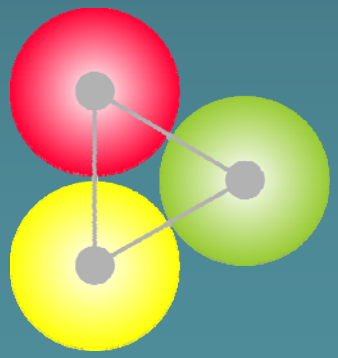
V2I With Less *I*

A Public-Private Partnership

David W. Etherington



Connected Signals

See the light.

Achieving V2I *Now*

A Public–Private Partnership

- Rapid deployment
- Negligible costs
- Keep public data *public*
- Maximize public benefit
- Maintain agency control

Safety

250,000 red-light accidents; 40% with injuries

- V2I can address 25% of all red-light crashes [US FHWA]
- Reduce red-light arrivals and incursions
- Red light incursion warnings
- Alert drivers before lights turn green

Safety is our overriding objective.

Fuel and emissions savings

2*T* urban vehicle miles; 80B gallons/year

- OEMs and national labs estimate 7-15%+ savings
- Increase arrival at green/green wave
- Encourage reasonable deceleration to red lights
- Save gas *and* improve traffic flow

Autonomy

- Vision isn't enough for signals [Google]
  - Obscured signals
  - Cluttered images
- Predictions inform efficient/safe approach speeds
  - Green wave
  - Deceleration to will-be-red signals

How Do We *Know* Traffic Signal V2I Helps?

Six month on-road study in San José

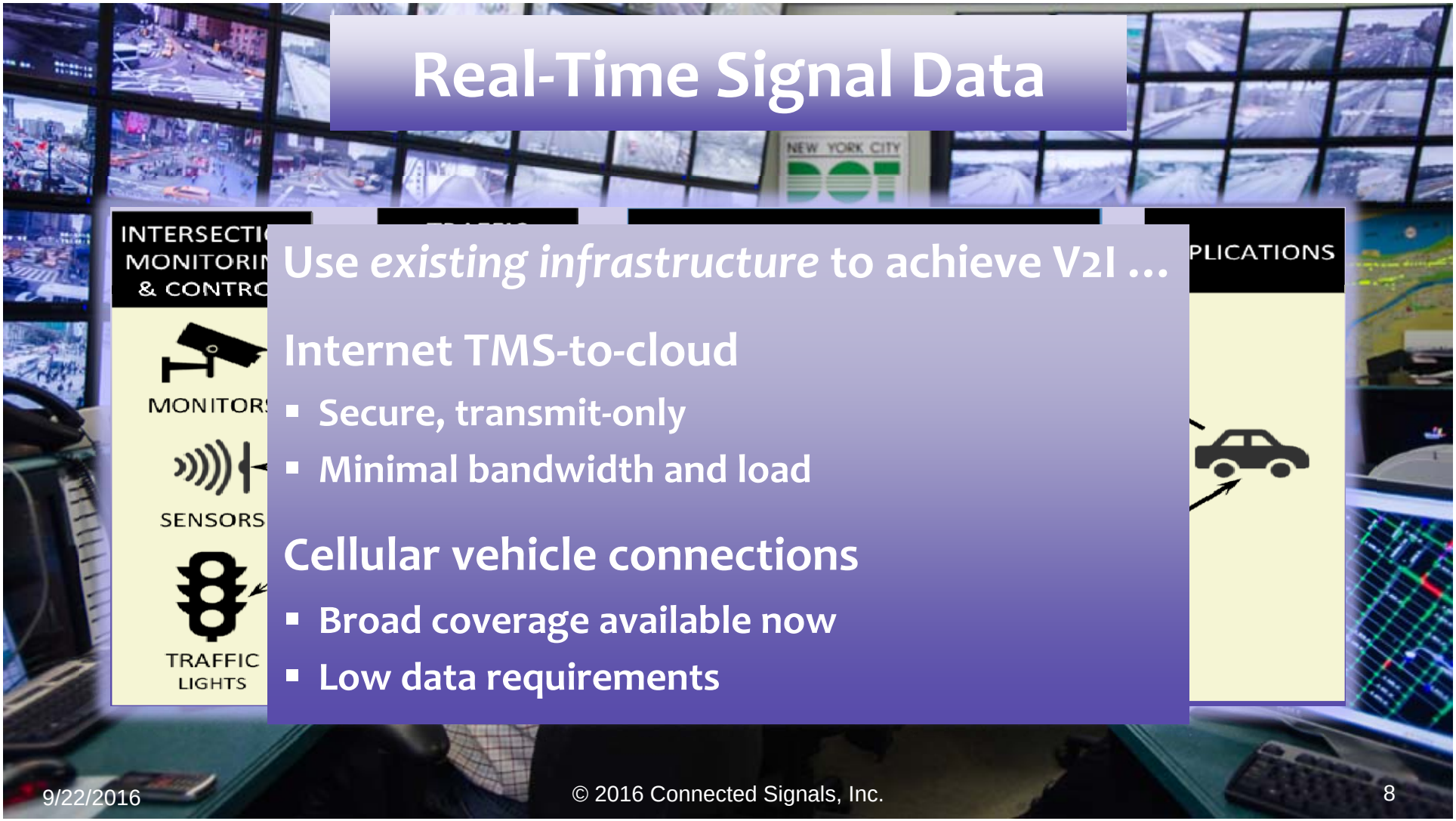
- 400 drivers with live signal information
- Position, speed, fuel flow, acceleration
- Anonymized longitudinal data collection
- Statistically significant sample size

Expected Results

Fuel, safety, and emissions impacts

- Driver behavior approaching lights
- Arrivals at red lights
- Sudden deceleration behavior
- Wait times at red lights

Real-Time Signal Data



Use *existing infrastructure* to achieve V2I …

Internet TMS-to-cloud

- Secure, transmit-only
- Minimal bandwidth and load

Cellular vehicle connections

- Broad coverage available now
- Low data requirements

V2I*f*

Dedicated Signal-Capture Device

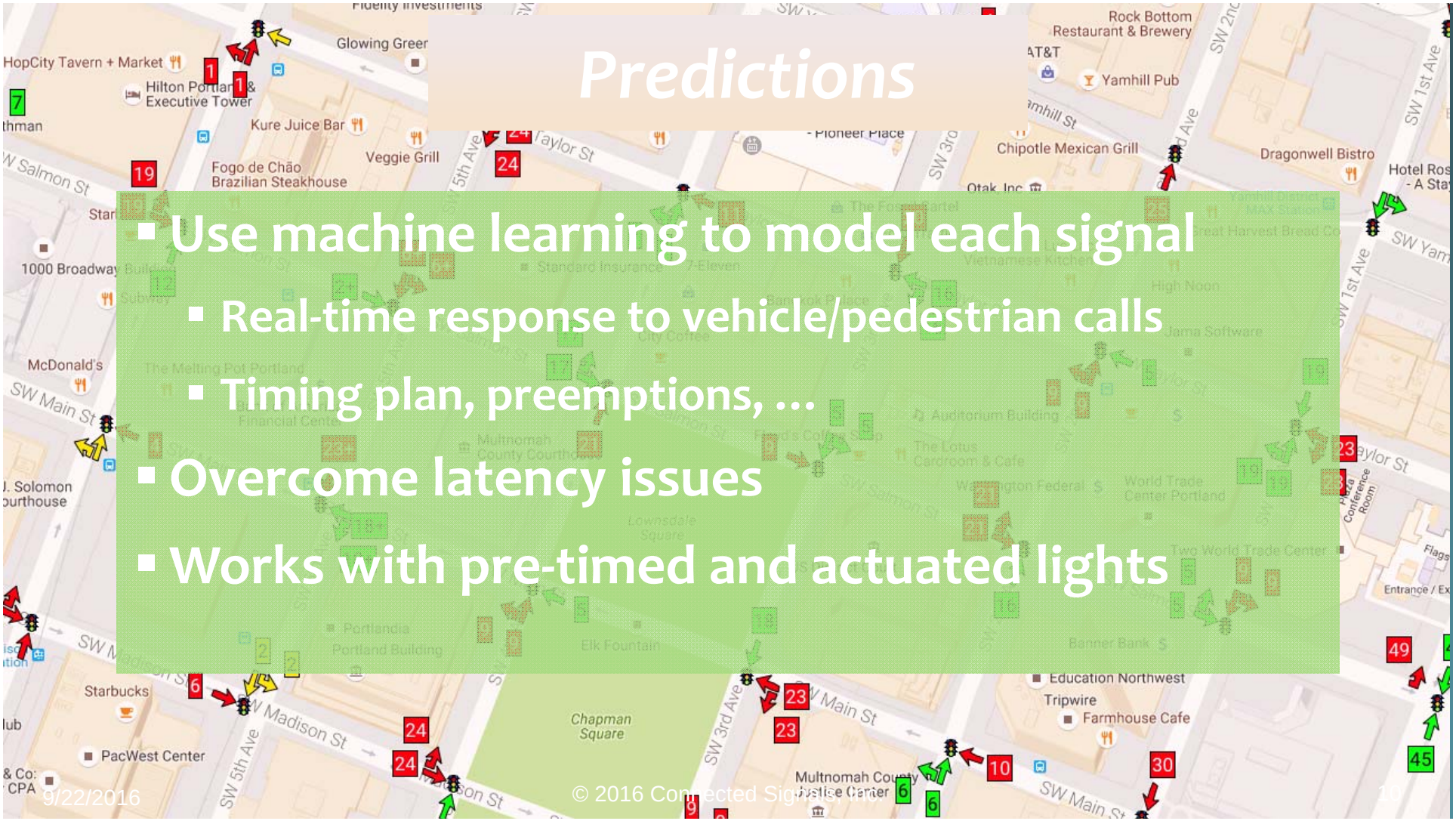
Simple

- No software to install, no system load
- Supports a wide range of traffic systems
- Minimal maintenance requirements

Secure

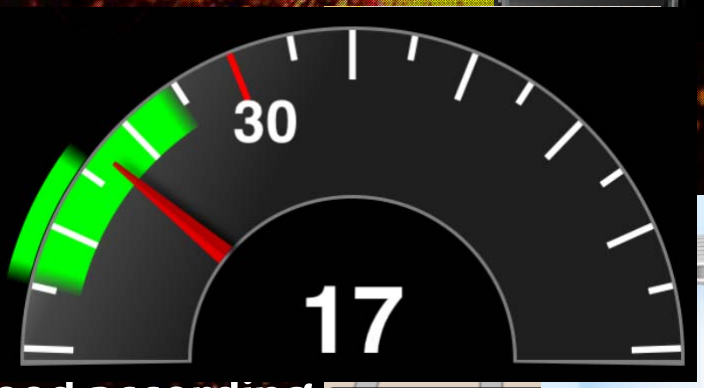
- 1-way: connectionless UDP protocol
- No new packets on your network
- Cryptographically signed

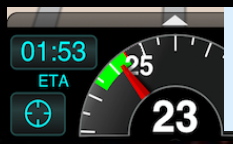
https://www.ConnectedSignals.com/V2If.php

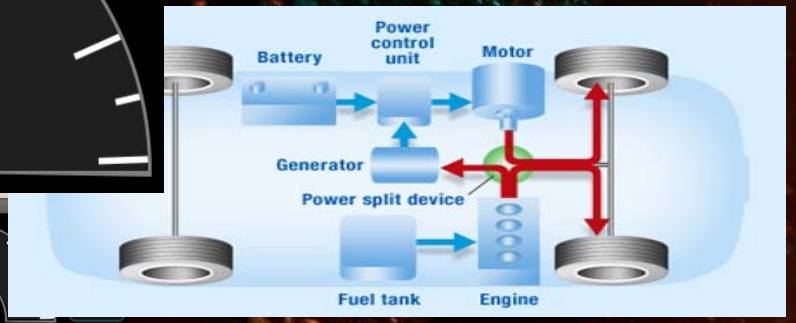


Signal-Aware Applications

- Improve compliance/safety
  - Green arc: don't speed up
  - Speeding turns display red
- Improve traffic flow: keep vel
- Signal-awa
  - Shorten t
  - Reduce id
- Signal-awa
  - Stop eng
  - Adjust speed according
  - 8–15% fuel savings







Benefits for Cities

- Achieve V2I, leveraging existing technology investment
  - No per-light/per-vehicle costs
  - Downstream provisioning
- Increase safety and reduce driver distraction
- Reduce congestion, fuel consumption, carbon emissions
- Enable future connected-vehicle applications
- Accessible technology demonstrator for ITS infrastructure


Connected
Signals