



Connected Vehicles: New Directions and Opportunities

AASHTO Connected Vehicle Task Force
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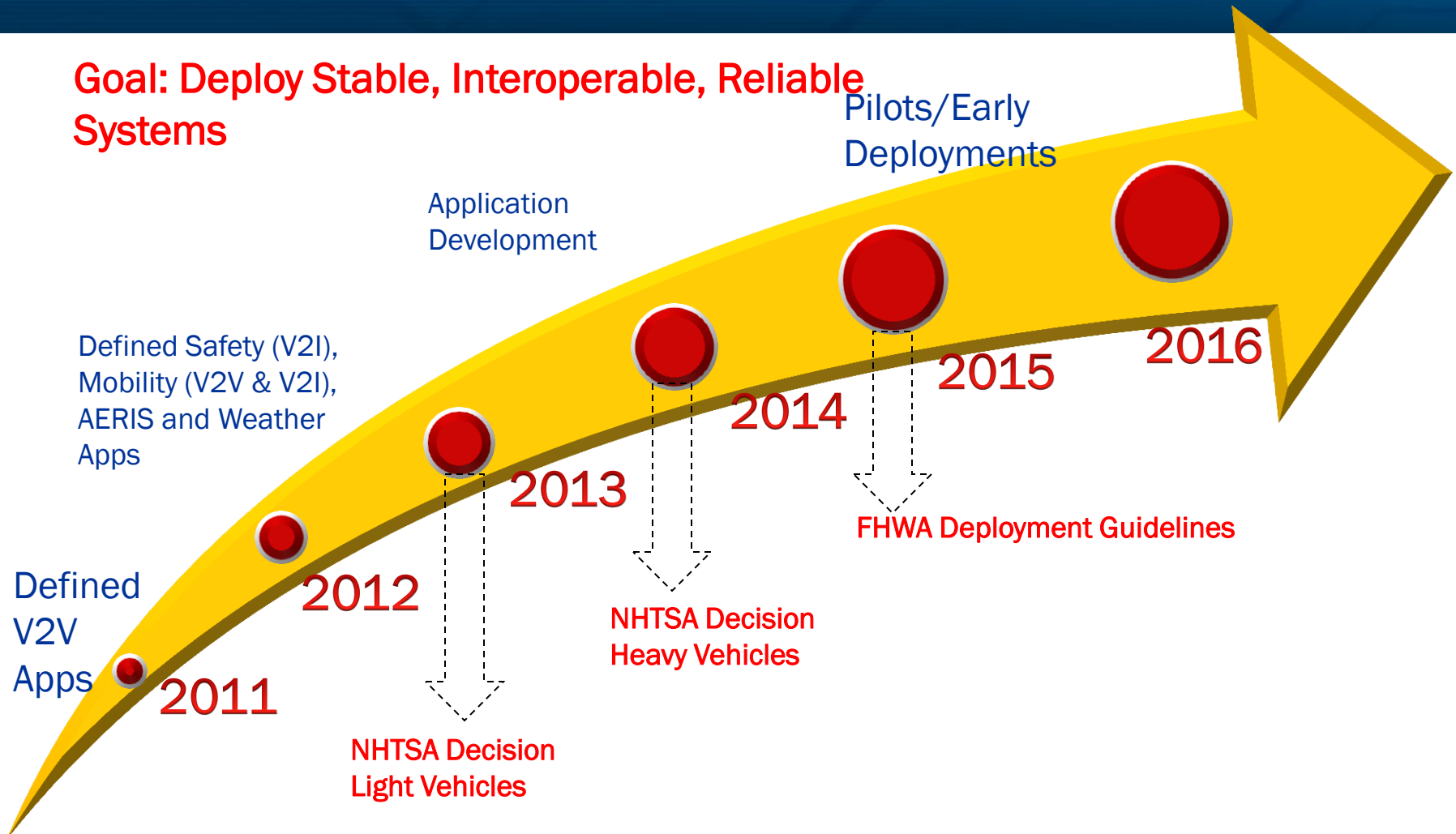
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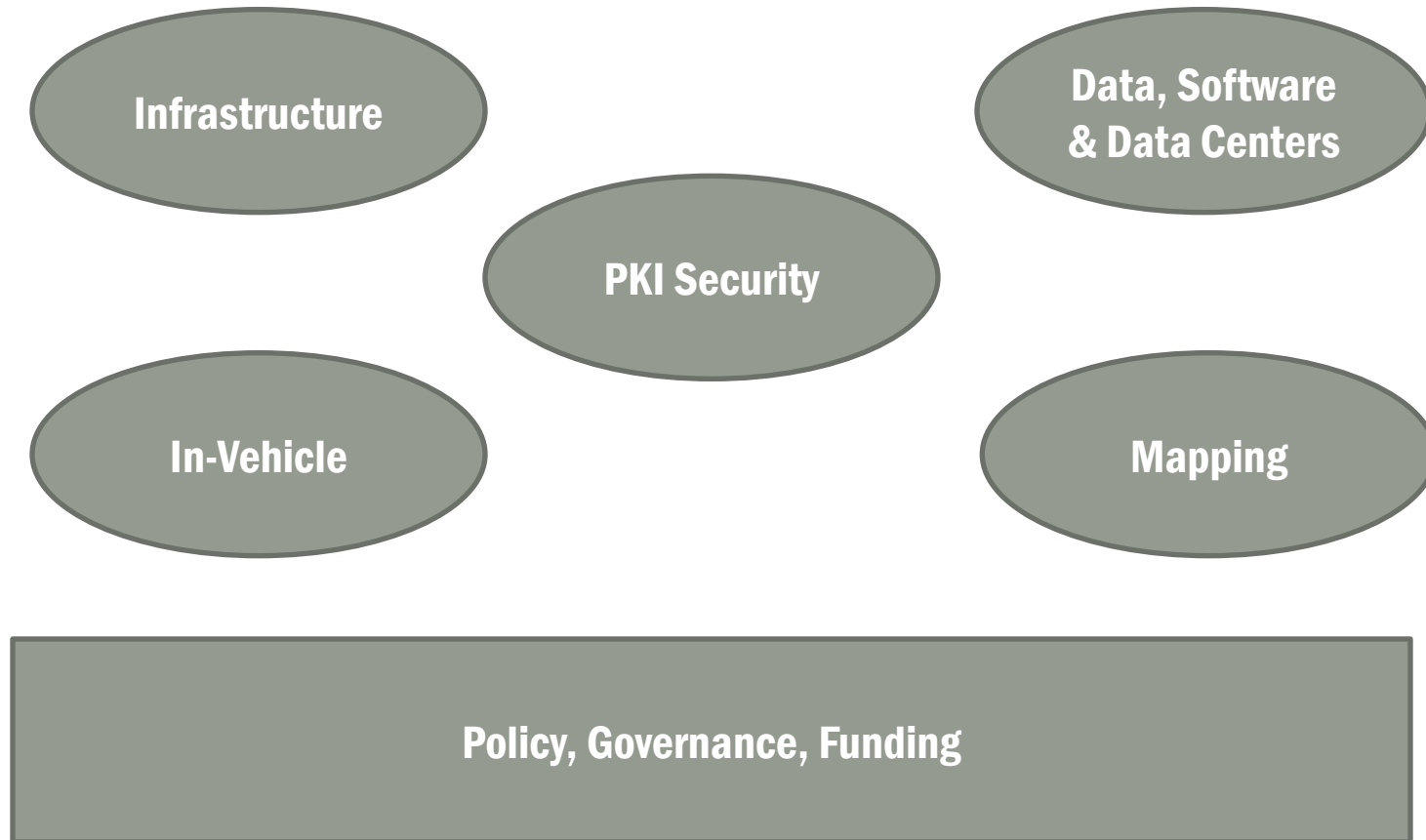
The Path To Deployment – US DOT Vision & Program

Goal: Deploy Stable, Interoperable, Reliable Systems



Technical Challenges– the BIG FIVE

Infrastructure Deployment
In-Vehicle Deployment and Systems
PKI Security
Back Office Systems and Data
Mapping



Infrastructure Deployment

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- 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

Infrastructure Magnitude - AASHTO 2040 Vision for V2I

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- 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

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- 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

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- Radios
- Applications
- Human Machine Interface
- Aftermarket
- Multiple Systems

In-Vehicle Systems - Security

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- 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 it's entire life



In-Vehicle Systems – Not One Size for All

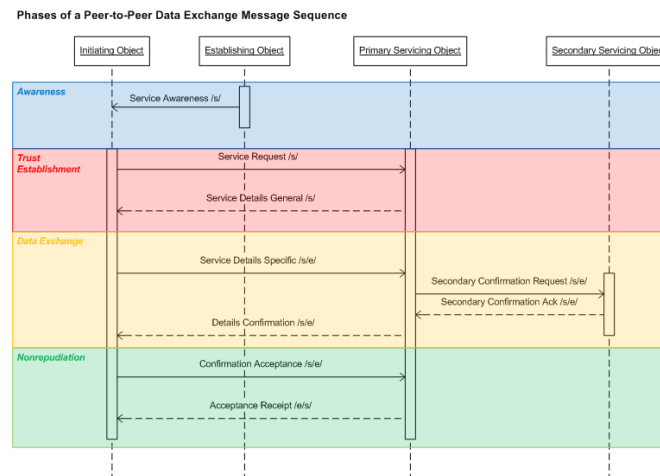
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- Primary initial focus has been V2V
- Transition is occurring to include V2I (and V2X)
- Integrating multiple vehicle types and fleets is not trivial
 - Passenger Cars
 - Taxi's
 - Commercial Vehicles / Trucks
 - Long-Haul
 - Short-Haul
 - Regional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

Security (Credential Management)

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- 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



- [illegible]

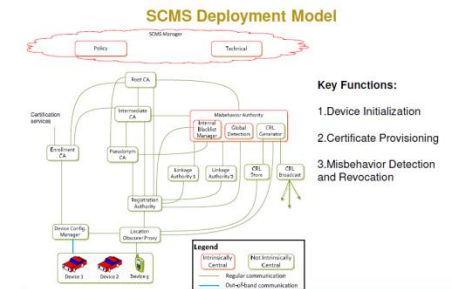


- Most (if not all) V2I systems require accurate mapping
- SPaT requires detailed mapping of signalized intersections
 - Approaches
 - Lanes and lane assignments
 - Stop Bars
 - Accuracy within 10cm to support SPaT and collision avoidance applications
- As vehicles increasingly rely on applications that 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

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- **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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