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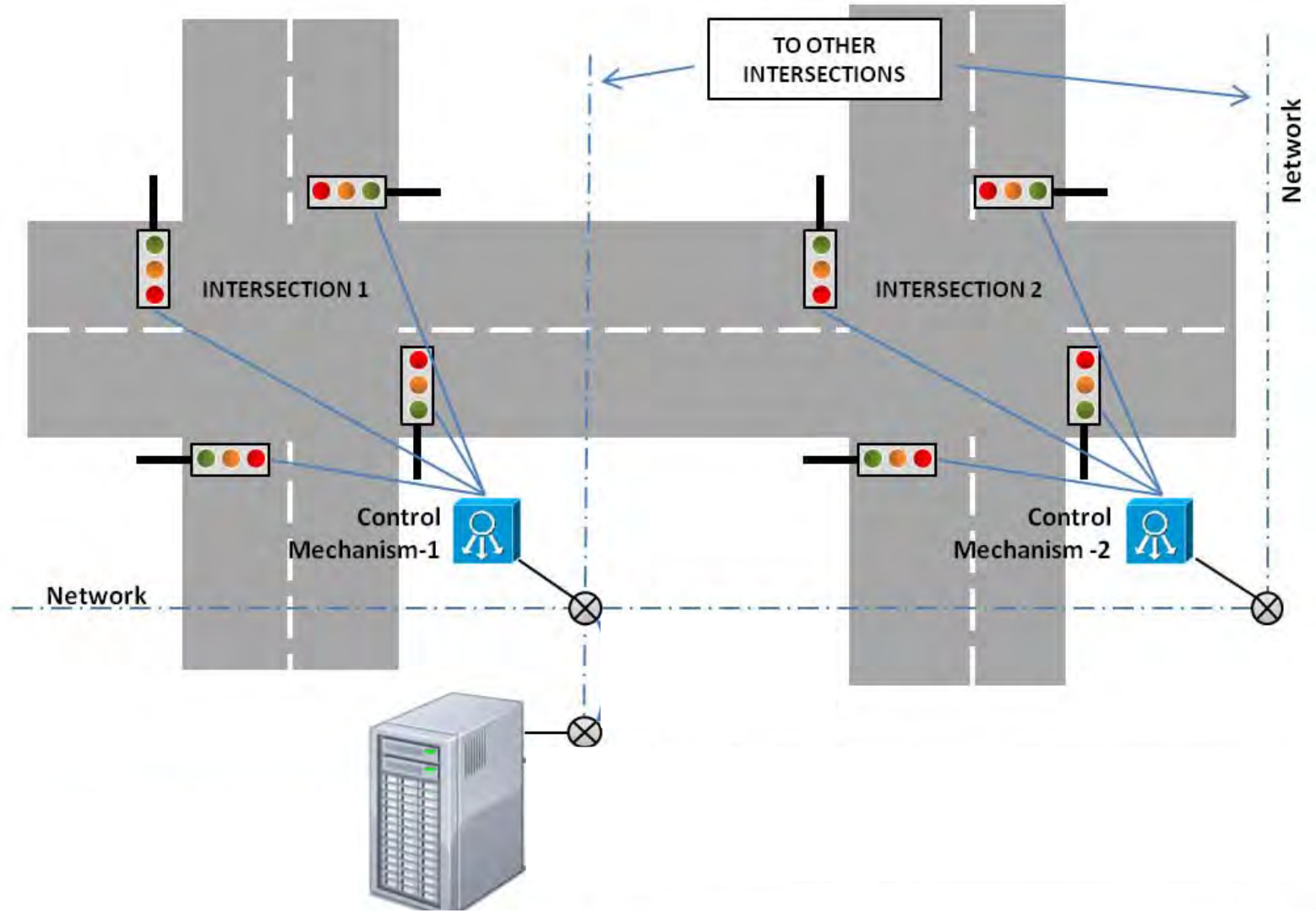
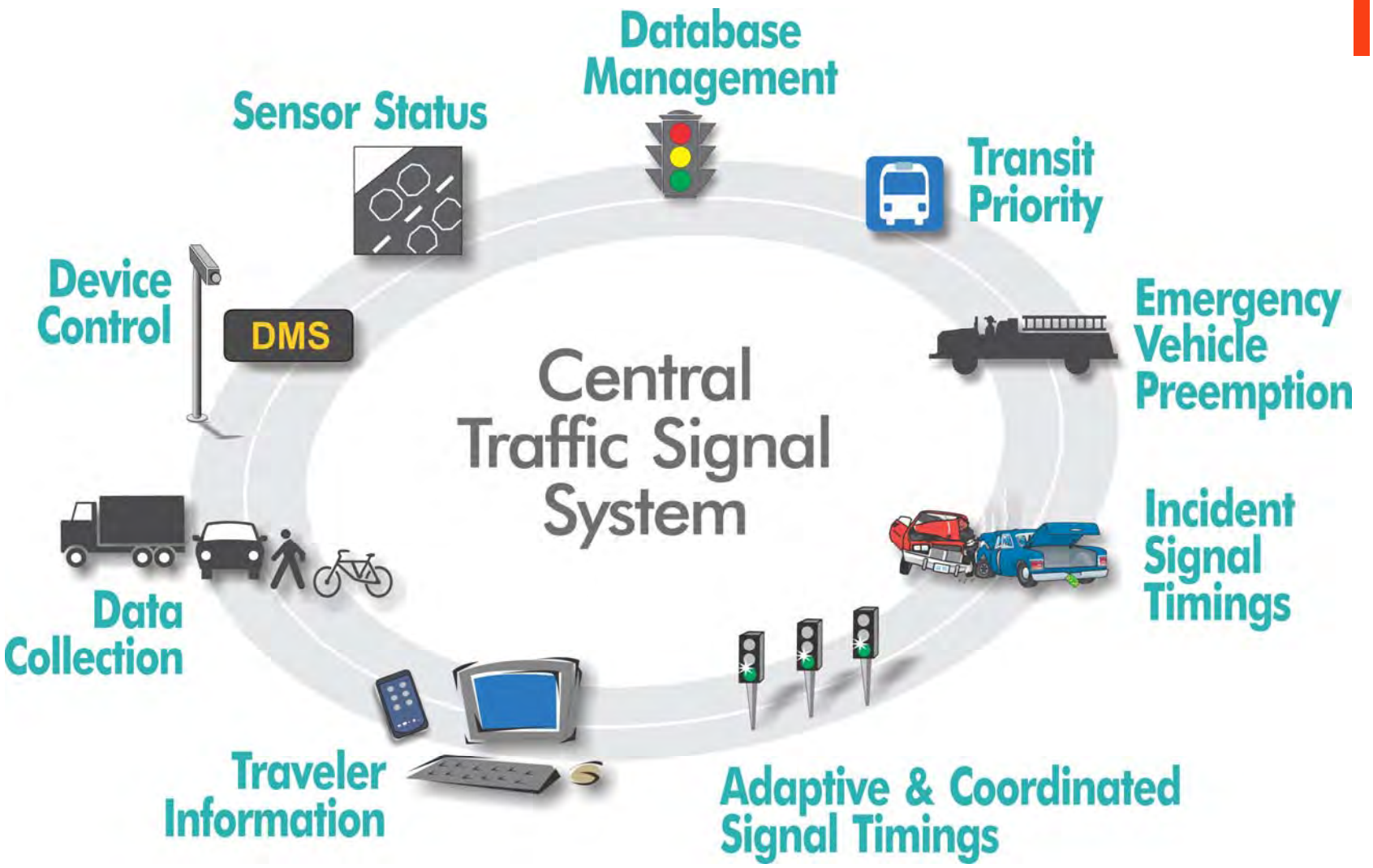
Central Traffic Signal Systems Primer

The Central Traffic Signal System



The central traffic signal system enables remote management and control

Current Signal System Capabilities



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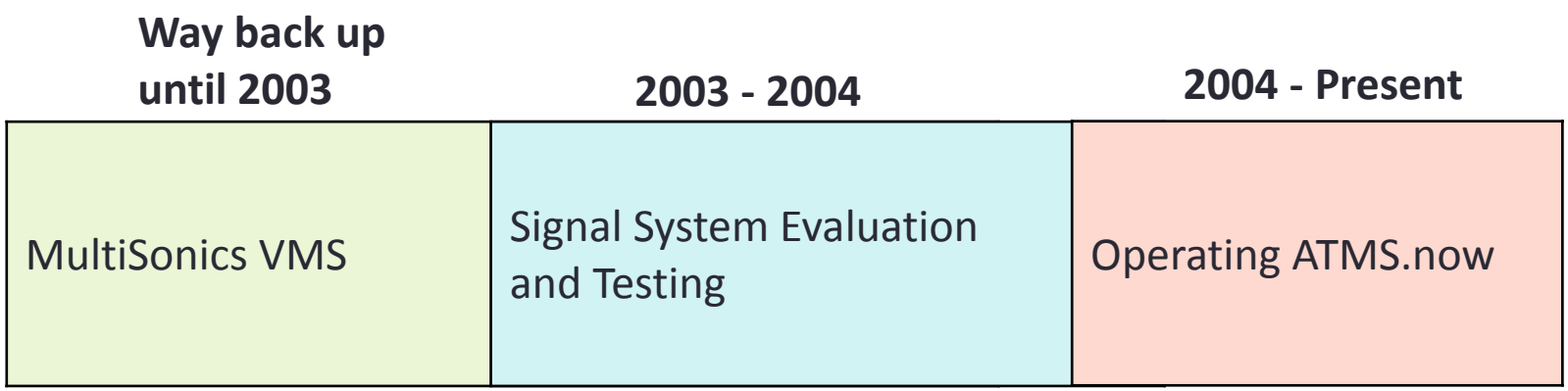
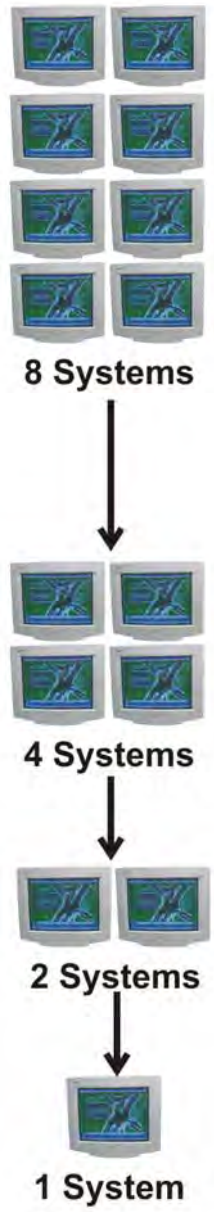
History of SW Washington ATMS

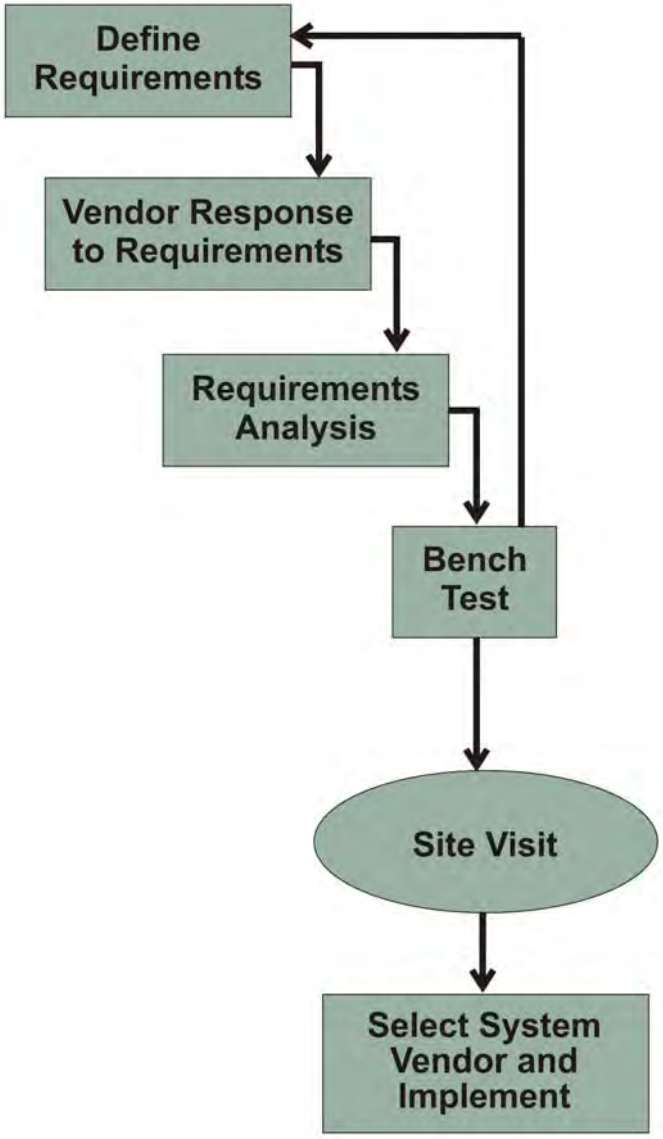
SW Washington Signal System Timeline



Signal System Procurement Process

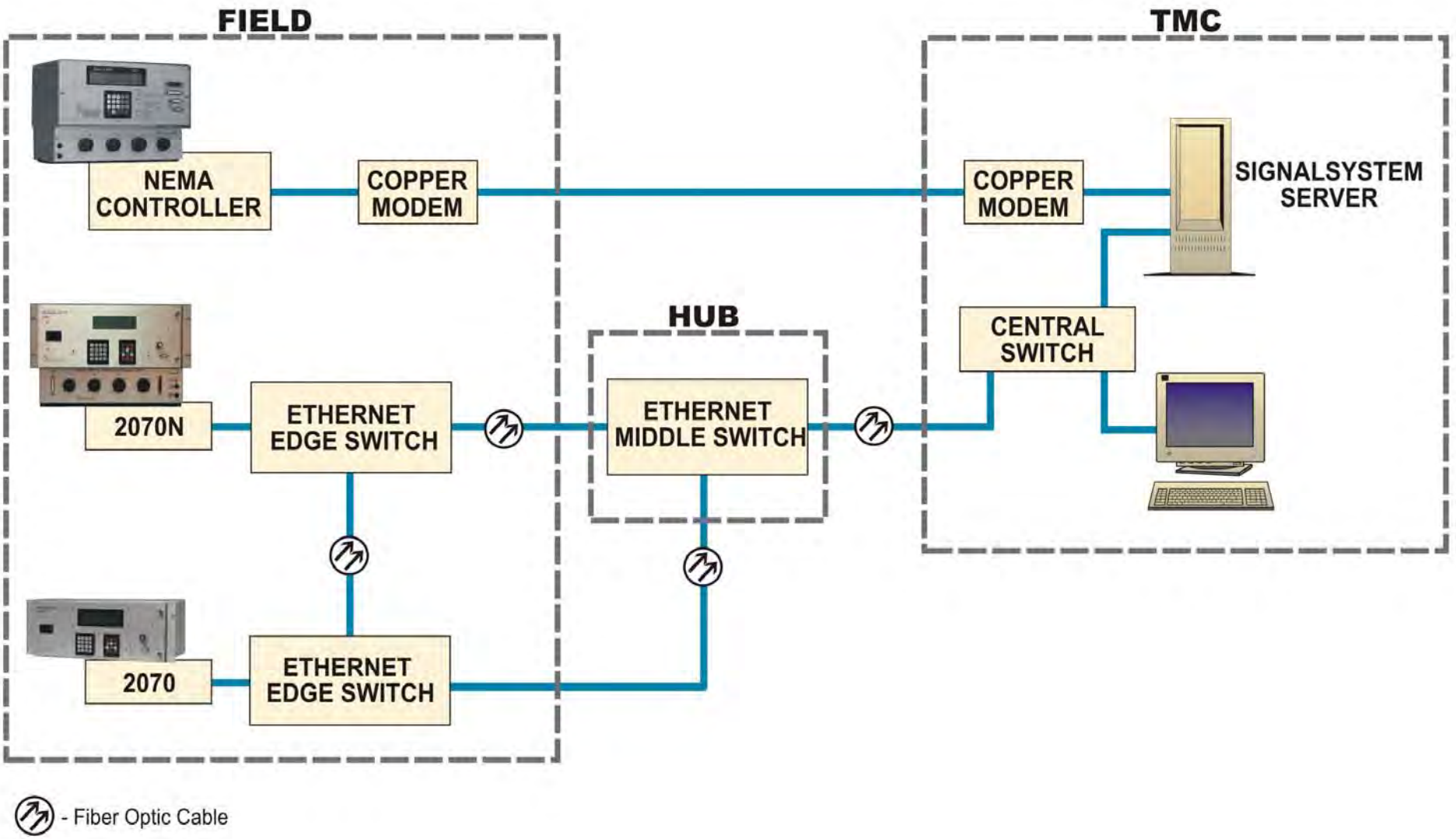
2003-2004





Technical Advisory Committee
(WSDOT, Vancouver Maintenance, Vancouver Engineers, FHWA)

System Diagram



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ATMS.now Capabilities

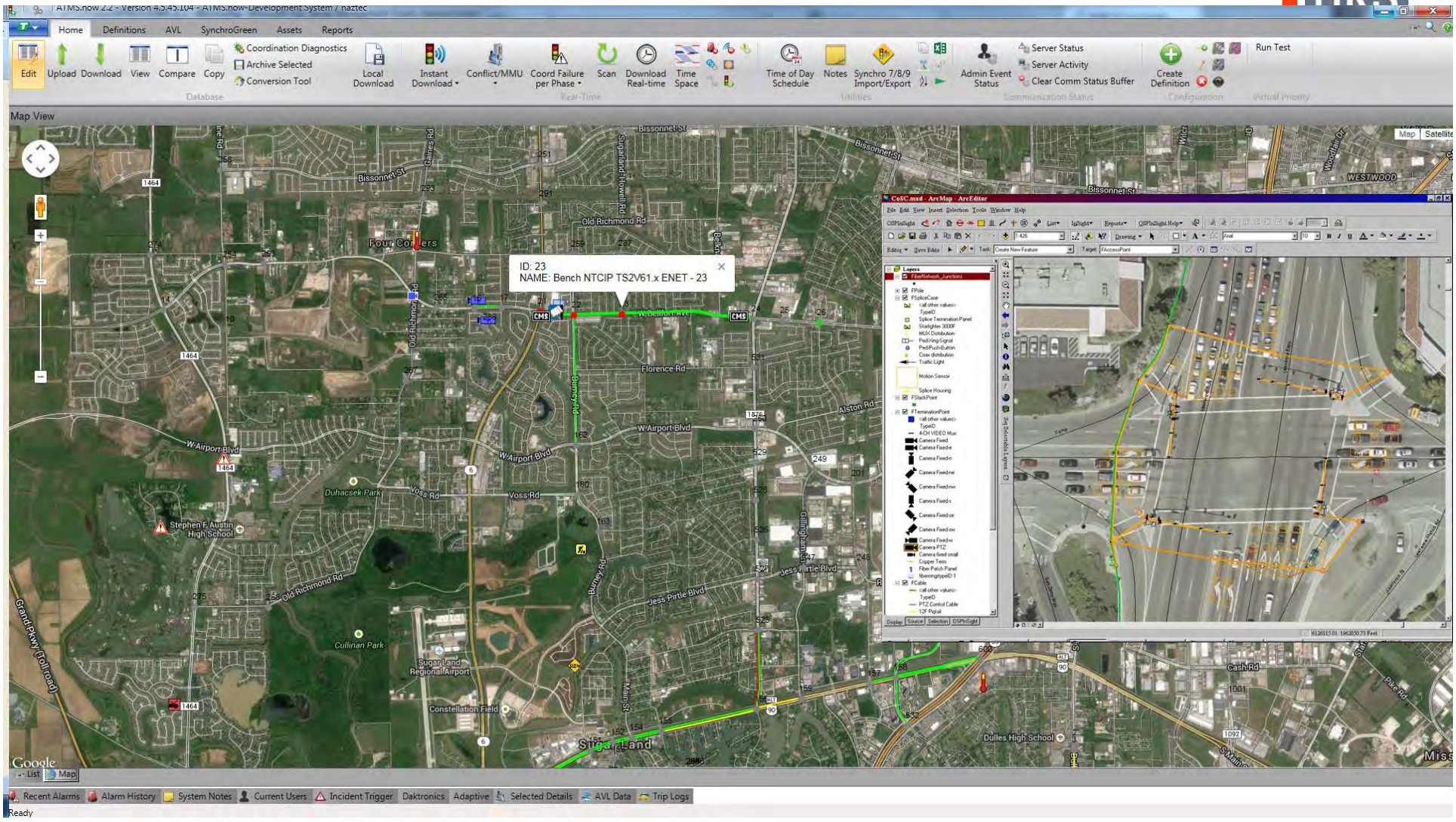
Intersection database management

DataSheet.1

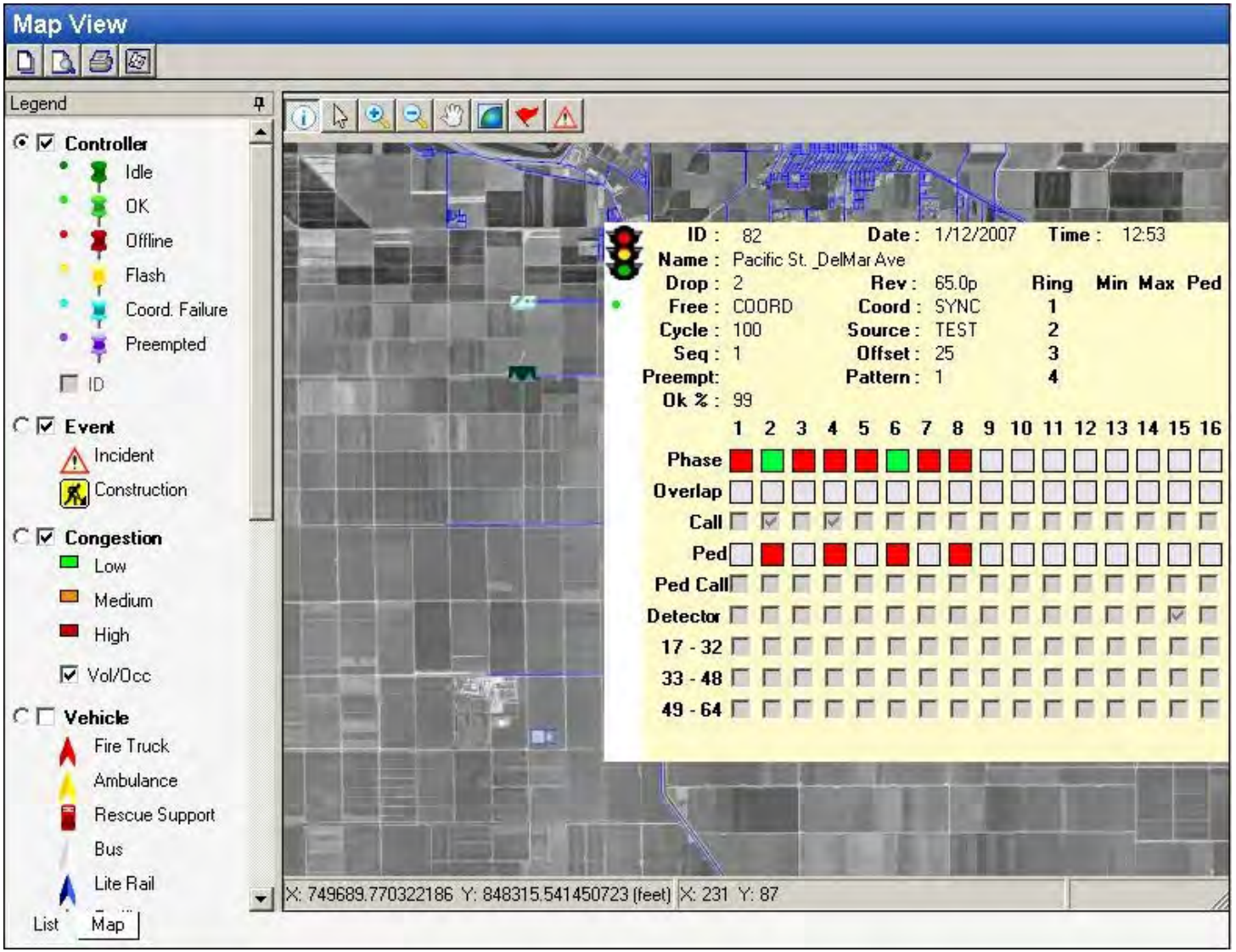
	Min	Max	Rate
Cycle (sec)	120	135	5
Green Band (sec)	30	90	

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Min Allocation (sec)	15	25	20	35	15	25	15	35								
Max Allocation (sec)	50	65	45	100	40	65	30	100								
Rate Limit (sec)	5	5	5	5	5	5	5	5								
Storage				1				1								
MinSplit%Adjust (%)																
Det Calibration	66	66	66	66	66	66	66	66								
Grn Util Det 1	1	2	3	4	5	6	7	8								
Grn Util Det 2																
Grn Util Det 3																
Grn Util Det 4																
Arrival Det 1																
Arrival Det 2																

Monitor intersection status and reporting



Monitor intersection status and reporting



Adaptive signal timing

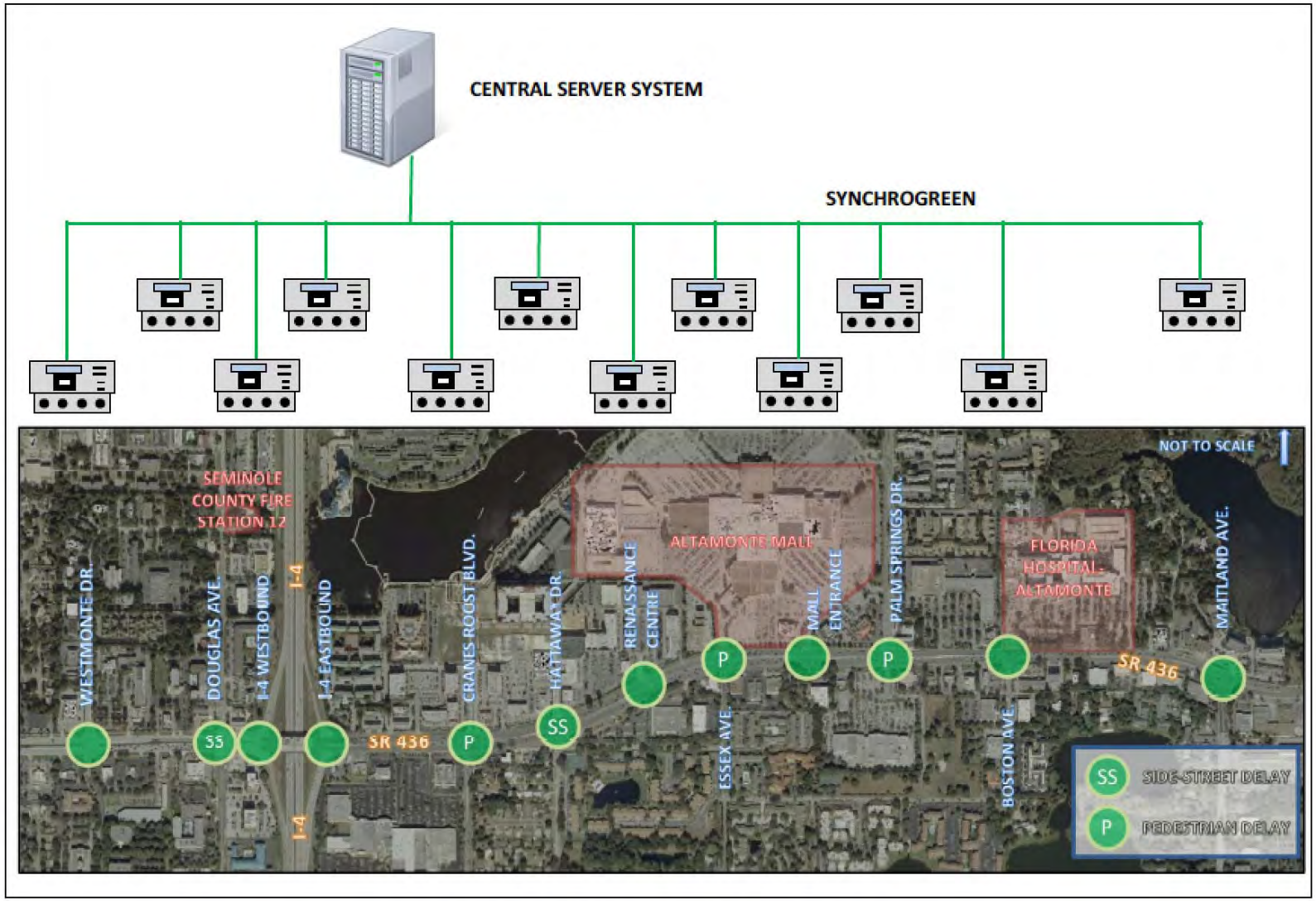
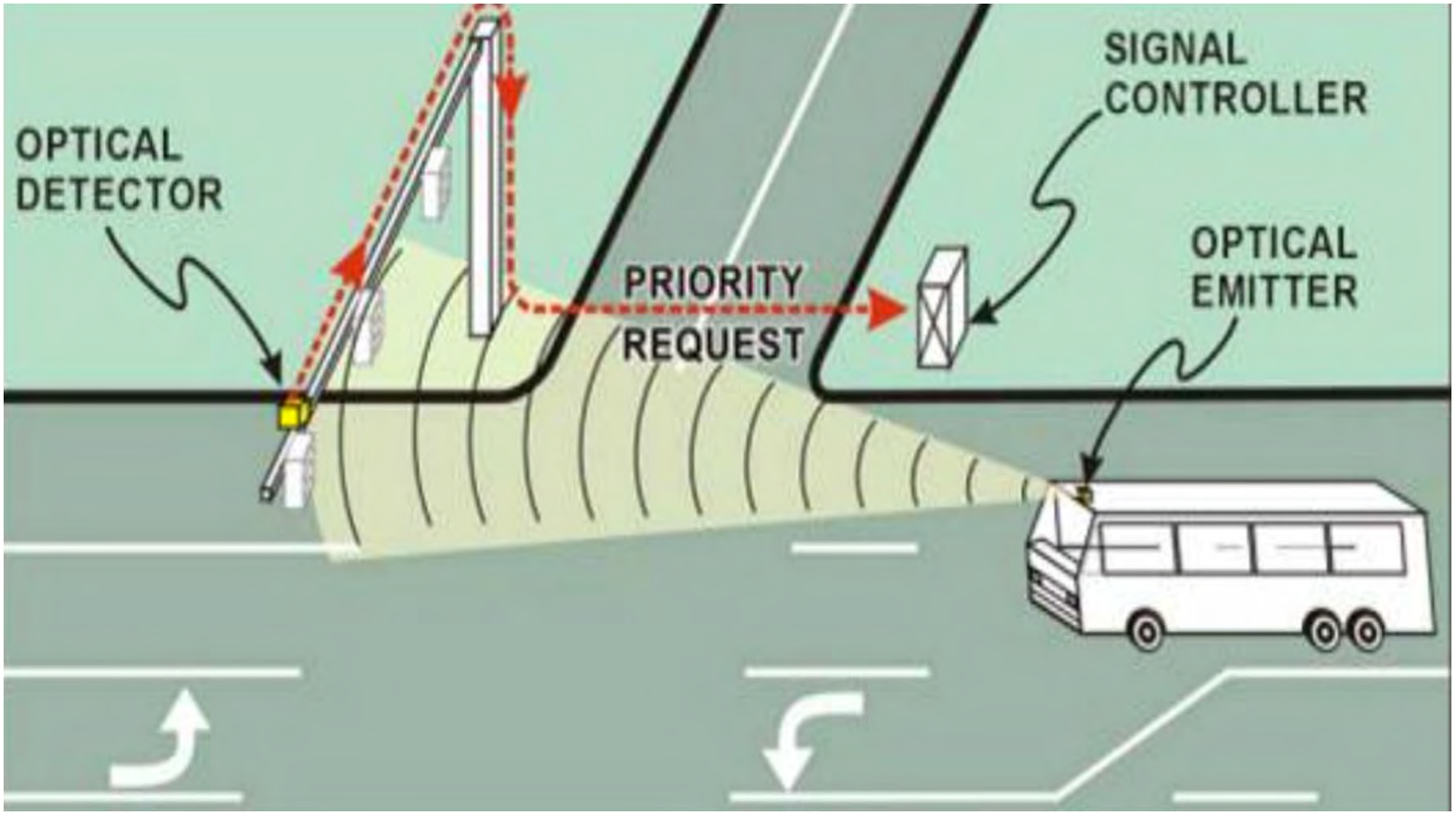
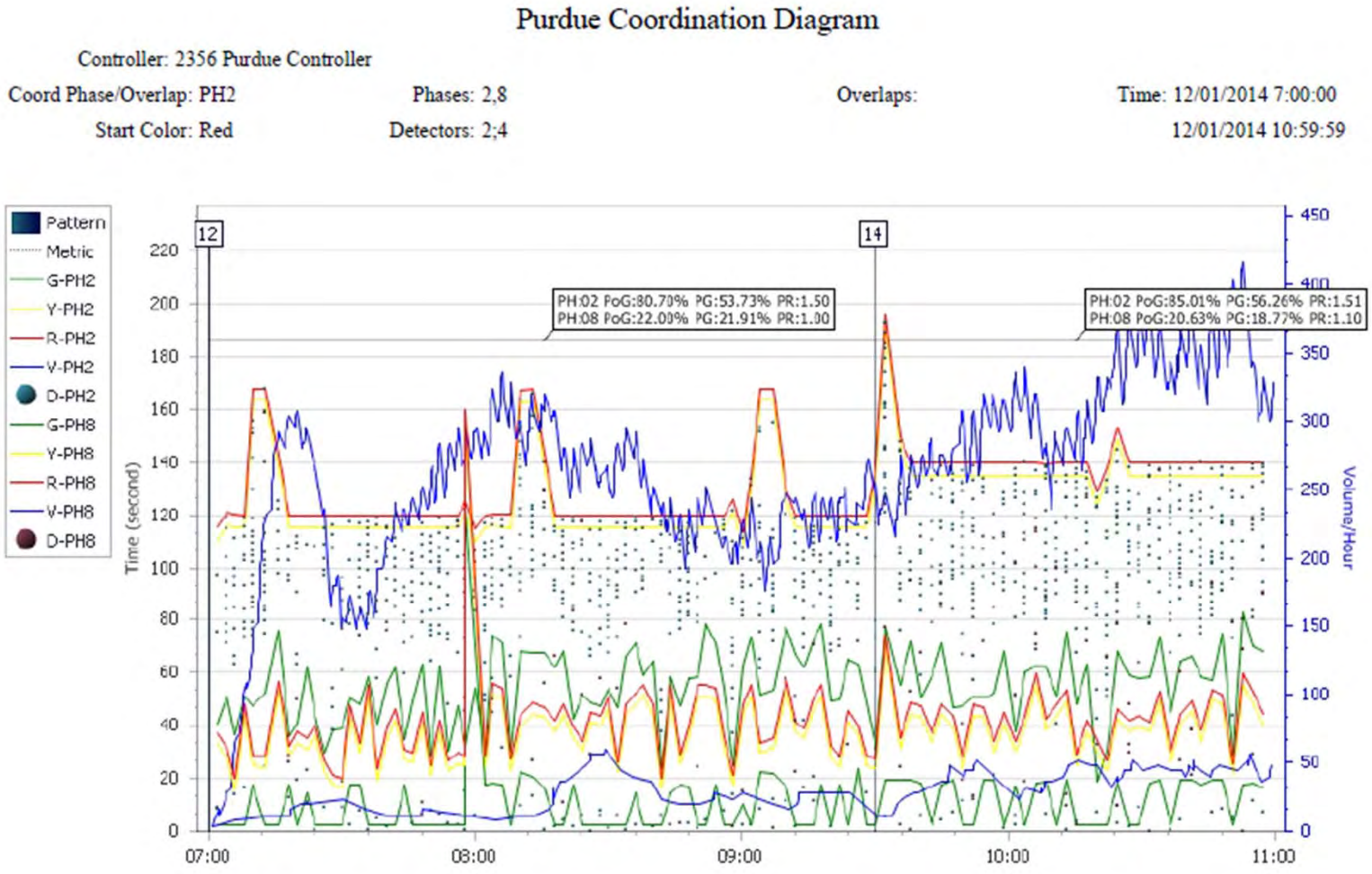


Figure 1 - SR 436 Deployment in Seminole County, Florida

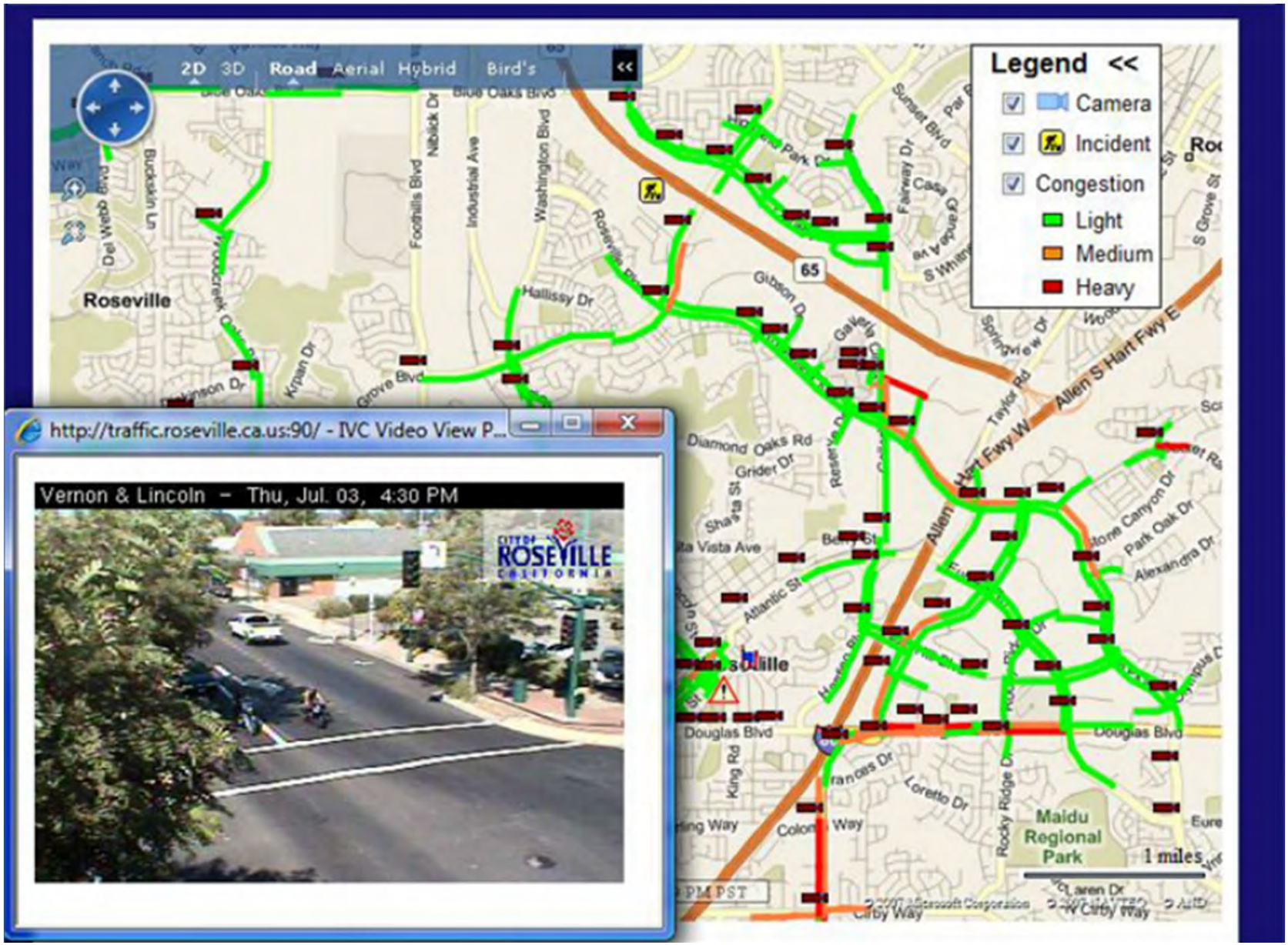
Transit signal priority



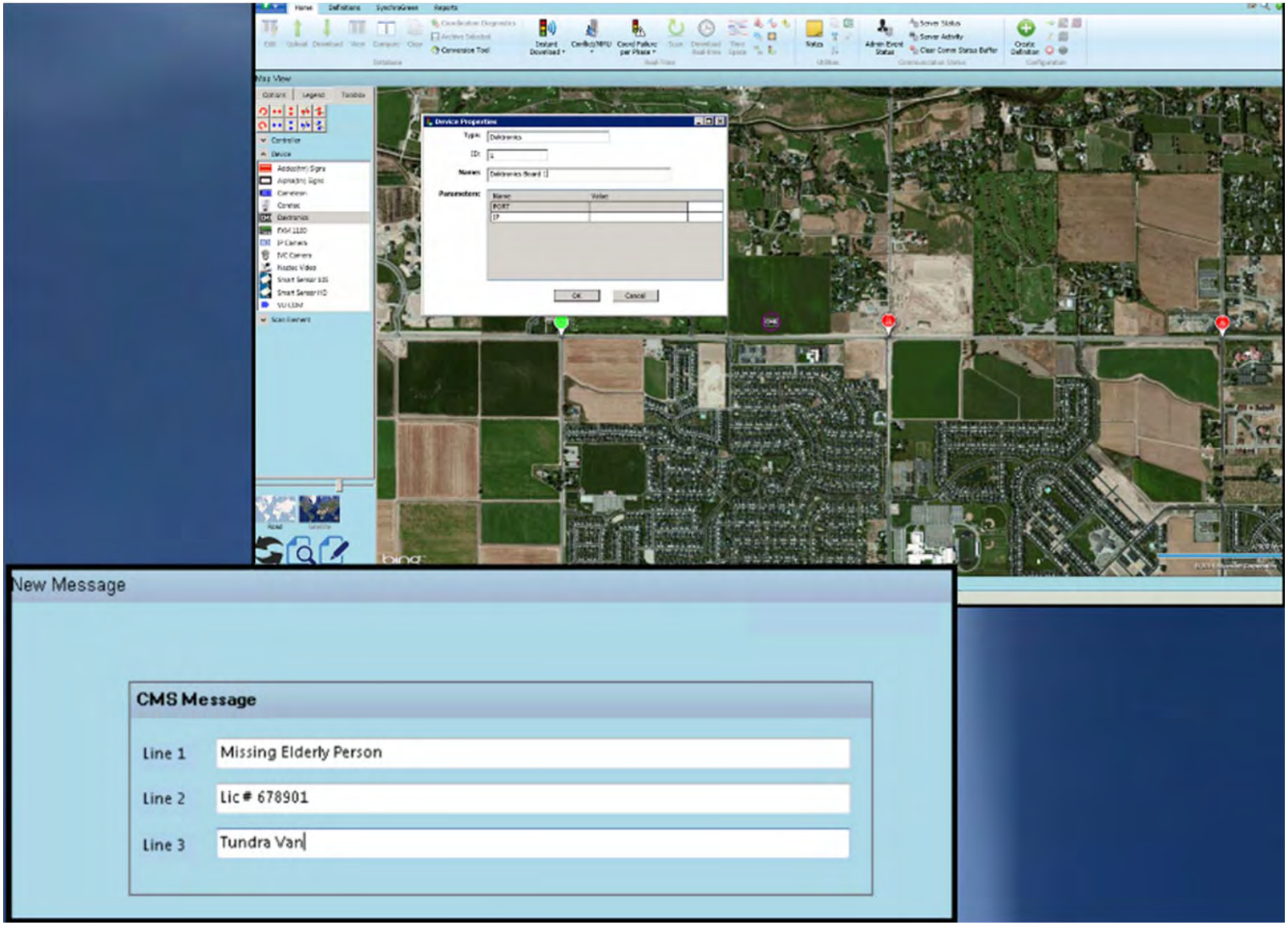
Performance reports



Camera control and monitoring



Dynamic message sign control



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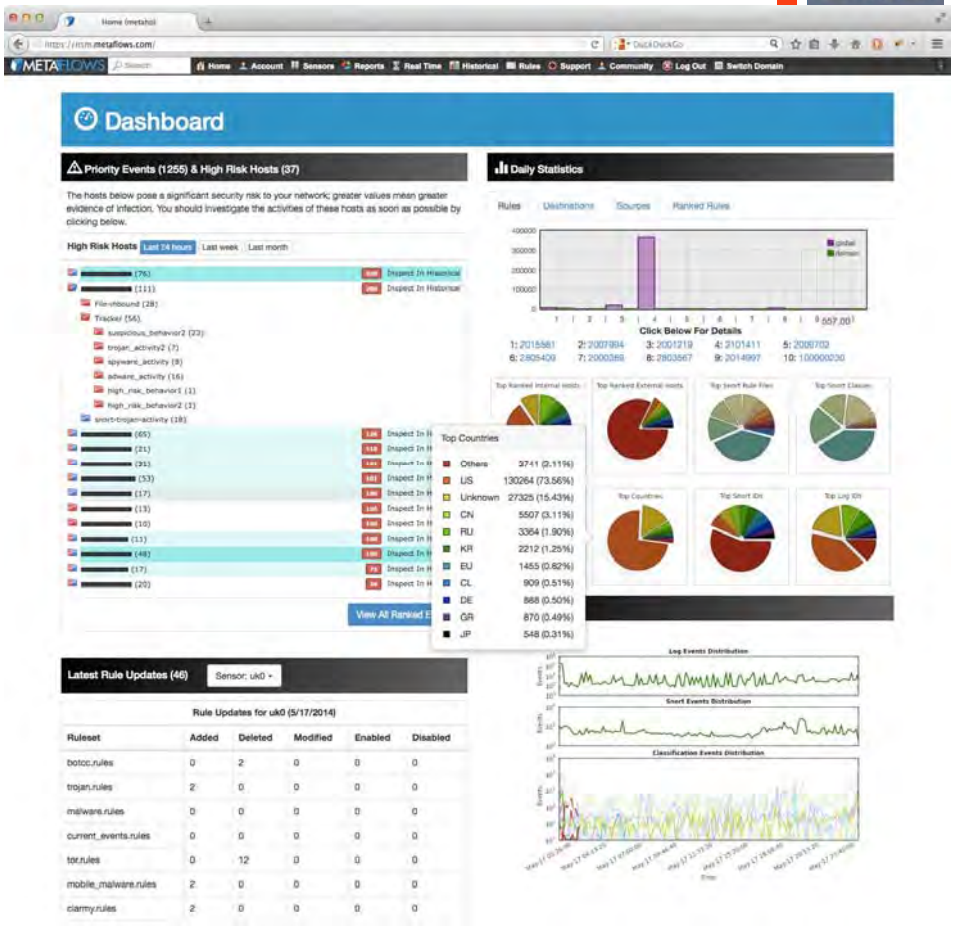
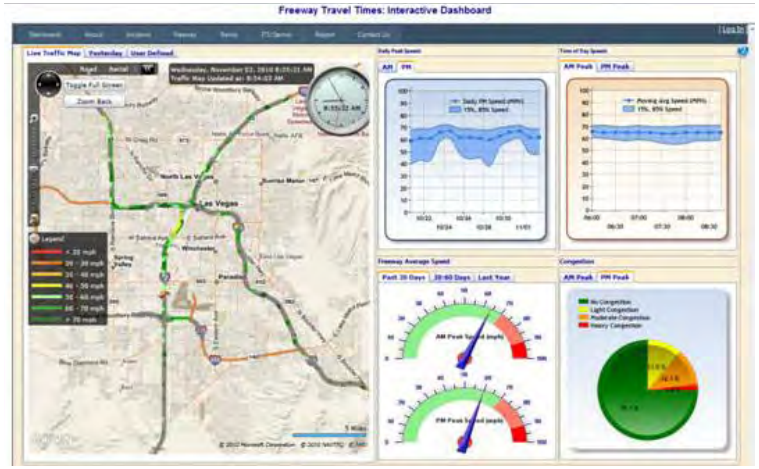
Future of Central Signal Systems

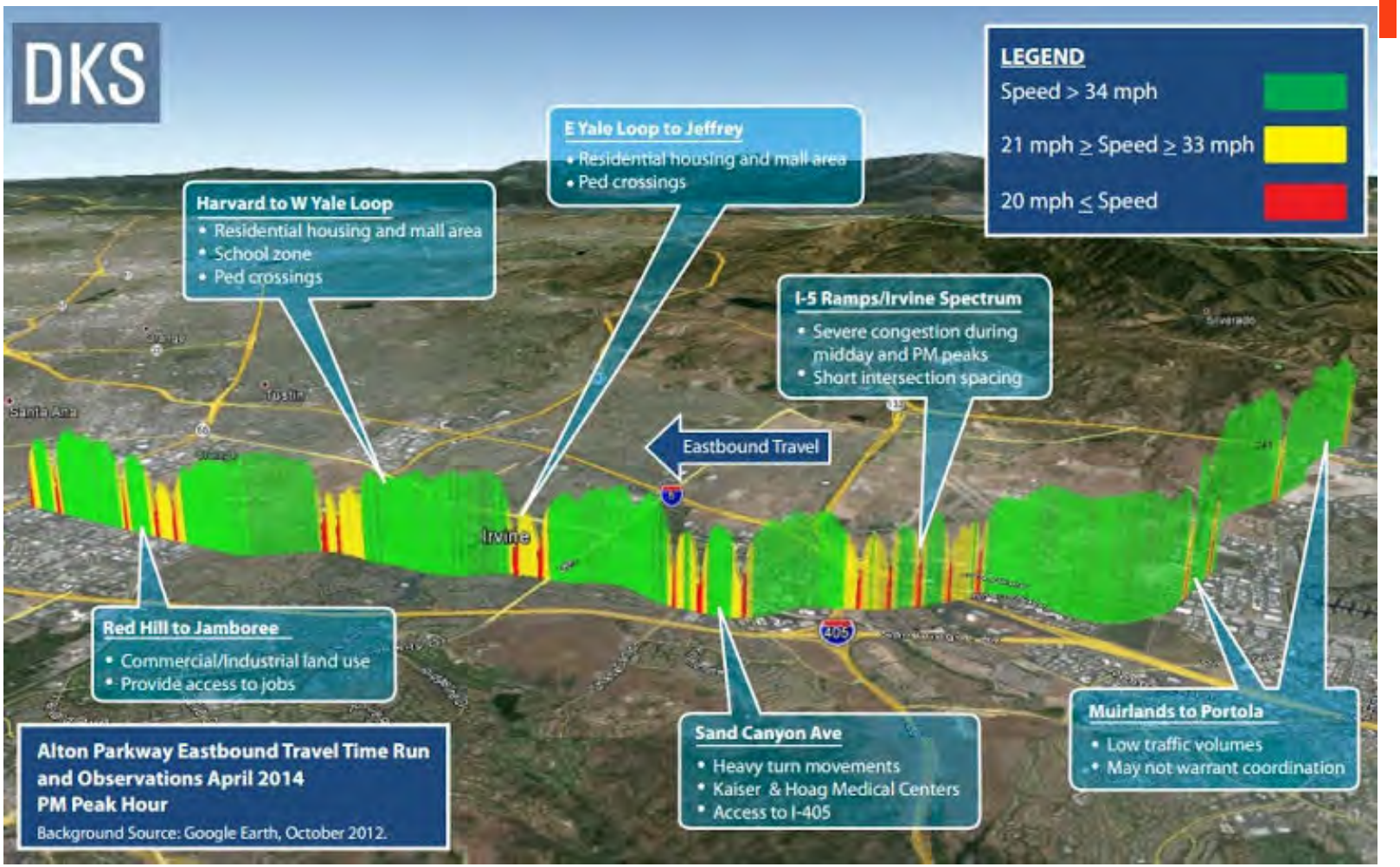
Real-time performance reporting

DKS

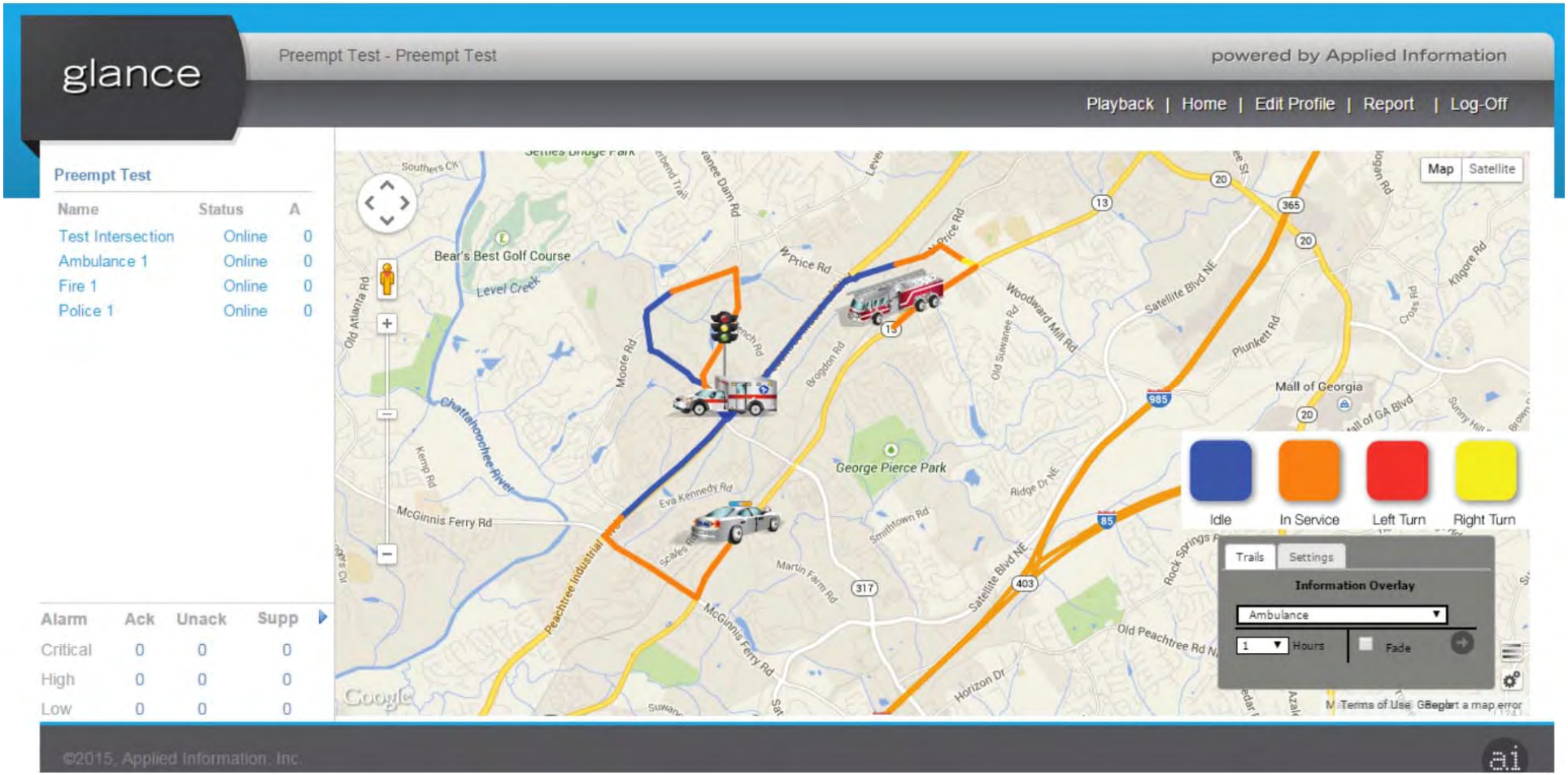




Arterial corridor data used for operational planning



Priority vehicle routing through central

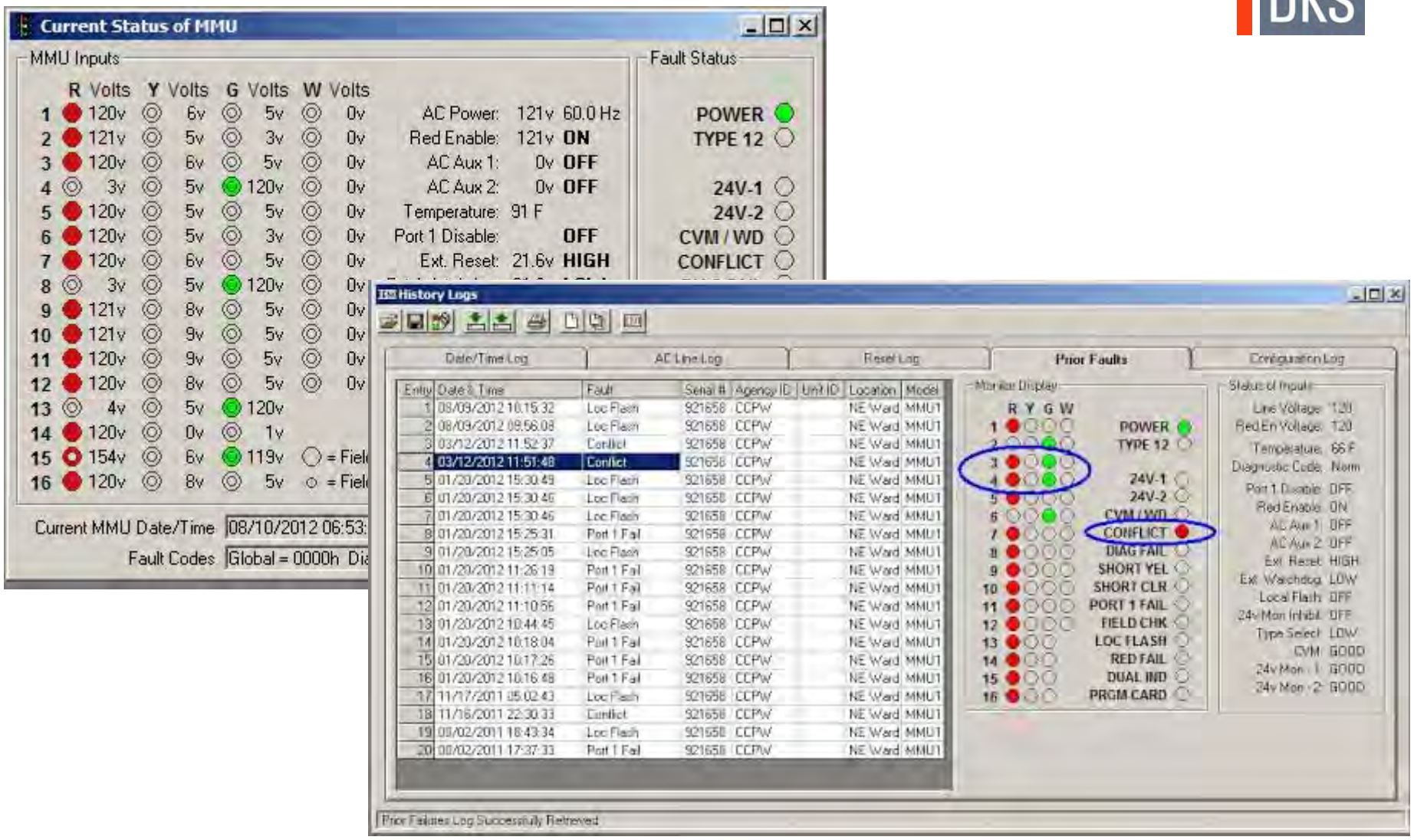


Proactive and predictive maintenance

Sensor status and health reports

Proactive and predictive maintenance

Intersection status and health reports



Signal phase and timing data will be delivered in vehicles

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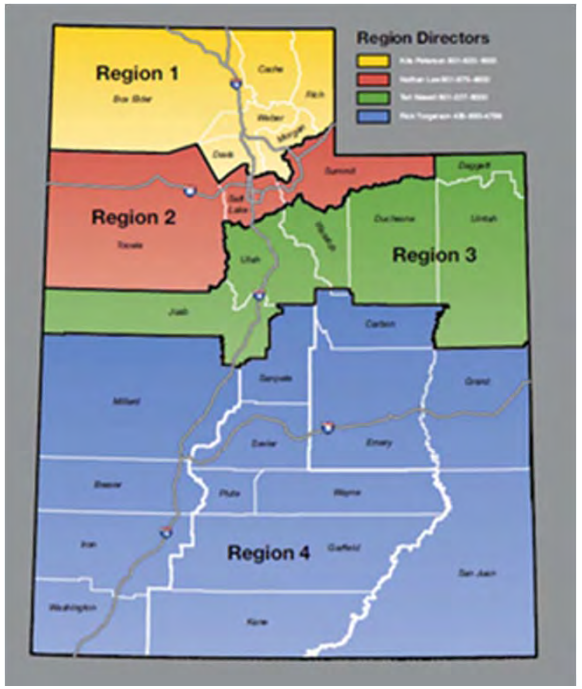
Shared Signal System Experiences

Utah DOT

Background

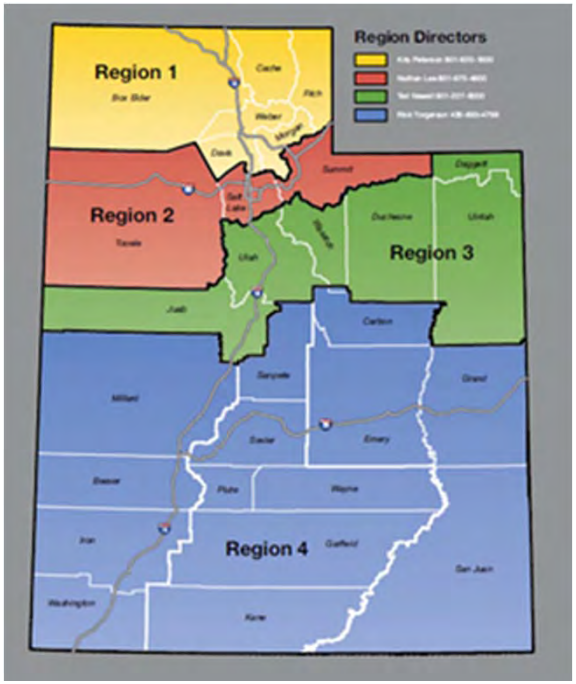
- Until mid-1990's – Salt Lake City had a central system and the rest of the state had a hodge-podge of closed loop systems.
- 2000 – ICONS was procured (funding from local and CMAQ). Encouraged all agencies to be integrated.
- 2015 – MaxView was procured. All agencies within the state are now on a single shared system.



Utah DOT

Today

- UDOT and all local agencies share the same ATMS (single server statewide)
- 60% of signals owned and operated by UDOT
- 40% owned and operated by 20 different cities /counties
- UDOT maintains the ATMS and communications network
- Local agencies responsible for operating/maintaining their own signals



Utah DOT

UDOT wants to provide "**world class traffic signal maintenance and operations**"

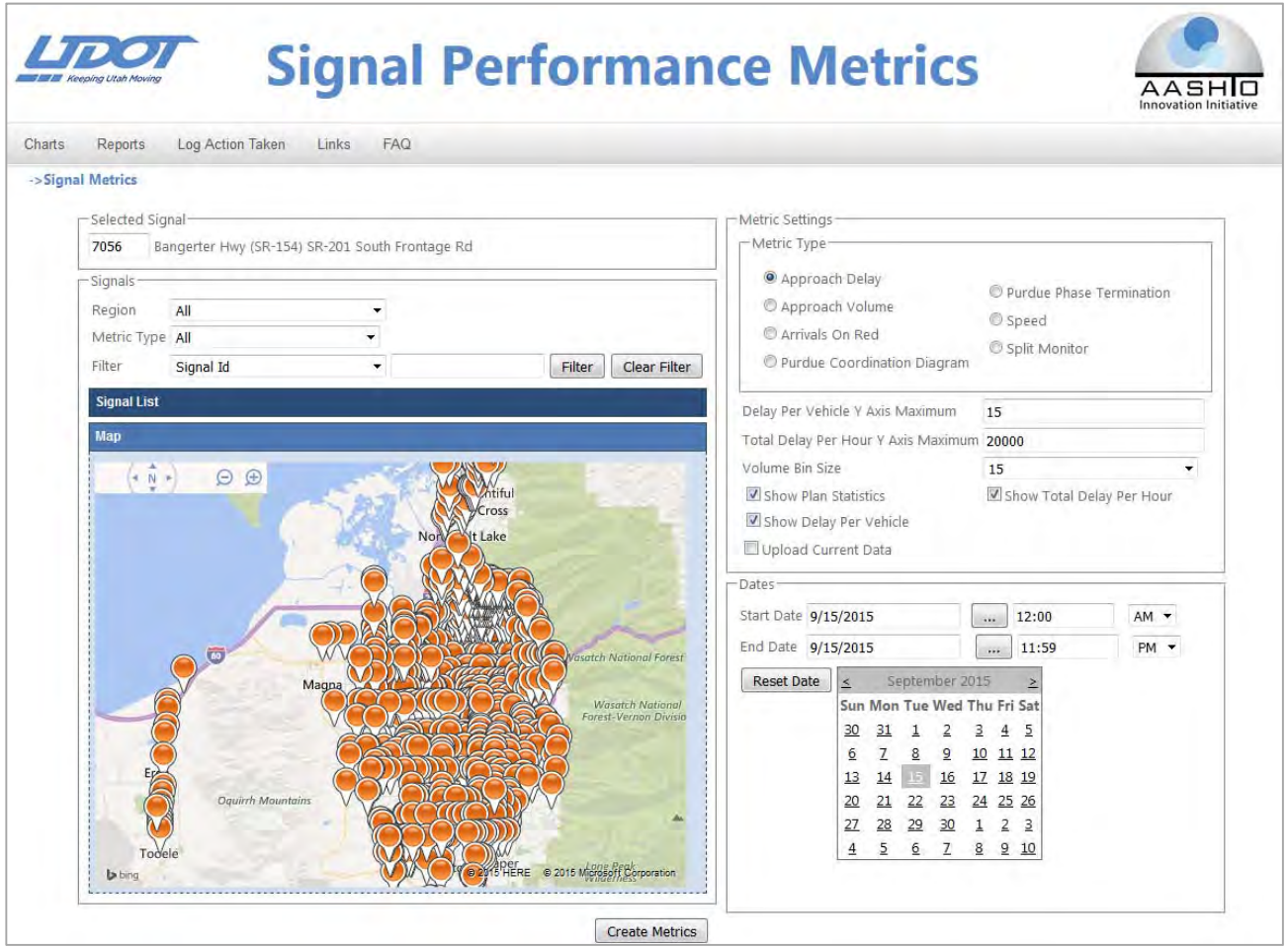
- Transition from "reactive" to "proactive" signal maintenance
- Implement real-time monitoring of system health and quality of operations

Utah DOT

Real-time System Monitoring

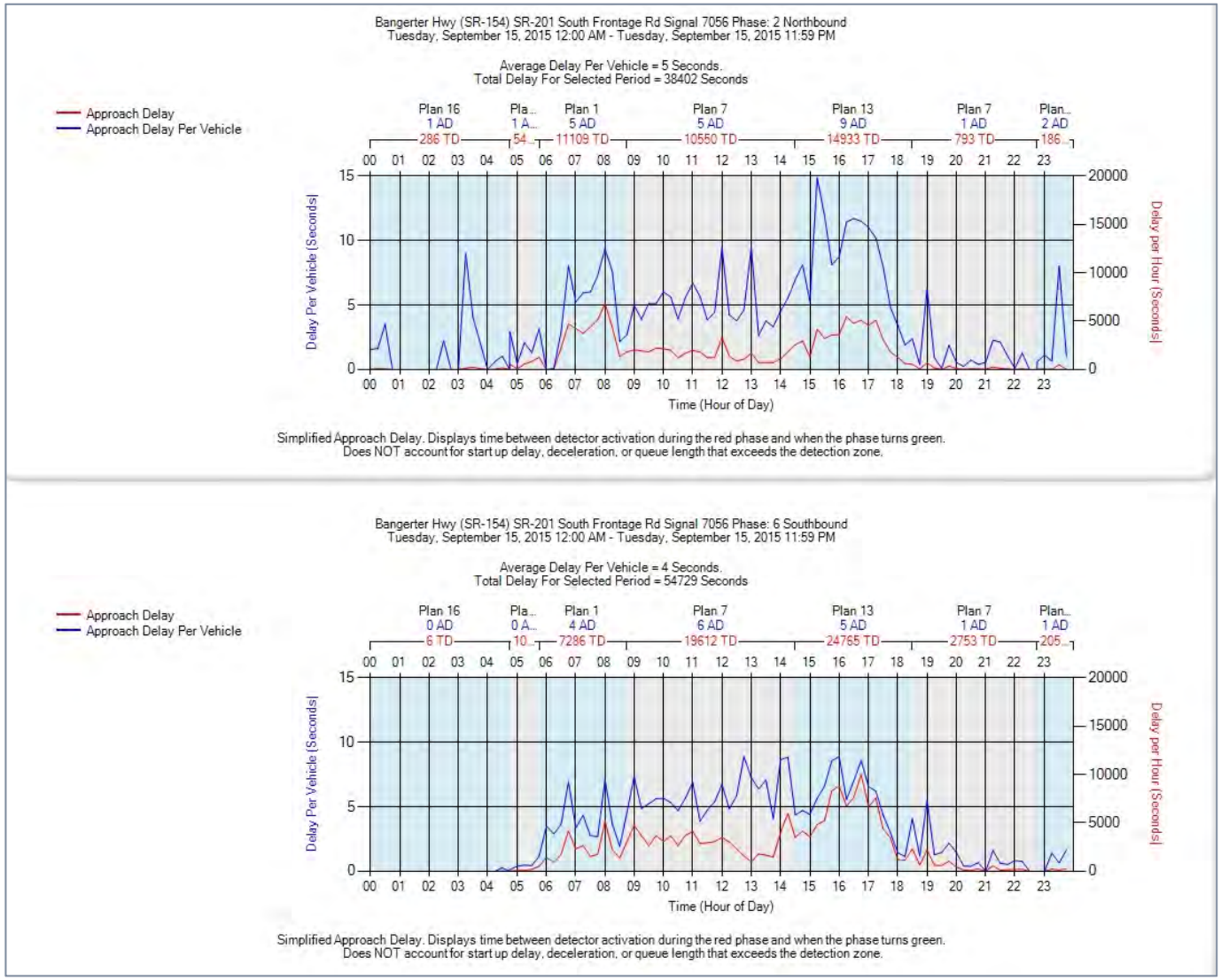
- Identify corridors in need of updated coordinated timing
- Identify intersections in need of updated local timing
- Identify detectors in need of maintenance
- Use high resolution data to monitor several types of performance measures:
  - Arrival on green
  - Volumes
  - Delay
  - Speed
  - Split monitor

UDOT Performance Measures Website



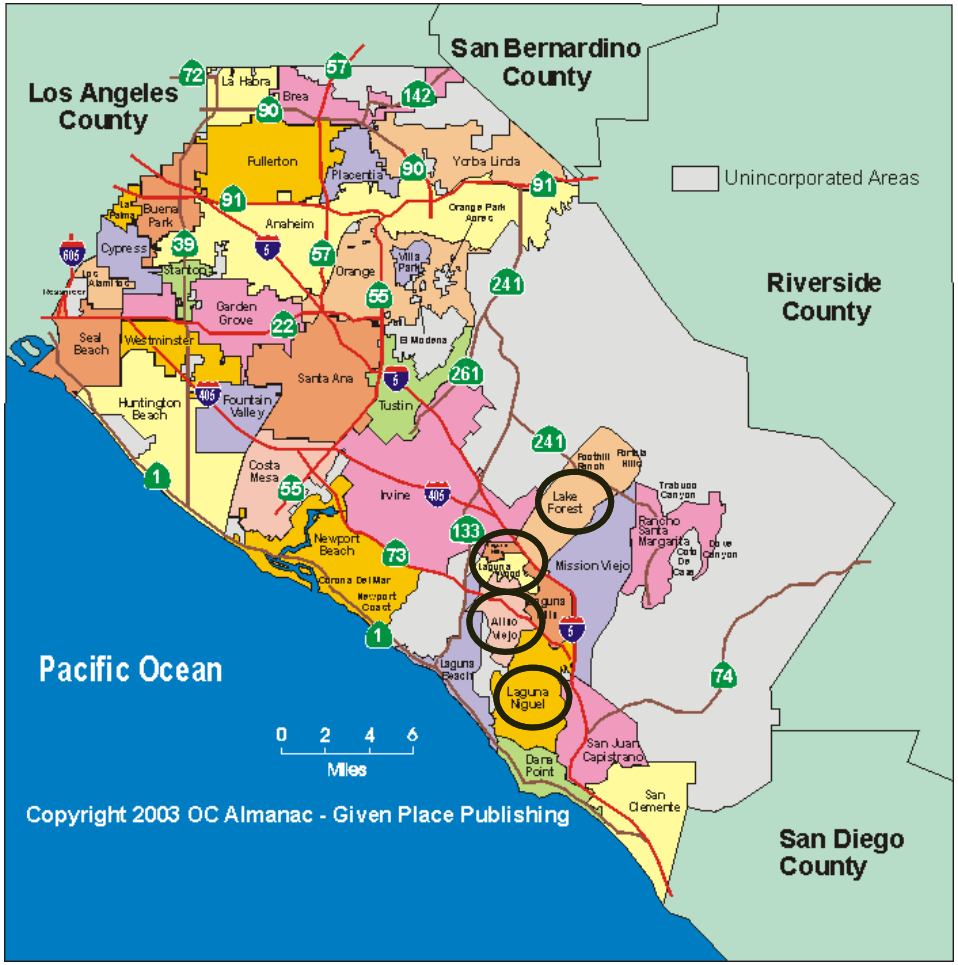
http://udottraffic.utah.gov/signalperformancemetrics/

Approach Delay



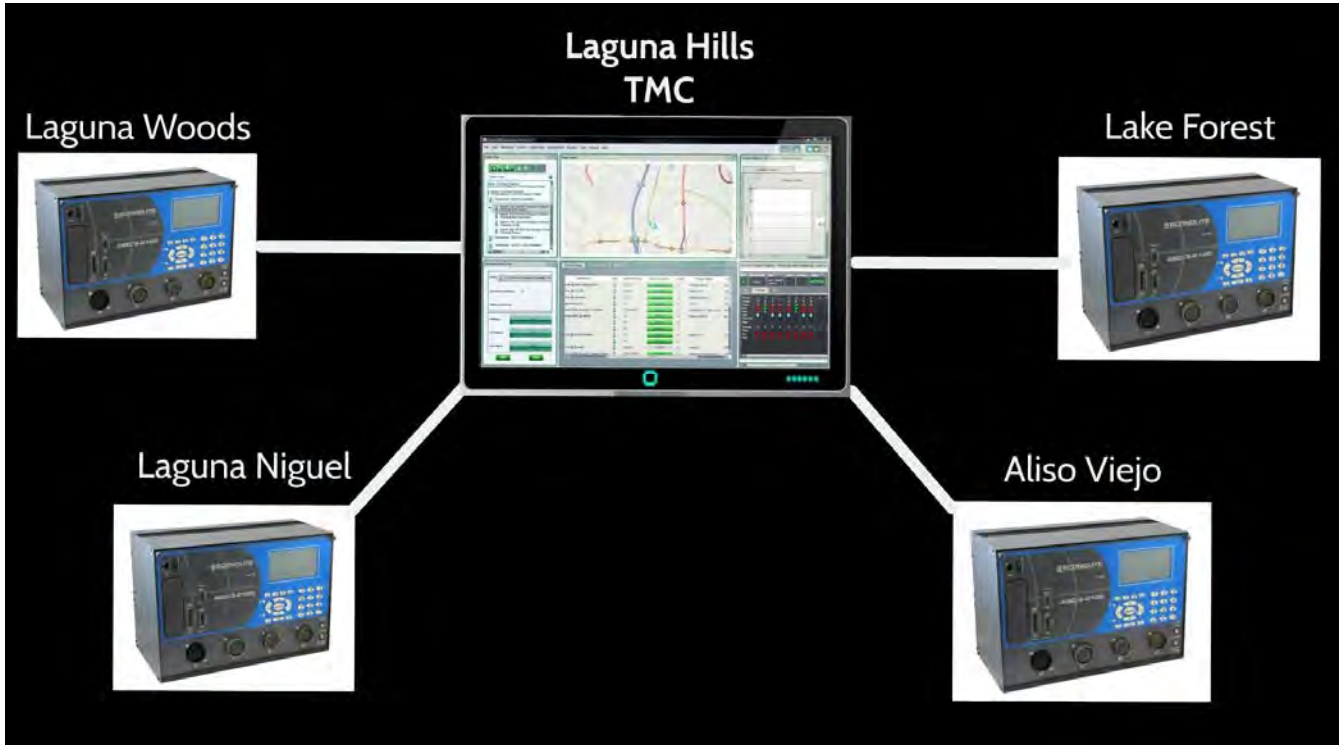
Orange County, CA

- 45 Cities
- Ranging in population from 13,000 to 340,000
- Capabilities and resources vary widely



Orange County, CA

- These cities have decided to connect to a single central signal system.
- They are able to share the network and staffing resources.



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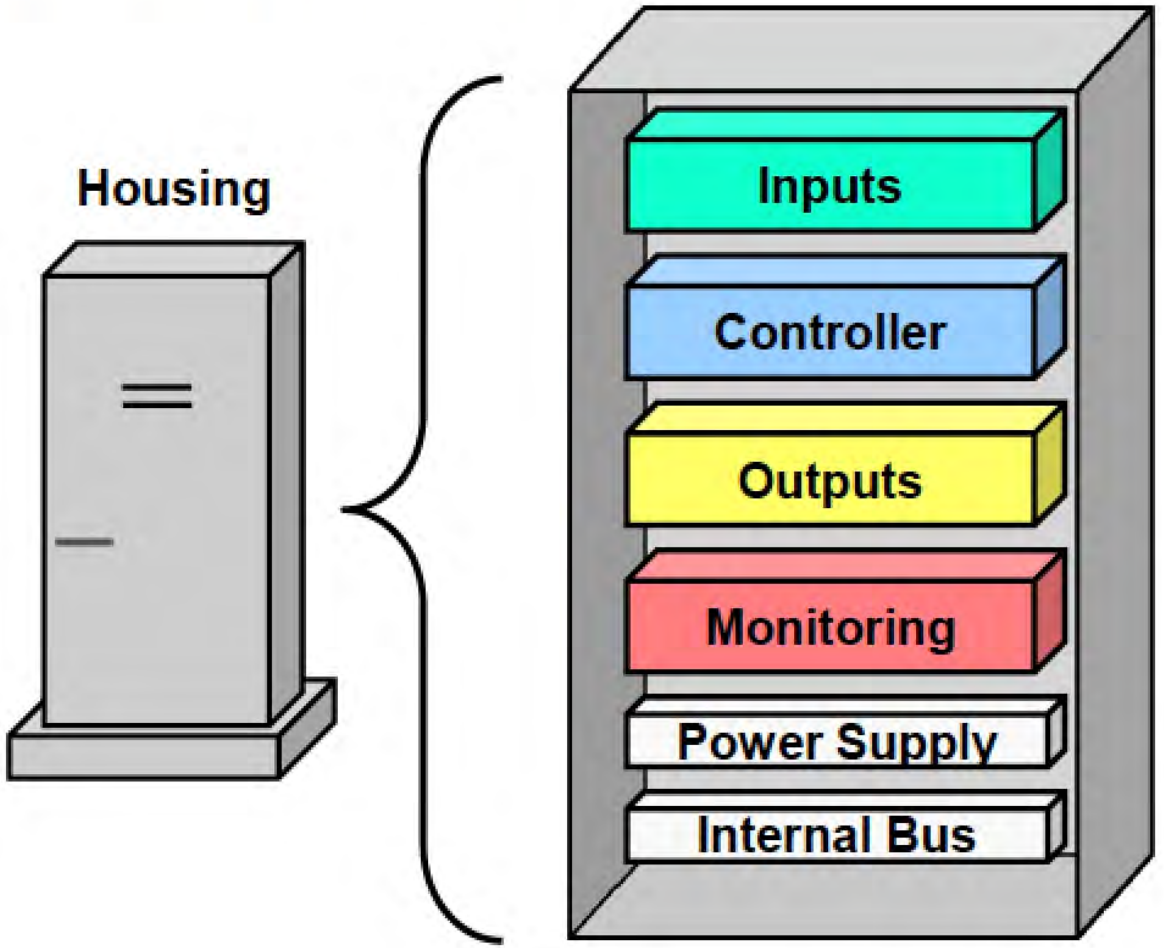
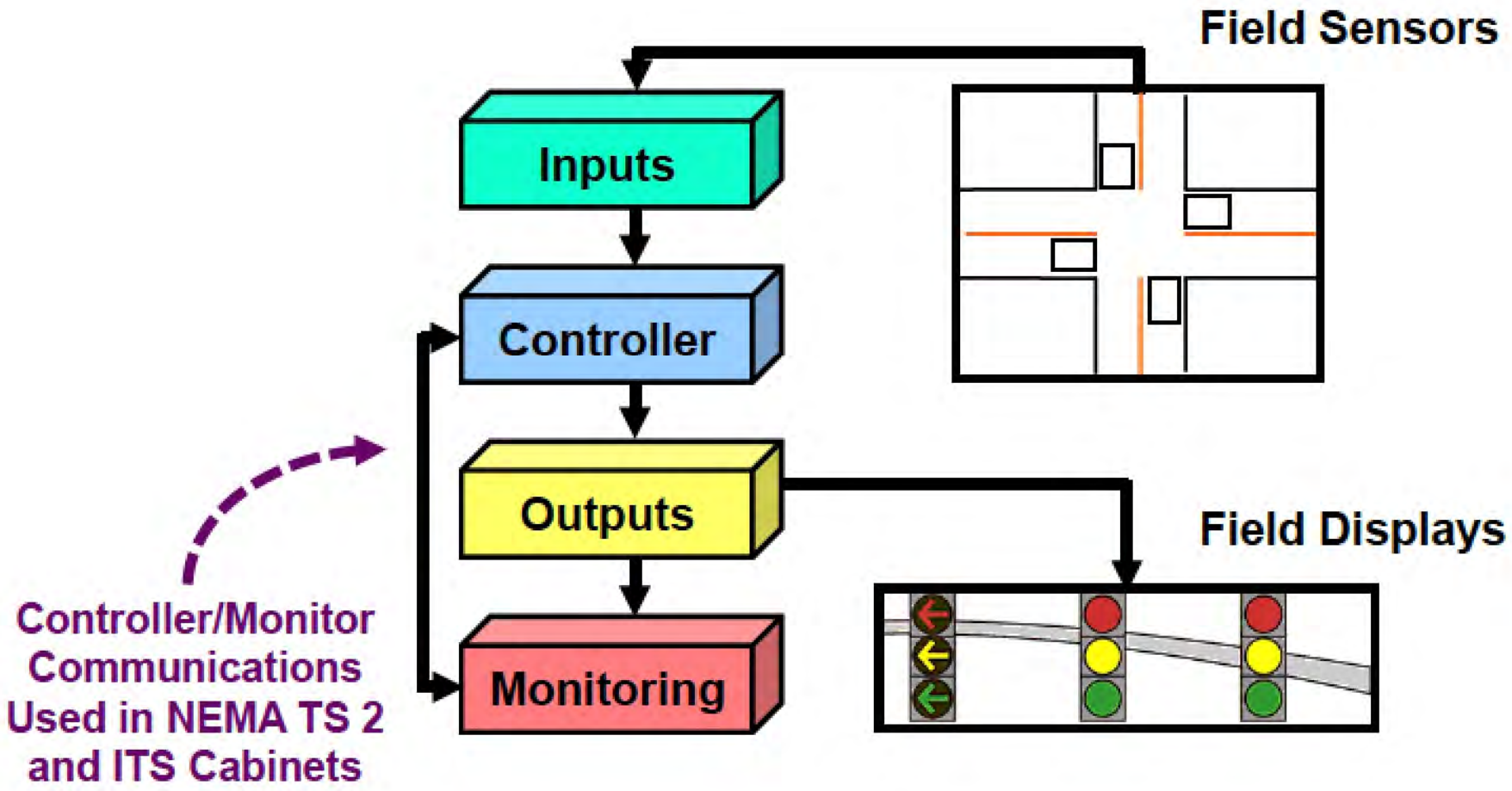
Implementing Standards

Basic Transportation Field Cabinet System (TFCS) Components



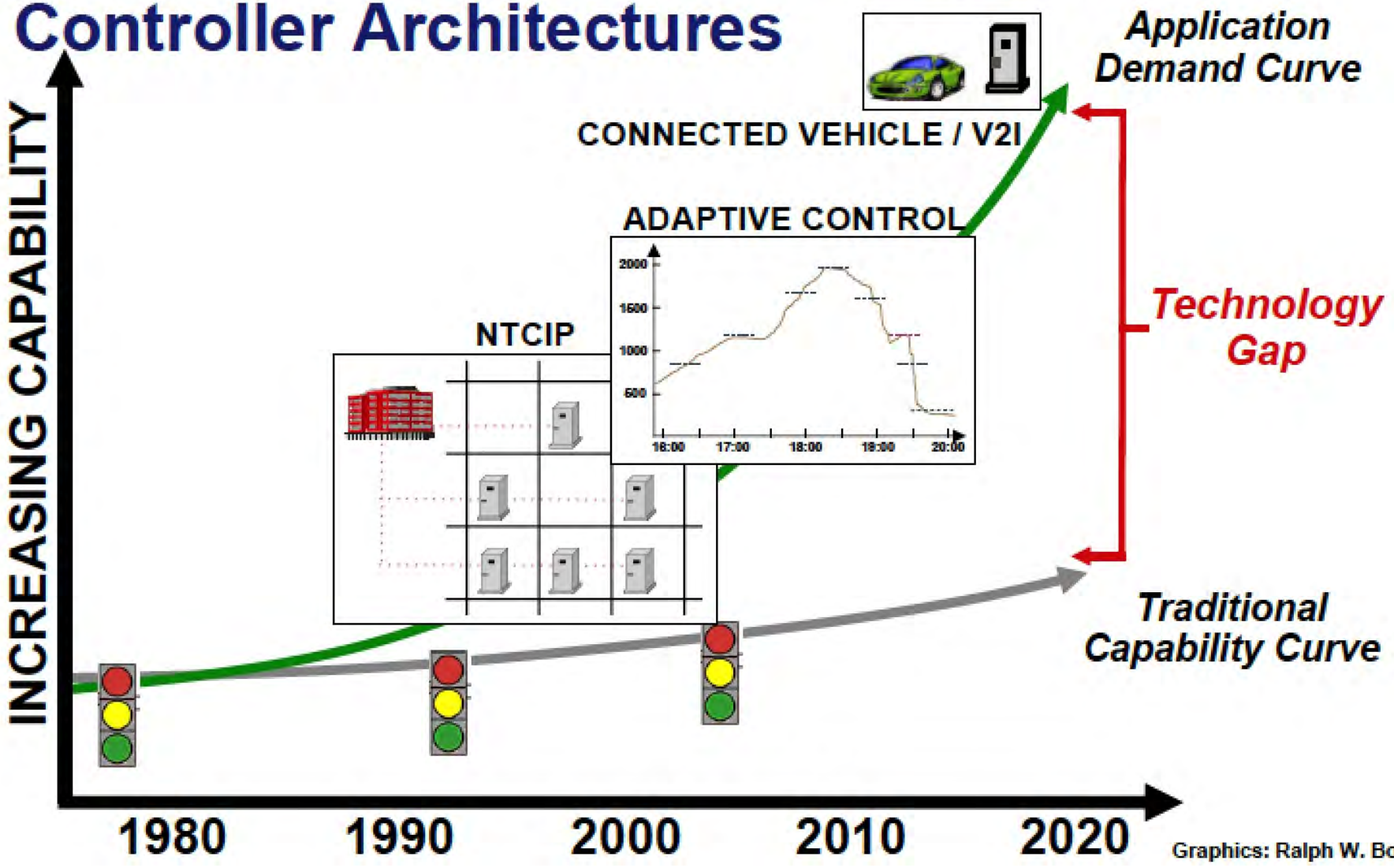
Graphics: Ralph W. Boaz

Basic TFCS Operation



Graphics: Ralph W. Boaz

Problem with Traditional Transportation Controller Architectures

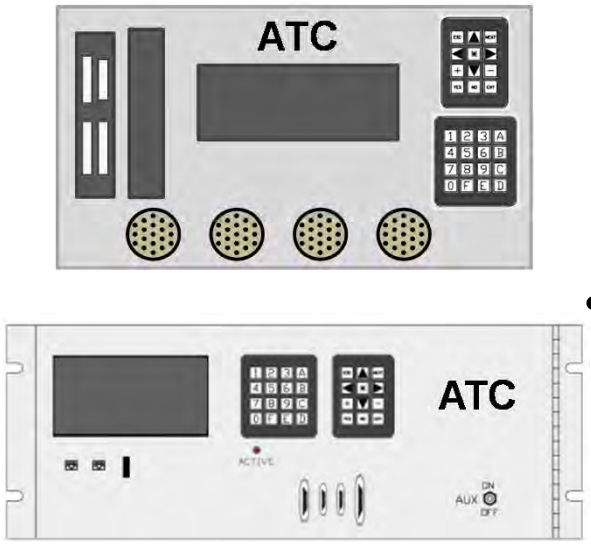


Graphics: Ralph W. Boaz

Purpose of the ATC Family of Standards

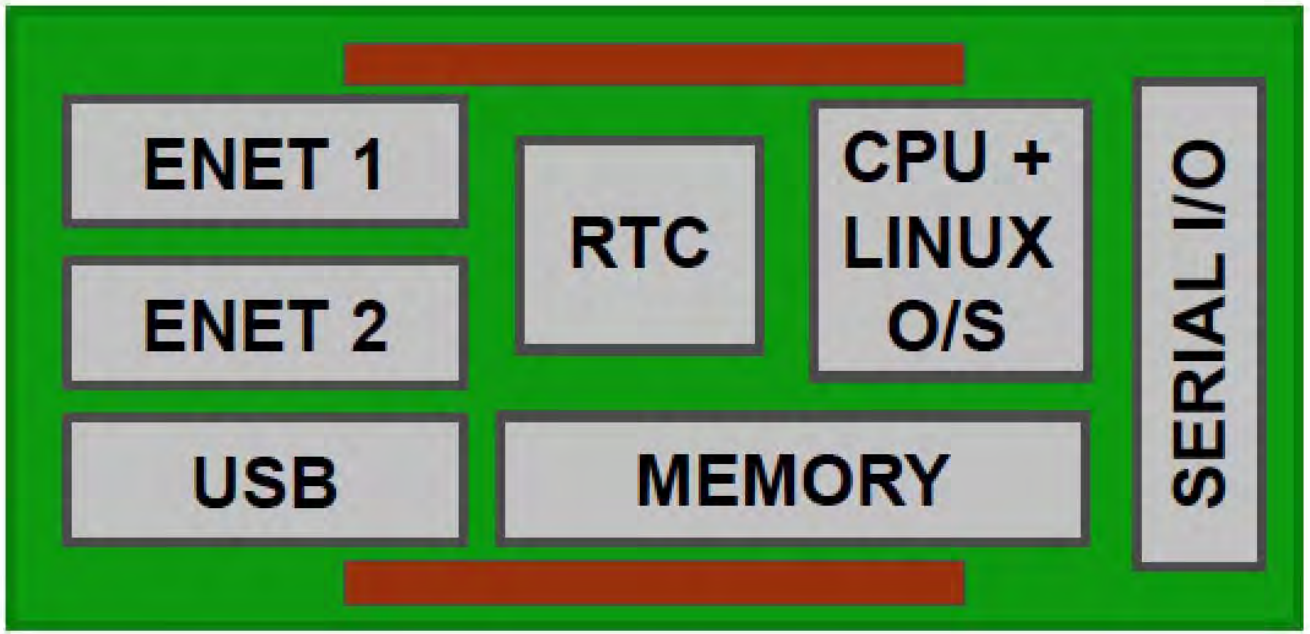
- Provide a general purpose field computing platform for transportation applications that is:
  - Open architecture
  - Modular
  - Multi-tasking / Multi-application
  - Can grow with technology
  - Upgrade legacy TFCSs

Advanced Traffic Controllers can run multiple applications at the same time



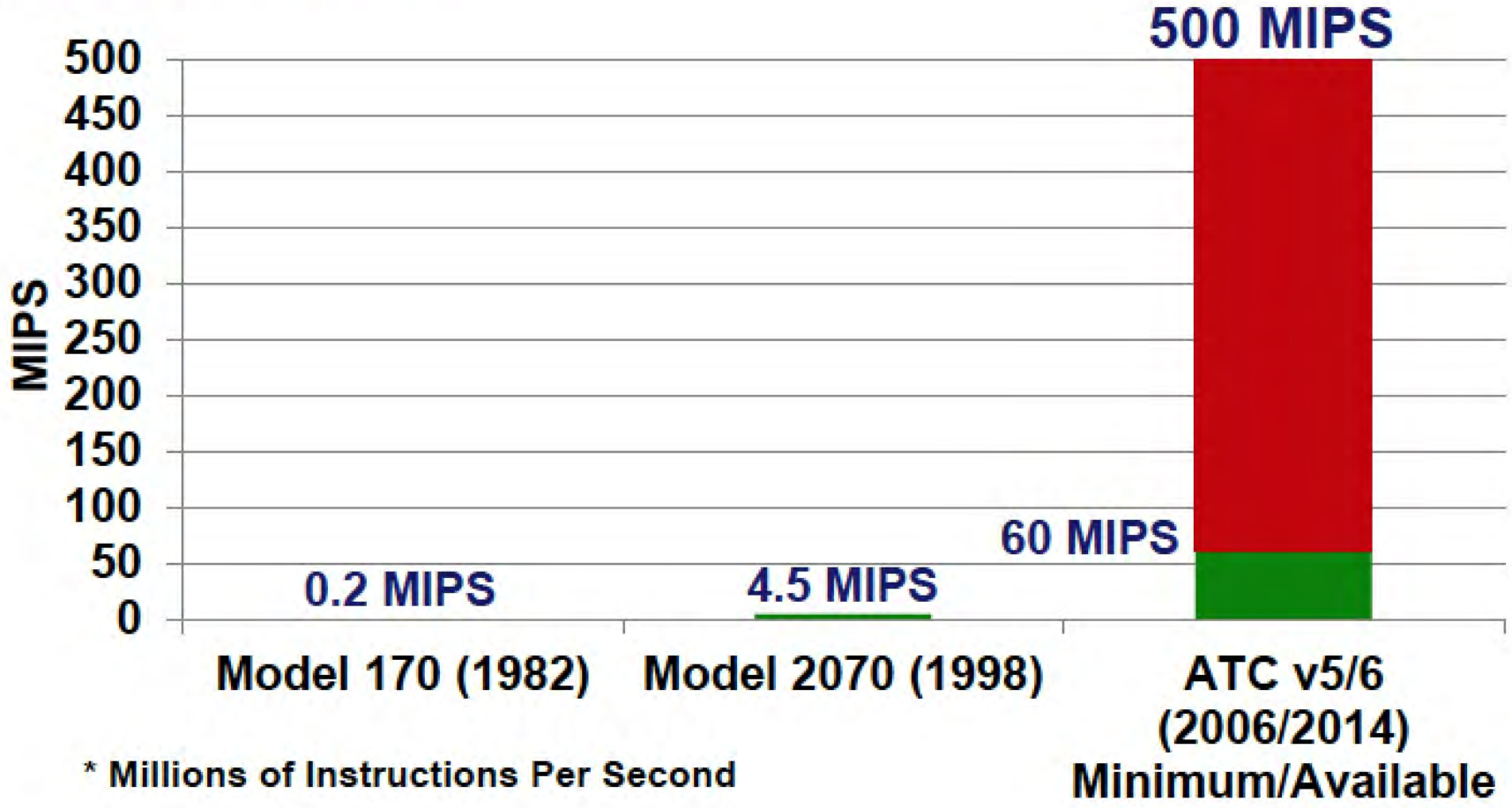
- Traffic Signal Control/Traffic Management
- Transit/Light Rail Priority
- Emergency Management
- Lane Use
- Red Light Enforcement
- Speed Monitoring/Enforcement
- Access Control
- Advanced Traveler Information Systems (ATIS)
- Data Collection Systems
- Connected Vehicle (CV) Applications
- Others

ATC Engine Board Concept



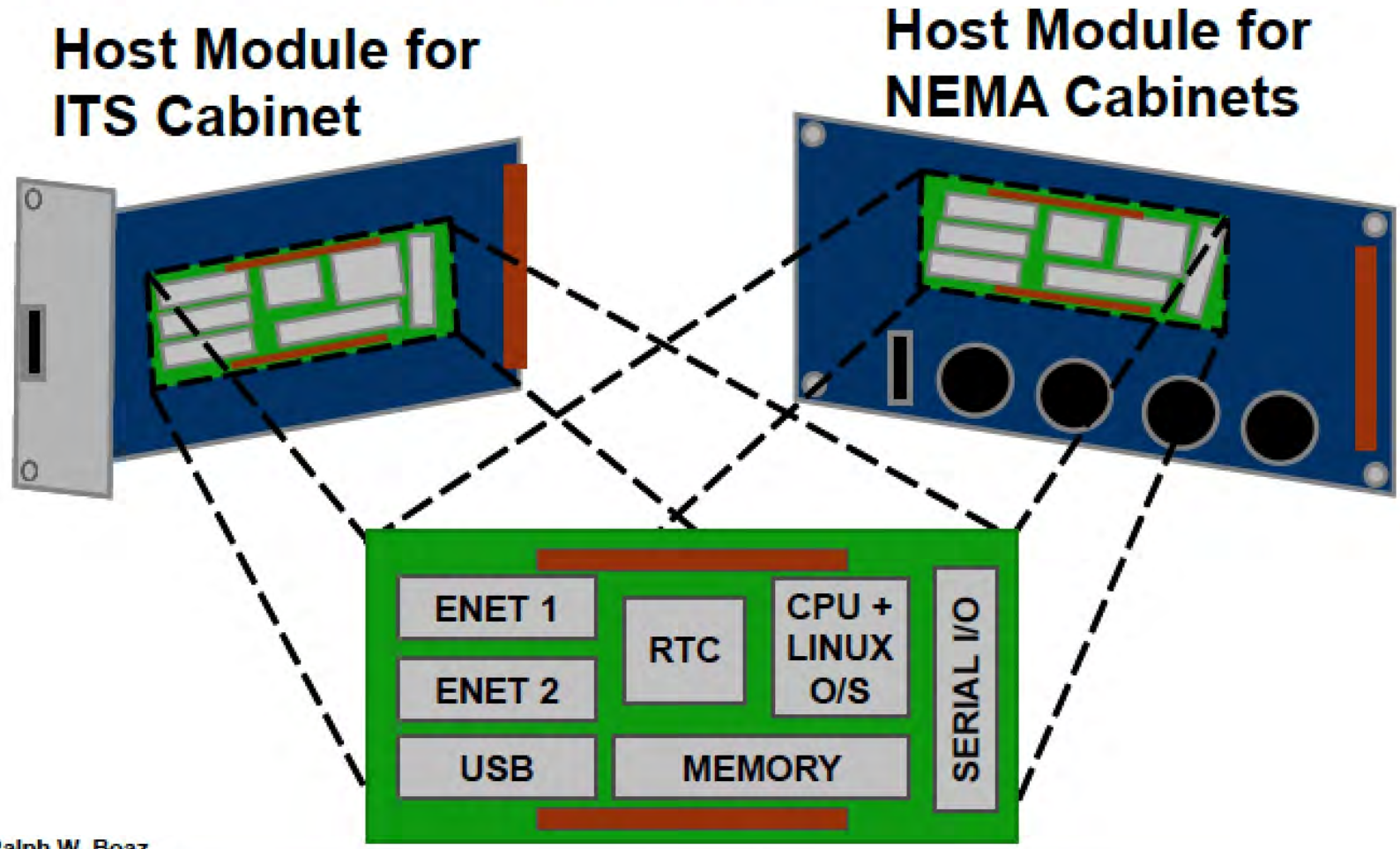
Graphics: Ralph W. Boaz

Transportation Controller Comparative Performance



Graphics: Ralph W. Boaz

Controllers Conform to Other Standards Using the Engine Board

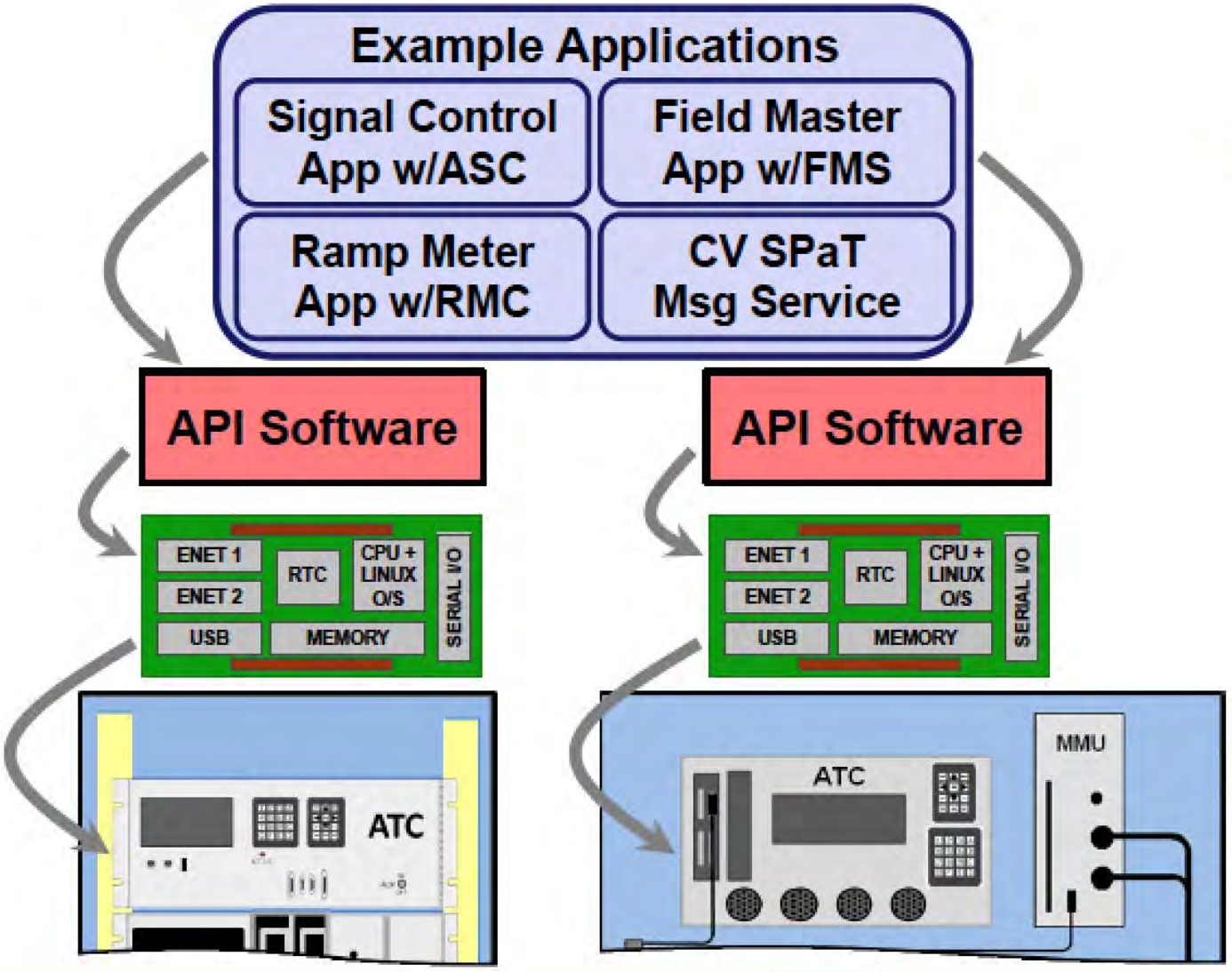


Graphics: Ralph W. Boaz

Examples of ATC Units

Photos: See Photo Credits

Bringing It All Together



NTCIP, Other Standards

ATC 5401 Standard

ATC 5201 Standard

TFCS Standards & Specifications

Graphics: Ralph W. Boaz

Open Source API Reference Implementation (APIRI)

Software Vendors

Consultants

Open Source APIRI

Manufacturers

Agencies

Photos: See Photo Credits Graphics: Ralph W. Boaz

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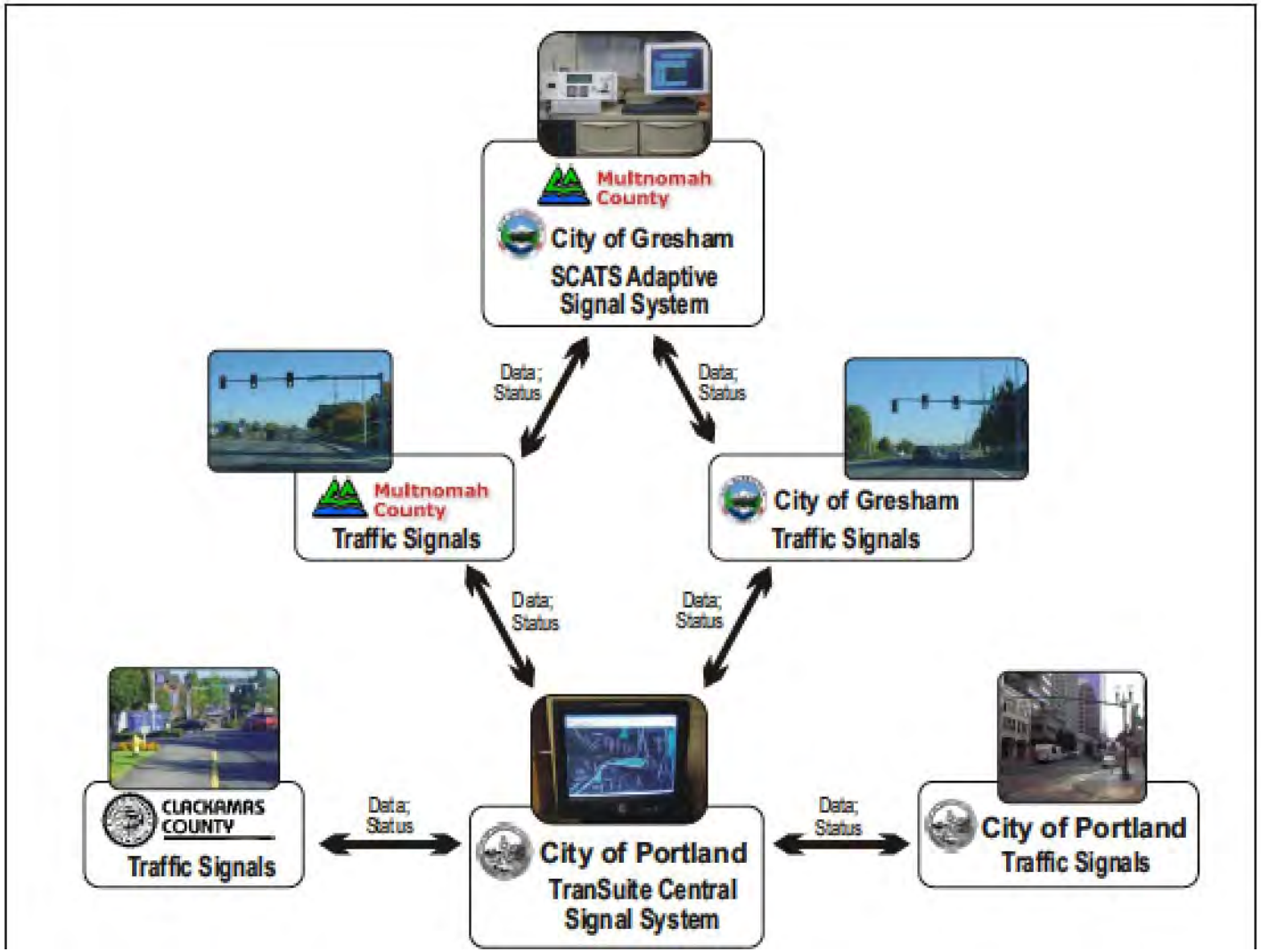
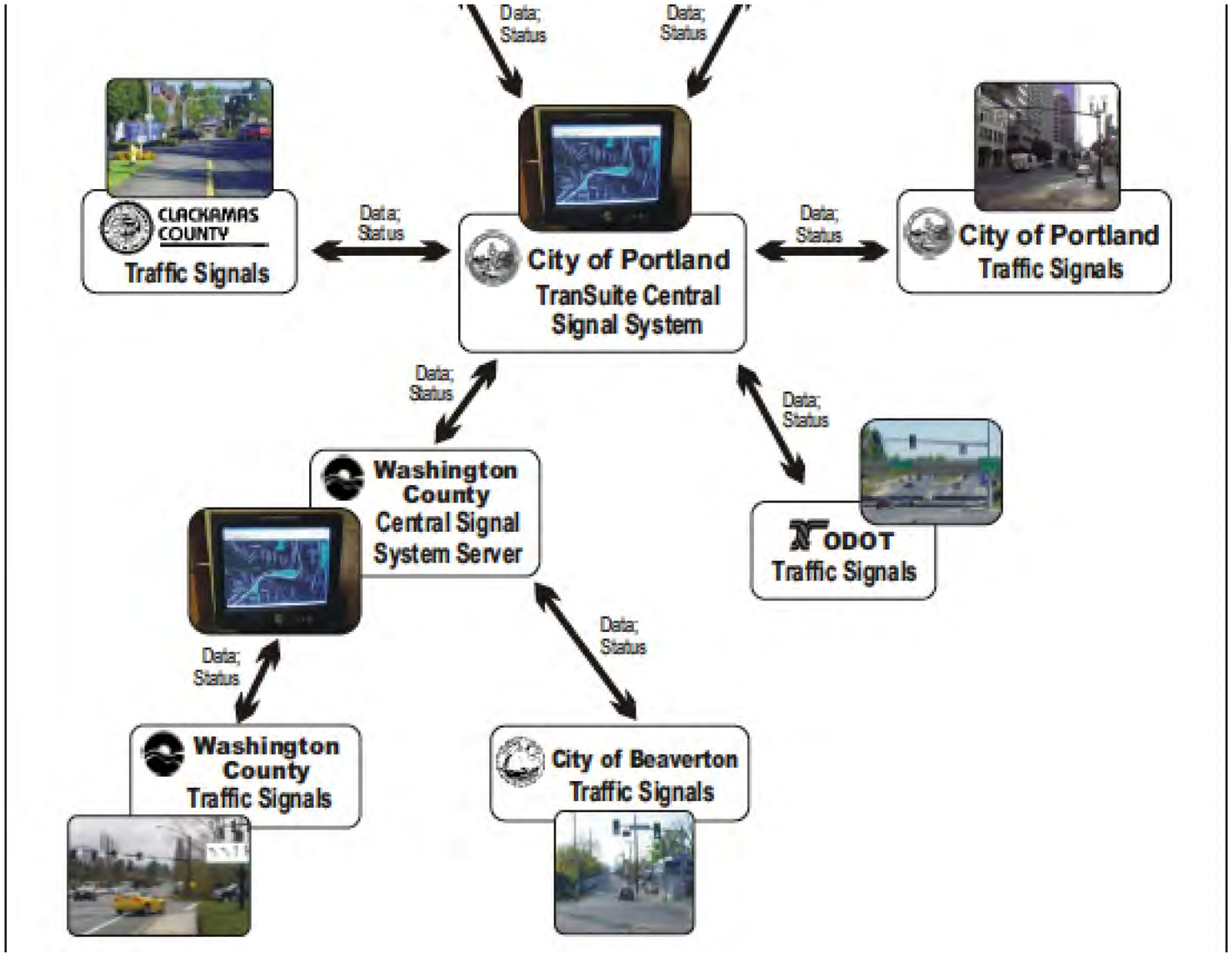
Shared Signal System Issues

- System architecture
- License and upgrade structure

Shared server architecture



Separate server architecture



Trade offs of a shared server

Advantages:

- Shared maintenance of the server reduces costs
- A central location to back up databases
- Visibility into another agency signals
- Automation of emergency patterns. For example: Incident triggers could be configured to trigger an automatic response.
- Remote database management
- Positions everyone for connected vehicle information

Disadvantages:

- Lead agency must configure user rights
- Lead agency has more responsibility for server up keep

Trade offs of a separate server

Advantages:

- Distinct separation of resources and assets
- From an IT perspective the lines of separation are clear

Disadvantages:

- The agencies must maintain the same version of software
- Agencies must keep separate device ID numbers

Business issues and license structure

- Users pay a use license to the larger agency.
- Still have to pay for installation. It's a small fraction less.
- There is a server license for each server. The small agencies have a license fee for their intersections. Cost is proportional to the number of traffic signals.
- Maintenance cost would be based on the total number of intersections.
- They can lock down modules to certain modules so it can be locked down by agency. They pay for this by number of intersections.

Discussion