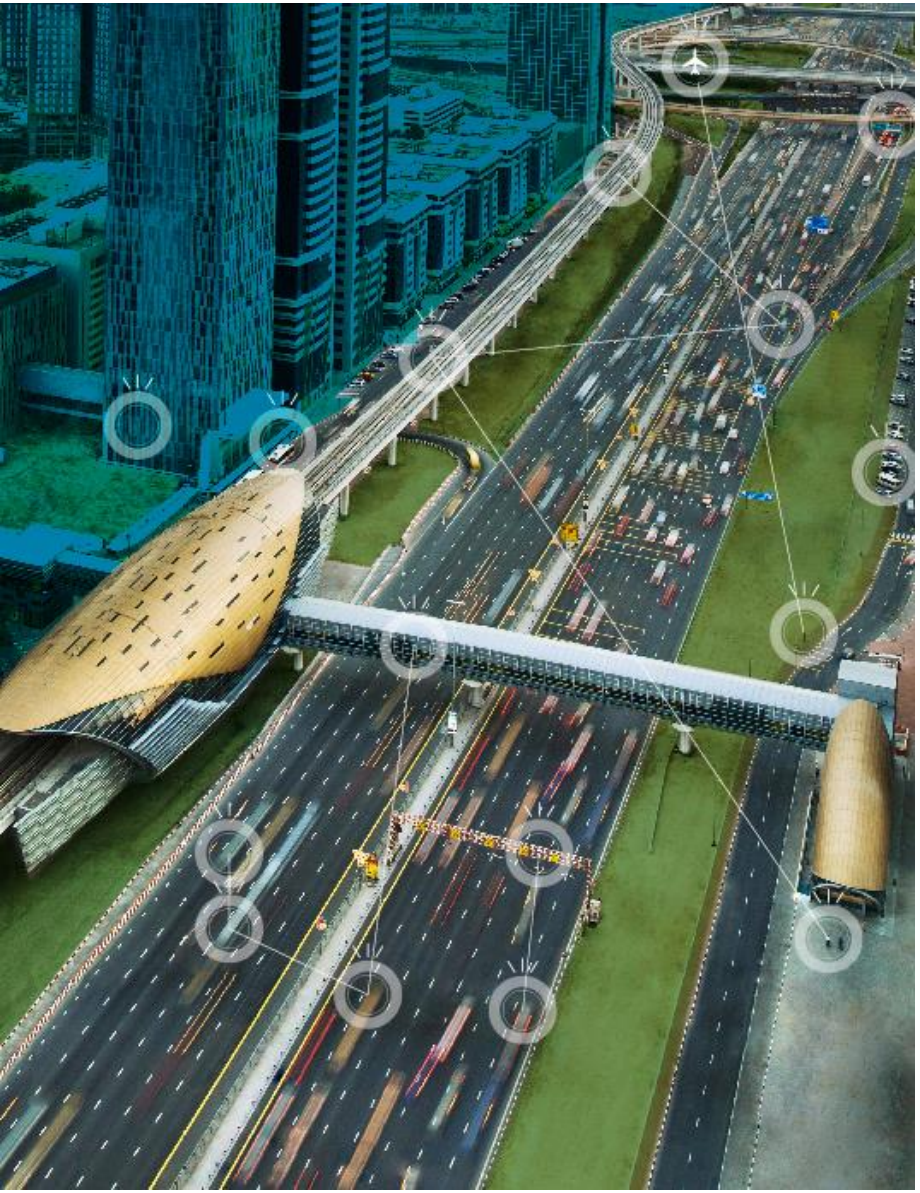

# *APTA Rail 2017 – Integration of Track Circuit and GPS Data*

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June 13, 2017

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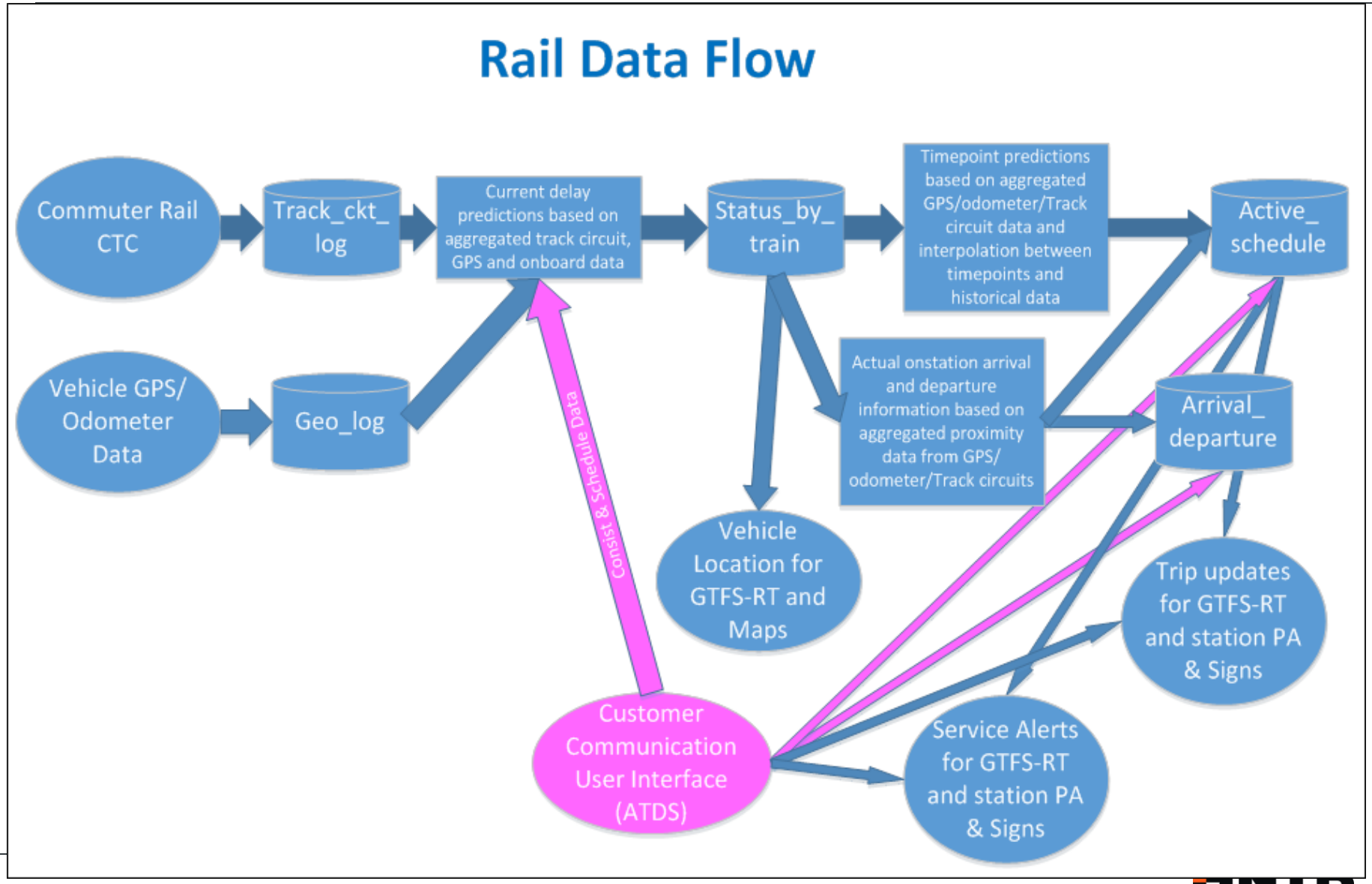
# Rail Uses of Integrated Data

- Improved Train Tracking
  - Fill in dark territories
  - Get location on long track circuits
  - Get speed
  - Improved arrival time estimates
- Accurate OTP Reporting
- Station by station arrival/departure for planning
- Yard Management/Consist management
- Improved PTC and CBTC

# Rail Uses of Integrated Data (Cont.)

- Right of Way Worker Warning
- Customer Communications
  - Improved arrival times
  - Accurate map displays
  - Complete coverage in all areas
  - Event triggering
  - Stopped train information
  - Provide GTFS Real-time for 3rd parties
  - Coordinated 1st/last mile trips

# Rail Data Flow Diagram



# Key Aspects to Integrating Data

- Having the right consist information is key to matching the train ID to the vehicle IDs
- Need to geocode the track circuit junctions by direction
- Can enhance with wheel turns and inertial data
- Kalman filter algorithm or other approach that allows weighting of data by accuracy
- Feeding data back to operating systems:
  - Update delay estimates
  - Update arrival and departure events

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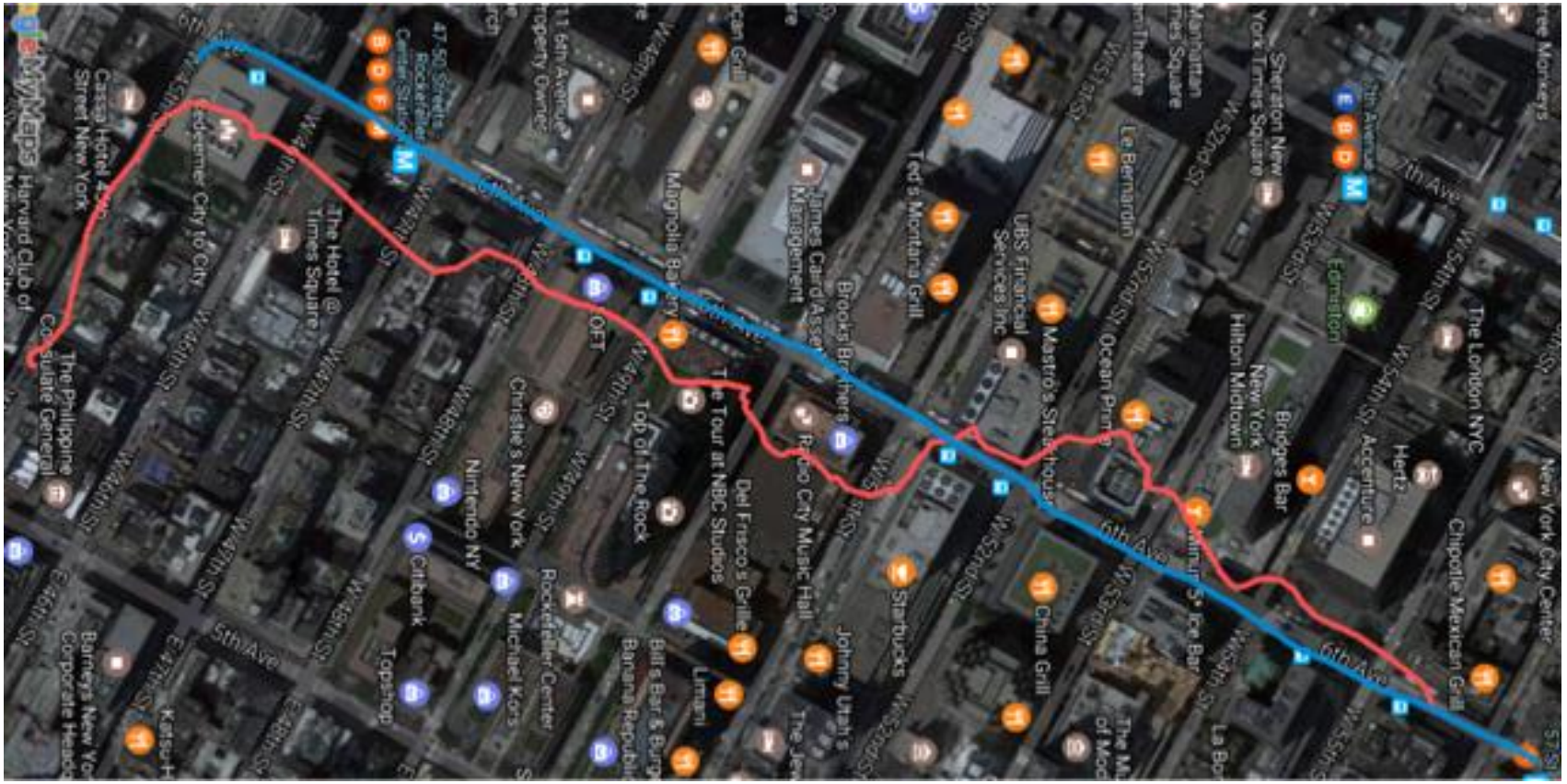
# Modifications to Train Control System

- Match train ID to GPS data based on consists
- Display changes
  - Web-based geo-display
  - Show train moving in track circuit
  - Indicate when train stopped
- Modify delay estimates and arrival estimates
- Modify reporting

# GPS Is Not Enough

- GPS is not available/accurate in
  - Tunnels
  - Cities
  - Mountainous areas
  - Inside stations/maintenance facilities
- Enhanced GPS with dead reckoning and inertial navigation still falls short
- GPS is not accurate enough to identify track
- GPS not accurate enough to build consists

# Ultra-wideband is the solution!




GPS

Ultra-wideband

# Ultra-wideband Benefits

- Provides 5-10 centimeter accuracies to location data
- Can build consists in the yard
- Can locate in tunnels and in city areas with poor GPS accuracy
- Very easy to install
- No FCC license required

# Ultra-wideband Deployment

- Small low-power unlicensed device
  - Can be integrated with lighting or solar powered (2W power)
  - No interference or FCC licensing
  - Rapid installation
- 50m-100m transponder spacing in right of way
- Chipset can be integrated into existing telematics devices
- Already integrated with top DSRC Vendors

# Questions?

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