	Route guidance incorporating real-time traffic, construction, weather and pavement conditions.
Pre-trip web information on parking.	Real-time, dynamic parking availability delivered to the driver.
Radio traffic reports, infrastructure-based dynamic message signs (DMS) and flashing lights to provide generic traveler information.	Real-time localized in-vehicle warnings of queues, shock waves, lane closures, merges, and speed changes due to traffic, incidents or work zones.

Use Case Requirements	
Yes	Trusted Communications
Yes	Privacy
Yes	Data Publish-Subscribe
Yes	Data Geocast
V2V&I	Type of Communications



Mobility Services cont'd

Stakeholders/Users	Benefits
Traffic Management Authority	<ul style="list-style-type: none">• Enhanced Safety, especially near queues and hazardous locations.• Less congestion, higher throughput.• Real-time traffic prediction and incident detection.• Ability to control traffic in real-time with variable speed control.• Fewer vehicles circling city streets looking for parking.
OEMs and their Customers	<ul style="list-style-type: none">○ Enhanced safety.○ Less congestion, lower travel times.○ Better route guidance by using dynamic factors.○ Less stressful travel



Electronic Tolling/Payment

Existing Capabilities	New Capabilities	Use Case Requirements
Fixed signs to communicate with drivers.	Direct in-vehicle messaging.	Yes Trusted Communications
Wireless toll collection-proprietary system, lane/location specific readers.	Wireless toll collection-universal system.	Yes Privacy
Reactive traffic management.	Real-time demand management.	Yes Data Publish-Subscribe
	Revenue from selling real-time data.	Yes Data Geocast
Fixed pricing on fixed network. Most current time variation is by a fixed time of day schedule or rudimentary measure of demand.	Possibility for dynamic pricing by mileage, conditions and location, even for roads off the network.	V2I Type of Communications

Electronic Tolling/Payment cont'd

Stakeholders/Users	Benefits
Toll Road Authority	<ul style="list-style-type: none">• New revenue sources.• Accurate real-time demand estimation.• Real-time traffic prediction and incident detection.• More flexible pricing (time, conditions, location).
State DOT	<ul style="list-style-type: none">○ Better prediction of toll road traffic affecting adjacent facilities and roads from real-time traffic data.
Users	<ul style="list-style-type: none">▪ Increased safety at toll plazas.▪ Less congestion, lower travel times.▪ No need for multiple devices to travel cross country.



Business – Rental Car Company

Existing Capabilities	New Capabilities	Use Case Requirements
Time & odometer based pricing only.	Dynamic and flexible pricing by other factors like mileage, even route, as well as precise time.	Yes Trusted Communications
Separate bills for rental car, tolls and gas.	Single combined bill for all vehicle related trip expenses. Can include electronically collected tolls and gas fill ups.	No Privacy
Customer or attendant must collect mileage, gas level and time stamp manually at return.	Fully automated wireless check in.	Yes Data Publish-Subscribe
	Mayday alert, vehicle tracking & remote diagnostics.	No Data Geocast
GPS Navigation systems.	Real-time predictive traffic information to customers.	V2I Type of Communications



Business – Rental Car Company cont'd

Stakeholders/Users	Benefits
Rental fleet operators	<ul style="list-style-type: none">• Faster vehicle service in incidents disabling the vehicle.• More efficient asset management.• Revenue from data stream.
Customers	<ul style="list-style-type: none">○ Expedited customer care in any incident disabling the vehicle (eg. breakdown or accident).○ Faster check in and check out.○ Convenience of single bill for all vehicle expenses.

