V2X Summit Speaker

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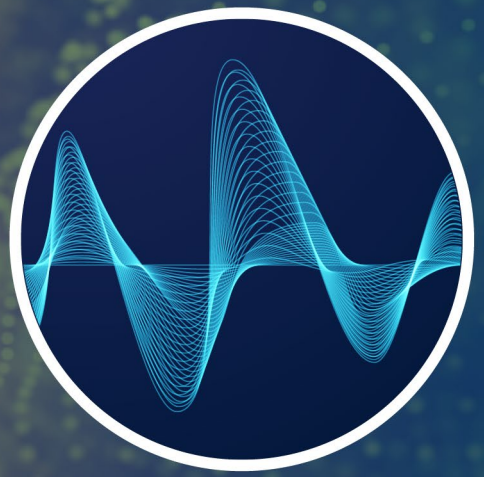

ITS / V2X
COMMUNICATIONS FOR DEPLOYMENT

ITS / V2X Communications Summit

U.S. Department of Transportation

System of Systems Architecture Perspective:

Concepts for Optimizing Public Benefits from V2X Communications

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U.S. Department of Transportation

ITS / V2X Communications Summit

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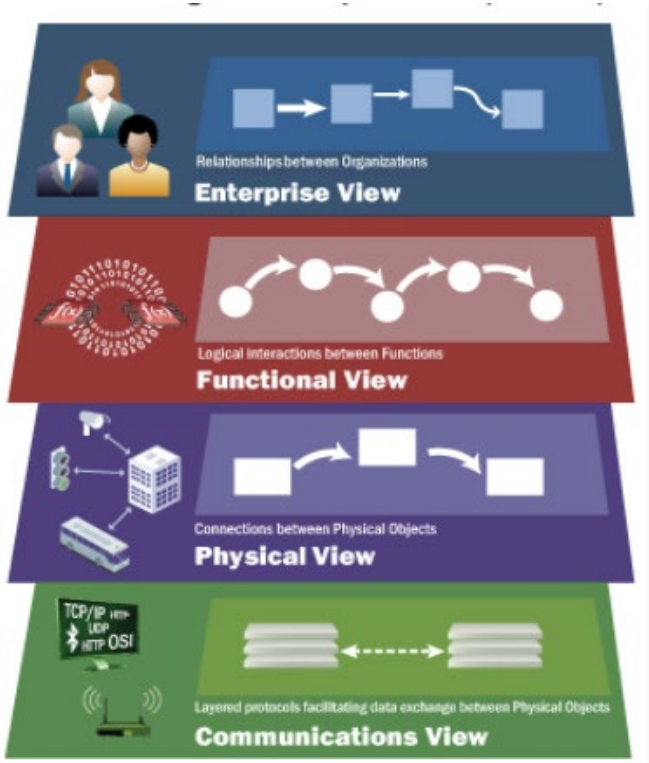
ITS National Architecture Reference ("ARC-IT")

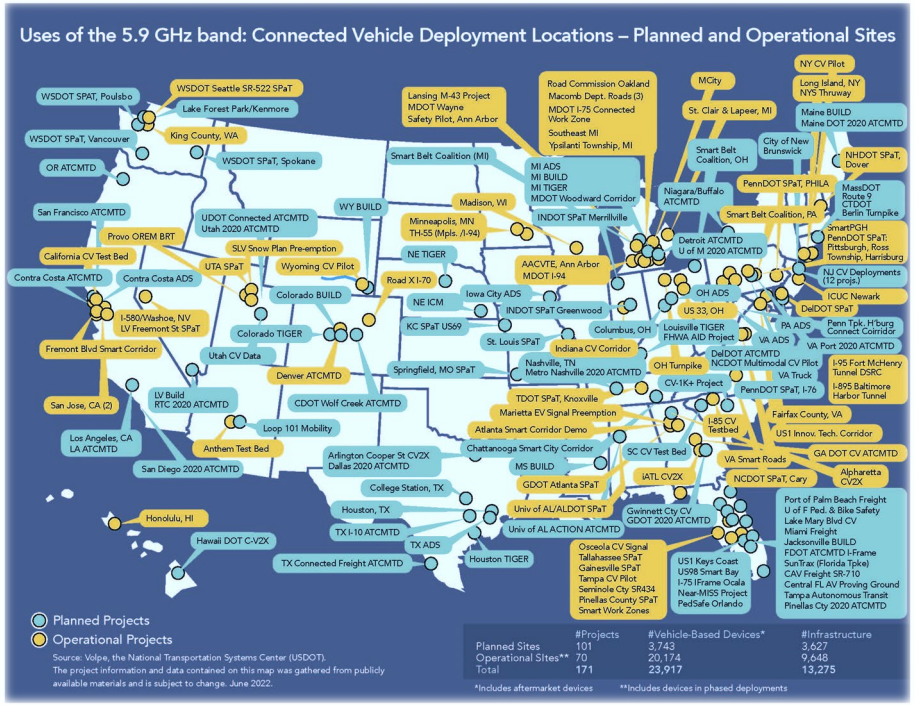
- U.S. DOT maintains and evolves the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT)
  - Supports customized Regional and project architectures
  - Identifies suitable standards options
  - Multiple means of service delivery when viable
  - ARC-IT is forward-looking, currently 150+ services—
    - 118 include a V2X component and thus must use wireless communications
    - All could utilize at least some wireless communications if beneficial
- Framework for safe, secure and effective *interoperable* ITS.



https://www.arc-it.net/

Optimizing V2X Public Benefits: Requirements

- **Technical suitability – "it must work well"**
  - Scalable/interoperable for National/North American deployments
  - Need not be latest thing – "Everywhere" is far more important!
  - Supportable over life cycles of vehicles and infrastructure, not just ICT devices
- **Acceptance – "people need to want to use it"**
  - Usability, affordability, acceptable privacy practices
- **Availability – viable business model**
  - Scalable/interoperable approach broadens marketplace
- **Adoption – public will benefit only if/when adopted**
  - Some services offer benefit with low penetration, some linear
  - Crash-imminent V2V warnings, for example, require *<u>both</u>* sides to participate
    - High levels of participation are essential to optimize benefits!



Leveraging V2X Successes for the Future…

✓ **Enormous potential public benefit of V2X remains unchanged**

✓ **Many applications and services with now-proven safety and efficiency benefits**

… by Optimizing Use of Available Spectrum

Today we have 30 MHz of dedicated spectrum ….

… and enormous and growing additional bandwidth

Available wireless communications options continue to evolve …

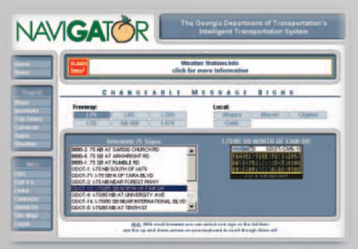
… initially, V2X designed around a customized protocol optimized for crash-imminent safety, thus requiring dedicated spectrum … a sensible choice at the time considering available options

Communications options evolving from “one way” to “many ways”

How do we best leverage this opportunity?

"WHEN" you need information drives "HOW" to get it

When?	As Convenient	Pretty Soon	Soon	Now	Right Now!!
Timescale	Hours +	Minutes	5 – 60 secs.	**0.5 - 5 secs.**	**< 0.5 secs.**
How?	▪ Internet Protocol (IP) suitable ▪ "Apps.", many other options ▪ Opportunistically leverage available, uncongested spectrum		"Either/Or"		**Customized Low-Latency Protocol**



Broadening V2X Participation: A Candidate Approach

As Convenient	Pretty Soon	Soon	Now	Right Now!!
Hours +	Minutes	5 – 60 secs.	5 – 0.5 secs.	**< 0.5 secs.**

- **Internet Protocol (IP) suitable**
- **"Apps.", many options**

Customized Low-Latency Protocol

When there are many choices … how to choose?

- Customized applications and/or internet protocol communications
  - Open to innovative services, applications and business models
- Many sources: cellular, Wi-Fi, satellite, etc.; will evolve over time
  - Architecture to accommodate diversity of equipment types, capabilities and ages across multiple lifecycles
- Options might vary by participants' technologies and cost tolerance, available choices, frequency congestion
- Where and how to get what information when?

➢ **Need universal dynamic ITS service availability information**

As participation and public benefit increase, 30 MHz may not be enough …

- What about "overflow"?
- Can a basic safety message be broadcast in mid-band U-NII?
  - Probably … but only beneficial if received!
- Will anyone receive it? Only if they are listening …

➢ **Need means for coordinated, dynamic selection of uncongested channels**

- Related updates to safety messages?
- How to maximize benefits in a mixed mode environment?

Thank you!

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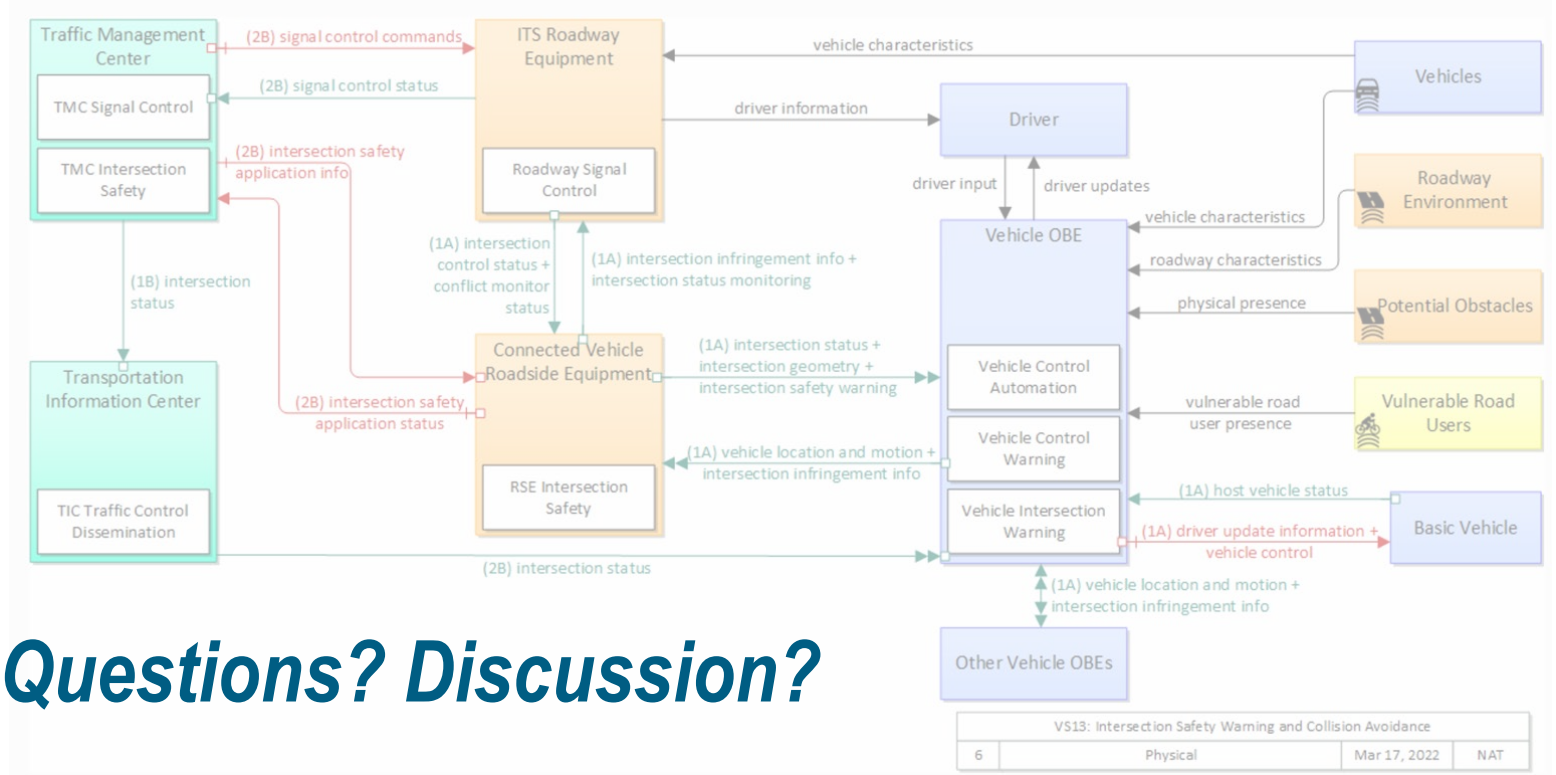
https://its.dot.gov/

Looking Forward to V2X Everywhere ….

- Many policy and engineering questions to be answered!
- Join us in evolving the ITS Architecture Reference to expand V2X benefits …



Questions? Discussion?