Using GTFS-realtime Data to Measure Transit Performance

Laura Riegel

November, 2015

Multi-disciplinary professional services firm

2,500+ staff

75+ offices including NYC, Boston, Albany, Toronto

What is the quality of service provided?

What is the quality of service experienced?

Types:

- **Vehicle Locations**
- **Arrival/Departure Predictions**
- **Passenger Counts**
- **Fare Collection**

Increasingly:

- **Collected automatically**
- **Accessible in real-time**
- **Available in large quantities**

Useful for:

- **Passenger information**
- **Service analysis**
- **Performance measurement**

Using archival data

Using real-time data

Using Real-time Data

Example

MBTA-performance

Client: MBTA

IBI Group: strategy, design and software development

Automate daily performance reports

Measure service performance in real-time

Daily Performance — Red Line — Wednesday, 03/26/14

Passsengers Waits

87%	97%	100%
< Headway	< Big Gap	< 2X Headway
Goal: 90%*	Goal: 98%*	Goal: 100%*

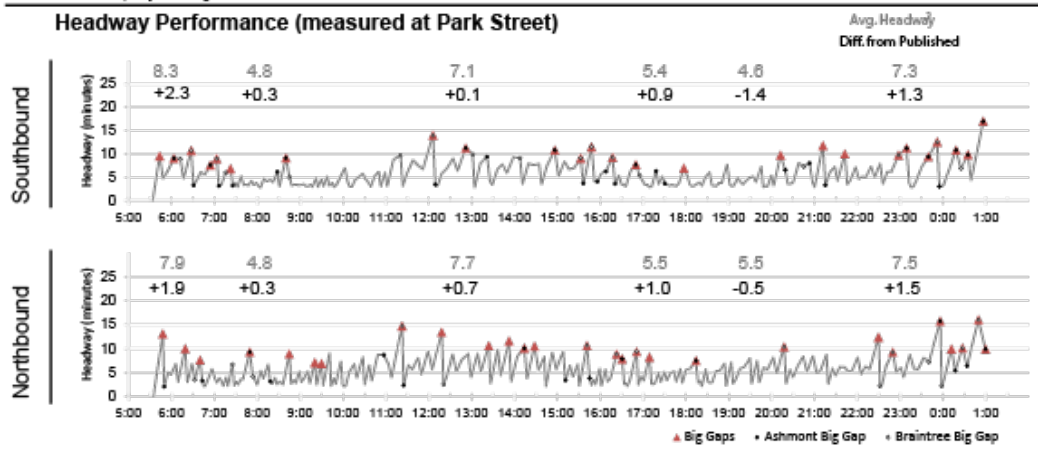
Passenger Travel Time[2]

96%	100%
delayed < 3 min.	delayed < 6 min.
Goal: TBD	Goal: TBD

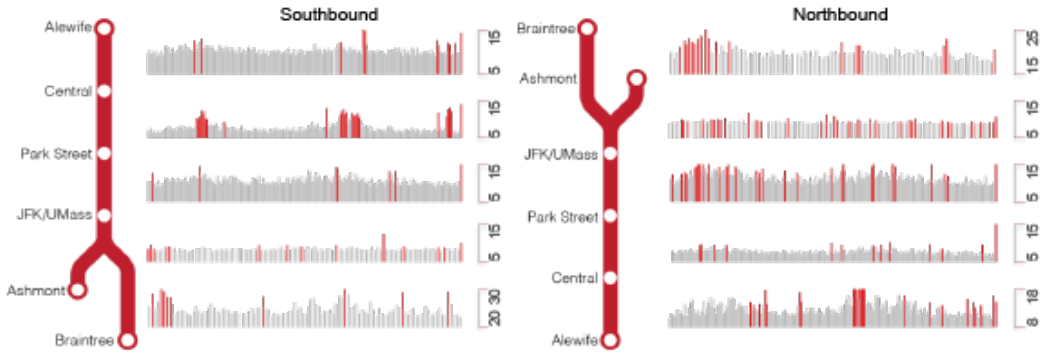
Comparison to range for each metric over prior 6 months (red bar is today, dark grey is worse than median, light grey is better)

* Goals are tentative, may be changed

Headway Performance (measured at Park Street)



Running Time Performance by Segment



Highlighted times are 15% higher than the median for the period

1. The standard for a big gap is either 1.5 times or 3 minutes greater than the scheduled headway, whichever is lower.
2. Passenger travel time is based on average passenger demand rates per period. I.e. 18000 people entering a station during the peak is a demand rate of 6000/hr or 100/min, which are further divided by destination. The rate is multiplied by the headway of a train to get the number of people boarding that train. If a train takes more than 3 minutes more than normal between any two points, the passengers on that train are considered delayed. *It does not account for people not being able to board a train due to crowding.*
3. Weighted average headway accounts for the fact that fewer people end up experiencing a short headway than a long headway, since fewer passengers arrive between trains.

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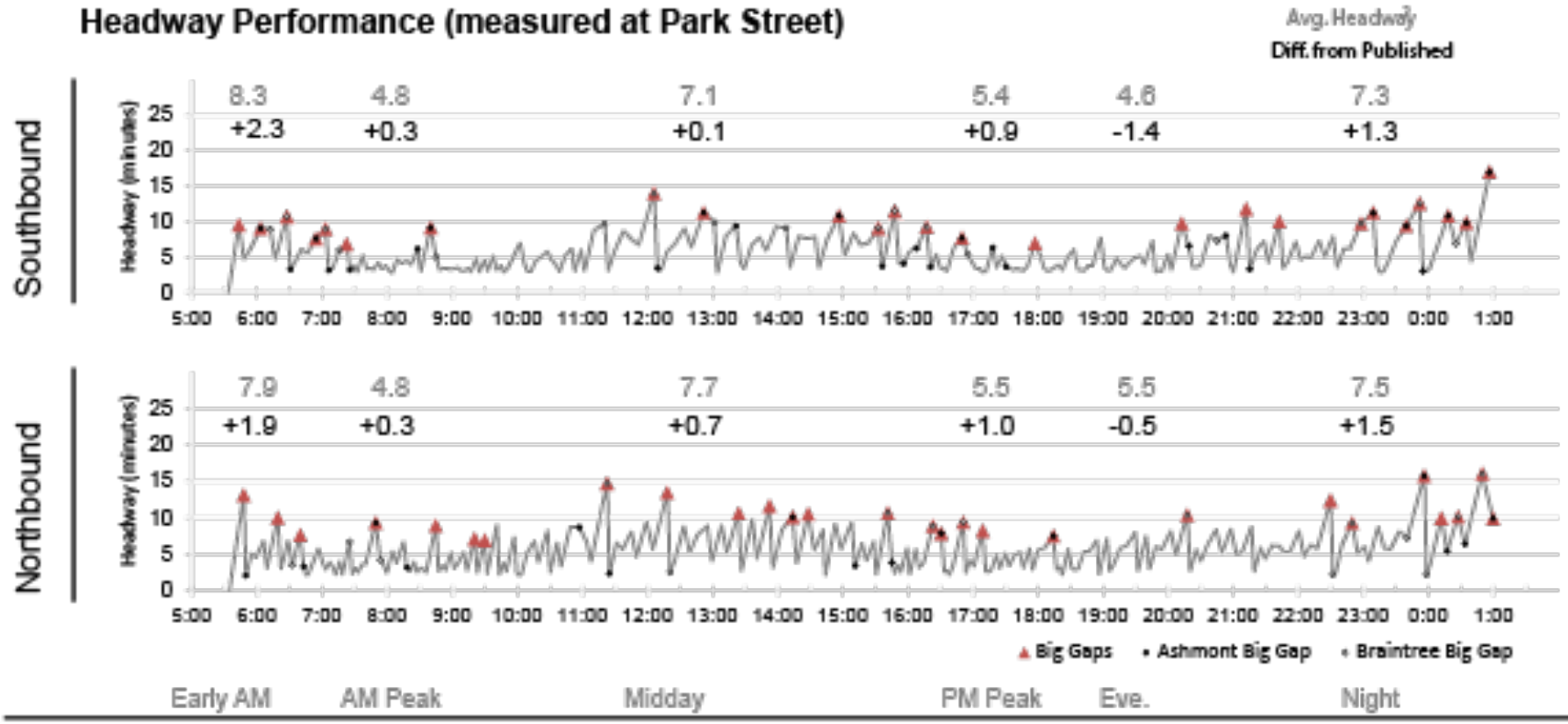

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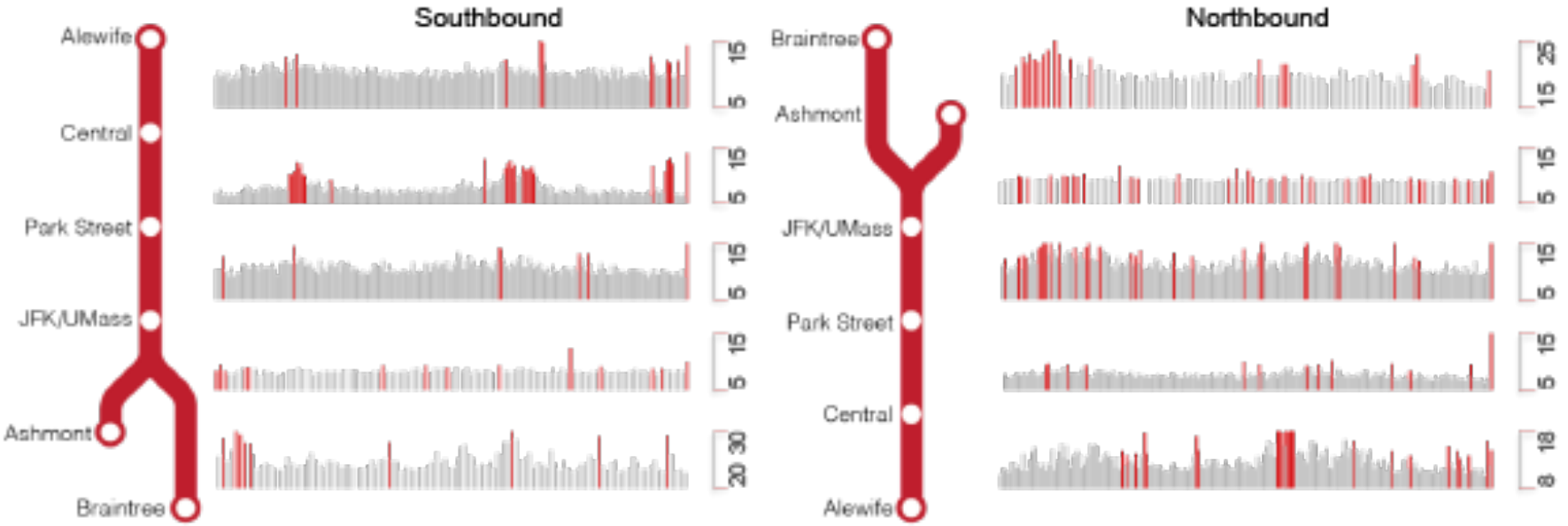

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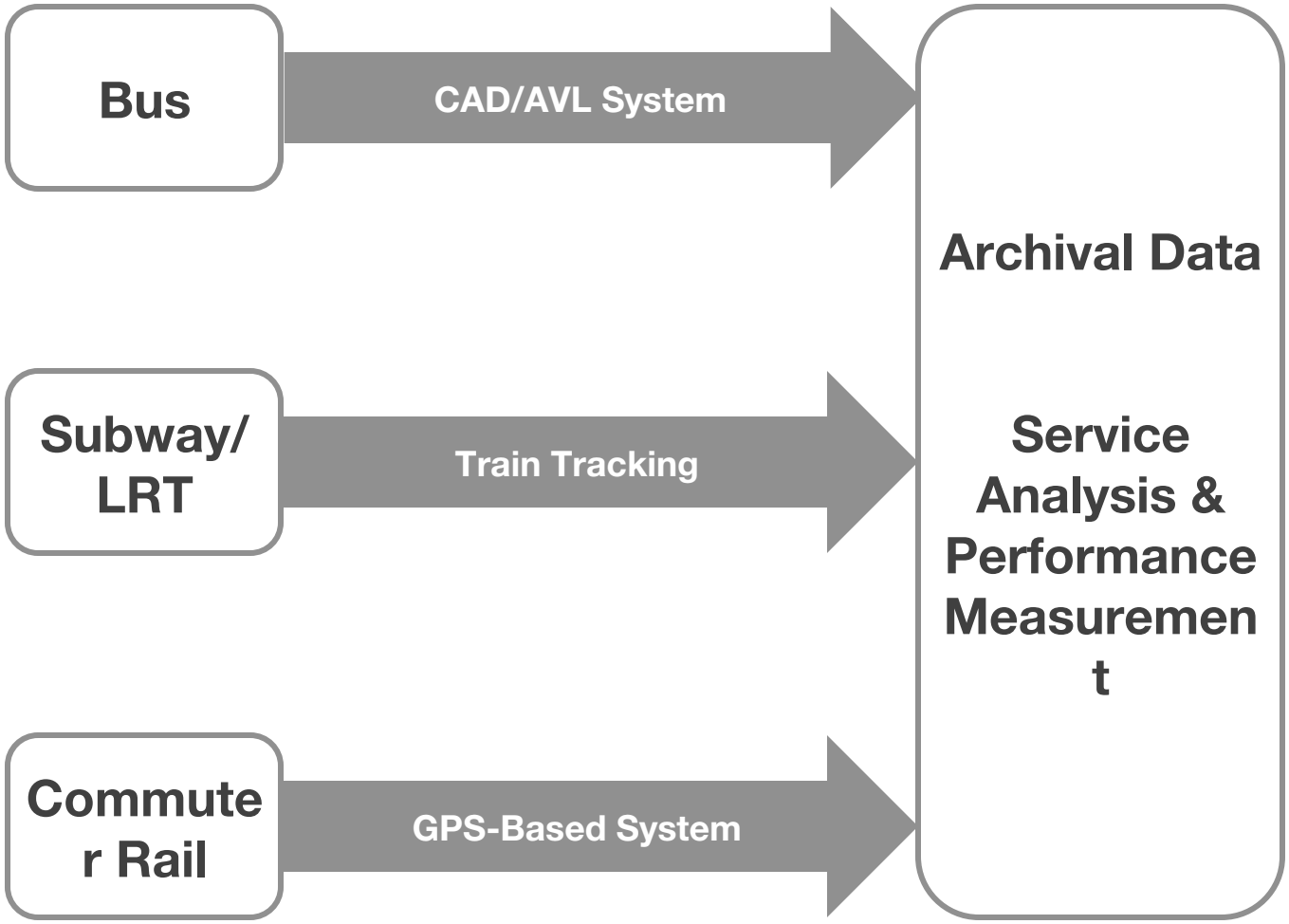
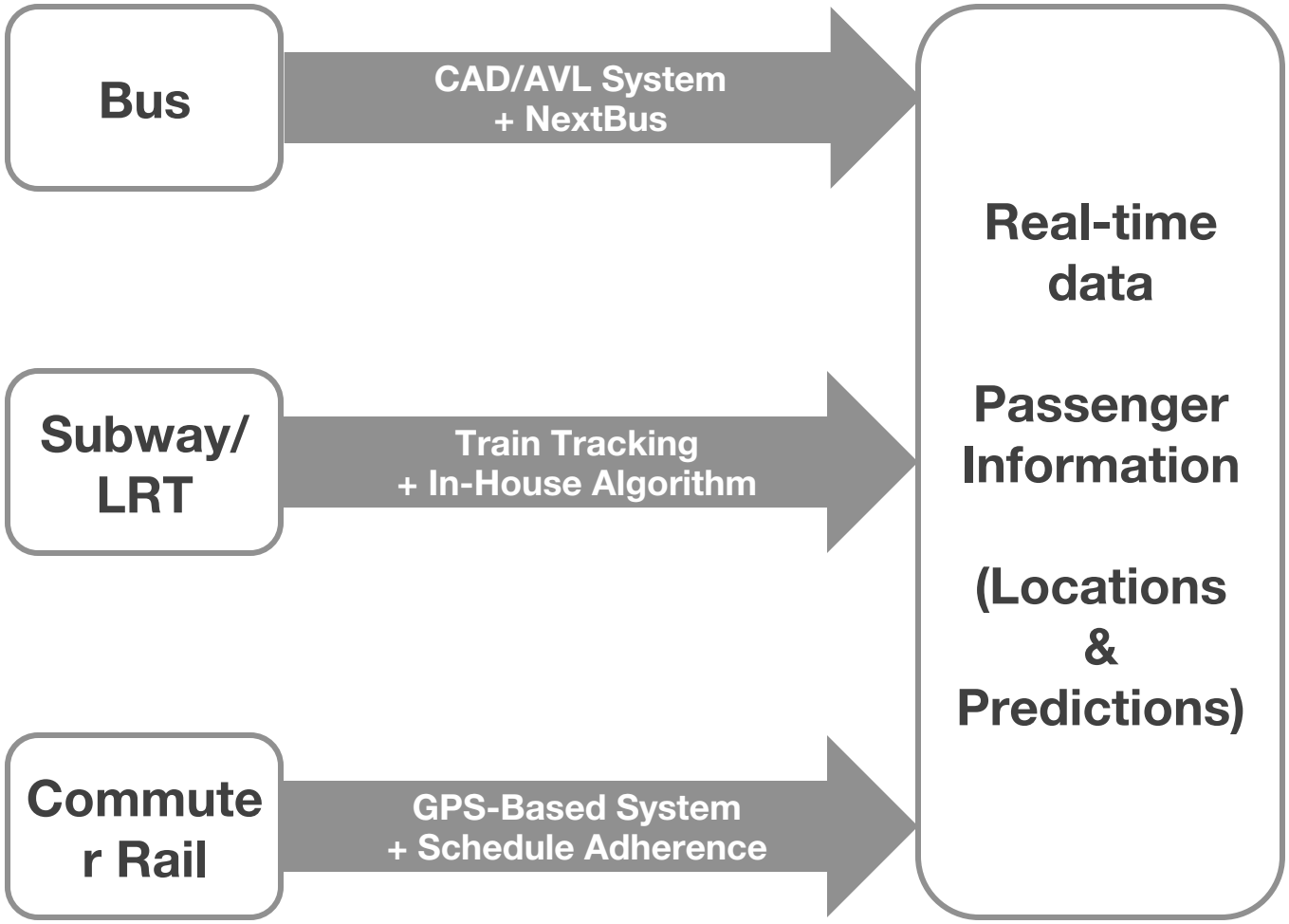
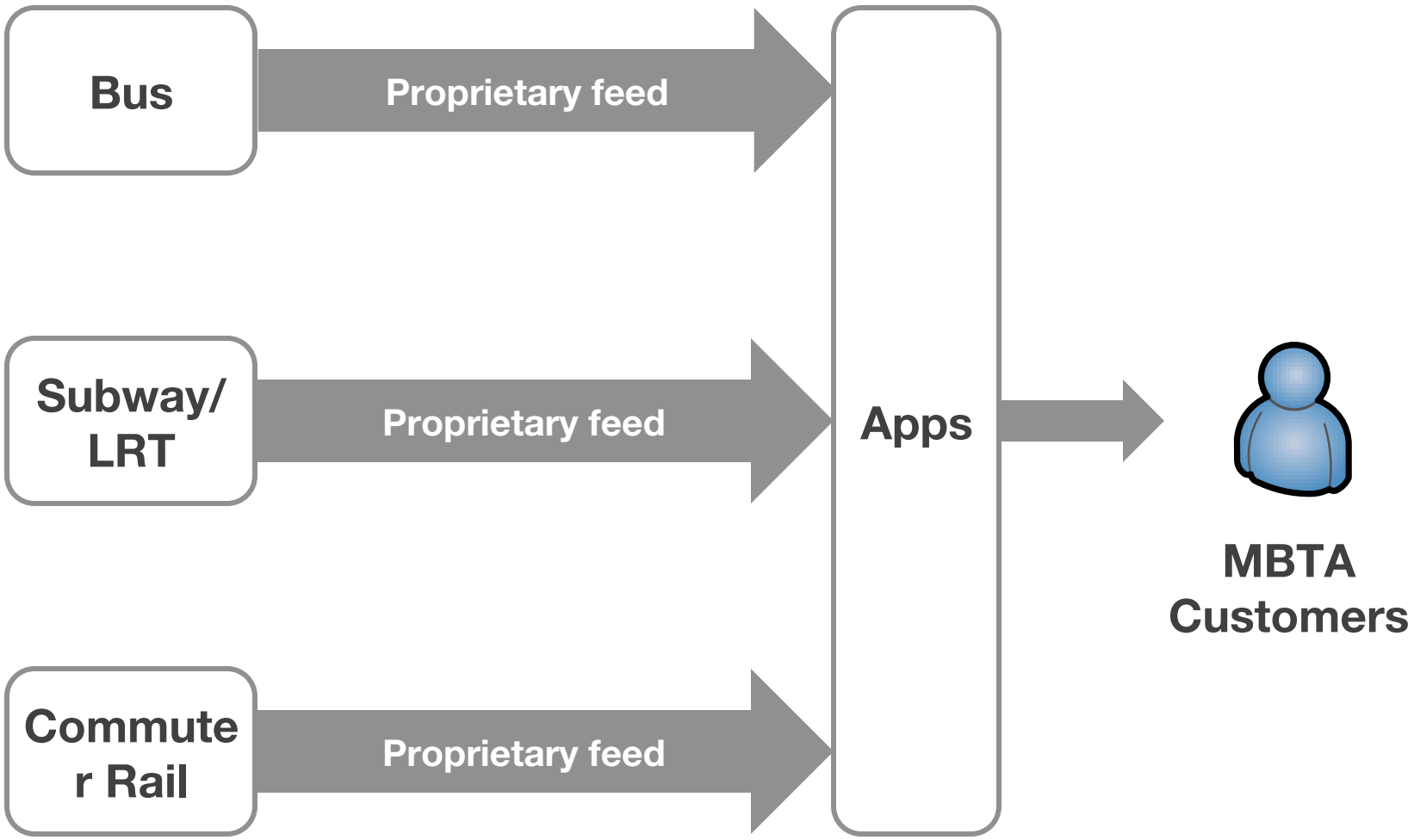
Framework

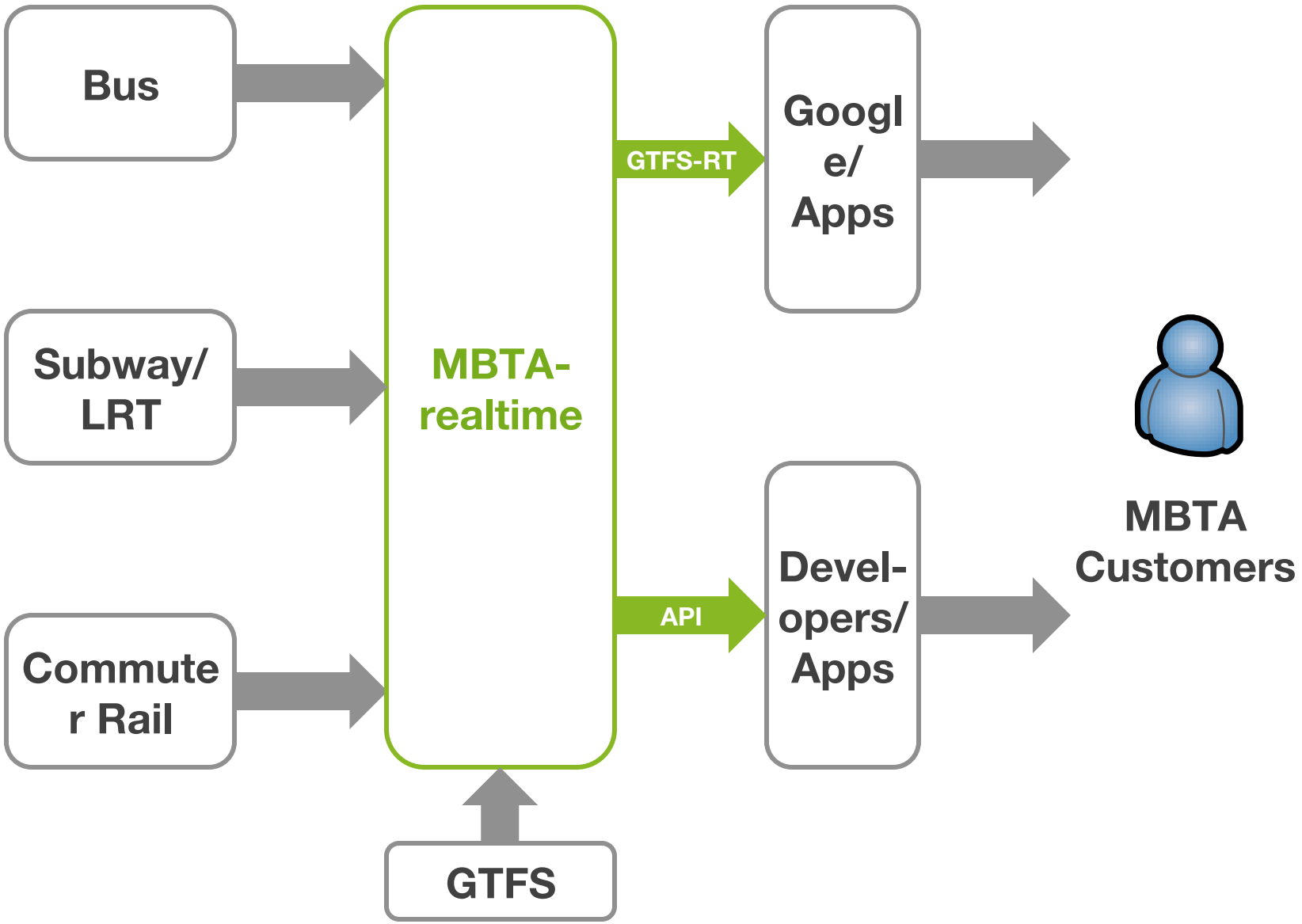
Use real-time data via GTFS-realtime feeds to measure performance:

- **Schedule adherence**
- **Travel times**
- **Headways**
- **Dwell times**
- **Passenger wait times**
- **Passenger travel times**


Bus
CAD/AVL System
Subway/ LRT
Train Tracking
Commute r Rail
GPS-Based System
Archival Data
Service Analysis & Performance Measuremen t


Bus
CAD/AVL System
+ NextBus
Subway/
LRT
Train Tracking
+ In-House Algorithm
Commute
r Rail
GPS-Based System
+ Schedule Adherence
Real-time
data
Passenger
Information
(Locations
&
Predictions)


Bus
Proprietary feed
Subway/
LRT
Proprietary feed
Commute
r Rail
Proprietary feed
Apps
MBTA
Customers


Bus
Subway/
LRT
Commute
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MBTA-
realtime
GTFS
GTFS-RT
API
Googl
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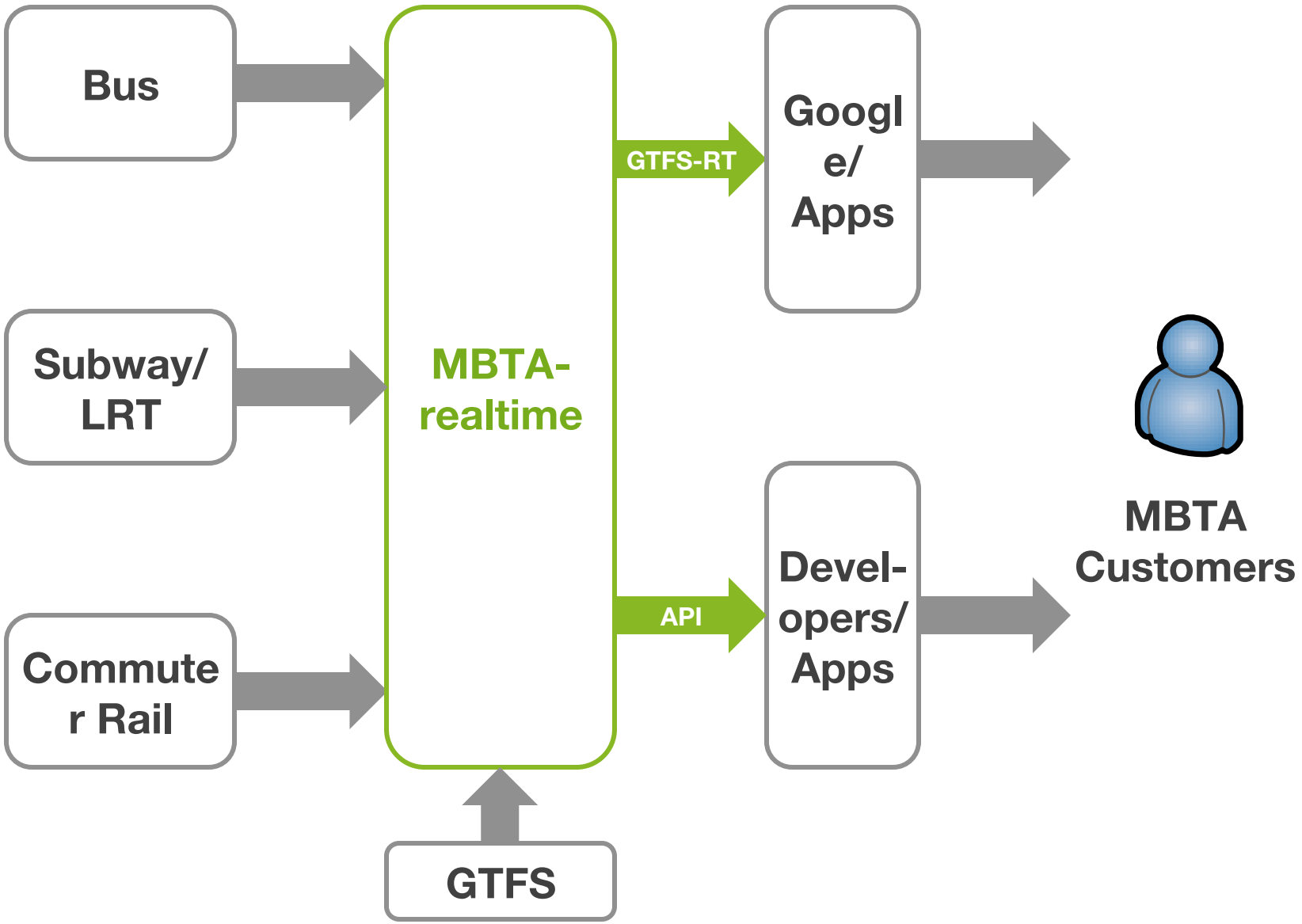
Apps
Devel-
opers/
Apps
MBTA
Customers

Trip Updates (arrival/departure predictions)

Vehicle Positions


Bus
Subway/
LRT
Commute
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realtime
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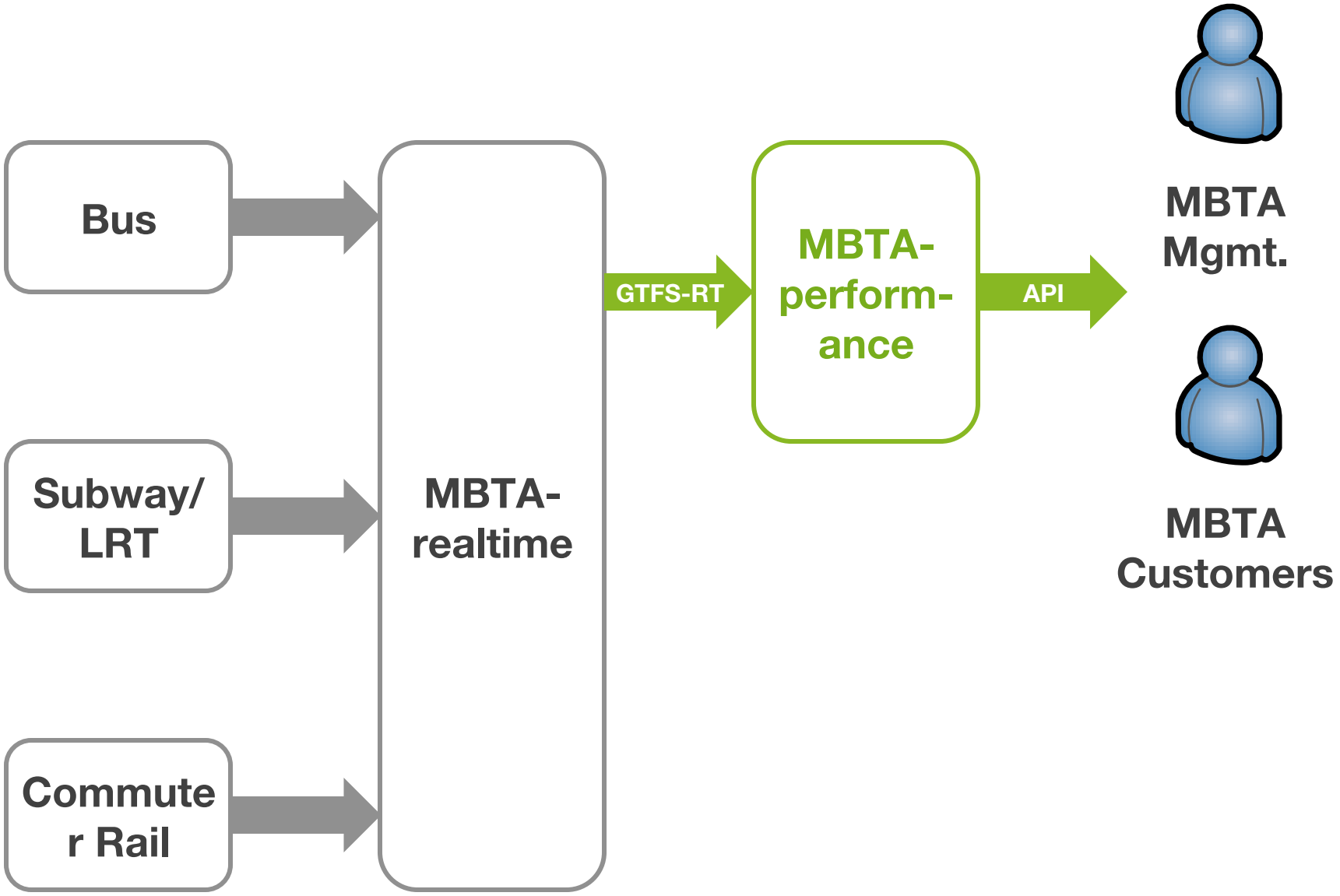
Apps
MBTA
Customers


Bus
Subway/
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perform-
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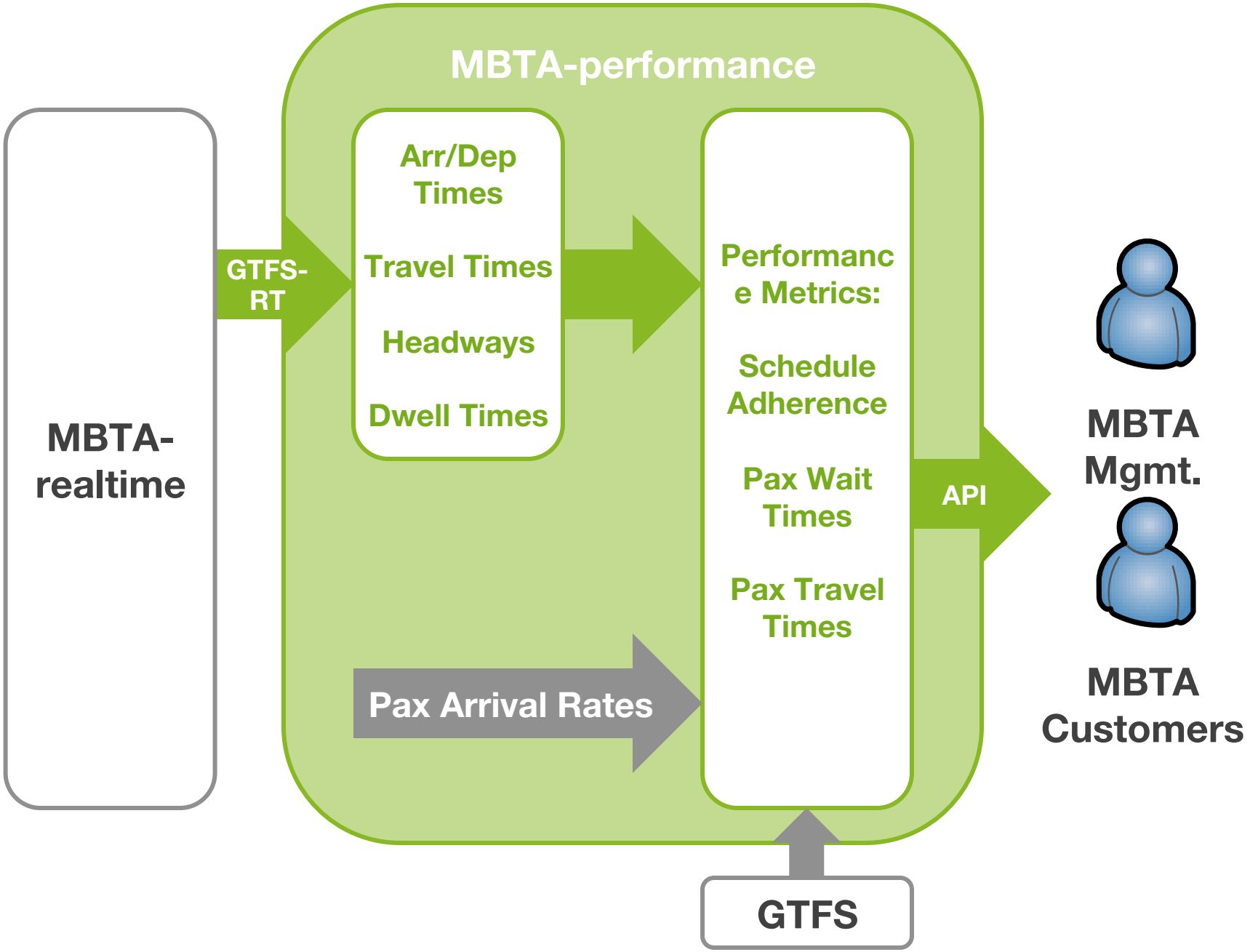
Customers


MBTA-performance
MBTA-realtime
GTFS-RT
Arr/Dep Times
Travel Times
Headways
Dwell Times
Performanc e Metrics:
Schedule Adherence
Pax Wait Times
Pax Travel Times
Pax Arrival Rates
API
GTFS
MBTA Mgmt.
MBTA Customers

Daily Performance **Red Line** Wednesday, 03/26/14

Passsengers Waits

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< Headway	< Big Gap	< 2X Headway
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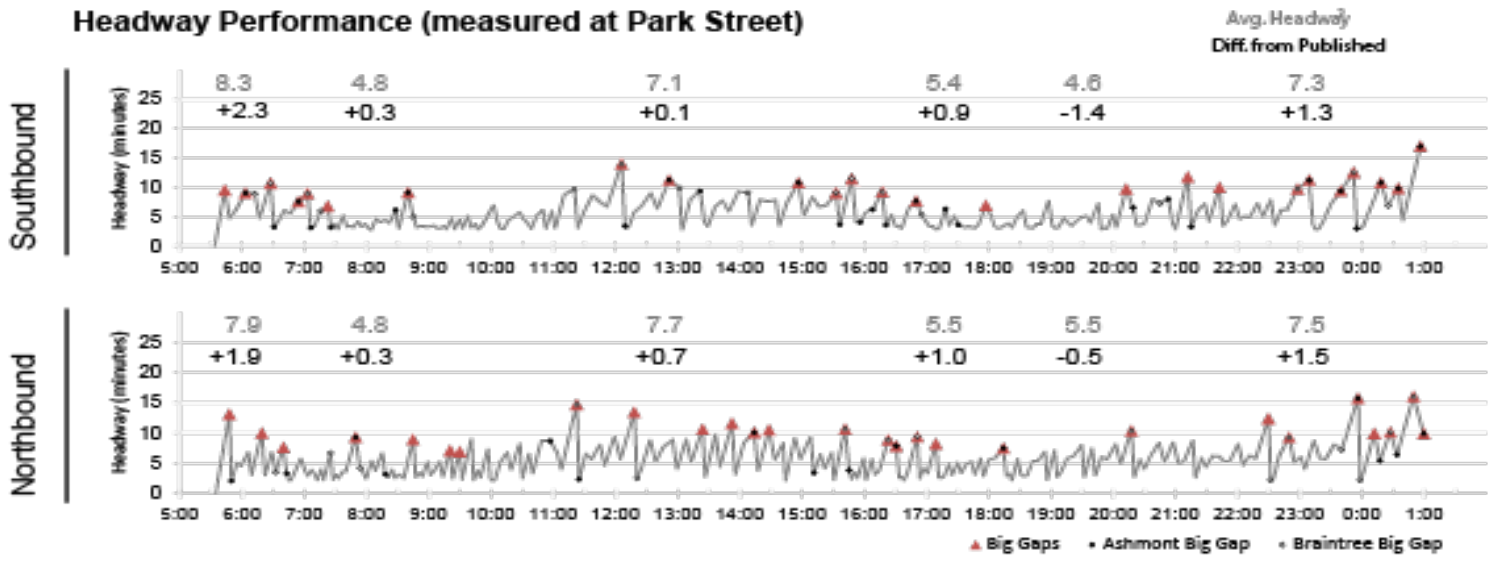
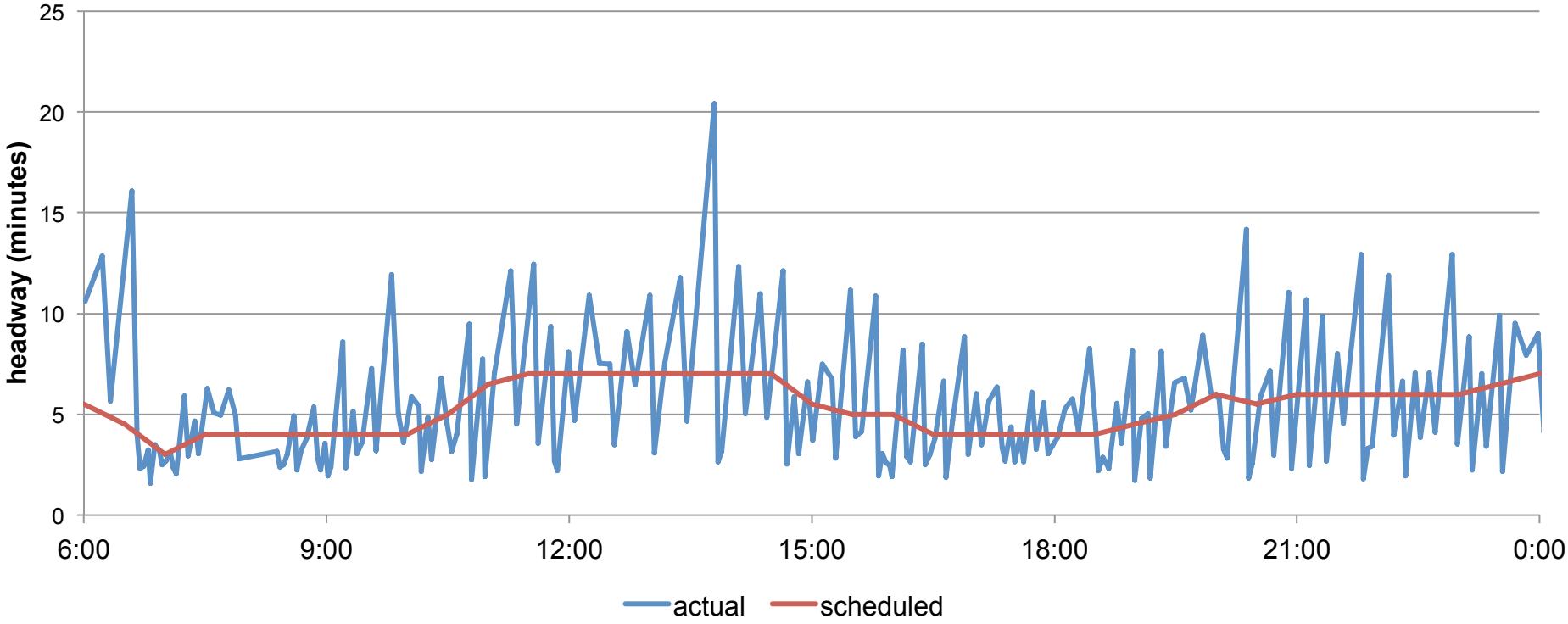
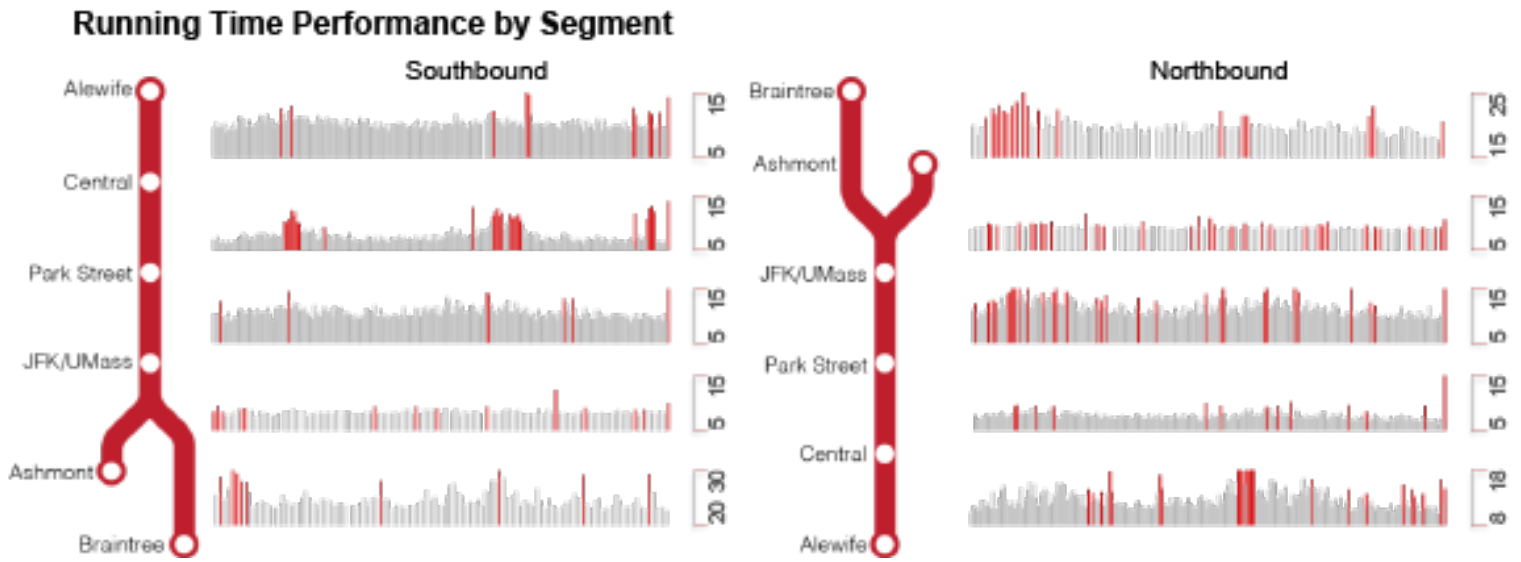
Goal: TBD	Goal: TBD

Date	Headway	Big Gap	2X Headway	delayed < 3 min.	delayed < 6 min.
Monday 06/01/15	88%	95%	98%	96%	100%
Tuesday 06/02/15	88%	95%	98%	96%	99%
Wednesday 06/03/15	87%	94%	98%	96%	100%
Thursday 06/04/15	86%	94%	98%	94%	99%
Friday 06/05/15	89%	95%	98%	99%	100%
Saturday 06/06/15	89%	95%	98%	99%	100%
Sunday 06/07/15	89%	95%	99%	98%	100%

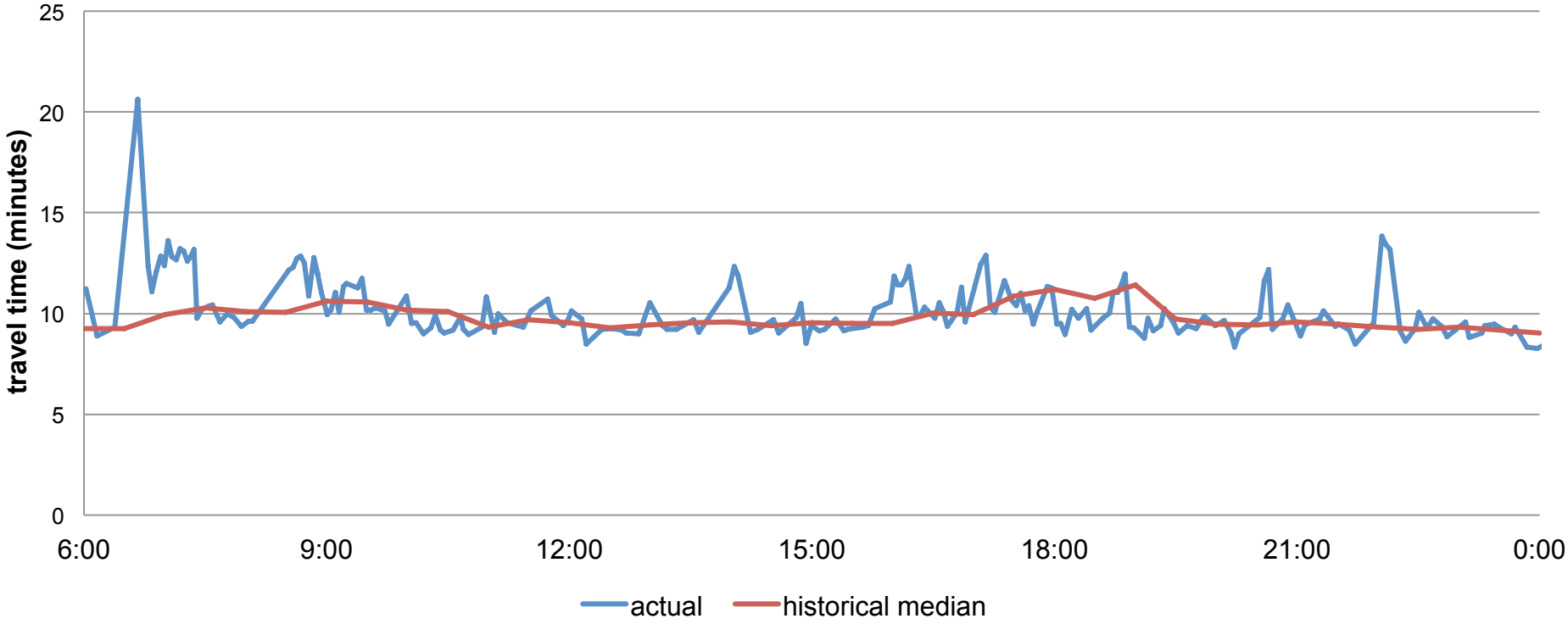


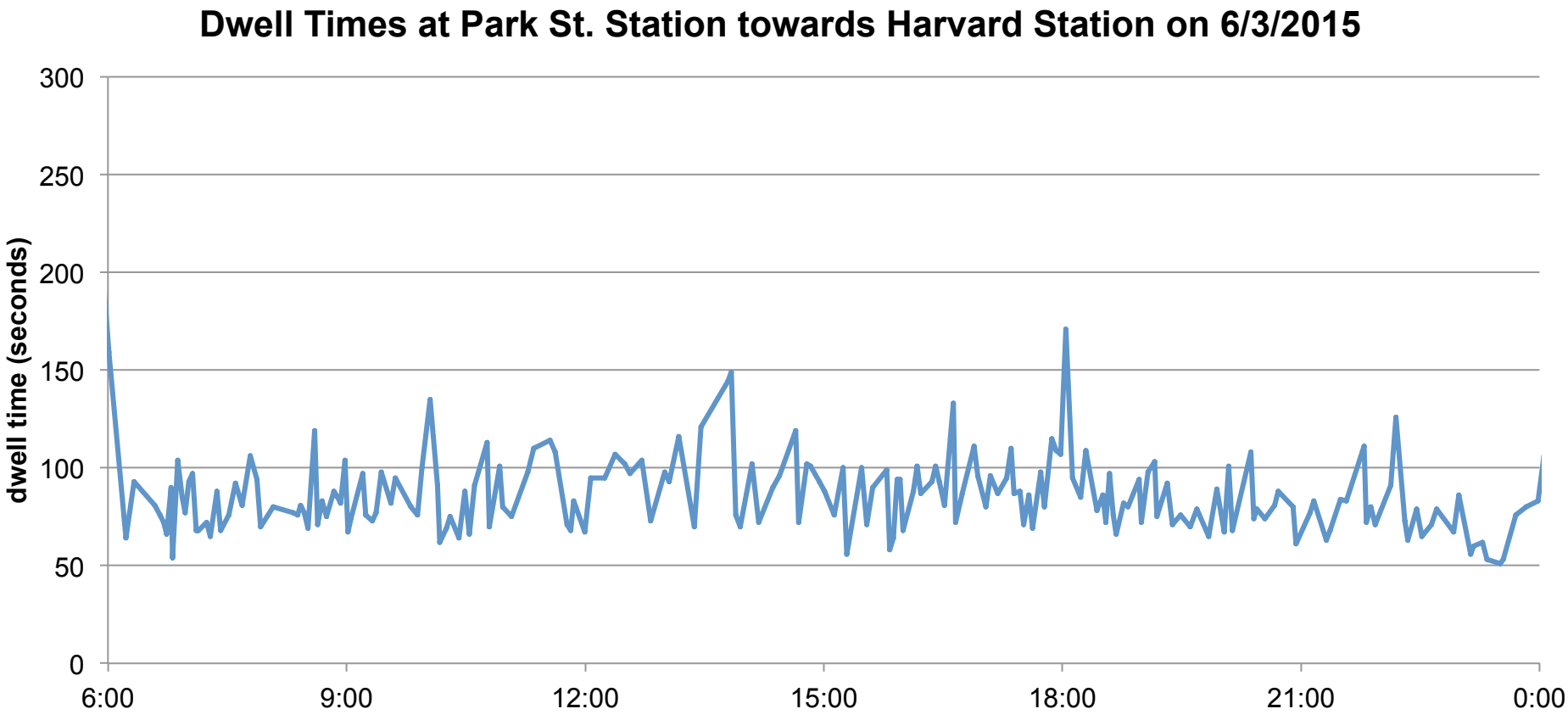
Headways at Park St. Station towards Harvard Station on 6/3/2015





Travel Times from Park St. Station to Harvard Station on 6/3/2015

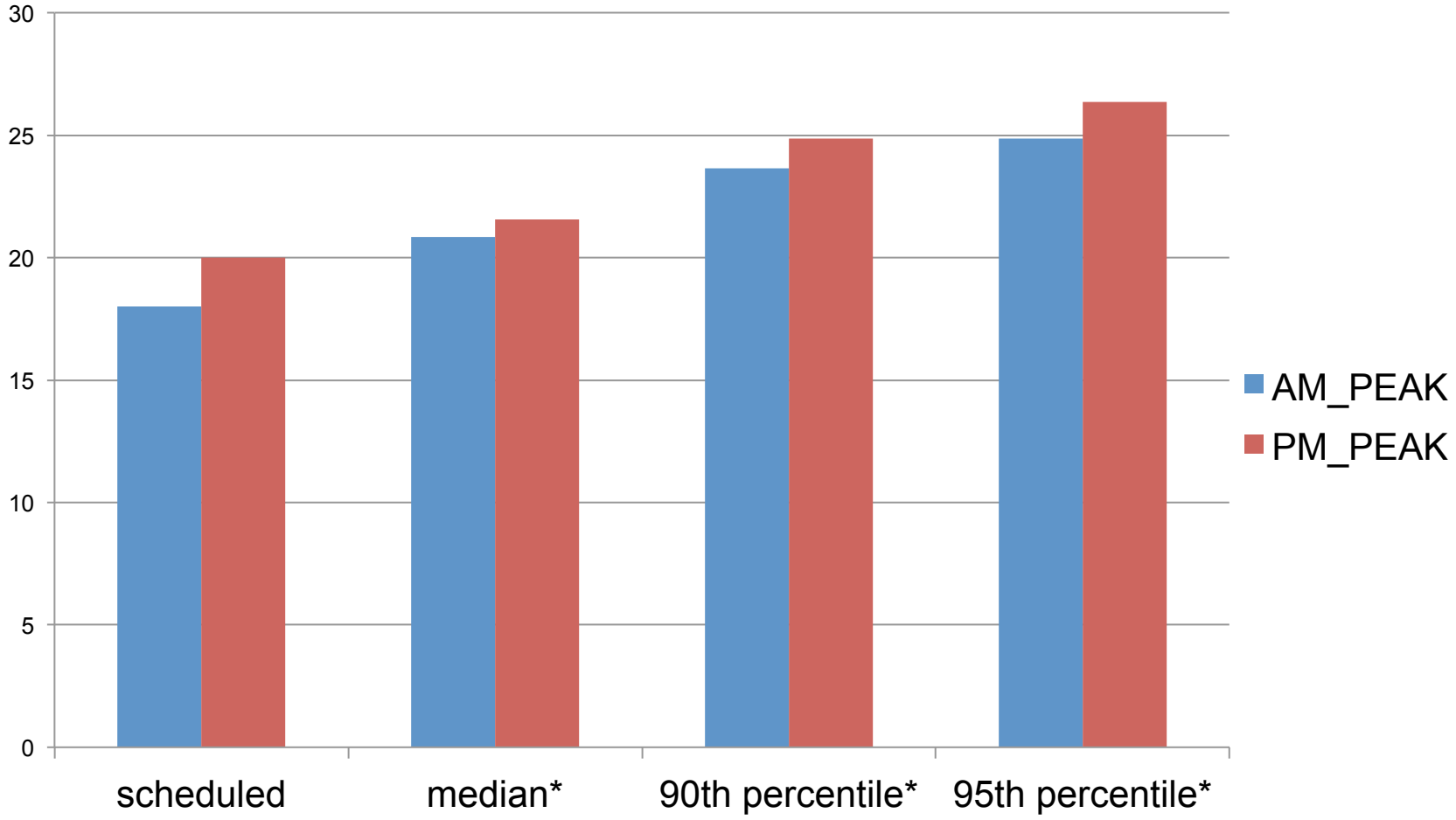



Dwell Times at Park St. Station towards Harvard Station on 6/3/2015
dwell time (seconds)
300
250
200
150
100
50
0
6:00
9:00
12:00
15:00
18:00
21:00
0:00

Monitoring Historical and Real-time Performance

Service Planning and Analysis

Findings: Travel Time for Green Line D-Branch Surface Portion (Longwood to Woodland)



*weekdays between 3/25/2015 and 6/05/2015

Other Uses

Integration with GTFS-realtime alerts feed

Evaluating extent of passenger impact caused by different service issues

Dispatch aid

Extension to any agency with GTFS-realtime feed for performance measurement and comparisons

Based on 100% sample of data collected in real-time

Does not need to be tightly integrated with the source of data

Can be segmented by day, time

Can be segmented by route, direction, stop, etc.

Open-source (in-progress)

Thank You,

Questions?

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