Connected Vehicles: New Directions and Opportunities

AASHTO Connected Vehicle Task Force
December 3, 2014
Irvine, CA
The Path To Deployment – US DOT Vision & Program

Goal: Deploy Stable, Interoperable, Reliable Systems

- Defined Safety (V2I), Mobility (V2V & V2I), AERIS and Weather Apps
- Defined V2V Apps
- 2011
- NHTSA Decision Light Vehicles
- 2012
- NHTSA Decision Heavy Vehicles
- 2013
- Application Development
- 2014
- 2015
- FHWA Deployment Guidelines
- 2016
- Pilots/Early Deployments

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Technical Challenges – the BIG FIVE

- Infrastructure
- In-Vehicle
- PKI Security
- Data, Software & Data Centers
- Mapping

Policy, Governance, Funding
Infrastructure Deployment

• To support Vehicle to Infrastructure (in a DSRC world), a significant infrastructure investment is needed
  – Roadside Devices / Radios
  – Backhaul
  – Integration with Roadside Devices (Traffic Signals, Tolling, etc.)
  – Application Development

• Infrastructure is a major effort!
  – Planning
    • Where do we deploy radios
    • How do we backhaul radios to a central system
    • How do we integrate into existing infrastructure and systems
  – Design
  – Deployment
  – Operations
  – Maintenance
AASHTO Deployment Vision

- 80% of traffic signals are DSRC enabled
- 50% ITS field sites are DSRC enabled
- 90% of the nations roads have real-time localized information
- 300,000+ locations nationwide
- Vision encompasses 50 states and hundreds of local operators
CyberSecurity – The White Elephant of Infrastructure

• 300,000 DSRC Hot Spots
• Current network security is primarily physical
  – Access is controlled by a key to get into the cabinet
  – ITS networks are isolated from Enterprise networks – physically or firewalled
• DSRC radios become “WiFi” hot spots at all 300,000 locations
• Need for significant new security of ITS networks and more stringent firewall implementations
  – New Hardware and Software
  – Active Monitoring of all systems to defend against outside attacks
  – Significant operations cost (not “Turn it on and forget it”)
In-Vehicle Systems

- Radios
- Applications
- Human Machine Interface
- Aftermarket
- Multiple Systems
In-Vehicle Systems - Security

- In-Vehicle Security
  - Cars are now “hackable”
  - Need new designs and implementations that protect in-vehicle systems
  - Security is evolving to meet new threats, so simply because a vehicle is secure at launch, doesn’t mean it will be secure over its entire life
In-Vehicle Systems – Not One Size for All

• Primary initial focus has been V2V
• Transition is occurring to include V2I (and V2X)
• Integrating multiple vehicle types and fleets is not trivial
  – Passenger Cars
    • Taxi’s
  – Commercial Vehicles / Trucks
    • Long-Haul
    • Short-Haul
    • Regional
  – Transit Vehicles
    • Busses
    • Light Rail
    • BRT
• Different applications, needs for V2X security, privacy, life-cycle, etc.
Security (Credential Management)

- V2V and V2I PKI-type security system
  - Enable trust between devices and vehicles
- Security Credential Management System (SCMS)
- CAMP Design requires multiple integrators/components
- Current deployment used by Safety Pilot & Test bed
  - Designed for 200 vehicles
  - Being used by 3000 vehicles
- Next generation CAMP Proof of Concept version being planned
- USDOT RFI for next generation
Back Office Systems and Data

- Transition into Big Data
  - (Volume, Velocity, Veracity/variety)
  - Significantly different from traditional transportation data
- Requirement for new systems and services
  - Architecture, Hardware and Software changes based on new requirements
  - Integration with existing systems
  - Data processing
  - Data Storage
  - Demands for data from outside data users
  - Need for compatibility with all other connected vehicle infrastructure systems in the area
Mapping

- Most (if not all) V2I systems require accurate mapping
- SPaT requires detailed mapping of signalized intersections
  - Approaches
  - Lanes and lane assignments
  - Stop Bars
  - Accuracy within 10cm to support SPaT and collision avoidance applications
- As vehicles increasingly rely on applications that require accurate mapping, maintaining accurate maps will become increasingly more important.
  - Map changes may require new policies and processes
    - New construction
    - Temporary closures
  - Integration with ALL map providers
Foundational Issues

- **System Governance**
  - How does a “system” designed in 2015 survive for 20+ years?

- **Policy**

- **Configuration Management**
  - What gets changed? (i.e. security patches)
  - When does it get changed?
  - How does it get changed?
  - Who determines if the impacts to legacy devices is acceptable?

- **Funding Issues and Models**
  - DOT funding and planning cycles – typically a 5-year window
  - Impacts of potential PPP models?
  - How will a system deployed with different funding models ensure interoperability?
Closing

- NHTSA Advanced Notice of Proposed Rule Making was the first step but we still have a lot of work to be done to prepare for deployment.
- Regional Pilots will be a good next step
  - Shift away from research towards preparing for deployment
  - Research and development is still required
- Projects / Deployments take time to come to fruition (plan/fund/design/deploy)
- Be careful with the foundational issues

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