
TRAFFIC
TECHNOLOGY
SERVICES
Delivering the
traffic signal
into the cloud...

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What We Are Doing

- TTS is currently deploying a nationwide V2I/I2V system for automotive OEMs, Tier 1s, and other services

- No DSRC equipment is required
- Interface at ATMS, limiting connection points for security and communication redundancy
- Vehicle models in 2017, released in Q3 2016, will support TTS data products

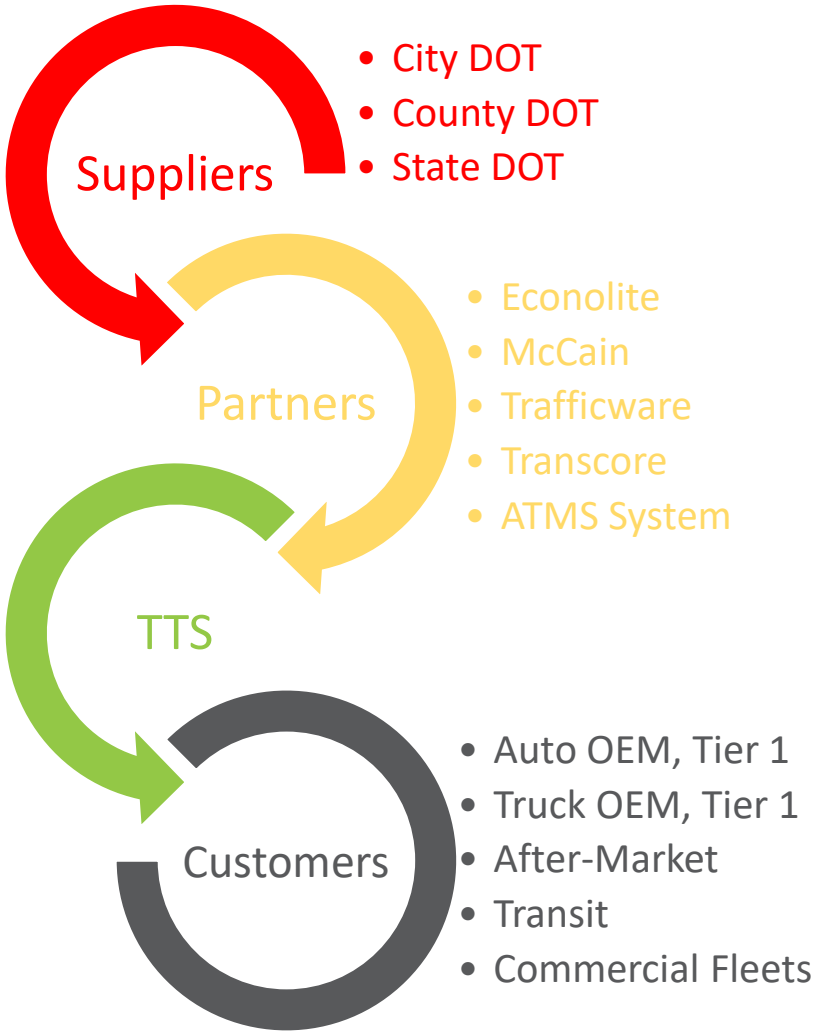
USDOT Connected Vehicle

- Applications for the Environment: Real-Time Information Synthesis (AERIS) Program
  - Eco-Approach and Departure at Signalized Intersections
  - Connected Eco-Driving
  - Eco-Integrated Corridor Management
  - Dynamic Eco-Routing

What is Our Product?

- Personal Signal Assistant
  - SPaT (Signal Phasing and Timing) message
    - Current signal status
    - Predicted signal switch times
    - Emergency vehicle preemption
    - Protected/permissive operations
  - MAP message
    - Lanes, geometry, stop bar locations
    - Phase assignments
    - Speed limits
  - SAE J2735 protocol, compliant
  - Customers access data via API or other sharing services

How Does It Work? Relationships



- Suppliers own data, as by-products of the infrastructure
- Partners deliver the data from ATMS, based on proprietary interfaces, NTCIP, or AB3418E
- TTS connects the systems, develops the information, and delivers the product
- Customers develop and provide the connected vehicle applications

Data from Suppliers

- Offline data
  - Signal timing
  - Phasing diagram
- Real-time data
  - Actuated signals
    - Phase active status (red, yellow, green)
    - Phase call status
    - Preemption or transit signal priority
    - Active timing plan
    - Cycle second
  - Fixed time signals
    - Active timing plan
    - Cycle second

Delivery from Partners

- Our partners deliver data formats based on our specifications or existing API's from their ATMS systems
- We work with leading technology providers, such as:

ECONOLITE Group, Inc.

McCain®

TRANSCORE

Trafficware

Personal Signal Assistant Mechanics

- Proprietary algorithms based on traffic signal control principles & machine learning techniques
- Data fusion techniques
  - Long term:
    - Movement vehicle arrival patterns
    - Day-to-day and time-of-day variations, special events
  - Short term:
    - Immediate vehicle arrival patterns
  - Current:
    - Signal state
    - Phase call
- Output
  - Next two switches for each signal
    - Time to green
    - Time to red

The End Result

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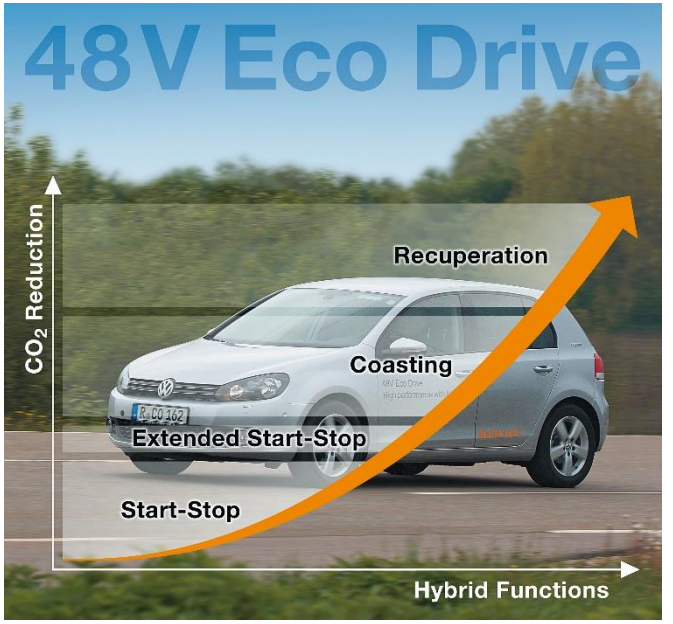
Continental Application Example[2]

- Approach on red
  - Automatic Recuperation
    - Recuperation/regeneration of brakes automatically applied
    - Suggestion by system to apply brake
    - Integrated into start-stop system, 1 second before green
- Approach on green
  - Coasting
    - If slower speed would be more efficient, the accelerator pedal vibrated



[2] As implemented by Continental for CES 2016.

The End Result

Agency Benefits

- Supplier Portal
  - Live Feed of Personal Signal Assistant
    - Time to green, Time to Red predictions
  - Log Files
  - Signal Operations Reports
    - Communication downtime
    - Time in offset seeking
    - Detector faults
    - Max times
  - Signal Performance Reports
    - Delay
    - Number of stops
    - Arrivals on green/red

How to Get Started

- Review and execute data licensing agreement
  - Permission to access and use signal timing data
  - Signal timing plan documents or data
- Work with ATMS vendor or consultant
  - Accommodation of minimal hardware at TMC per recommendation by ITS / ATMS vendor
  - Internet Service Provider if necessary

Thank You!

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