

Los Angeles Transit Priority Systems: *Alternate Infrastructure Uses and Inter-City Integration*

Institute of Transportation Engineer Meeting
January 16, 2008

Presented by Chun Wong,
P.E.

Transit Priority Systems

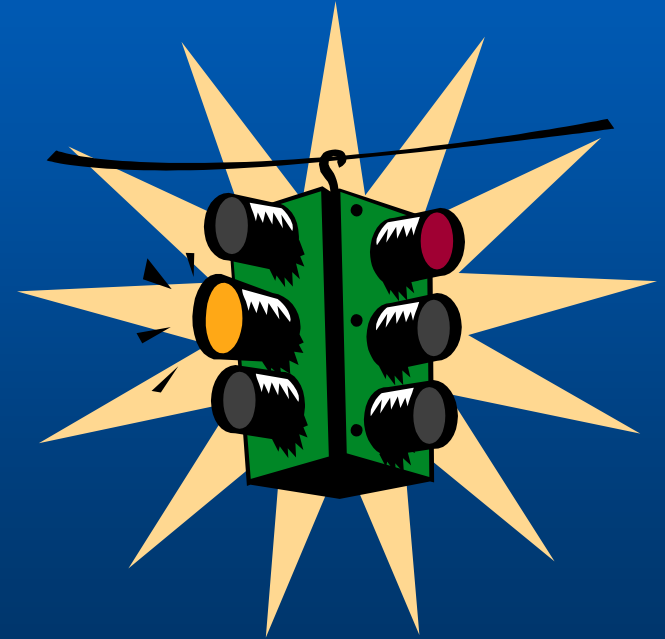
- **LADOT partnered with LA Metro in National Bus Rapid Transit (BRT) Demonstration Program since 2000**
 - Wilshire/Whittier & Ventura
- **Strong Mayor commitment to improve LA transit services**
- **Improve bus run time performance**
- **Improve ridership**
- **Successfully implemented 18 Metro Rapid bus corridors and the Metro Orange Line**
- **Reduced 25% total travel time**



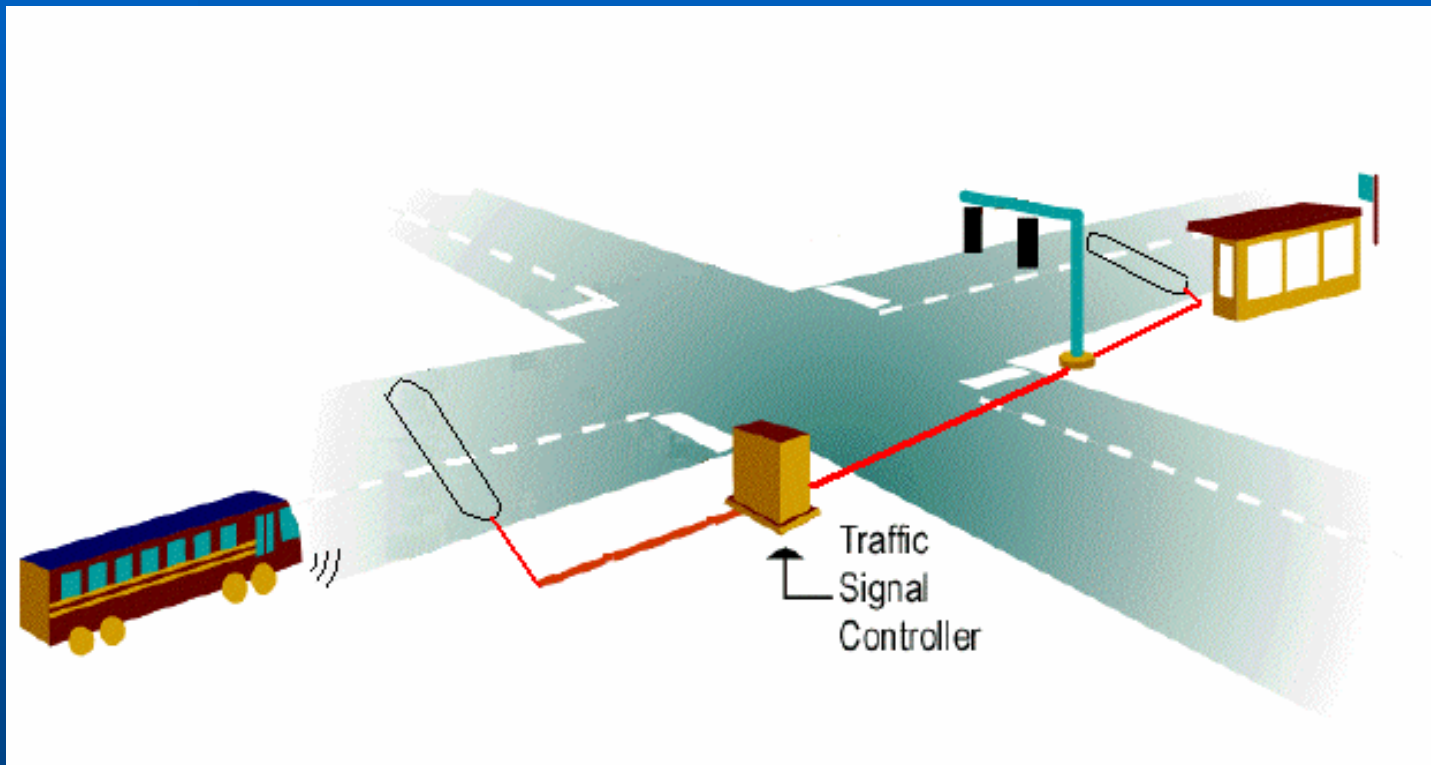
Transit + Signal Priority =
Transit Priority System (TPS)



+



Loop/Transponder Detection



Existing Infrastructure

- **City's central Urban Traffic Control System (UTCS) - ATSCAC**
- **One-second communication poll**
- **Type 2070 traffic controllers**
- **RS-232 @ 1200 baud**
- **Fiber Optic between field hubs**
- **Copper wiring for hub-to-intersection**

TPS Components

- **Inductive loop/transponder detection**
 - Low frequency hockey puck liked transponder
 - Curb-to-curb elongated loop sensor
- **Model 2070 traffic controller**
- **Check-in / Check-out detection**
- **ATSAC communication network**

Transponder

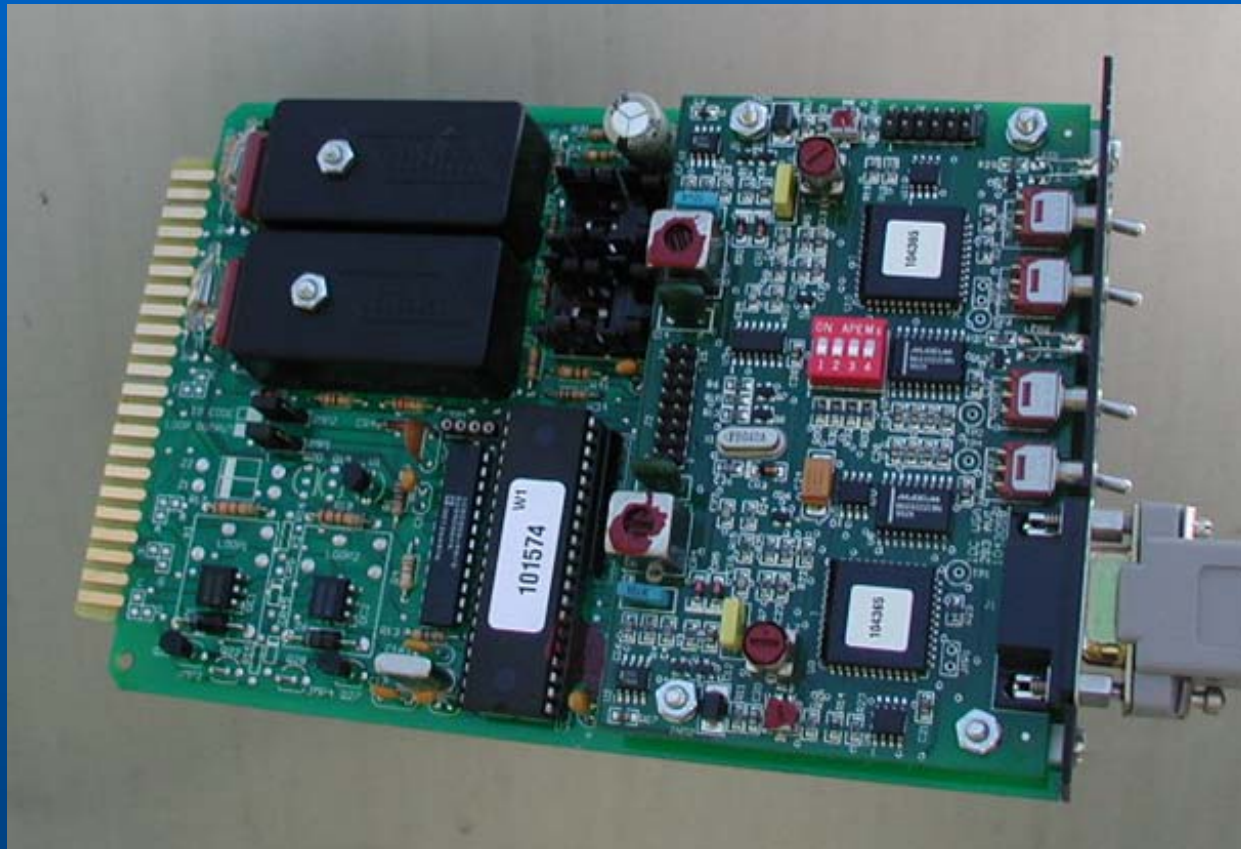


Transponder

Street Embedded Loop Sensor



Sensor Card



Model 2070 Traffic Controller



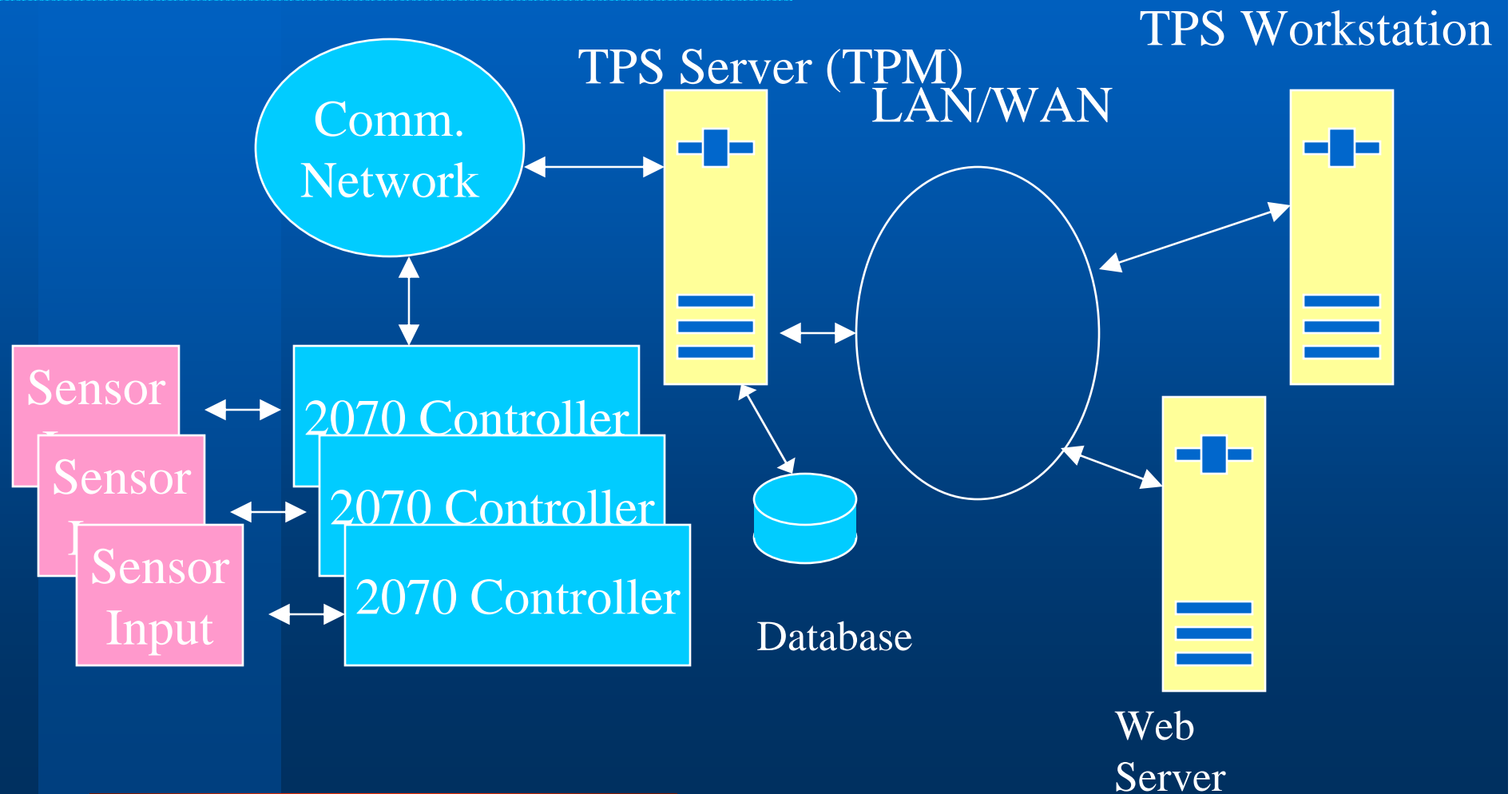
Preemption \neq Signal Priority

- **Preemption**
 - Interrupt signal operations
 - R x R crossings
 - Emergency vehicles
- **Signal Priority**
 - Modify signal operations
 - Maintain coordination
 - Borrowed time

Priority Treatments

- **Early green**
 - Vehicle detection required
 - Red truncation
- **Green extension**
 - Vehicle detection required
 - Extend green phase
 - Most efficient priority
- **Call Phase**
 - Left/Right turns

System Architecture



LADOT Transit Priority Systems (TPS)



Metro Rapid Bus



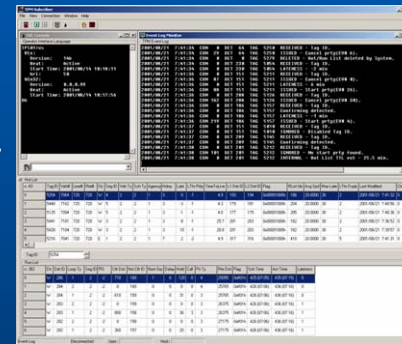
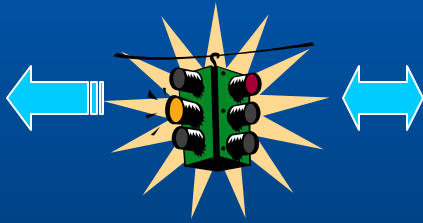
Street Embedded Bus Sensor



Transponder



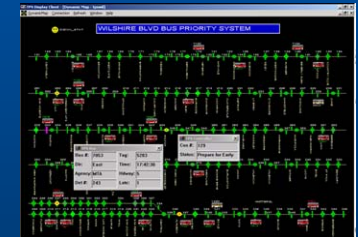
Metro Orange Line



Transit Priority Manager



iTRAQ



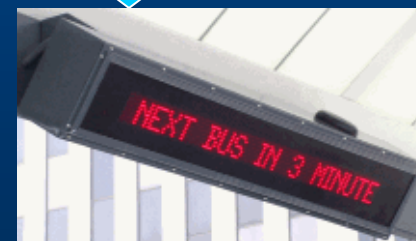
TPS Graphics



EV Preemption



Mobile Internet Passenger System



Passenger Information System

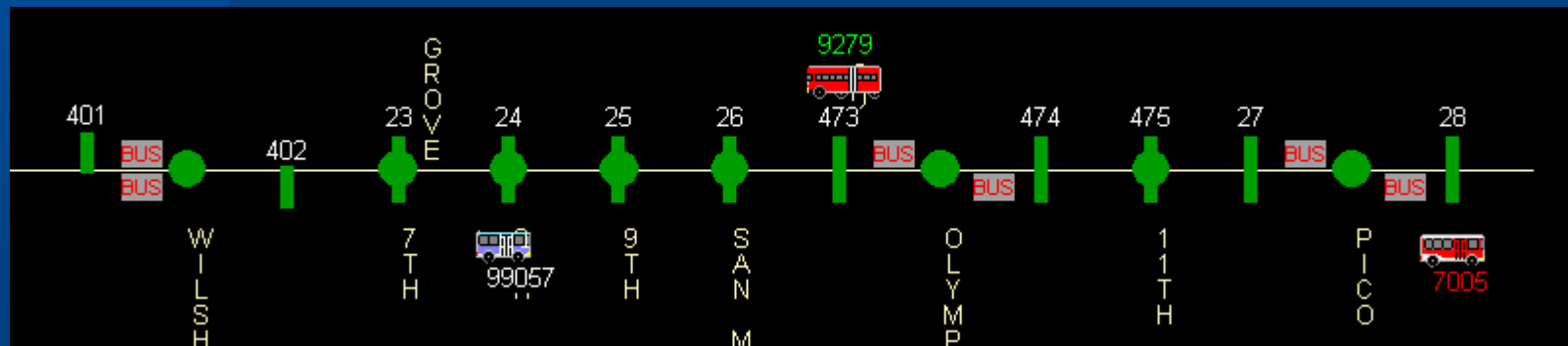
Transit Priority Manager

- **Centralized system**
- **Real-Time**
 - Track vehicle positions
 - Determine late/early
 - Issue signal priority
 - Calculate bus arrival
 - Publish bus data
 - Retrieve and data logging
 - Implement TOD headway plan
- **Non Real-Time**
 - Archive to database for trip analysis

LADOT

Transit Priority Systems

- Automated bus detection using loops and transponders
- Designed to reduce bus delay and maintain bus spacing
- Designed to minimize impact on cross-traffic
- Provide bus performance reporting from actual bus time points



Passenger Information System

- Real-time data
- ETA Count down
- Lead bus' travel time
- LED Displays

Bus Arrival Signs



Passenger Information System Messages

Metro Rapid Bus

NEXT BUS IN 3 MIN

NEXT BUS IN 2 MIN

NEXT BUS IN 1 MIN

NEXT BUS ARRIVING

NEXT BUS DELAYED

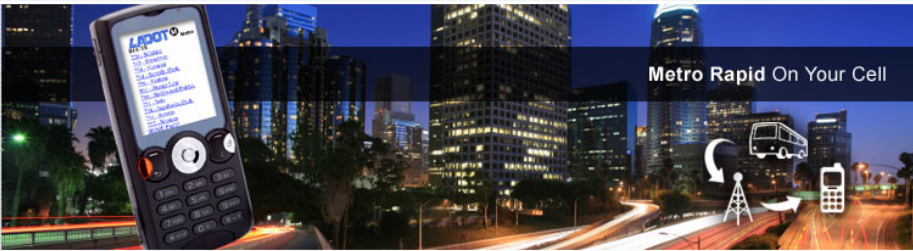
Mobile Internet Passenger Systems (MIPS)

Metro Rapid Arrival Times On Your Mobile Device - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Recycle Bin Mail Print Bluetooth

Address <http://lacity.org/ladot/RapidBus/index.html> Go



Metro Rapid On Your Cell


How Does It Work?

Selected bus services are equipped with a transponder for vehicle tracking. Using this position information, the Los Angeles Transit Priority System helps buses to stay on schedule and reduce delays on bus routes. Additionally, this data is used to develop the bus arrival predictions in real-time which are made available via the public Internet.

How Can I Access The Bus Arrival Information?

The information can be accessed by any Internet enabled devices such as desktop browsers, cellular phones, PDAs, and other mobile devices.

[Go to rapidbus.net](#)



Done Internet

Headway Algorithm

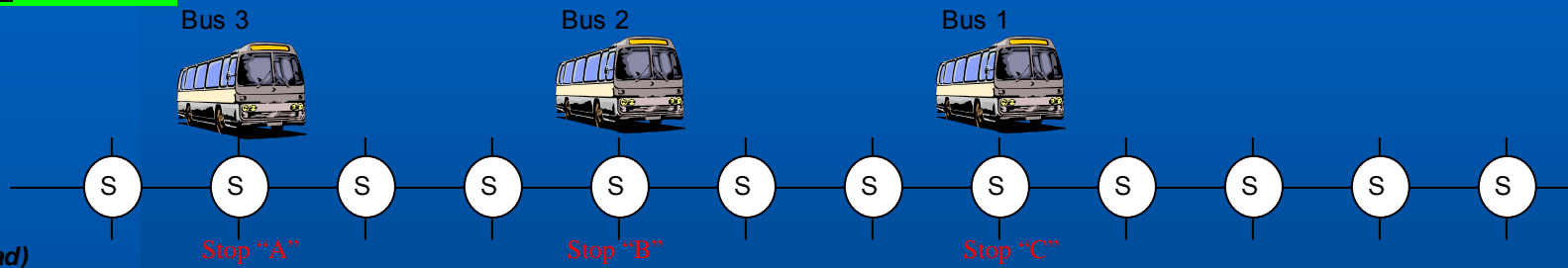
- In-house developed
- High bus frequency service – low headway
- Leverages Hot List / Run List
- Time-point propagation (TPP)
- Load-balanced

Time-Point Propagation

HEADWAY: 5

Arrival Time
 BUS 3 in 15 min (1:28 – 1:13)

Arrival Time
 BUS 2 in 18 min (1:42 – 1:24)
 BUS 3 in 33 min (1:28 – 1:13) + 19min



Bus 1 (Lead)

Schedule	1:00	1:05	1:10	1:16	1:22	1:30	1:36	1:43	1:51	1:58	n/a	n/a
Actual	1:01	1:07	1:10	1:15	1:24	1:31	1:37	1:42	n/a	n/a	n/a	n/a

+ 5 ↓ + 5 ↓ + 5 ↓ + 5 ↓ + 5 ↓ + 5 ↓ + 5 ↓ + 5 ↓

Bus 2

Schedule	1:06	1:12	1:15	1:20	1:29	1:36	1:42	1:47	n/a	n/a	n/a	n/a
Actual	1:06	1:13	1:16	1:20	1:28	n/a	n/a	n/a	n/a	n/a	n/a	n/a

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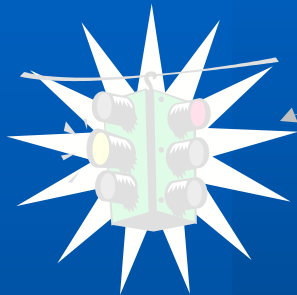
Bus 3

Schedule	1:11	1:18	1:21	1:25	1:33	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Actual	1:10	1:18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a



TPS Real-Time Data Collection

Signal Priority



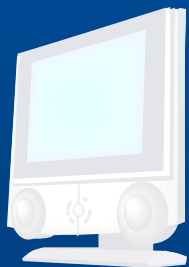
Transit Priority Manager (TPM)



Real-time Data Logging



Real-time Graphical Displays



Transit Report And Query (iTRAQ) Web Server



i Transit Report And Query

- **Leverages existing TPS architecture**
 - Field equipment (Loop/Transponder AVL, 2070 Controller, etc.)
- **Automates 24 x 7 transit trip data collection**
 - TPM
- **Uses commercially standardized Relational Database system (RDBMS)**
 - Oracle Database System
- **Publishes through Web Server**
 - Simplify RDBMS data access
 - Client workstations request no complicated ODBC and/or RDMBS setup
 - In-house developed web application
 - Microsoft IIS 6.0


iTRAQ Web Interface

TripDetail - Microsoft Internet Explorer

File Edit View Favorites Tools Help


Back Forward Stop Refresh Home Search Favorites

Address <https://intra.lacity.org/http/atmsweb.dot.ci.la.ca.us/Dash/TripDetail.aspx>



LADOT
Moving Los Angeles Forward

Advanced
Transportation
Management Systems



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- [Broadway Map](#)
- [Van Nuys Map](#)
- [Wilshire Map](#)
- [Crenshaw Map](#)
- [Ventura Map](#)

MTA Vehicles - Trip Details

From:

Feb	March 2006					Apr
Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

3/31/2006 00:00

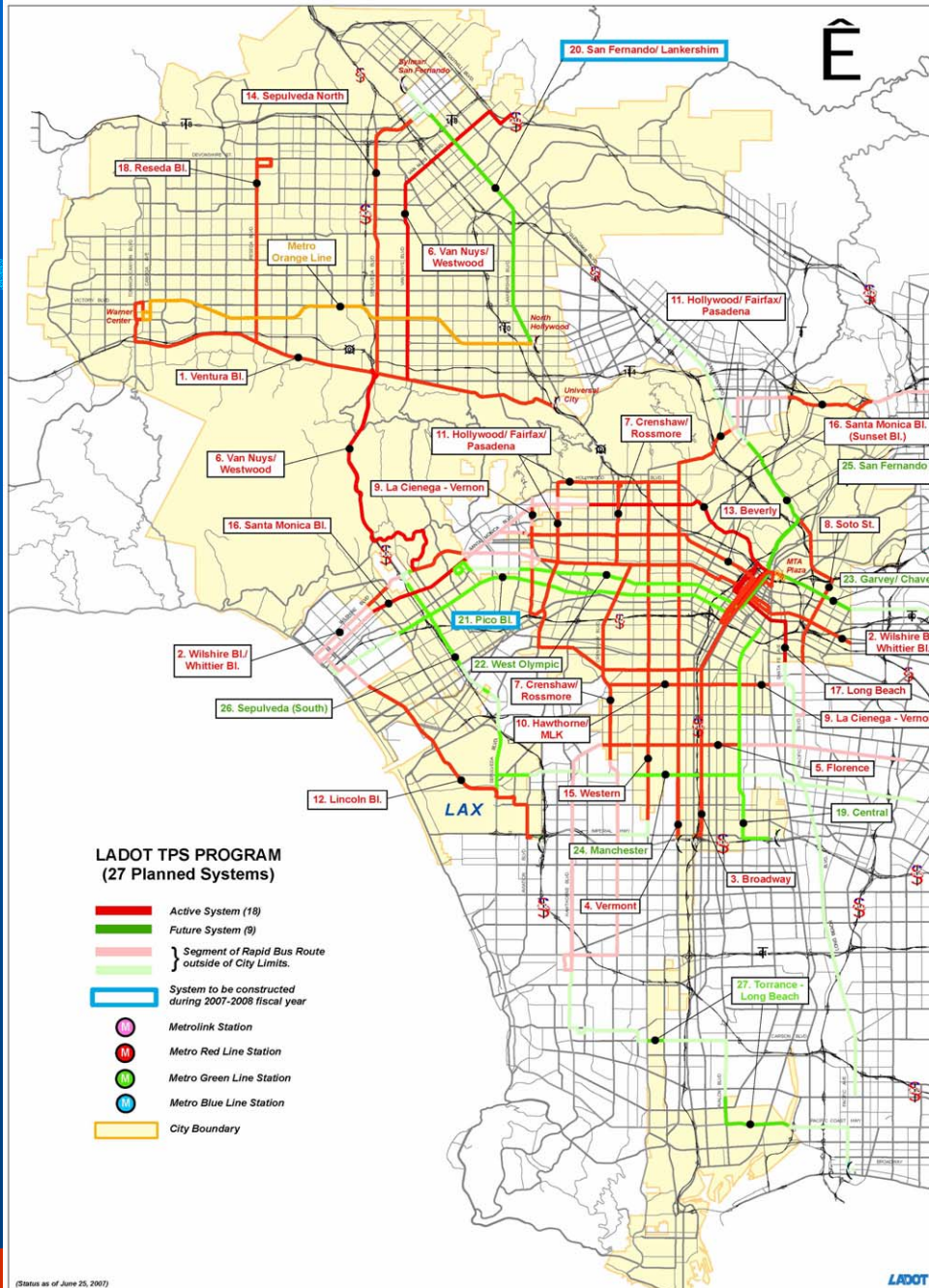
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Feb	March 2006					Apr
Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

3/31/2006 23:59

VehNum
 TagID
 Show Details

LADOT Transit Priority Systems for Metro Rapid Bus Corridors



(Status as of June 25, 2007)

LADOT

Multi-Jurisdictional TPS

- **TPS coverage gaps**
- **LADOT TPS hosting and Metro BSP**
- **Implementation challenges**
 - **Field hardware**
 - **Communication infrastructure**
 - **Control / Ownership**
 - **ITS expertise**

L.A. TPS Hosting

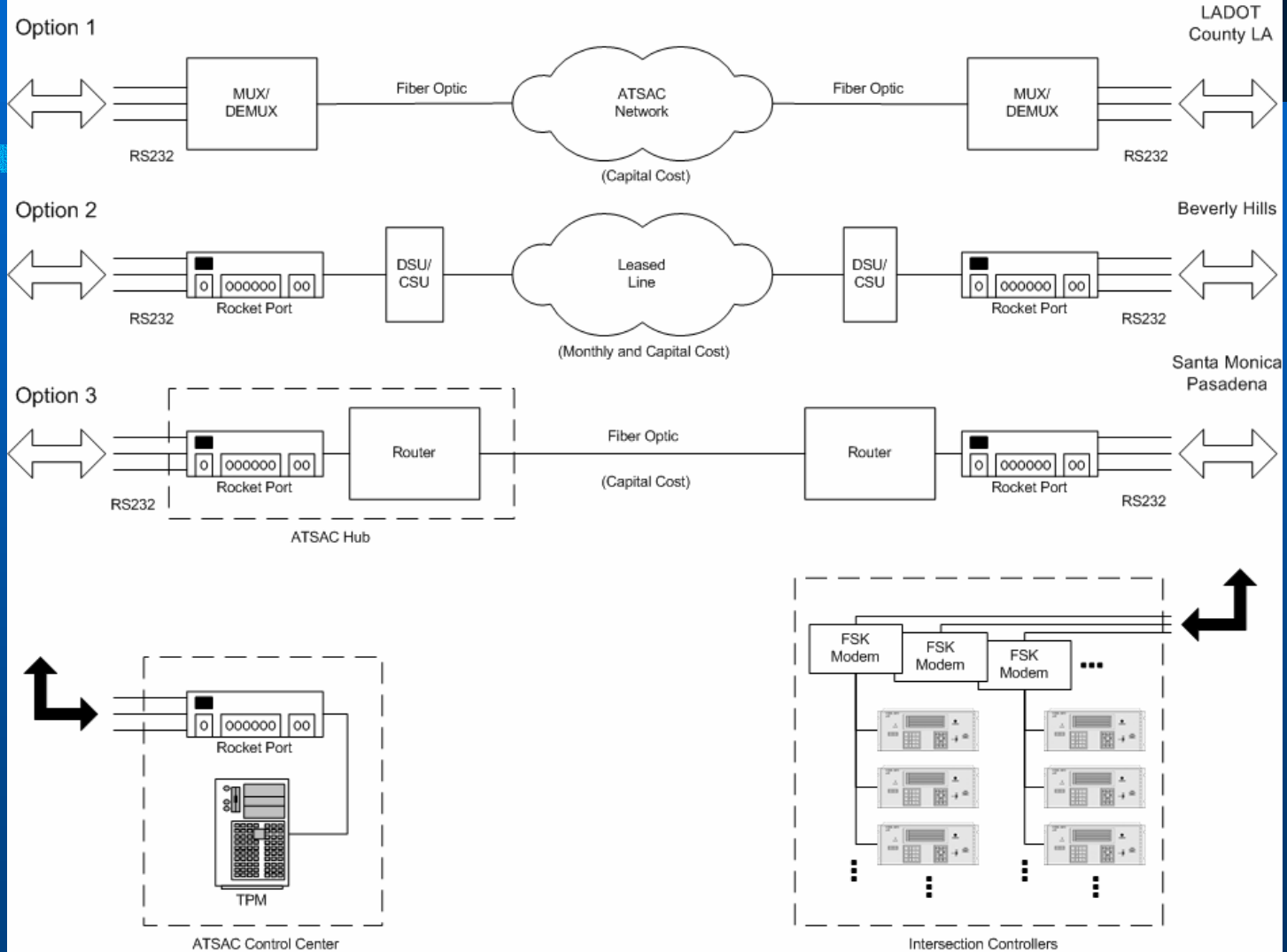
- Existing subsystem benefits
- Centralized TPS processing
- Centralized priority granting
- Centralized schedule update
- Eliminate multiple control systems
- Simplify TPS deployment for smaller cities.

Issues

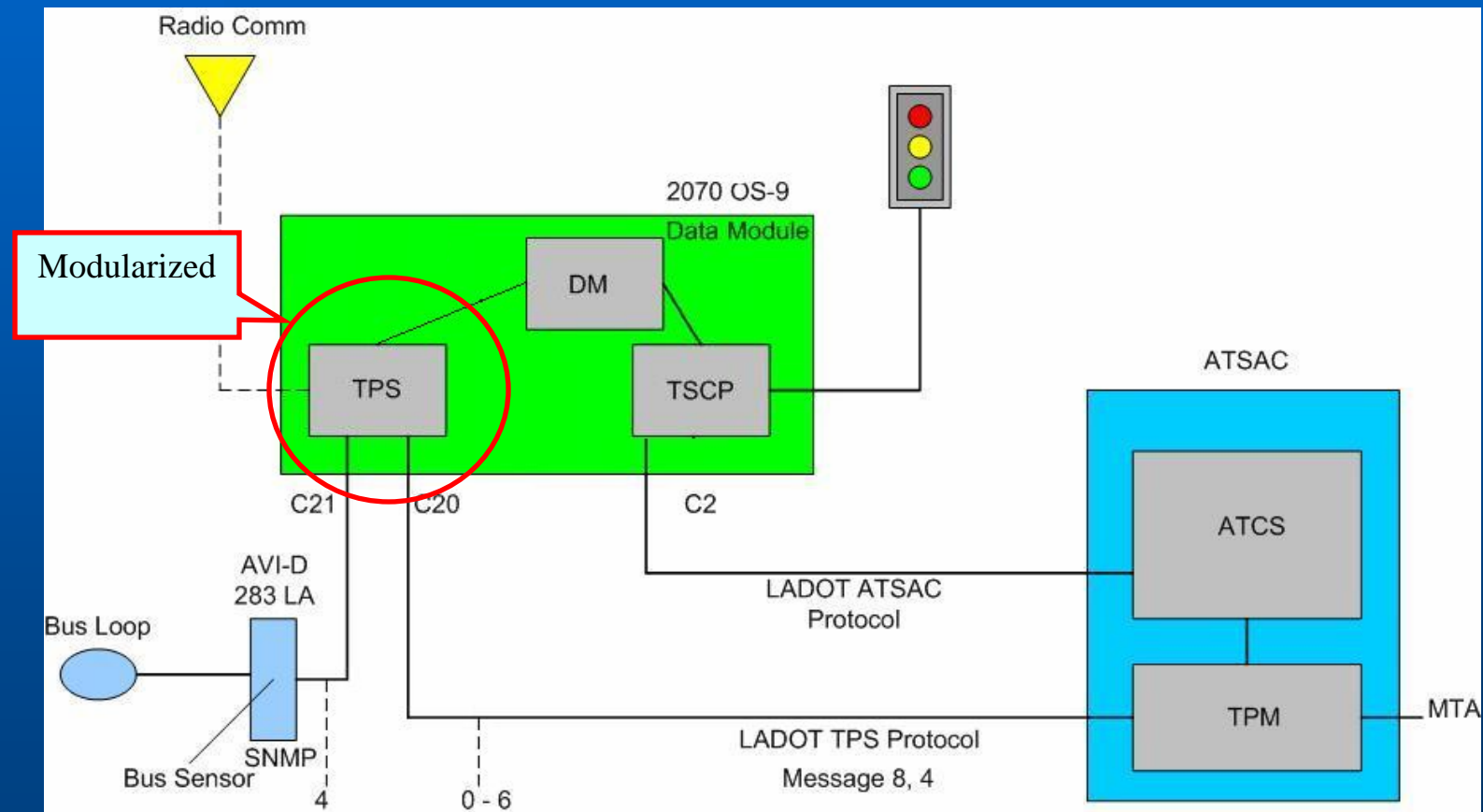
- **Implementing L.A. TPS protocol**
- **Interconnect (RS-232)**
- **Controller**

TPS Communication Options

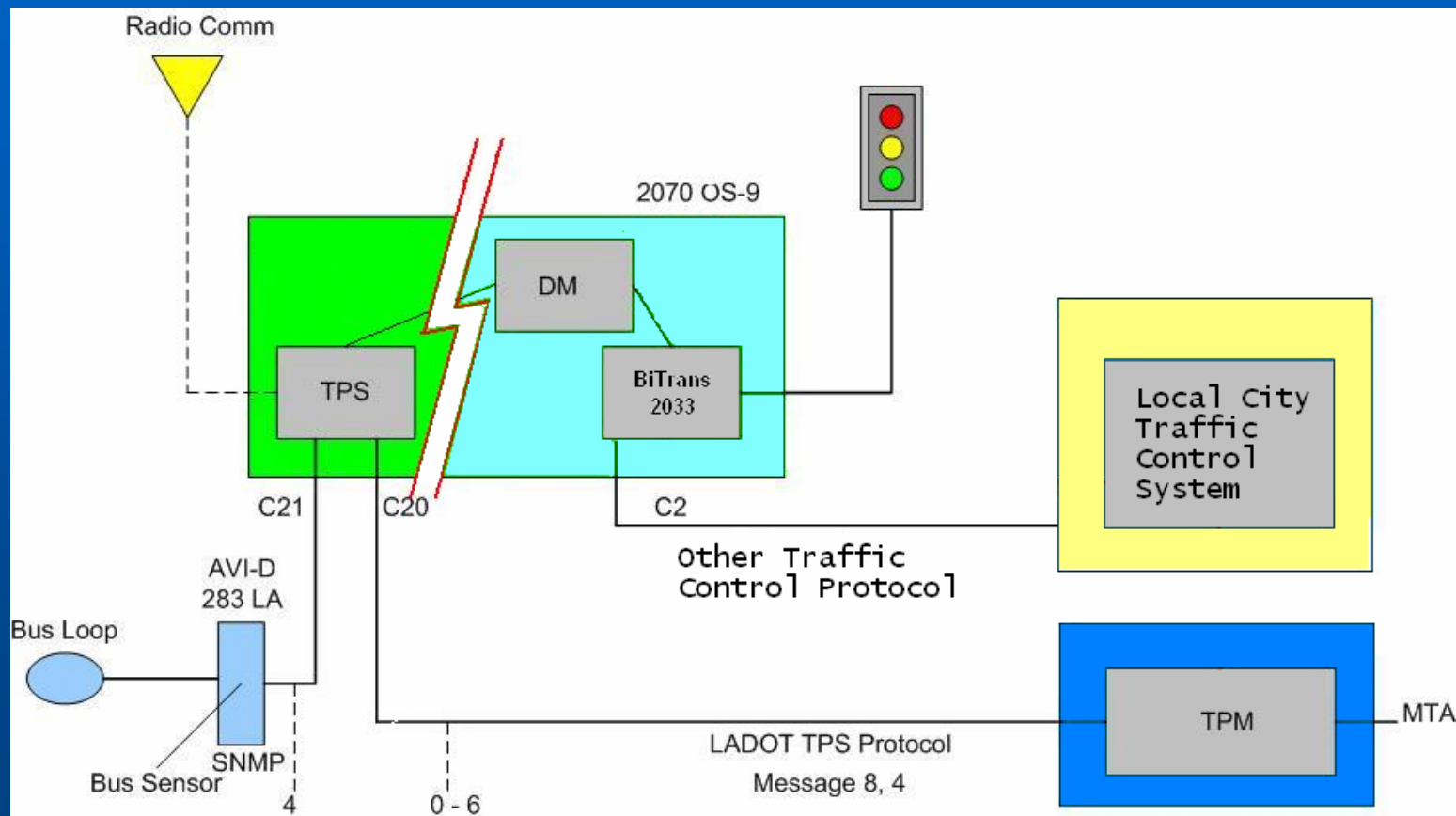
Updated 11/2/07



L.A. 2070 Software



BiTran 2033 & L.A. TPS

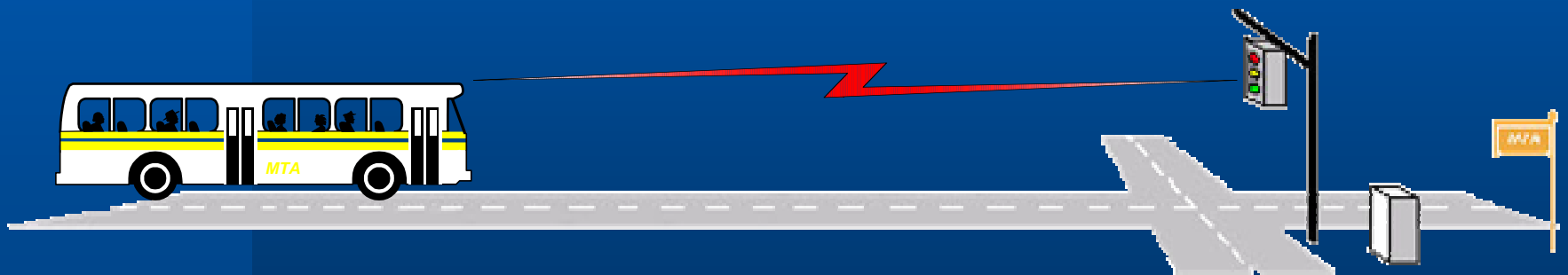


Bus Signal Priority

- Crenshaw TPS
- Wi-Fi 802.11x wireless technology
- Distributed system
- On-board GPS/GIS
- Pre-loaded schedule
- Virtual loop detection
- Integrated TPS graphic display (optional)

Bus Signal Priority - Wireless

- Uses an onboard processing unit
- Request transmitted via wireless communications technology



On-Bus Equipment

Processing Unit, GPS & Communications Equipment



Typical on-bus
processing unit



GPS/WLAN
roof mount antenna

Lesson Learned

- Transit and DOT partnership
- Existing infrastructure
- Budget constraint
- Must / desired features
- Operating / On-going cost
(software/hardware renewal)
- Maintenance cost (schedule update)

The End

Questions & Comments

Send questions to:

Email: chun.wong@lacity.org