



Leveraging V2X Data to Create a Sustainable Public-Private Partnership

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V2X Data Exchange Platform Concept

- V2X data platform:
 - ▶ Ingests data from **CAV devices** (roadside units (RSUs) and on-board units (OBUs))
 - ▶ Ingests data from **ITS**
 - ▶ Ingests data from **third parties**
 - ▶ Optionally interacts with **SunGuide®** (ActiveITS)
 - ▶ Allows data to be shared between computer programs, data systems, and users
 - ▶ Ultimate solution for data generated in all CAV projects in Florida



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ATMS vs. V2X Data Exchange Platform

- ATMS platform:

- ▶ Direct to device
- ▶ Producer of data (events, travel times, traffic aggregation)
- ▶ Can be a consumer of 3rd party data
- ▶ Operations Centric

- V2X Data Exchange platform:

- ▶ CV Heavy (inbound/outbound messaging)
- ▶ Less direct to device
- ▶ Producers send data
- ▶ Consumers pull data
- ▶ Less about control, more about knowledge
- ▶ Data Centric for civil or educational use.

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Purpose and Need of the Platform



- Collect, manage, and store CAV data
- Coordinate with and integrate additional data sources and systems
- Normalize, filter, aggregate, and disseminate data
- Send and receive data from automobile OEMs (reduce OBU purchasing)
- Develop real-time and predictive analytics
- Leverage existing infrastructure
- Provide visualization

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V2X Data Exchange Platform Users



Districts



Traffic Engineers



University Researchers



AOEMs



Other FDOT Personnel



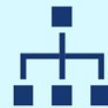
Cloud-Based Strategy



Device Drivers and APIs



Real-time and Predictive Analytics



Edge Computing



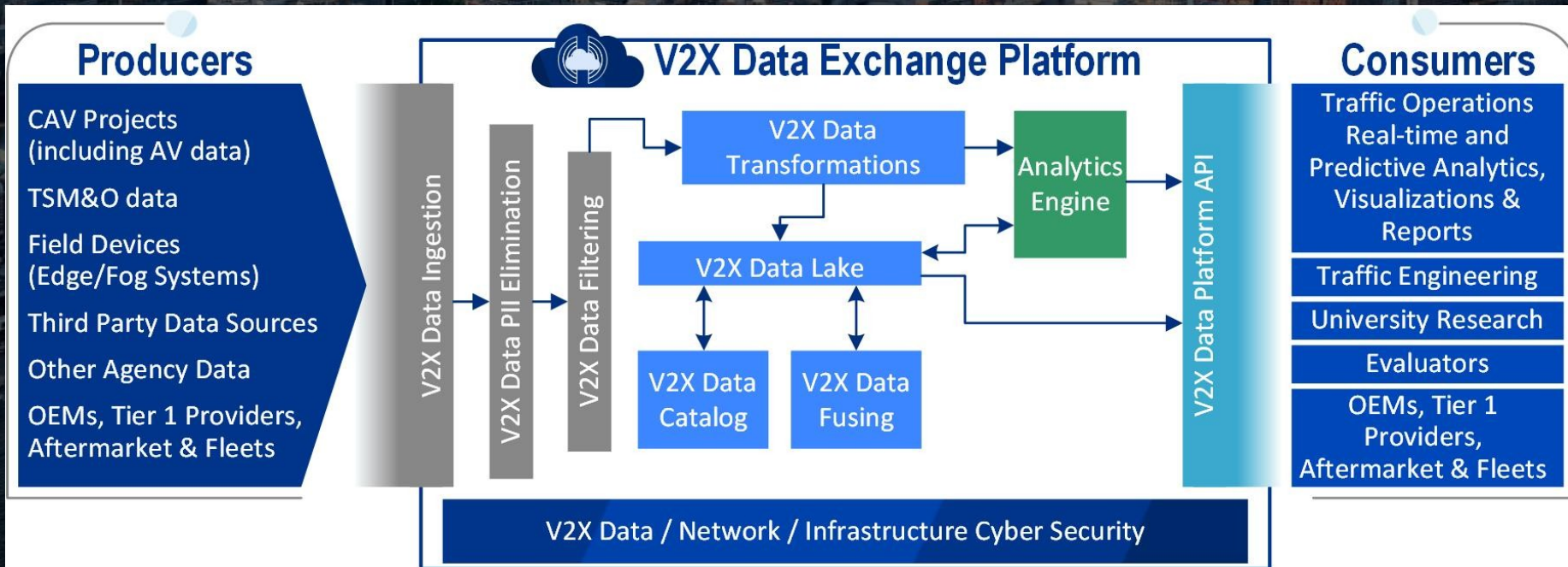
Requirements and Specifications



Open-Source and Open-Architecture Tools

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Platform Architecture



◆ SwRI ◆ AWS ◆ Ford
◆ Google ◆ Amazon Fleet ◆ FIU
◆ Kodiak

FDOT V2X Data Exchange

Record of all API calls made in the environment (CloudTrail)

Intelligent threat detection (Guard Duty)

Monitoring/logging of the environment (CloudWatch)

Monitoring the environment's configuration in line with standards (Config)

Identity and Access Management (IAM)

Automated software vulnerability scanning (Inspector)

Producers

Field Devices

SUNGUIDE
DIVAS
VDS

Partner Data Sources

SunStore
ArcGIS

FDOT Systems & Local Agencies

Simulated CV Data

Consumers

Business Intelligence Dashboards

Power BI

Standards Compliant Data Feeds

Researchers

Other

CV equipped vehicles

Non-CV equipped vehicles

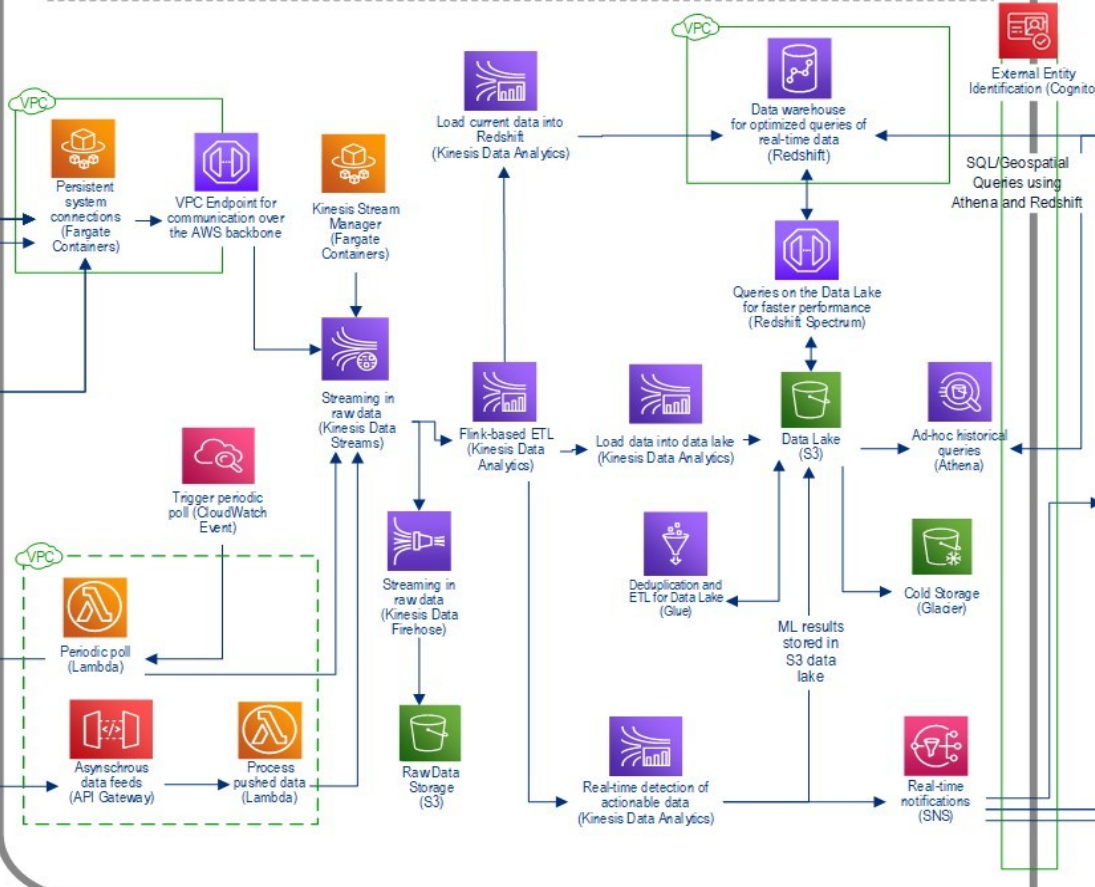
Field Devices

LEFT LANE CLOSED AHEAD

Data Consumers

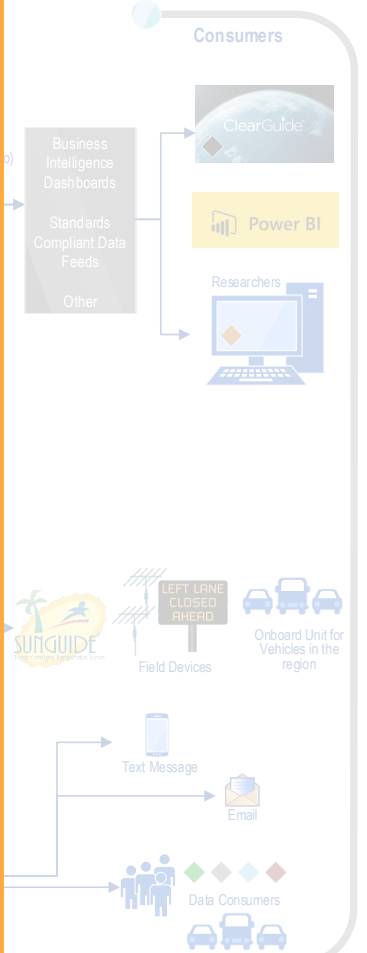
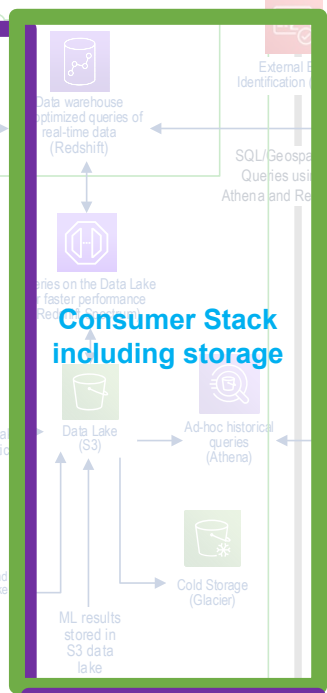
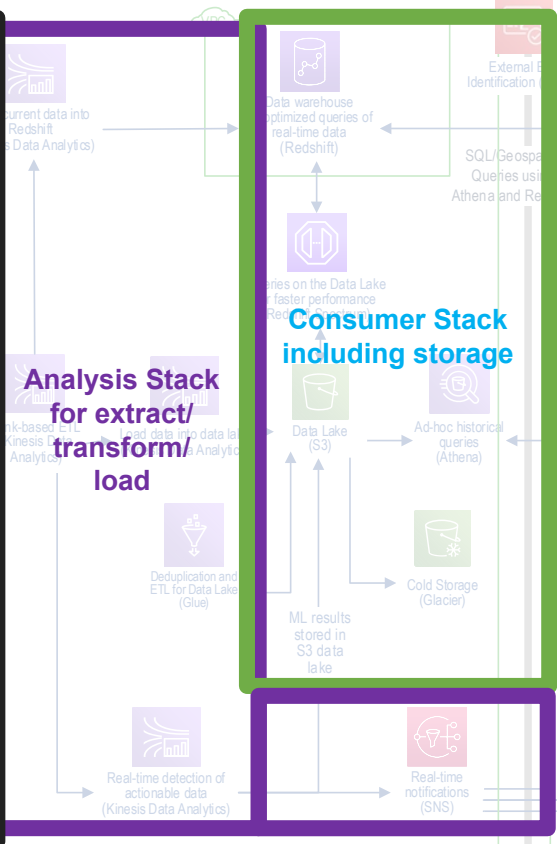
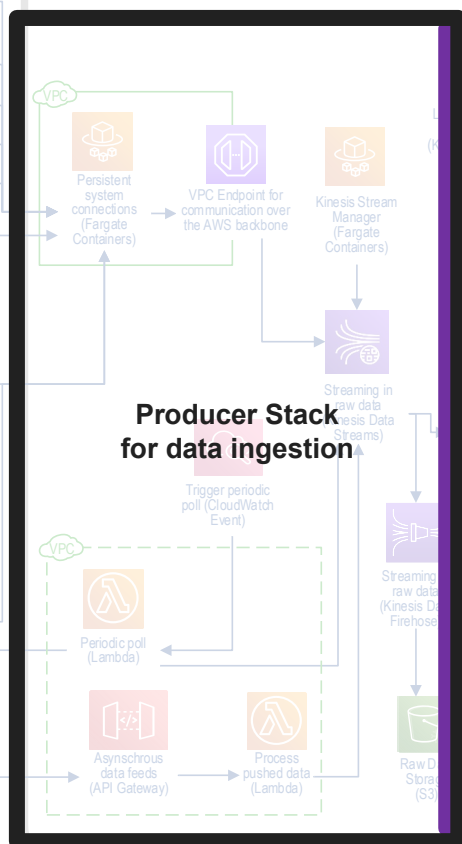
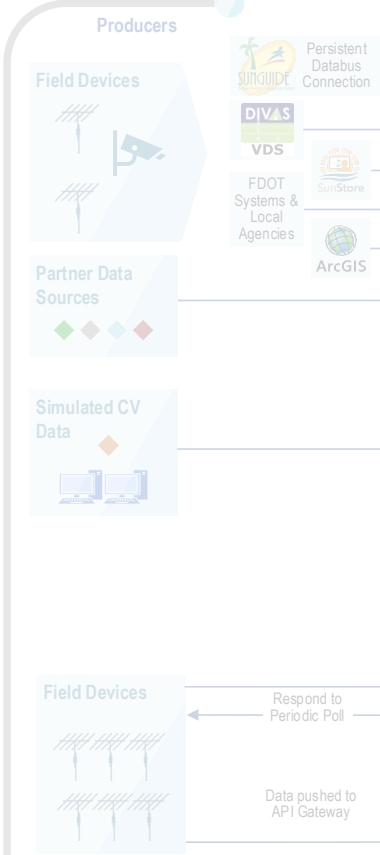
Text Message

Email





Network Stack



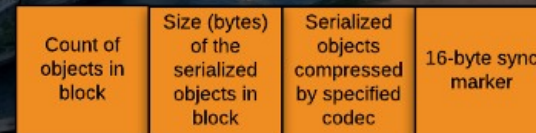
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Platform Architecture (Avro)

- Compact binary encoding (as opposed to text-based serialization like JSON and XML)
- Fast encoding/decoding performance
- Industry standard for streaming data
- Robust support for many programming languages (C#, Python, C++, Java, etc.)
- Open source (Apache 2.0 license)

4 bytes: ASCII 'O','b','j', followed by
File Metadata *: Includes avro.schema and avro.codec*
16-byte sync marker

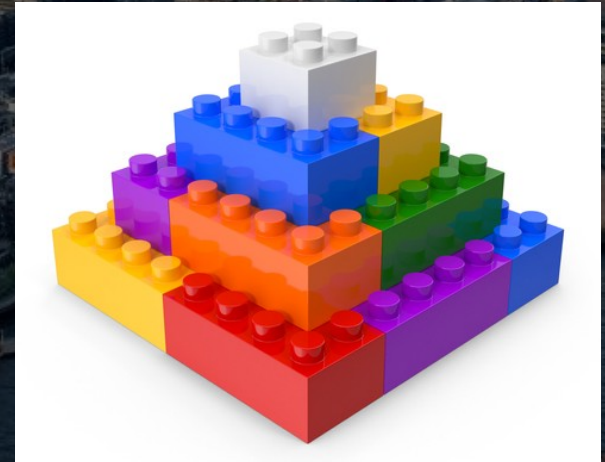
* File Metadata follows ("type": "map", "values": "bytes")



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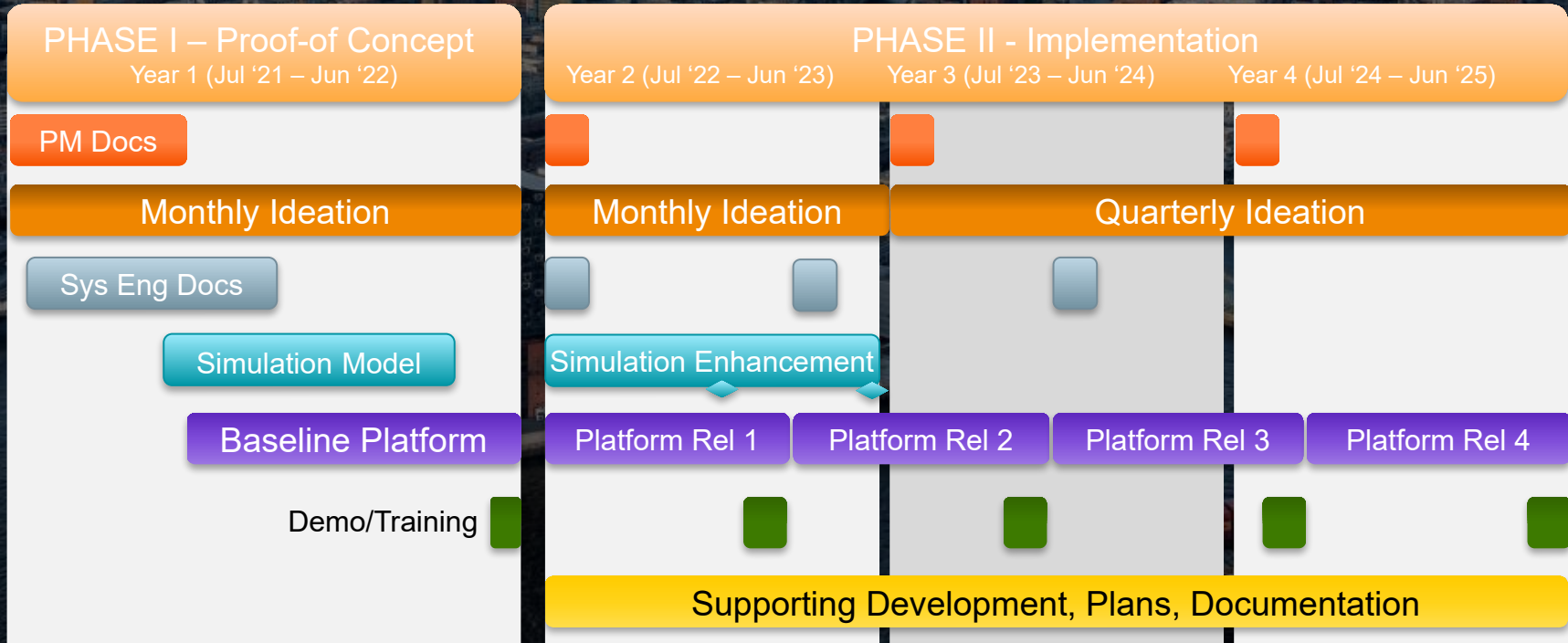
Platform Architecture

- AWS Infrastructure as Code (IaC)
 - ▶ Declarative (description of architecture) instead of imperative (set of update operations)
 - ▶ Version Control
 - ▶ Replica Environments
- Support standard programming languages (C#, TypeScript, Python, etc.) instead of Domain Specific Language (DSL)
 - ▶ Complex modeling, configuration, and architectural pattern reuse.



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Project Schedule



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Implementation Team

Google

amazon

FORD MOBILITY

aws

SwRI

JK
kodiak

iteris

FIU

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Licensing

- V2X data platform licensing:
 - ▶ FDOT intends to license the Data Exchange Platform as an “open source” like software.
 - ▶ Open to DOT and government agencies at no cost.
 - ▶ Enhancements/Additions **MUST** be passed back to all licensed states but integration is up to the individual states.
 - ▶ Intent is to collaborate with states and allow them to leverage previous work.
 - ▶ License will not be available until late in the project cycle.



GET IN TOUCH

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