SFMTA

Introduction to Train Control

Dan Howard
Muni Technology Systems Manager


Market St Subway
N Judah
L Taraval
K Ingleside
Twin Peaks Tunnel
J Church
T Third
M Oceanview

What is Train Control?

Primarily, train control is a **safety system** which is designed to prevent train-to-train collisions.

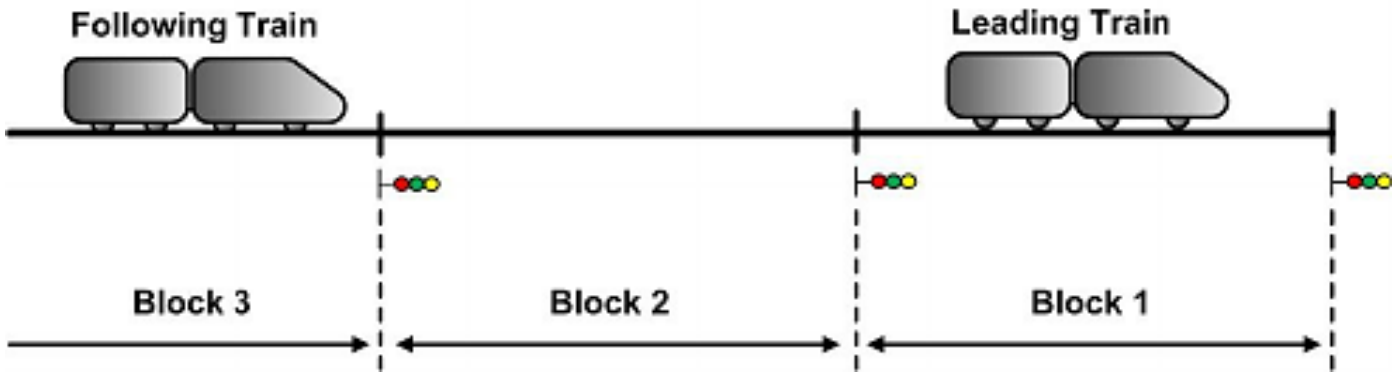
Generally, train control systems do not address the risk of collision between trains and other vehicles, bicycles, or pedestrians. These capabilities are currently being researched.

What is Train Control? (cont)

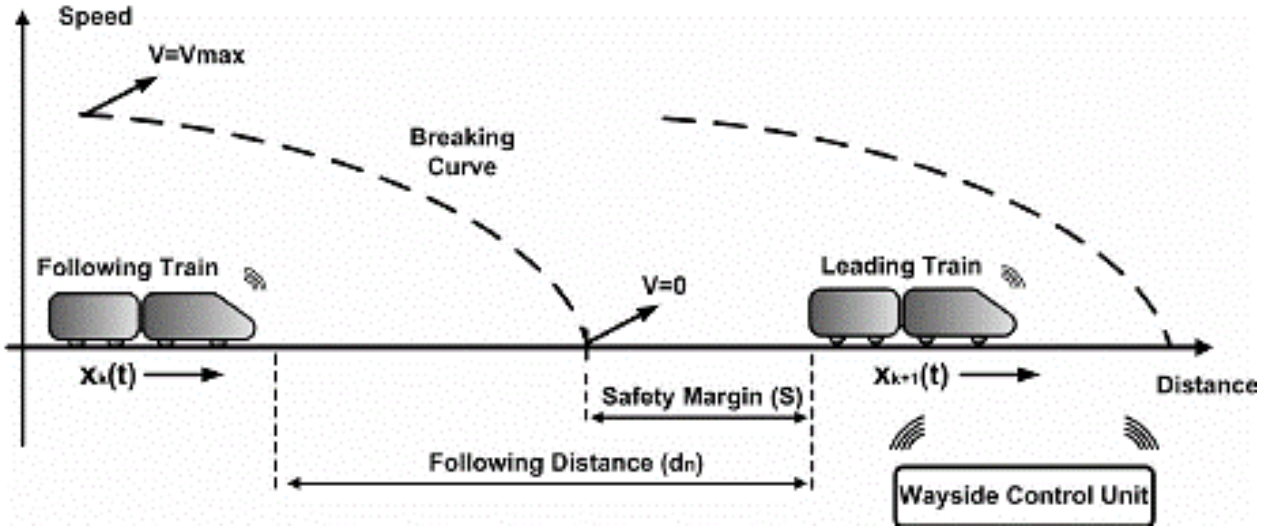
Secondarily, more modern train control systems can be used to manage rail service, giving operations staff the tools to monitor and adjust trains' speeds and dwell times to ensure the trains stay on schedule and maintain consistent headways.

Types of train control

Fixed block



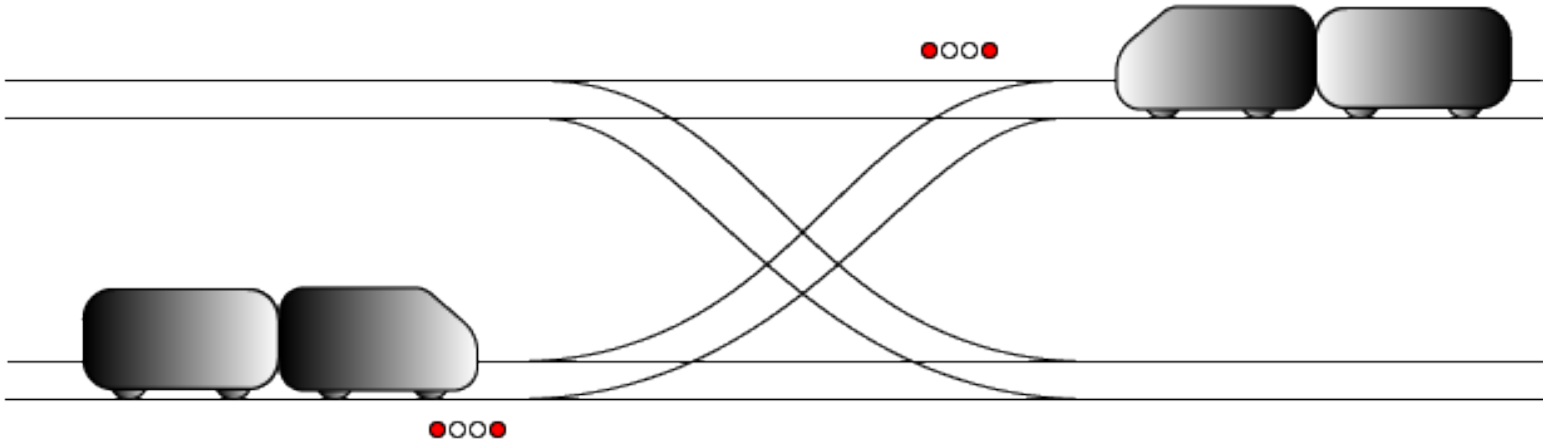
Moving block



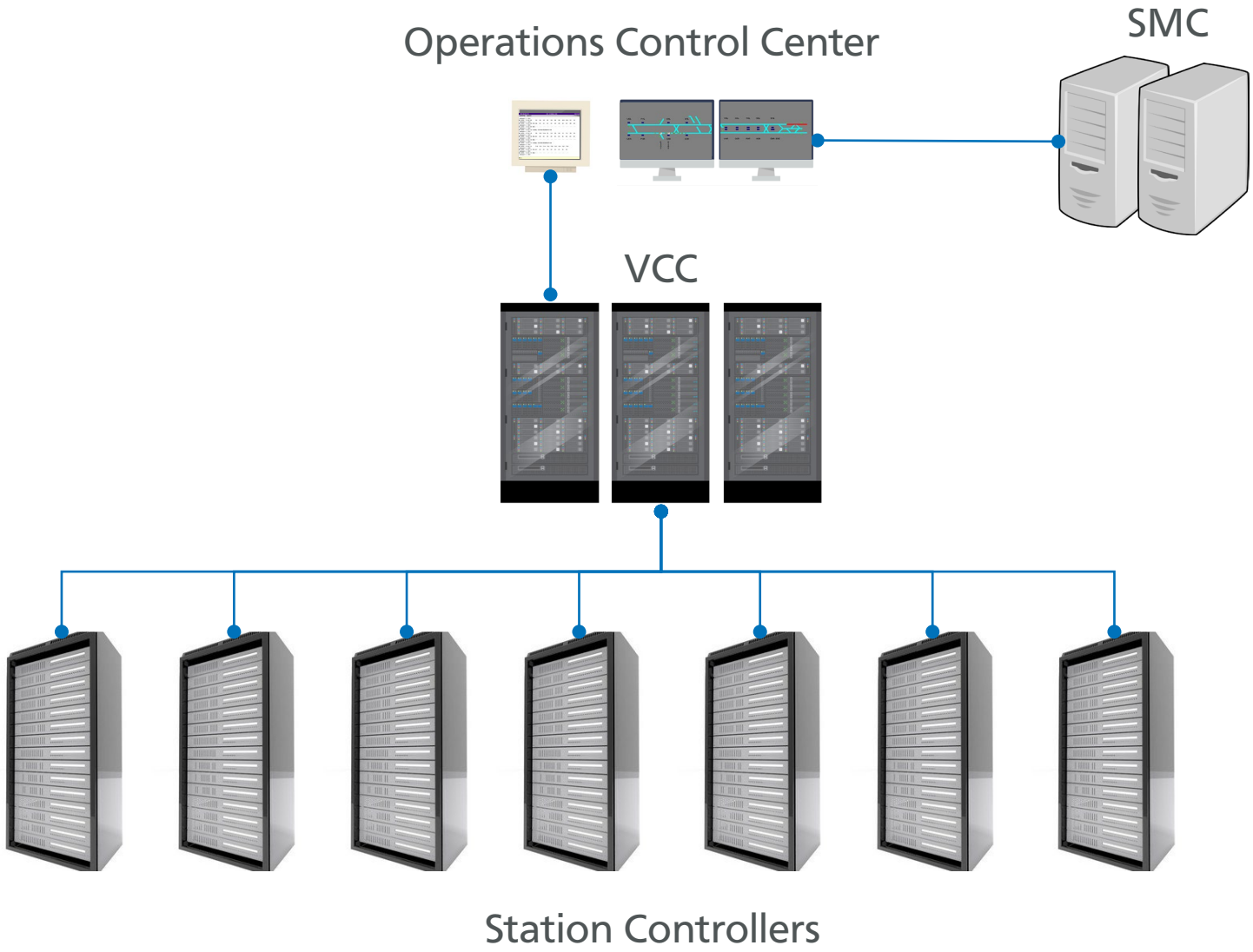
What is Train Control? (cont)

In addition, we need to control movement through junctions (called ‘interlockings’).

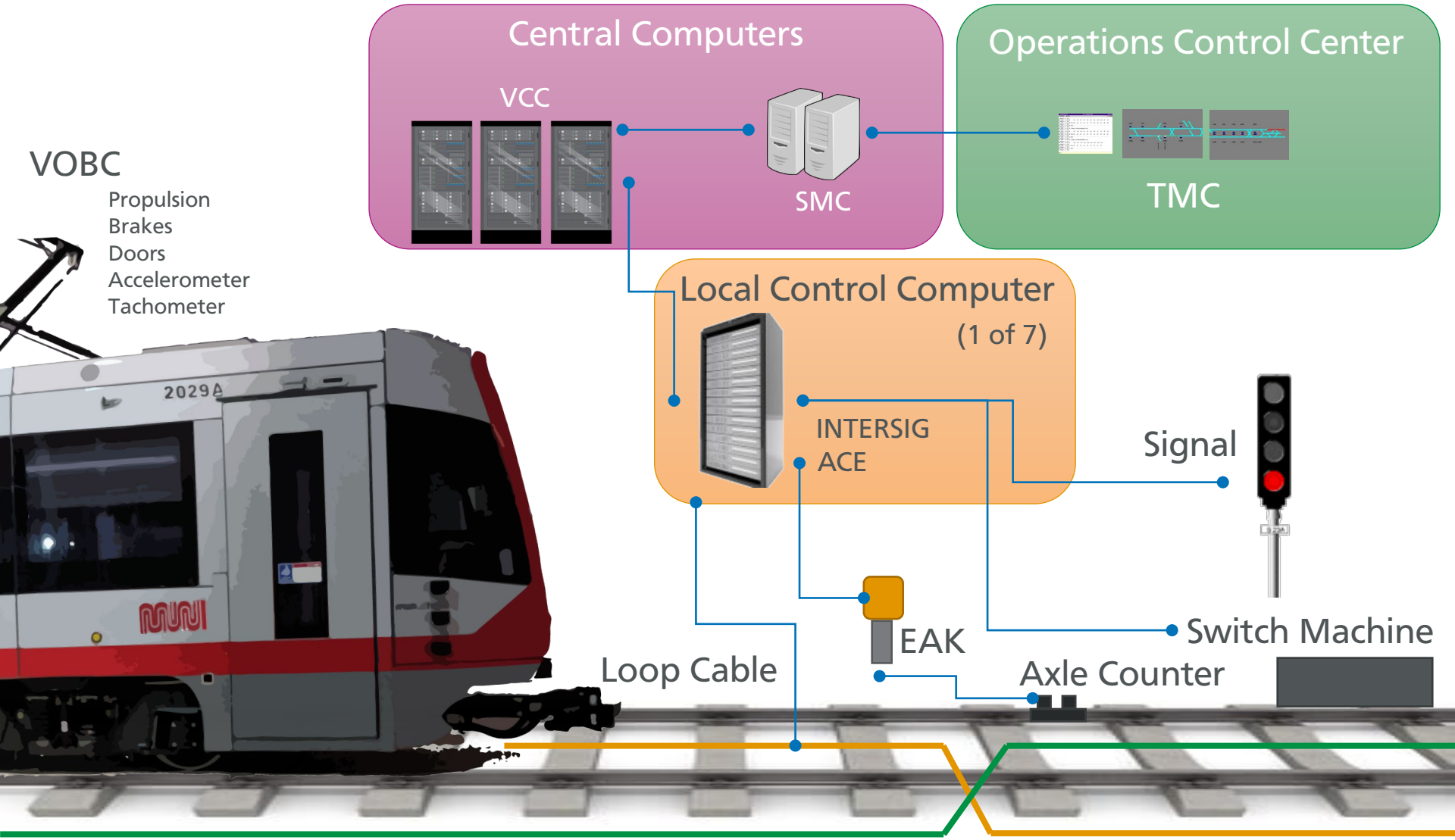
This includes both occupancy control (fixed block and moving block) as well as switch position



ATCS System Overview

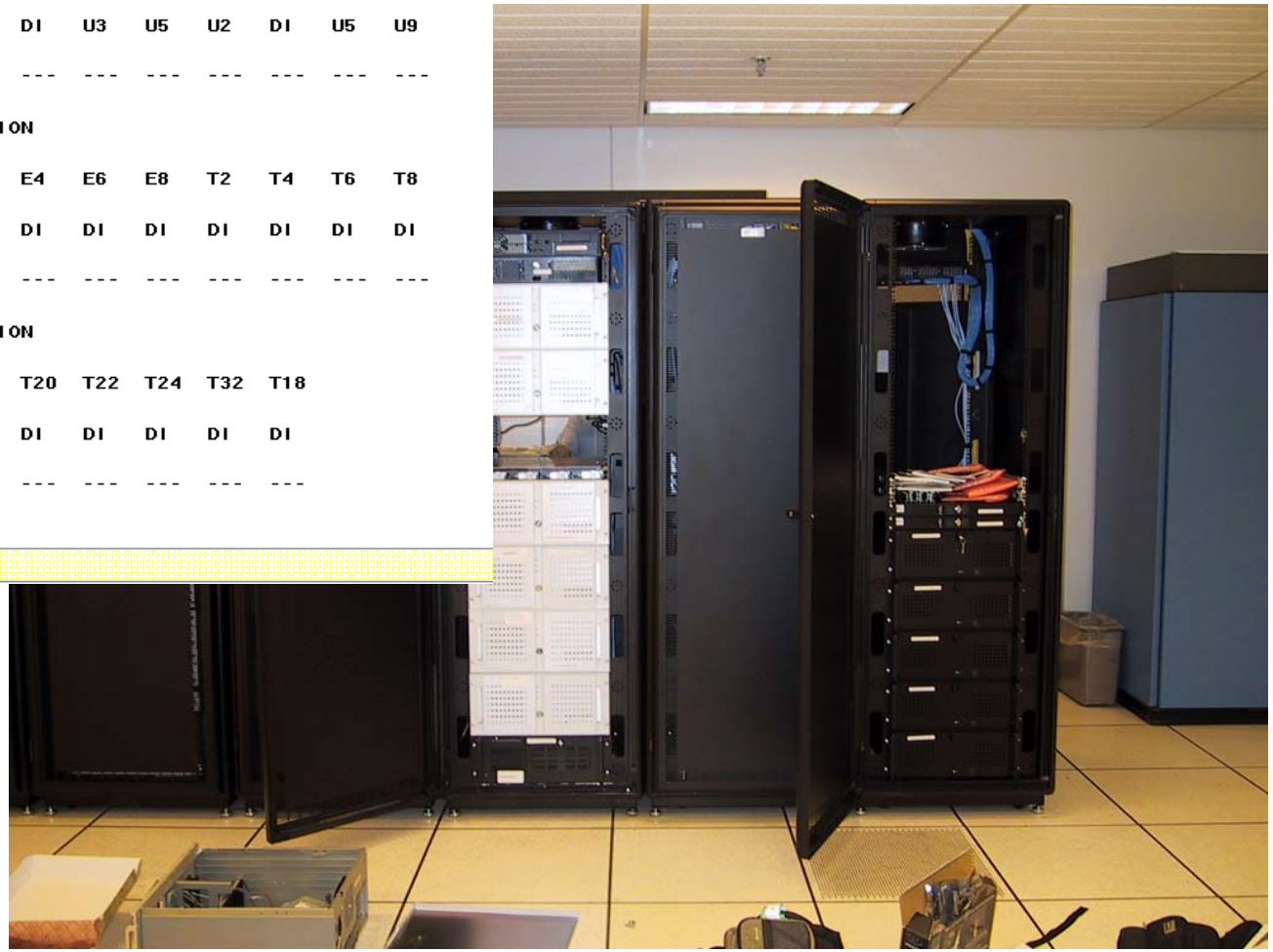


ATCS System Overview



VCC – Vital Control Computer

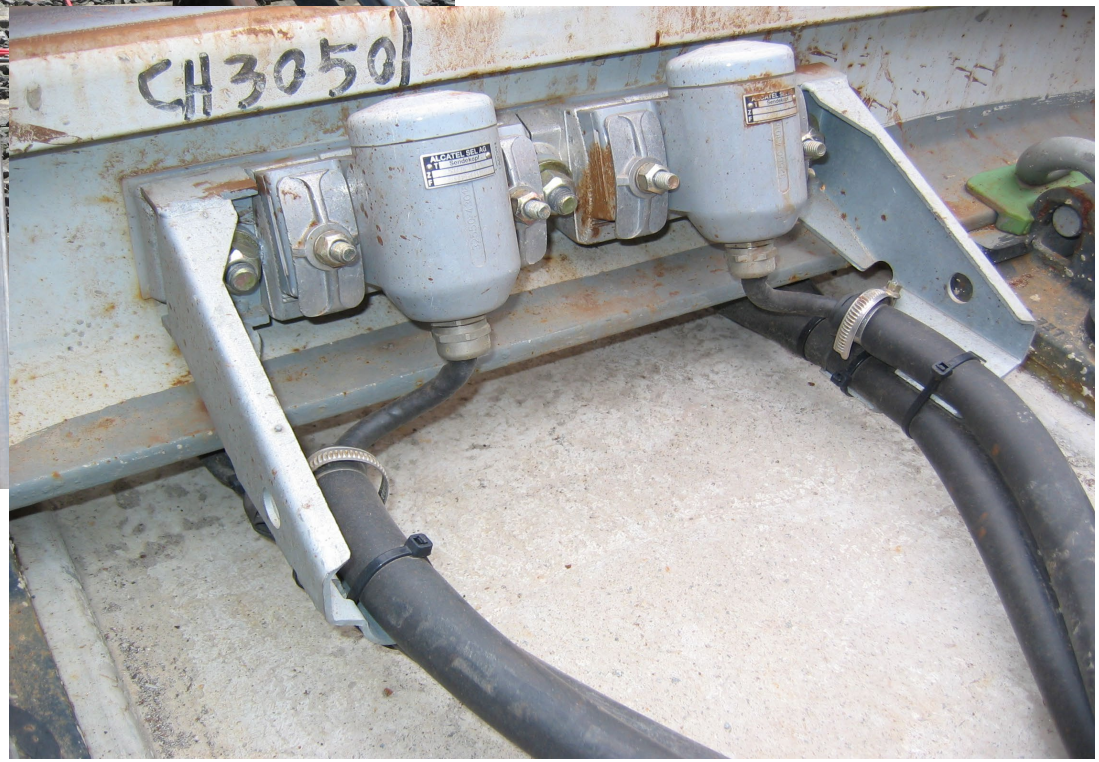
```
THU 08/07/97                    VCC-CCO(Rel1.30)                    18:22:22
Authority   System                                                  F1=Help

 pbasgslr.c 153
M1.CPU1: 13:53:09      C4   C6   C8   D2   D4   D6   D8   D10  D12  V2   V4
 pbasgslr.c 184
M1.CPU1: 13:53:09 STA UA   U1   DI   DI   DI   U3   U5   U2   DI   U5   U9
 pbasgslr.c 303
M1.CPU1: 13:53:09 RES ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
 pbasgslr.c 363
M1.CPU1: 13:53:10 SIGNAL STATUS/RESERVATION
 pbasgslr.c 153
M1.CPU1: 13:53:10      V8   V12  V14  E2   E4   E6   E8   T2   T4   T6   T8
 pbasgslr.c 184
M1.CPU1: 13:53:10 STA DI   U1   DI   DI   DI   DI   DI   DI   DI   DI   DI
 pbasgslr.c 303
M1.CPU1: 13:53:10 RES ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
 pbasgslr.c 363
M1.CPU1: 13:53:12 SIGNAL STATUS/RESERVATION
 pbasgslr.c 153
M1.CPU1: 13:53:12      T10  T12  T14  T16  T20  T22  T24  T32  T18
 pbasgslr.c 184
M1.CPU1: 13:53:12 STA DI   DI   DI   DI   DI   DI   DI   DI   DI
 pbasgslr.c 303
M1.CPU1: 13:53:12 RES ---  ---  ---  ---  ---  ---  ---  ---  ---
 pbasgslr.c 363

PG 1
```



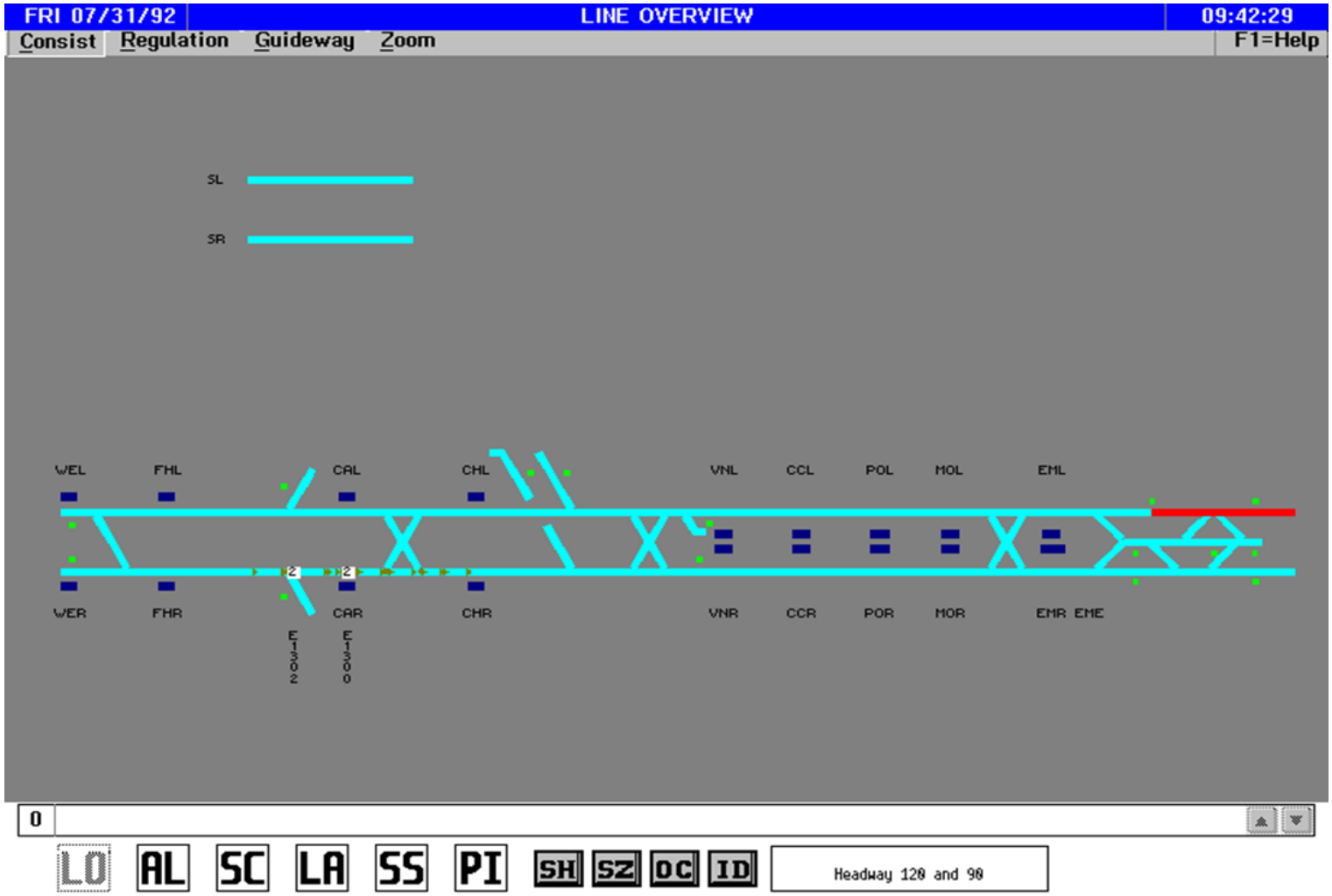
Station Controllers

Carborne Equipment (VOBC)

Wayside Equipment



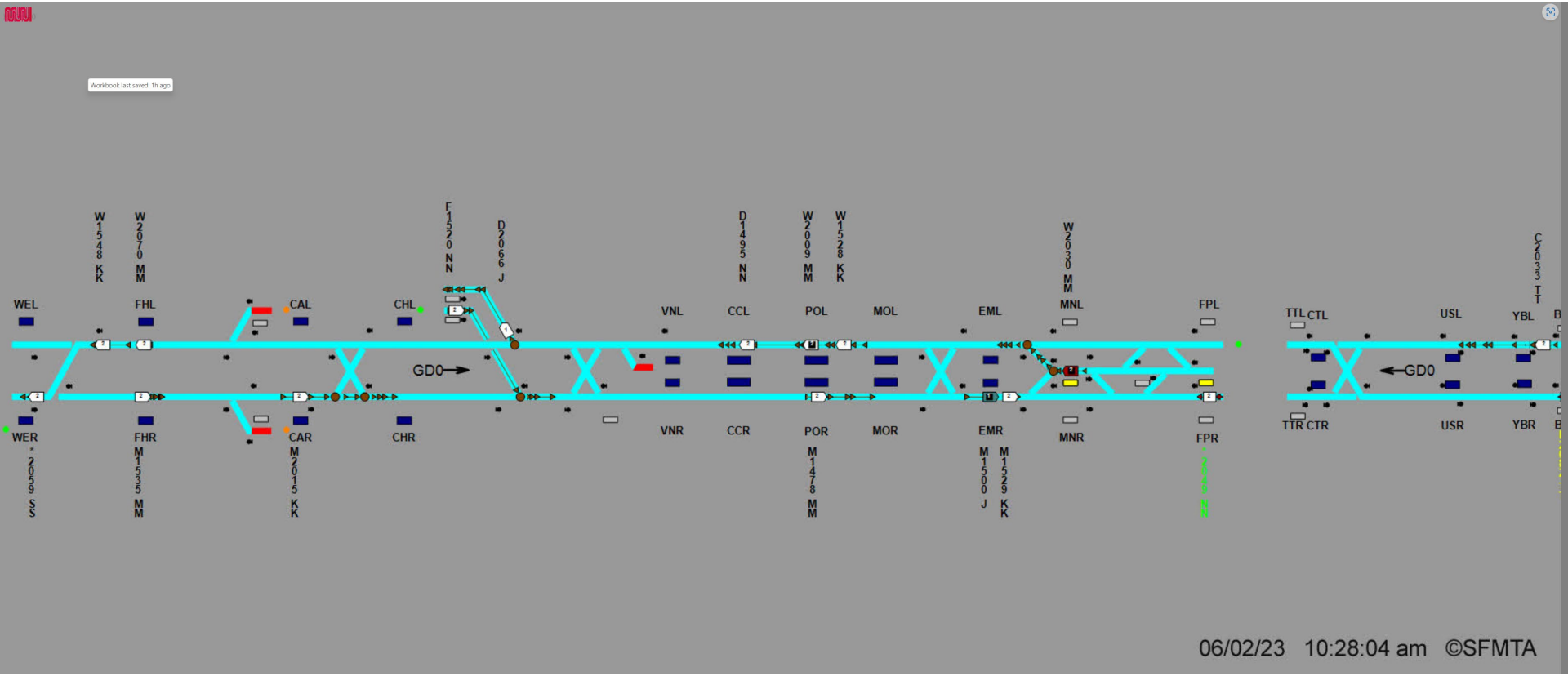
SMC – System Management Center



OCC Control Center - Then

TMC Control Center - Now

Managing Service



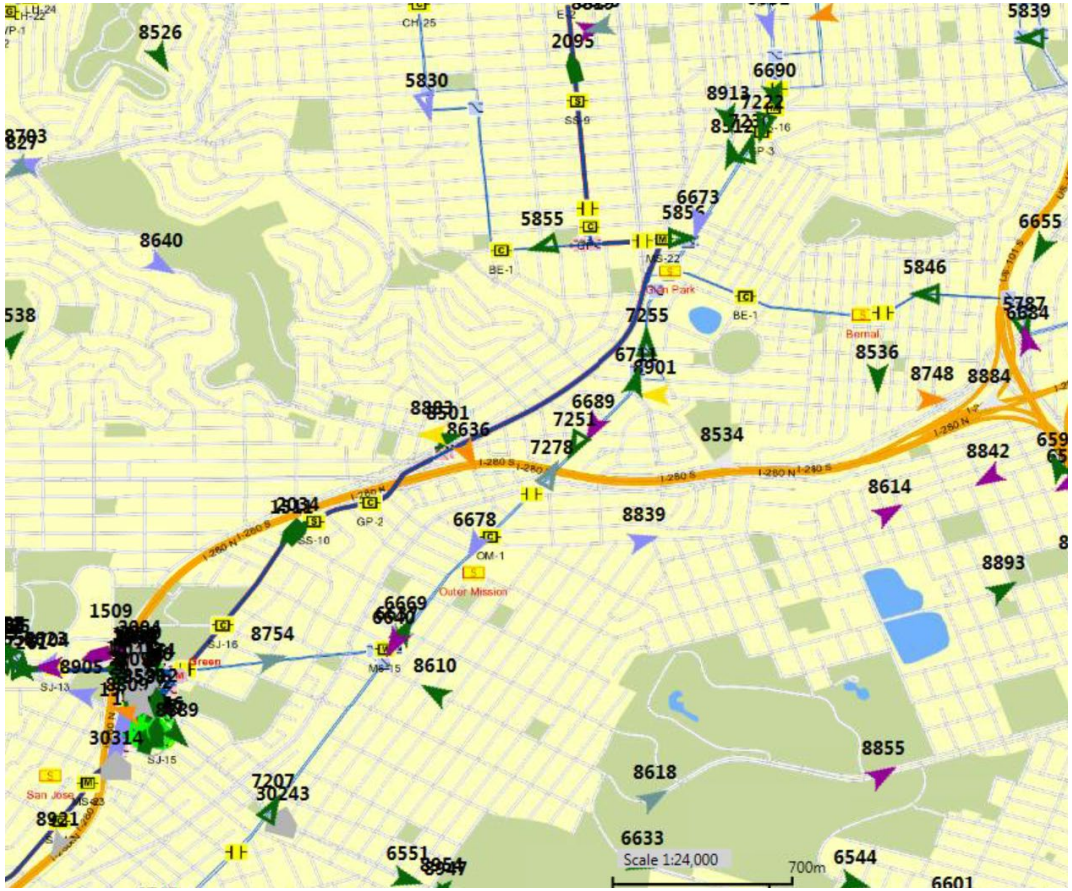
SFMTA

Introduction to CAD-AVL

Katelyn Stangl
Transit Operations Systems Planner

What is a CAD-AVL system?

- Connects vehicles to scheduling & dispatching
- Allow for real-time monitoring of transit operations & adjustments to transit service
- Our system is called “OrbCAD”

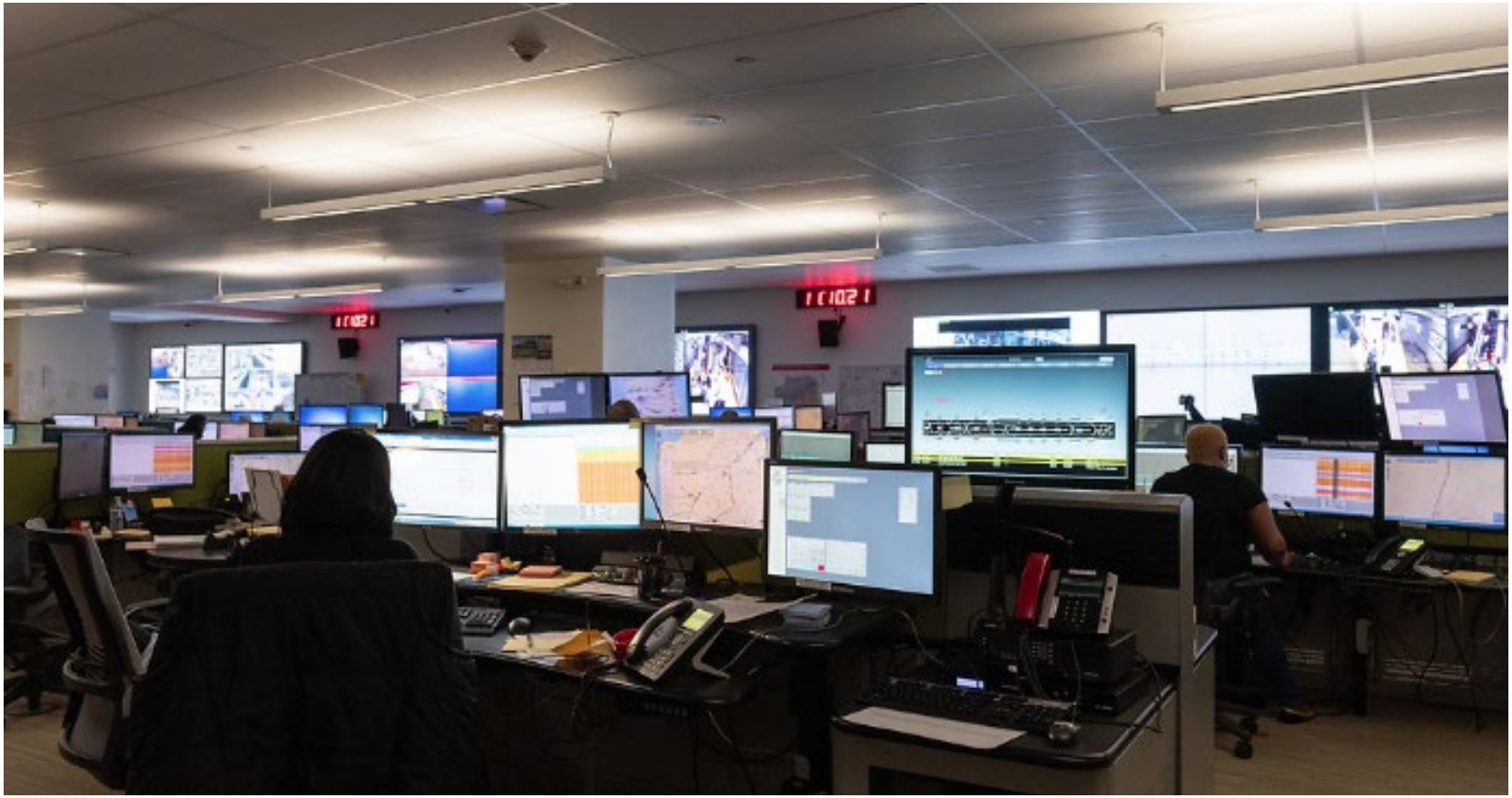


What types of data does it include?

- Schedule data
- Automatic Vehicle Location Data (AVL)
- Incident log
- Automatic Passenger Counter Data (APC)

Trip	Timepoint	Time	Sign ID
	DALY CITY BART LAYOVER LOCATION	05:12	
014R-I			
11346320	DALY CITY BART LAYOVER LOCATION	05:12	(1435)
	DALY CITY BART	05:13	
	MISSION & SAN JOSE	05:16	
	MISSION & ACTON	05:20	
	MISSION & GENEVA	05:24	
	MISSION & SILVER	05:29	
	MISSION & 30TH ST	05:33	
	MISSION & 24th ST.	05:37	
	MISSION & 16TH ST	05:42	
	MISSION & 11TH STREET	05:46	
	MISSION & 5TH ST	05:50	
	Mission St&Main St N-NS	05:59	

How do we use our CAD-AVL system in real-time?



Monitoring Transit Operations

Route & Direction

Operator & Vehicle Assignments

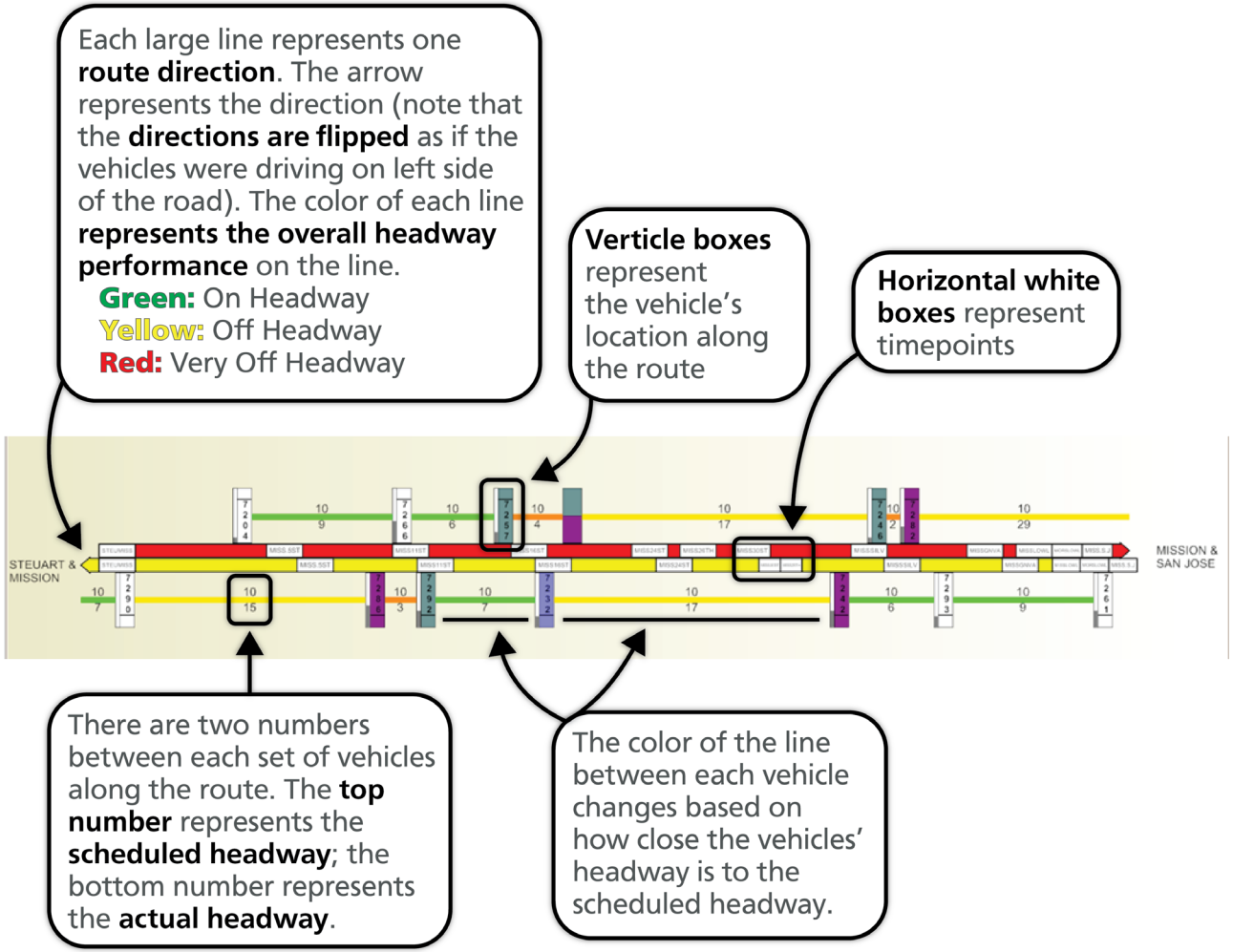
On-Time Performance

Vehicle Location

Route	CurRt	Dir	Oper	Block	VID	Vehicle Type	Status	Time	Dev	HDev	Delta	Last TP	Next TP	Intersection
014R	014R	OUTBOUND	5310	1430	6613	Motor Coach	NORMAL-N	10:56	1p	0		MISSSILV	MISSGNVA	MISSION & SILVER
014R	014R	INBOUND	2549	1431	6691	Motor Coach	GPSNA	06:01	NR	-			DE LONG	
014R	014R	OUTBOUND	4967	1432	6711	Motor Coach	NORMAL-N	10:57	0	1		MISS16ST	MISS24ST	MISSION & 16TH ST
014R	014R	INBOUND	3329	1433	6671	Motor Coach	NORMAL-N	10:53	0	0		MISS16ST	MISS11ST	MISSION & 16TH ST
014R			5216	1434	6689	Motor Coach	MISSEDRL	10:27	3	-		MISSMAI0	MORSLOWL	Mission St&Main St N-NS
014R	014R	INBOUND	3842	1435	6708	Motor Coach	NORMAL-N	10:56	1p	2		DC BART	MISS.S.J	DALY CITY BART
014R	014R	OUTBOUND	2390	1436	6615	Motor Coach	NORMAL-N	10:54	-1p	4		MISSMAI0	MISS.5ST	Mission St&Main St N-NS
014R	014R	INBOUND	4936	1437	6667	Motor Coach	LAYOVER	10:54	0p	0		MISSMAI0	MISSMAI0	Mission St&Main St N-NS
014R	014R	OUTBOUND	4659	1438	6618	Motor Coach	LAYOVER	10:50	0p	-1		DE LONG	DE LONG	DALY CITY BART LAYOVER LOCATION
014R	014R	OUTBOUND	5201	1439	6633	Motor Coach	GAP-L	10:51	-5p	-5		MISSMAI0	MISS.5ST	Mission St&Main St N-NS
014R	014R	INBOUND	5550	1440	6653	Motor Coach	LAYOVER	10:47	0p	1		MISSMAI0	MISSMAI0	Mission St&Main St N-NS
014R	014R	INBOUND	5466	1441	6614	Motor Coach	NORMAL-L	10:52	-5p	4		MISS11ST	MISS.5ST	MISSION & 11TH STREET
014R	014R	INBOUND	6043	1442	6647	Motor Coach	NORMAL-N	10:53	2p	2		MISS24ST	MISS16ST	MISSION & 24th ST.
014R			0	1443	0	Unknown	LOGOFF	10:15	0	-		FLNGARAG		FLYNN-GARAGE
014R	014R	OUTBOUND	5280	1444	6684	Motor Coach	NORMAL-N	10:51	-2p	-2		MISS16ST	MISS24ST	MISSION & 16TH ST
014R			5997	1445	6706	Motor Coach	DEADHEAD	10:47	0p	-		MORSLOWL	MORSLOWL	Morse St&Lowell St S-NS/BZ
014R	014R	OUTBOUND	6532	1446	6660	Motor Coach	NORMAL-E	10:53	1p	3		MISSFLNY	DC BART	MISSION & FLOURNOY
014R	014R	INBOUND	6604	1447	6668	Motor Coach	NORMAL-L	10:47	-5p	-2		MISS.5ST	MISSMAI0	MISSION & 5TH ST
014R	014R	INBOUND	3090	1448	6637	Motor Coach	NORMAL-N	10:56	-2	-2		MISSGNVA	MISSSILV	MISSION & GENEVA
014R	014R	INBOUND	5540	1449	6674	Motor Coach	NORMAL-N	10:51	1p	-1		MISSSILV	MISS30ST	MISSION & SILVER
014R	014R	INBOUND	2147	1450	6664	Motor Coach	NORMAL-L	10:57	-8p	-4		MISS.5ST	MISSMAI0	MISSION & 5TH ST

Headway Management

Instead of using a static schedule, vehicle departures are dynamically timed to maintain a consistent spacing along the route (i.e. a bus arrives at a stop every 10 minutes)



CAD-AVL On Transit Vehicles

- Send alerts to operators
- Show operator trip notes, directions
- Operators can communicate with controllers – send emergency alarms

How do we use the data created by the CAD-AVL system?

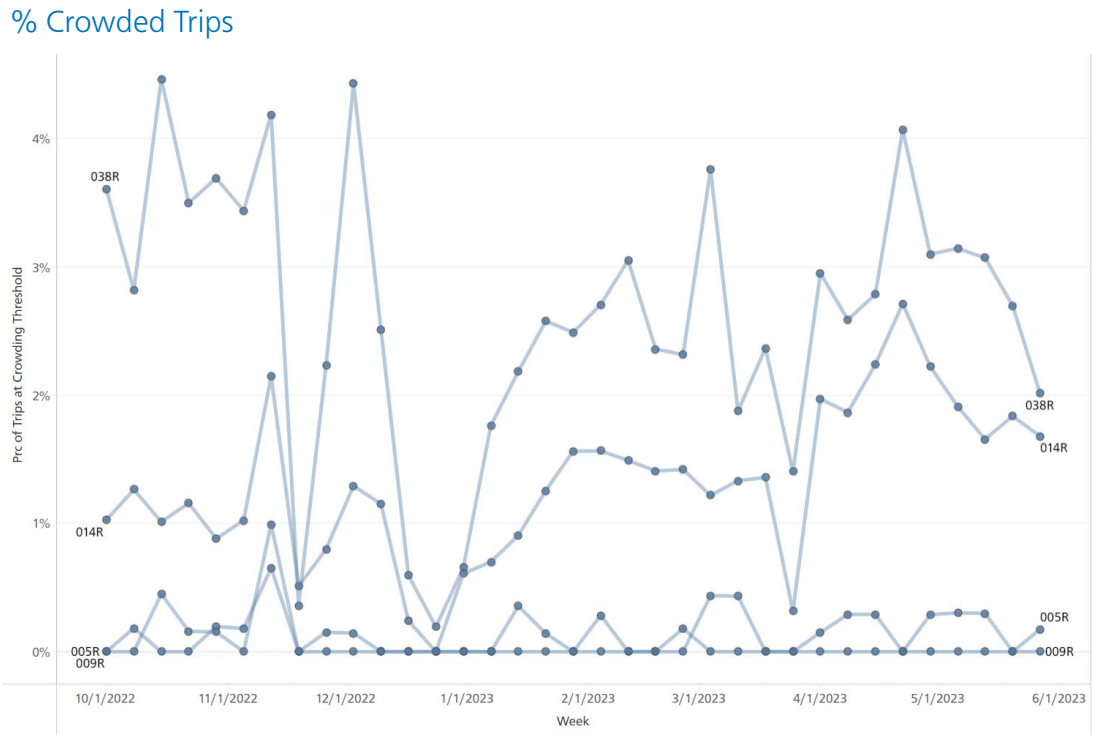
All data is archived

Data is analyzed

Data is used for transit operations, service planning, and, & Muni Forward

Crowding, vehicle capacity, & service planning

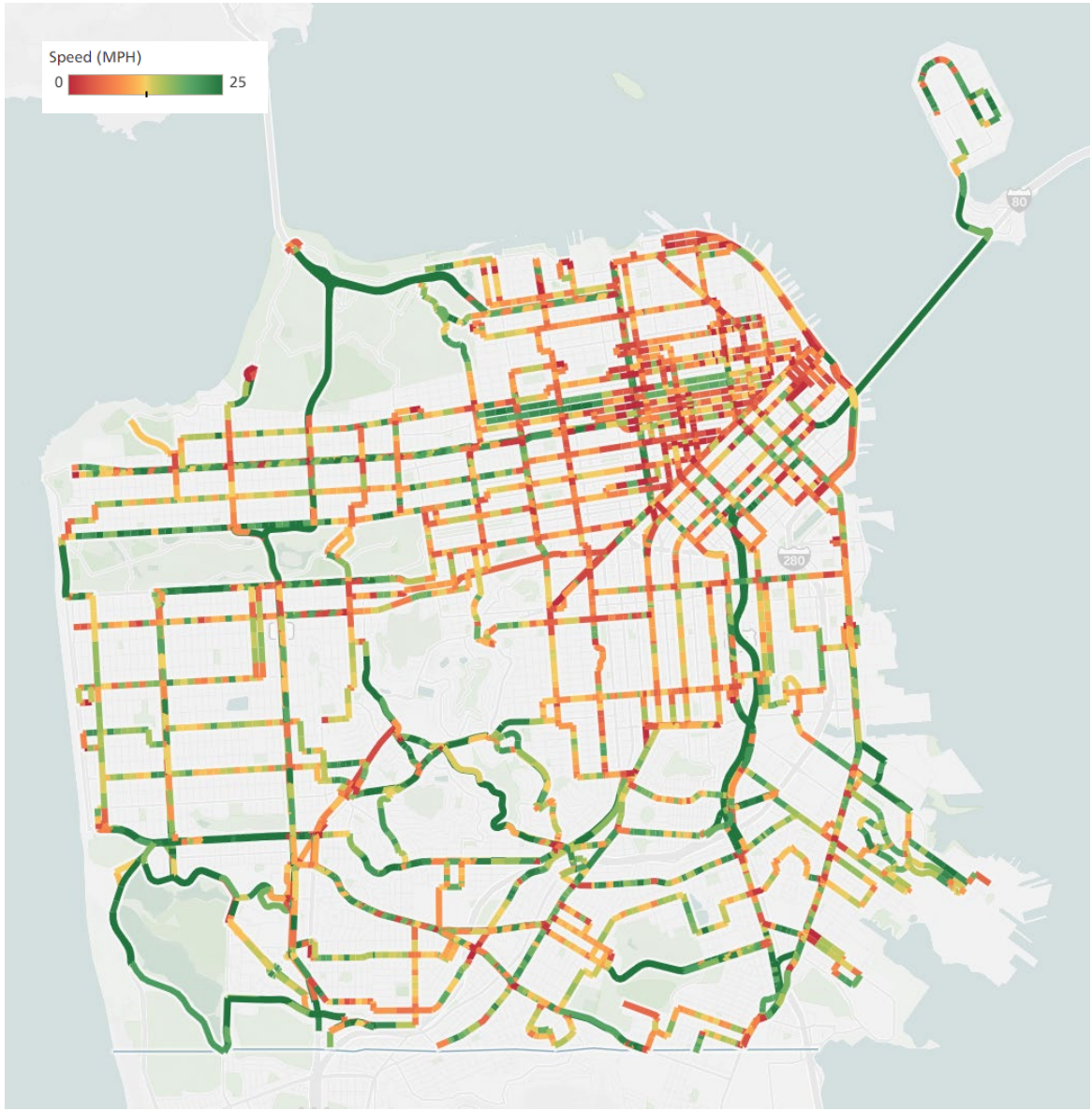
- Use archived APC data to calculate how many people are on board the vehicle
- Compare vehicle load to vehicle capacity
- Identify trips or route segments where the vehicle is crowded



https://www.sfmta.com/reports/percent-daily-muni-trips-crowded-route-and-month

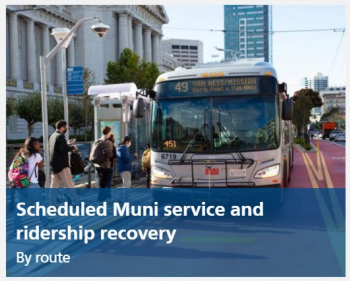
Vehicle Speeds & Muni Forward

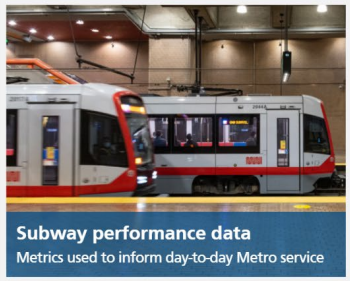
Use archived AVL data to calculate how fast transit vehicles are traveling per street block



Check out more of our data analysis work at sfmta.com

https://www.sfmta.com/muni-data





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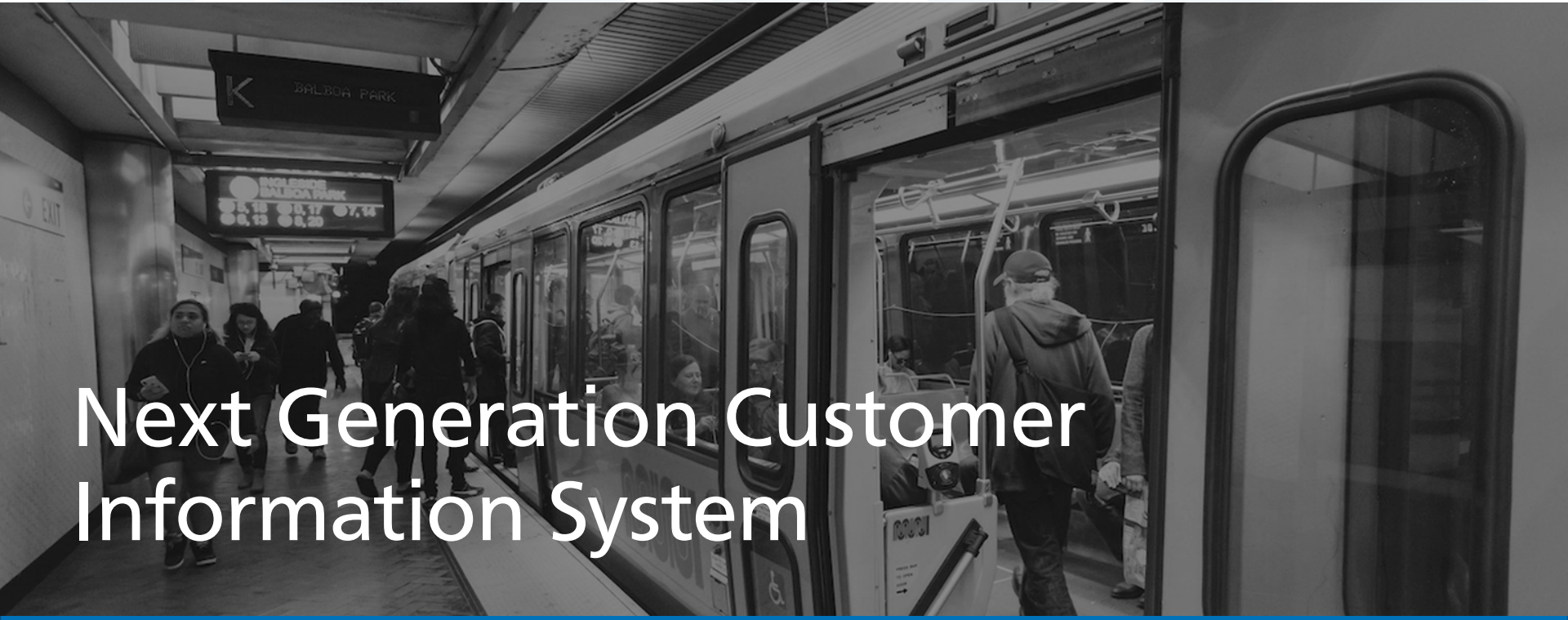


Next Generation Customer Information System

Ossmand Ruano
Customer Information Systems Planner

What is CIS?

Our Customer Information System (CIS) is a real-time transit information system, designed to provide customers with up-to-date Muni transit information.

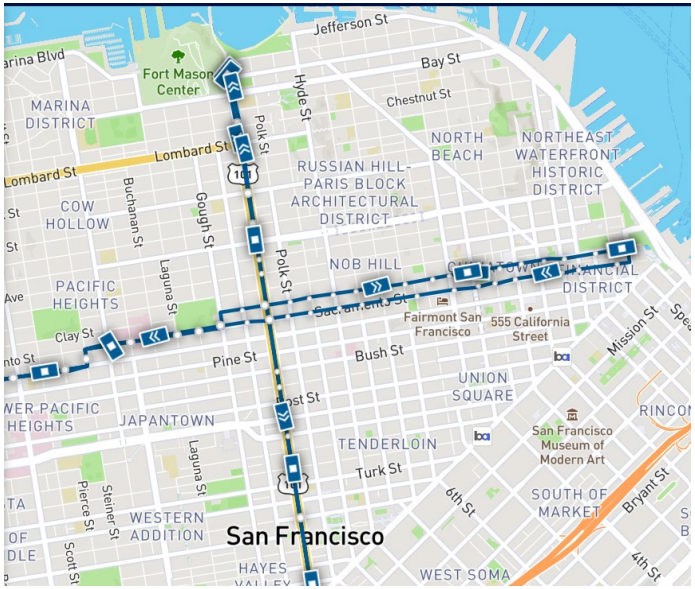
Background

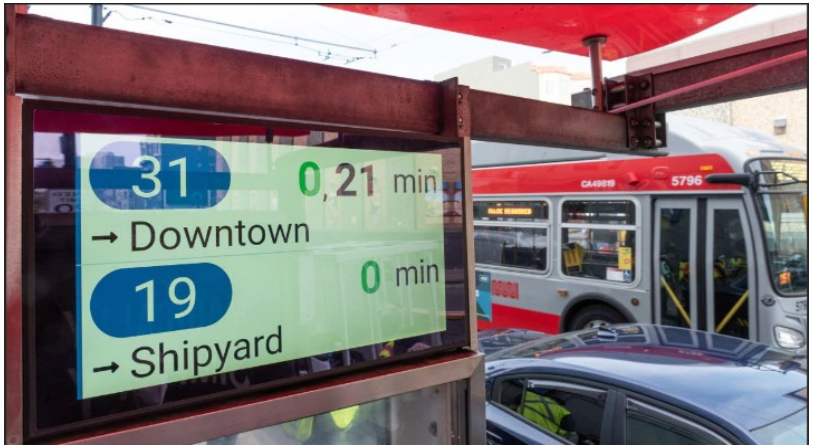
- In 1999, San Francisco piloted the first U.S. real-time information system.
- Since then, the technology and transportation landscape has rapidly evolved.
- Next-Gen CIS project began in 2020 with a focus on upgrading the CIS system.

Next-Gen CIS

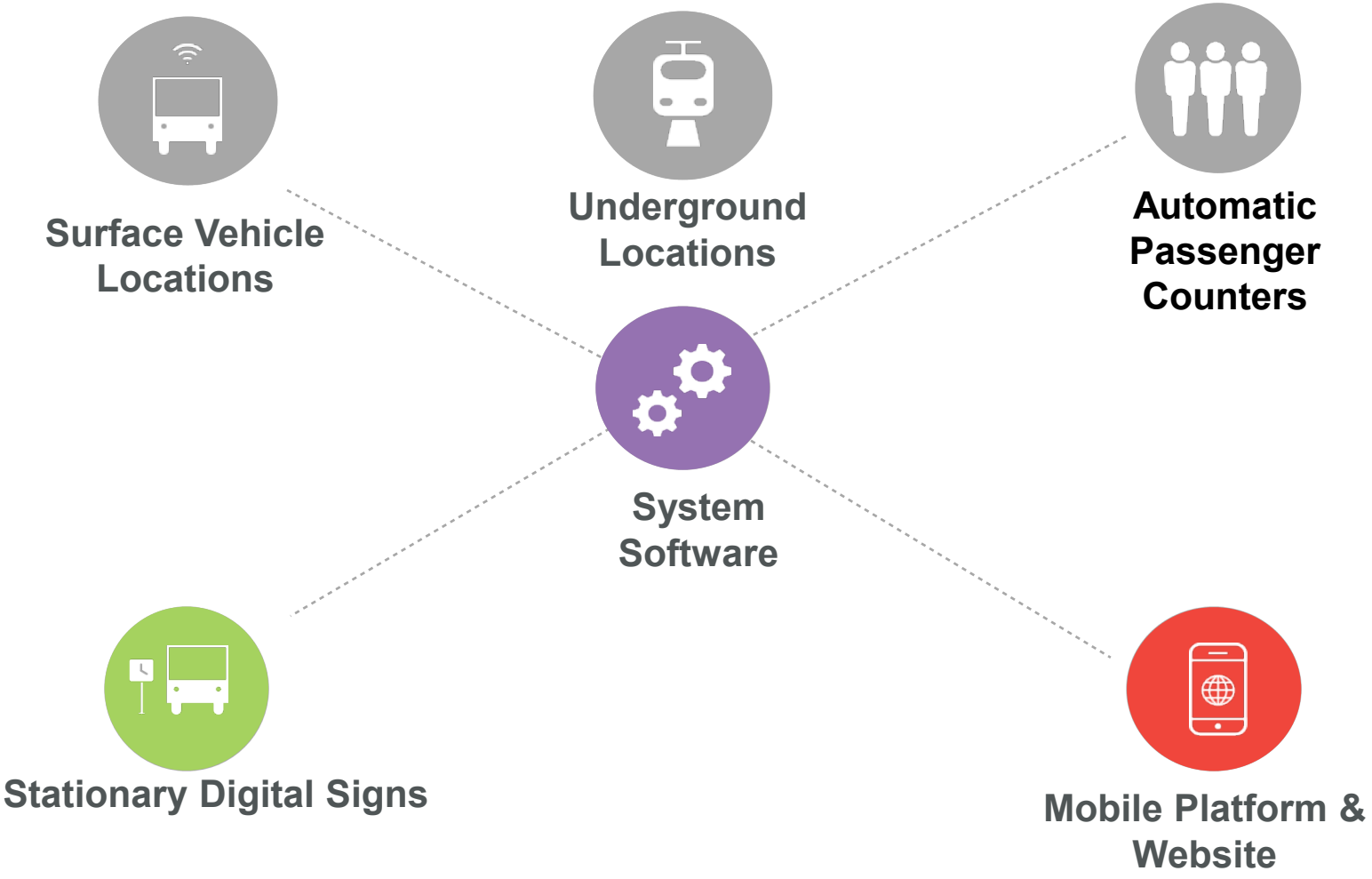

muni
mobile
Buy Tickets
Ride on.


N JUDAH
OCEAN BEACH
14, 38
11, 35
6, 21
M 10, 30
N 1, 19
powell

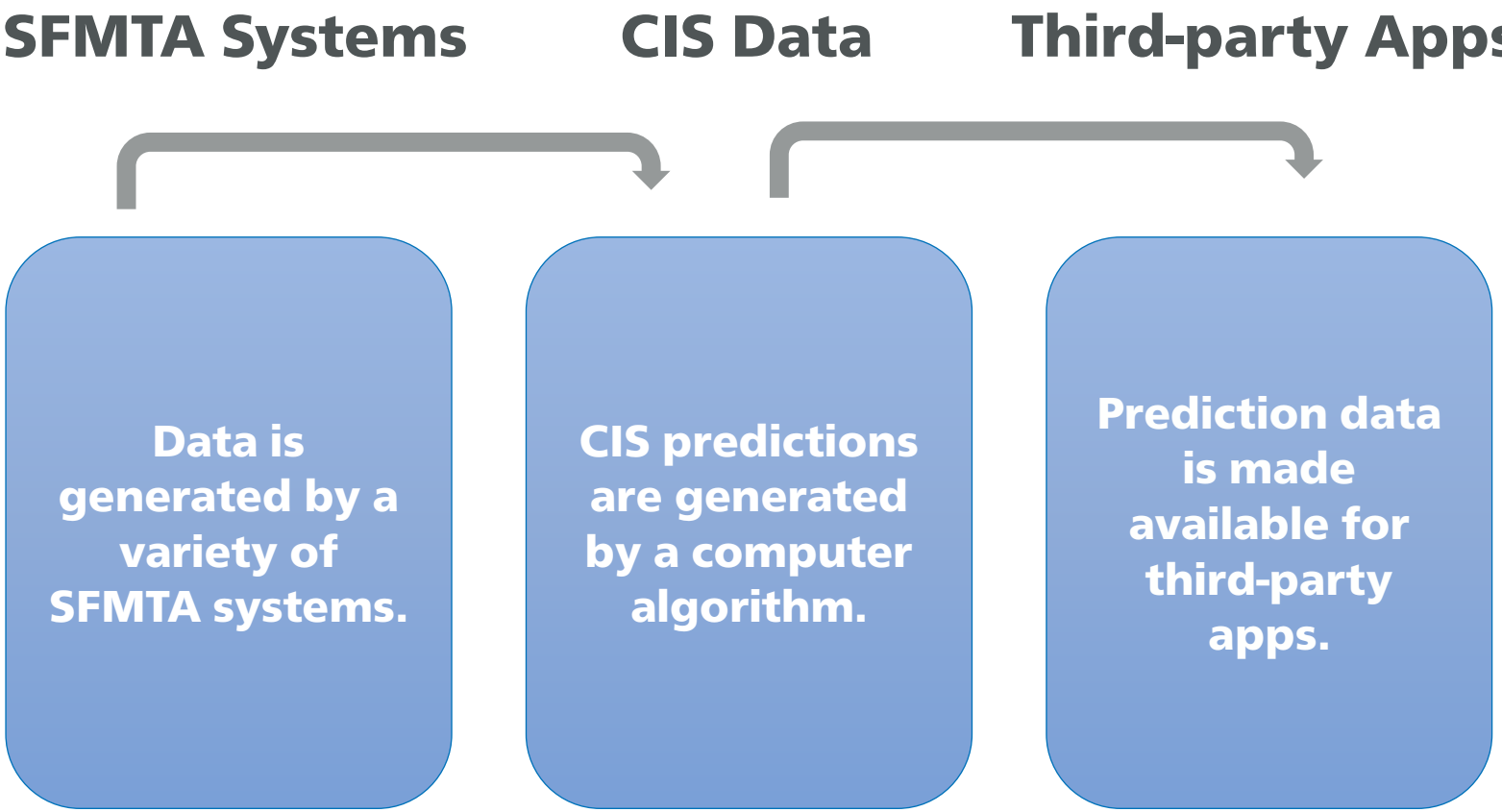

Jefferson St
Fort Mason Center
Bay St
Chestnut St
MARINA DISTRICT
Lombard St
Hyde St
Polk St
NORTH BEACH
NORTHEAST WATERFRONT HISTORIC DISTRICT
RUSSIAN HILL-PARIS BLOCK ARCHITECTURAL DISTRICT
COW HOLLOW
Buchanan St
Gough St
NOB HILL
PACIFIC HEIGHTS
Laguna St
Clay St
Pine St
Bush St
Fairmont San Francisco
555 California Street
Mission St
UNION SQUARE
JAPANTOWN
TENDERLOIN
San Francisco Museum of Modern Art
Turk St
6th St
SOUTH OF MARKET
Bryant St
WESTERN ADDITION
Steiner St
Pierce St
San Francisco
WEST SOMA
4th St


31
0, 21 min
→ Downtown
19
0 min
→ Shipyard
5796

Next-Gen CIS


Surface Vehicle Locations
Underground Locations
Automatic Passenger Counters
System Software
Stationary Digital Signs
Mobile Platform & Website

How is CIS data generated?



Next-Gen CIS: Stationary Signs

- New larger Liquid Crystal Displays (LCDs) at Muni shelters and stations, replacing existing signs and expanding real-time information coverage.

- Over halfway completion on the installation of new shelter signs.

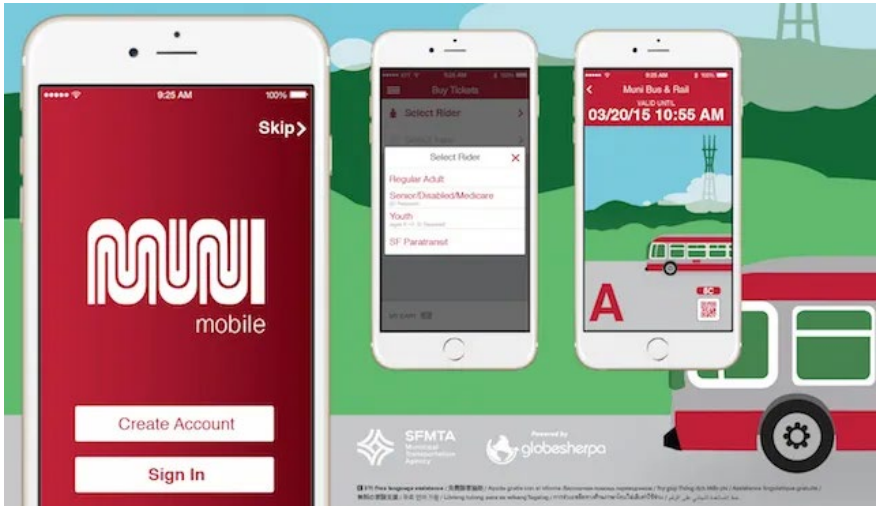
Next-Gen CIS: Muni Mobile

Trip Planner

- Point-to-point directions, vehicle arrival times and other new customer information
- Live trip tracking to inform customer of changes in journey
- Customer configurable for language, accessibility and service preferences

Upgraded MuniMobile App

- Provides all-in-one mobile ticketing and trip planning functionality for transit and multimodal services
- Automatically reflects real-time service changes



How do we use CIS?

- Monitor routes/predictions
- Create rider messages/alerts