



U.S. Department of Transportation

A network diagram on the left side of the page. It features a central white circle containing a car icon, connected by white lines to several other nodes. These nodes are also circles, some containing icons for a train, a bus, and another car. The background is a blurred image of a city street with a red car and a building, overlaid with a teal and purple color gradient and a grid of white dots and lines.

CONNECTED VEHICLES 101

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U.S. Department of Transportation (USDOT)

Federal Highway Administration

Intelligent Transportation Systems Joint Program Office

JULY 2018

THE SCALE OF THE PROBLEM IN THE U.S.



SAFETY

- 37,461 highway deaths in 2016
- 6.29 million crashes in 2015
- Leading cause of death for ages 11, 16-24



MOBILITY

- 6.9 billion hours of travel delay
- \$160 billion cost of urban congestion



ENVIRONMENT

- 3.1 billion gallons of wasted fuel
- 56 billion lbs of additional CO₂

Data Sources:

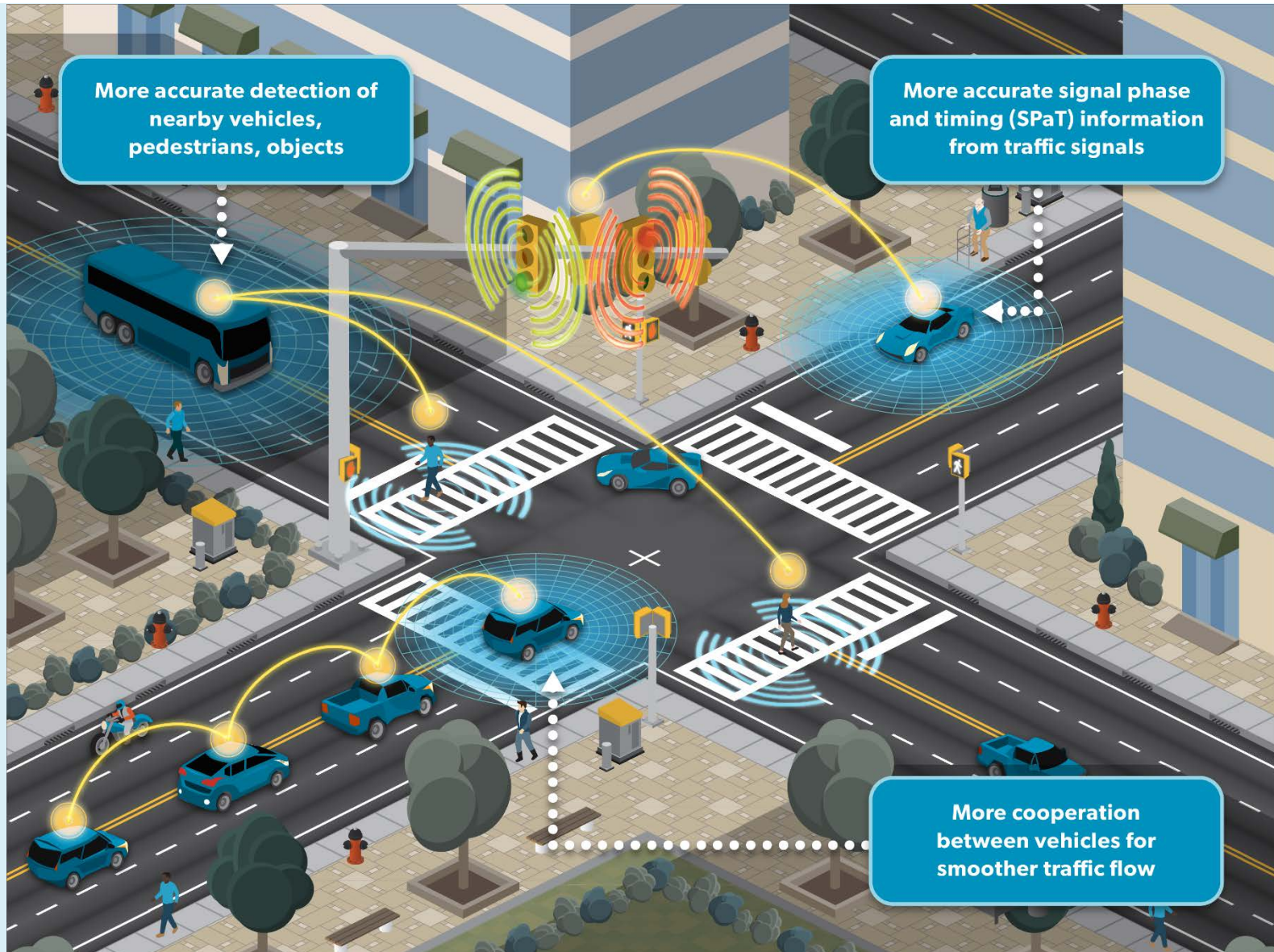
Quick Facts: 2016 Data, National Highway Traffic Safety Administration (October, 2017); 2015 Annual Urban Mobility Report, Texas Transportation Institute (Aug 2015); Centers for Disease Control

WHAT IS CONNECTIVITY?

- **Vehicle-to-vehicle** and **vehicle-to-infrastructure** communications enable the vehicle to exchange data with nearby vehicles and roadside infrastructure
- Different communications technologies (e.g., LTE, DSRC, Satellite) are utilized depending on the performance requirements of the applications



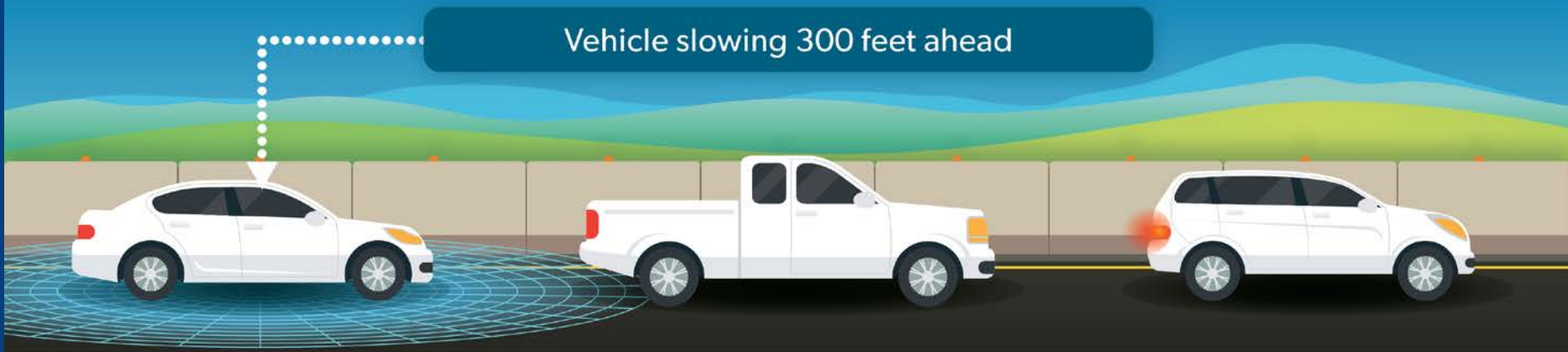
CONNECTIVITY OFFERS POTENTIAL SOLUTIONS



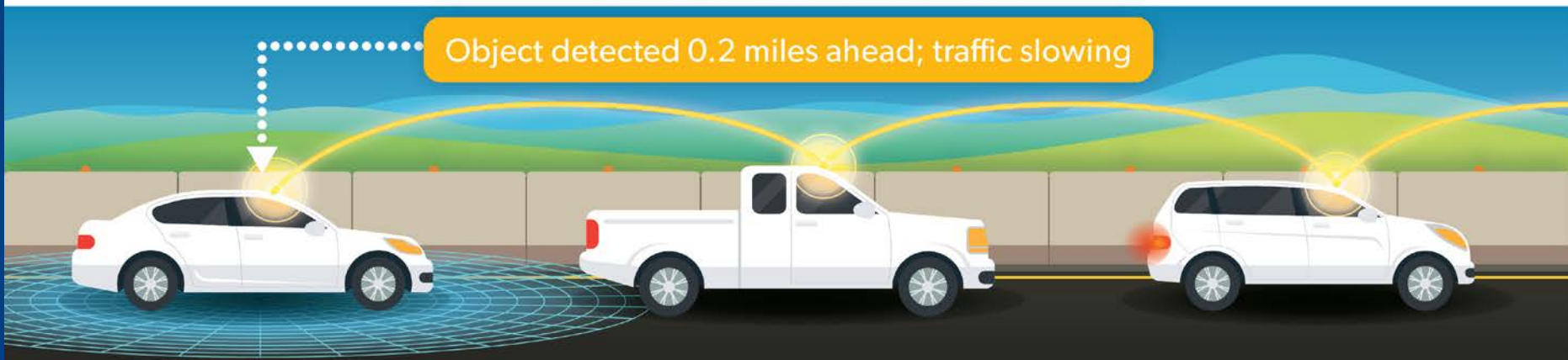
CONNECTIVITY CAN PROVIDE ADDITIONAL DATA

On-board sensors only collect data within their line-of-sight.
Connectivity can extend upon and provide additional information.

Non-Connected Automated Vehicles



Connected Automation



Imagine a Transportation System in which
VEHICLES CAN SENSE
Things That You Can't.





'TALKING' CARS? THEY NEED TO HAPPEN, FEDS SAY



How Connected Vehicles Work

- 1 A wireless device in a car sends basic safety messages 10 times per second
- 2 Other nearby cars and roadside equipment receive the messages
- 3 Drivers get a warning of a potential crash

*Connected vehicles have the potential to reduce non-impaired crash scenarios by **80%****

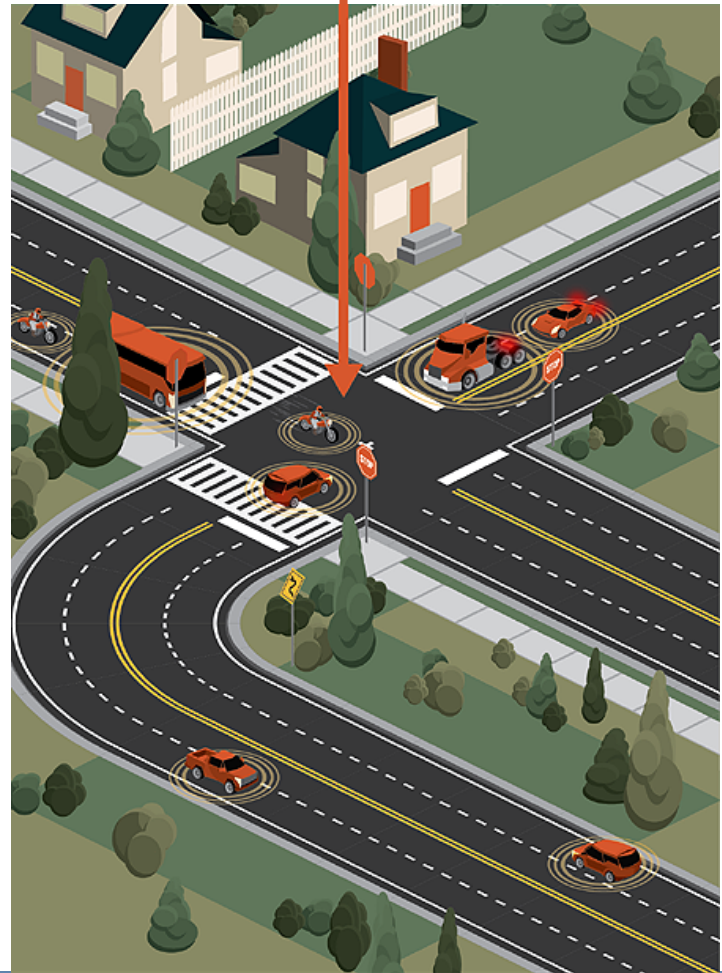
*Source: NHTSA



CONNECTED VEHICLES: SAVING LIVES

INTERSECTION MOVEMENT ASSIST:

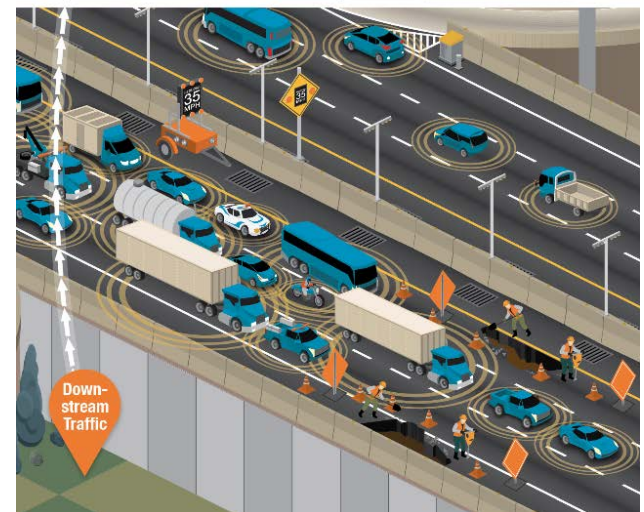
Warns the driver when it is not safe to enter an intersection—for example, when something is blocking the driver's view of opposing or crossing traffic



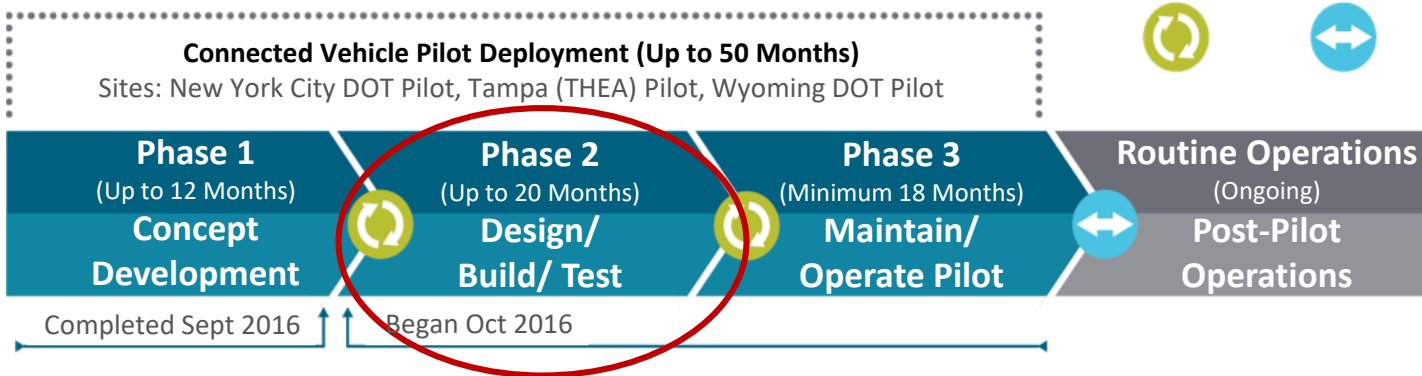
CONNECTED VEHICLES: SAVING LIVES

QUEUE WARNING AND SPEED HARMONIZATION:

Warns drivers of upcoming congestion and provides speed recommendations



CONNECTED VEHICLE PILOT DEPLOYMENT PROGRAM



PILOT SITES



New York City



Wyoming



Tampa (THEA)

CONNECTED VEHICLES ARE ON THE ROAD TODAY



- Reduce the number and severity of adverse weather-related incidents in the I-80 Corridor in order to improve safety and reduce incident-related delays.
- Focused on the needs of commercial vehicle operators in the State of Wyoming.



- Improve safety and mobility of travelers in New York City through connected vehicle technologies.
- Vehicle to vehicle (V2V) technology installed in up to 10,000 vehicles in Midtown Manhattan, and vehicle to infrastructure (V2I) technology installed along high-accident rate arterials in Manhattan and Central Brooklyn



- Alleviate congestion and improve safety during morning commuting hours
- Deploy a variety of connected vehicle technologies on and in the vicinity of reversible express lanes and three major arterials in downtown Tampa to solve the transportation challenges.

WYDOT PILOT DEPLOYMENT OVERVIEW

Wyoming I-80 Corridor – Connected Vehicle Map



Approach:

- Equip fleet vehicles (combination of snow plows, maintenance fleet vehicles, emergency vehicles, and private trucks) that frequently travel the I-80 corridor to transmit basic safety messages (BSMs), collect vehicle and road condition data and provide it remotely to the WYDOT TMCs
- Deploy DSRC roadside equipment (RSE) to supplement existing assets and initiatives
- Road weather data shared with freight carriers who will transmit to their trucks using existing in-vehicle systems

WYDOT Pilot Deployment Vision

Traffic Management Center



Road Condition Reports

BLACK ICE!



High Wind Warning Lifted

Zero Trucks Blown Over

Open to Light, High Profile Vehicles



- 400 Equipped Trucks:
- 100 WYDOT Fleet
- 150-200 Integrated Commercial Trucks
- 20-30 Retrofit Vehicles
- 100-150 Basic Vehicles

Interstate 80



122 VSL Signs

Low Visibility / VSL

Low Visibility Zone Ahead



75 RSU

Roadside Equipment (RSE)



Available Truck Parking



Truck Parking Notification

Truck Parking Available

Low Visibility Zone Ahead



402 Miles of I-80

On-site Meteorology



55 Parking Locations

NYCDOT PILOT DEPLOYMENT OVERVIEW

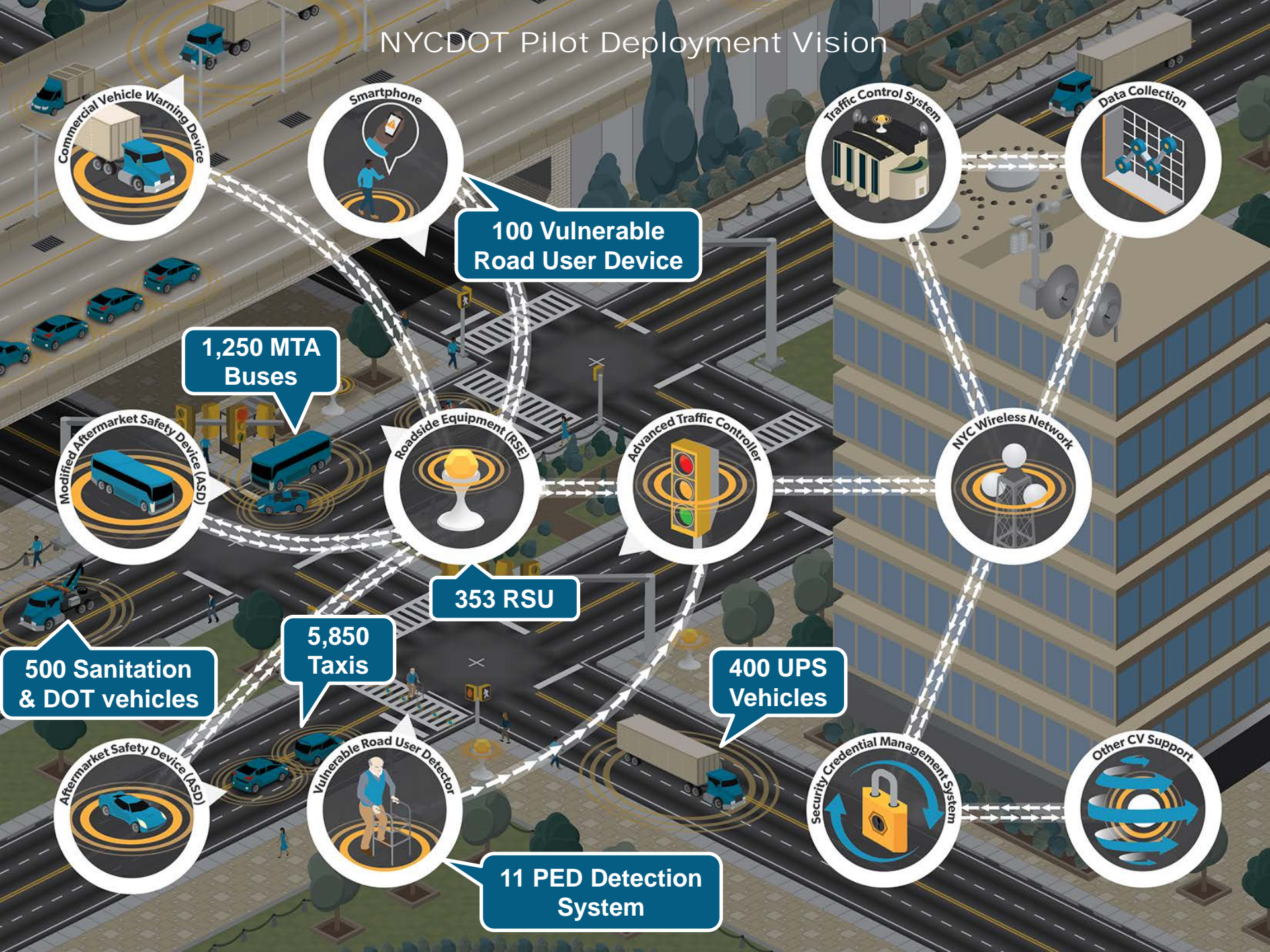
New York City Department of Transportation – Connected Vehicle Map



Approach:

- Equip up to 8,000 vehicles (taxis, buses, commercial fleet delivery trucks, and City-owned vehicles) that frequently travel in Midtown Manhattan and Central Brooklyn to transmit and receive connected vehicle data
- Install V2I technology at high-accident rate arterials:
 - Upgrade 310 traffic signals along 1st, 2nd, 5th, and 6th Avenues in Manhattan and Flatbush Avenue in Central Brooklyn (emergency evacuation route)
 - Deploy Roadside equipment (RSE) along FDR Drive

NYCDOT Pilot Deployment Vision



TAMPA (THEA) PILOT DEPLOYMENT OVERVIEW



Tampa Hillsborough Expressway Authority – Connected Vehicle Map

LEGEND: Connected Vehicle Application

V2I Safety

- Curve Speed Warning
- Pedestrian in Signalized Crosswalk
- Mobile Accessible Pedestrian Signal (PED-SIG)

V2V Safety

- Emergency Electronic Brake Light
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Vehicle Turning in Front of Bus

Mobility

- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (Transit)

Agency Data

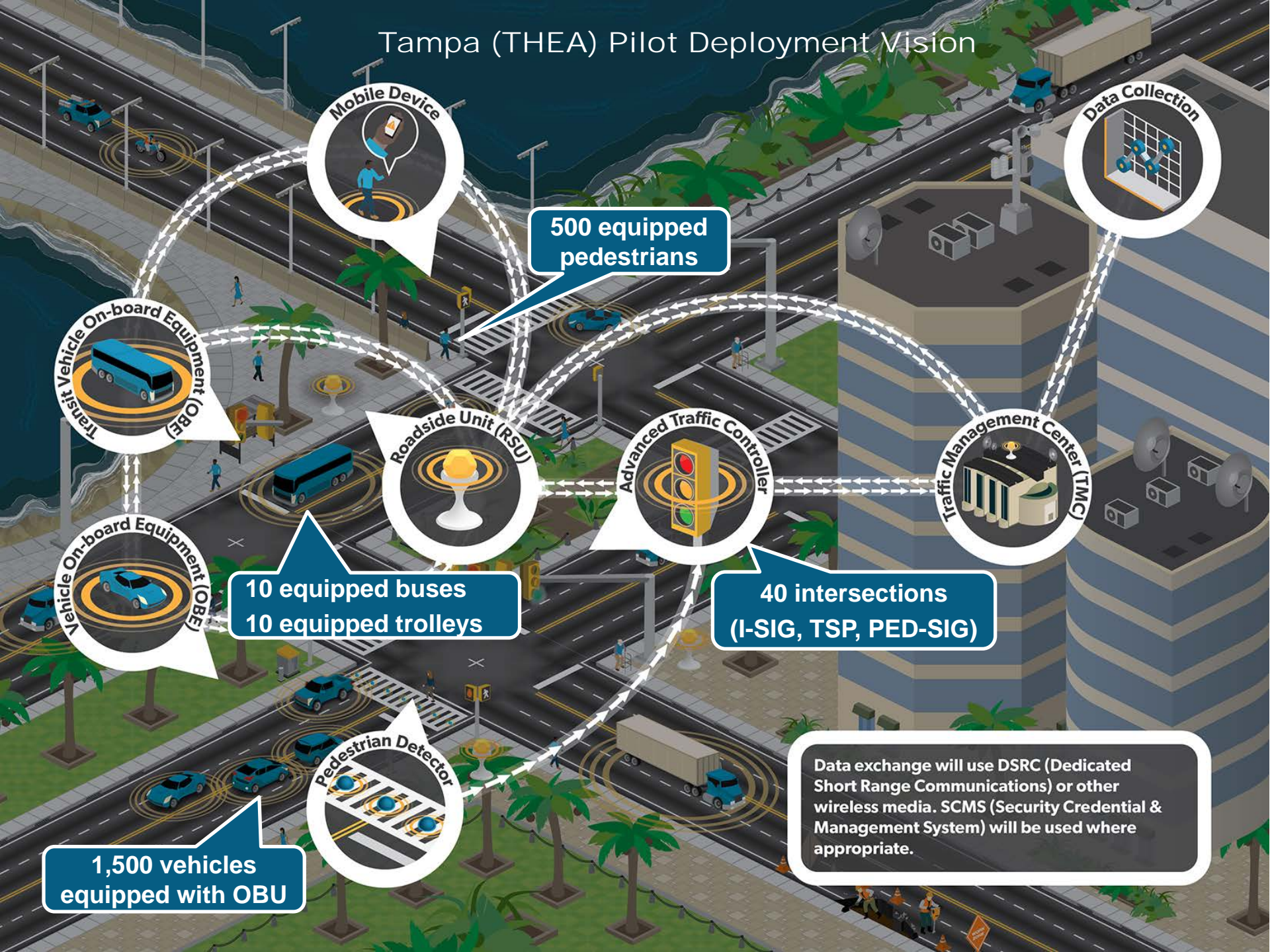
- Probe-enabled Traffic Monitoring

*** update the map and apps**

Approach:

- Deploy a variety of connected vehicle technologies on and in the vicinity of reversible express lanes and three major arterials in downtown Tampa to solve the following transportation challenges:
 - Morning peak hour queues, wrong-way entries, pedestrian safety, bus rapid transit (BRT) signal priority optimization, trip time and safety, streetcar trolley conflicts, and enhanced signal coordination and traffic progression.

Tampa (THEA) Pilot Deployment Vision



500 equipped pedestrians

Transit Vehicle On-board Equipment (TOBE)

10 equipped buses
10 equipped trolleys

Vehicle On-board Equipment (OBE)

1,500 vehicles equipped with OBU

Pedestrian Detector

Roadside Unit (RSU)

Advanced Traffic Controller

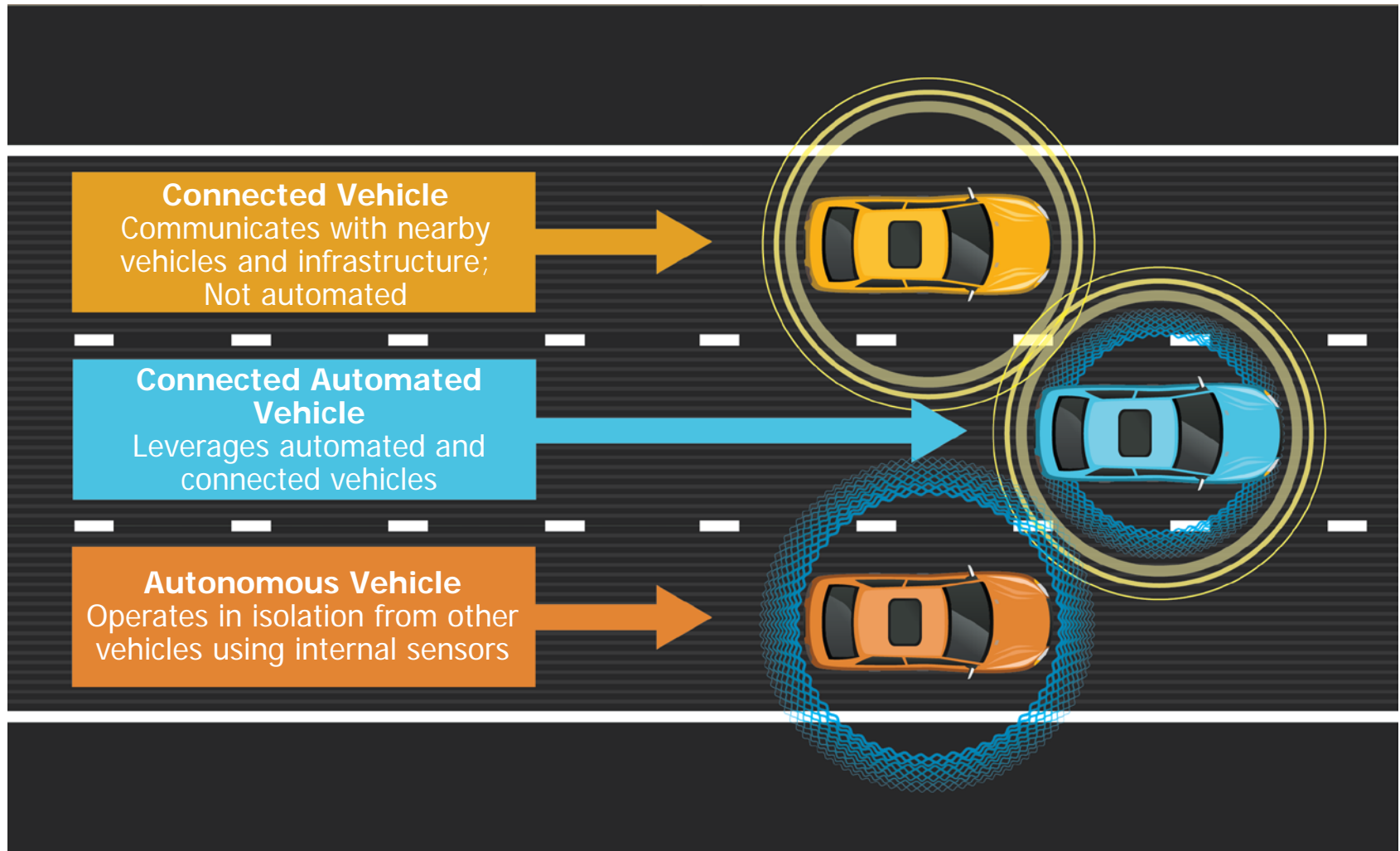
40 intersections (I-SIG, TSP, PED-SIG)

Traffic Management Center (TMC)

Data Collection

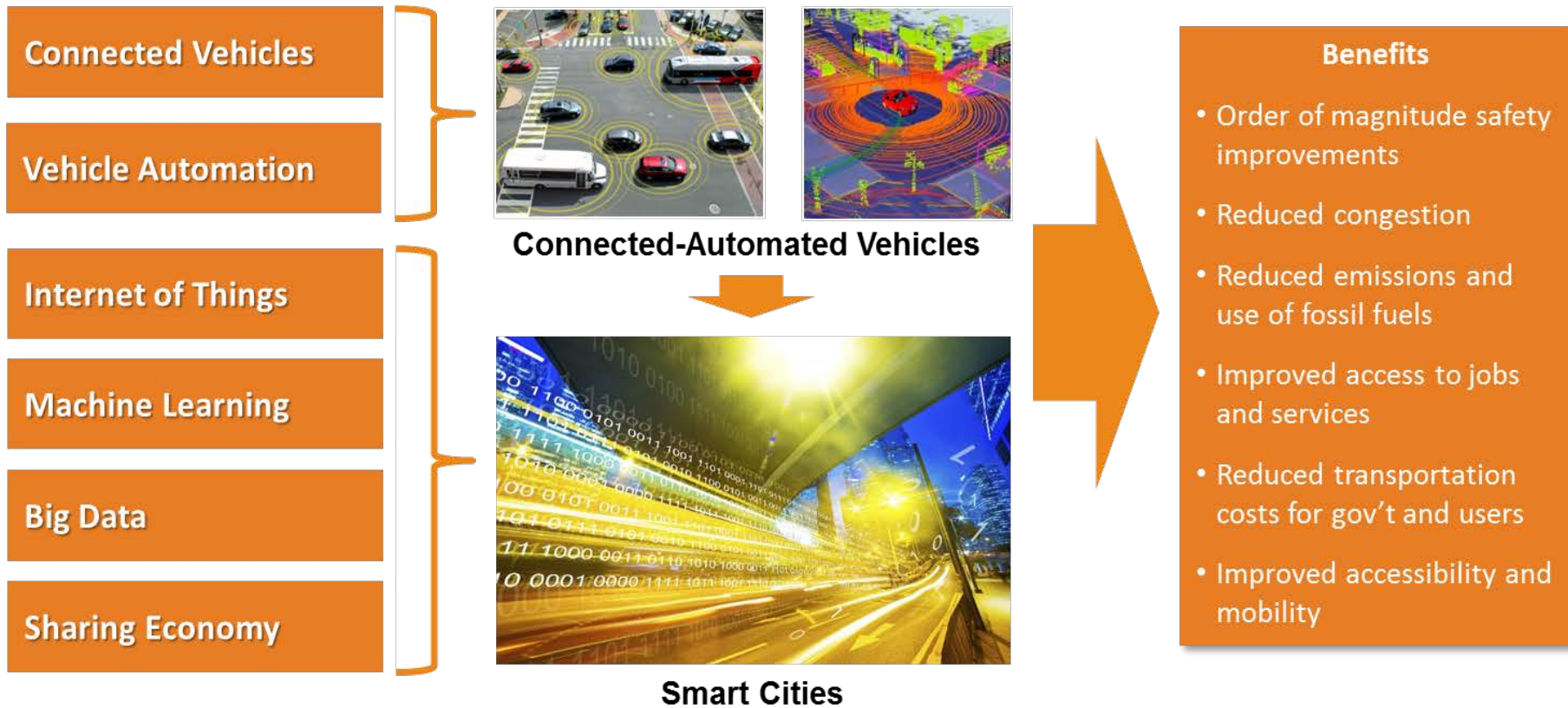
Data exchange will use DSRC (Dedicated Short Range Communications) or other wireless media. SCMS (Security Credential & Management System) will be used where appropriate.

CONNECTIVITY ENABLES COOPERATIVE AUTOMATION

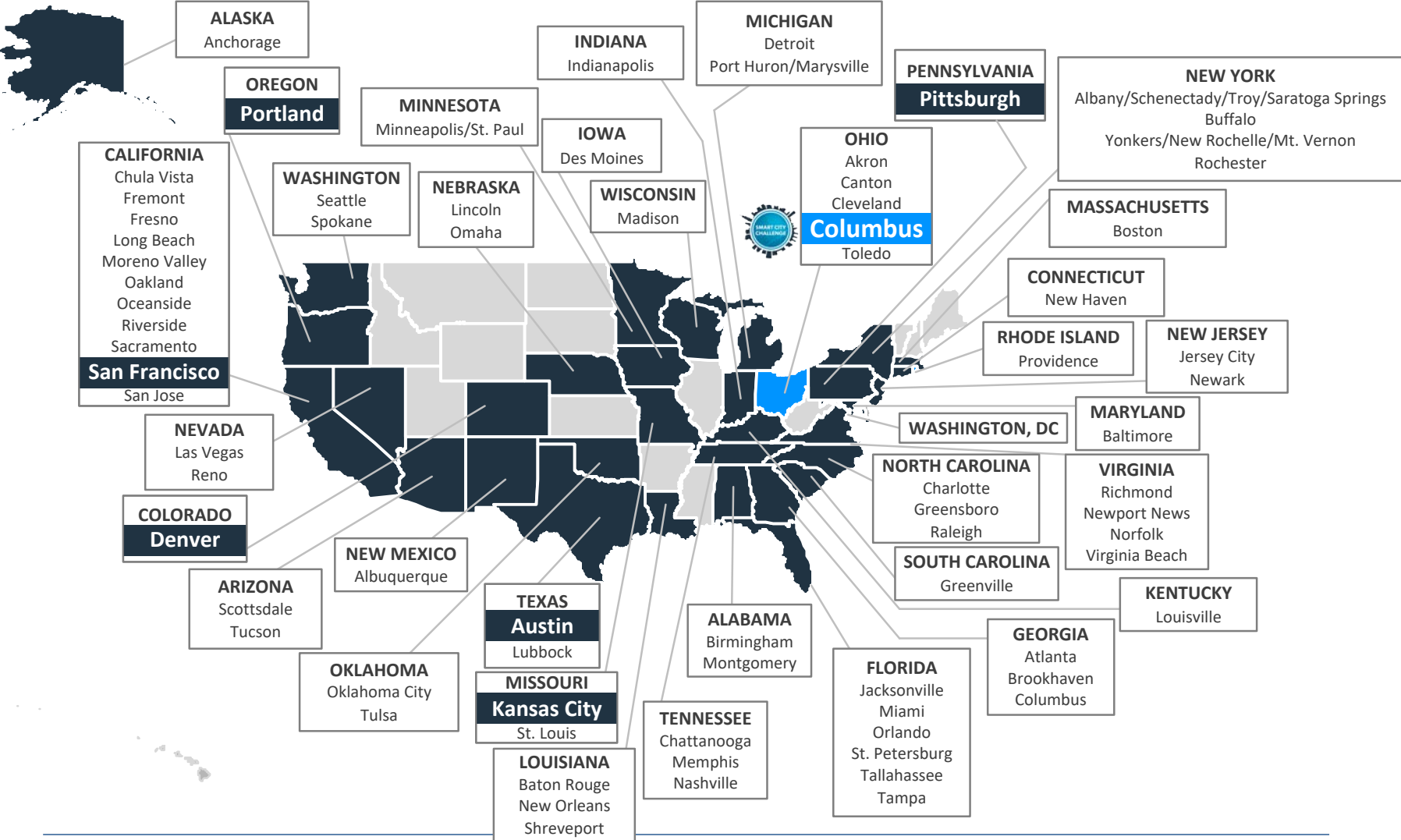


ADVANCED TECHNOLOGIES AND SMART CITIES

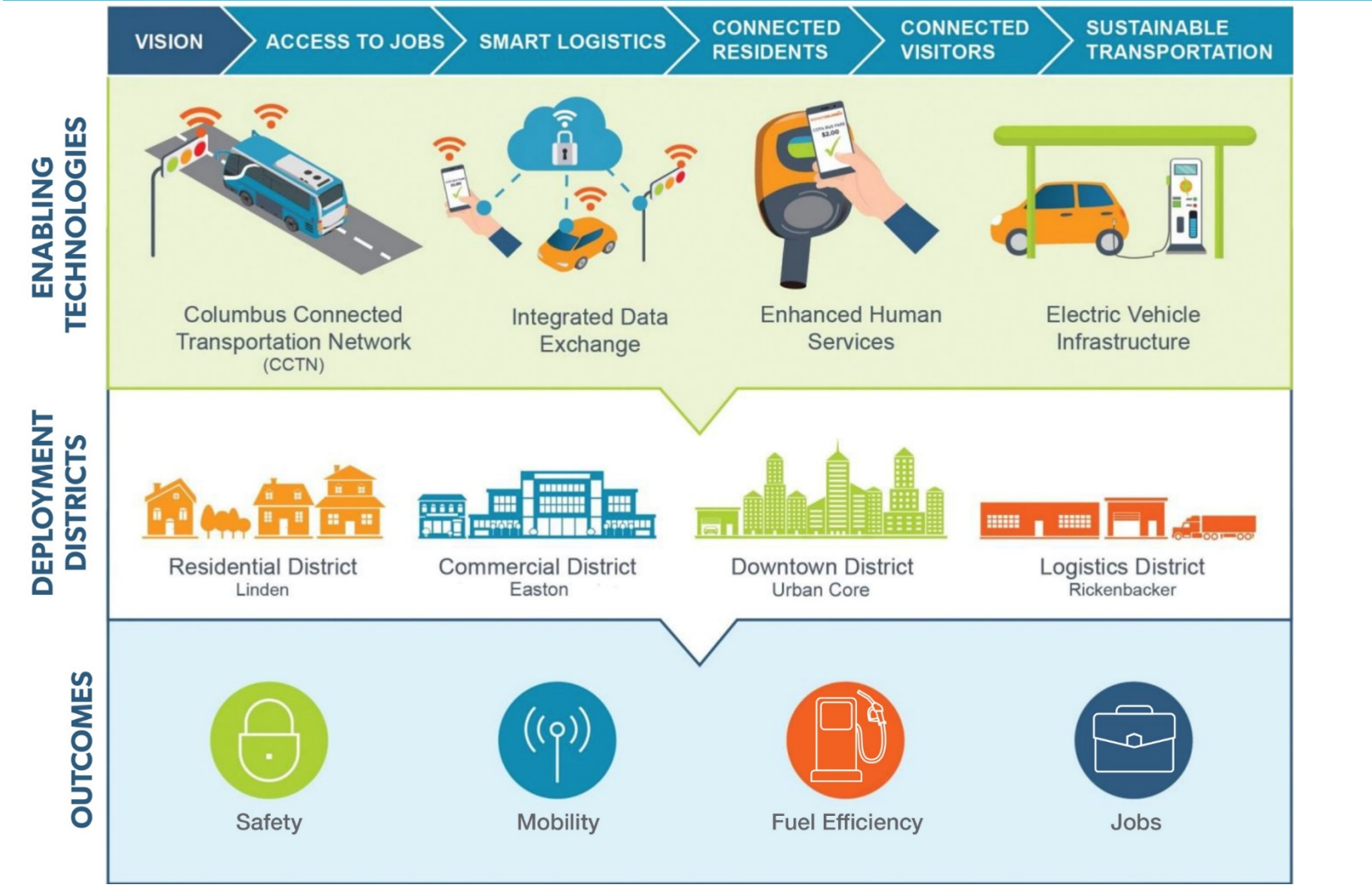
Technology convergence will revolutionize transportation, dramatically improving safety and mobility while reducing costs and environmental impacts



SMART CITY CHALLENGE



SMARTCOLUMBUS



Source: The City of Columbus

<https://www.columbus.gov/smartcolumbus/>

SMART COLUMBUS PROJECTS

- Connected Vehicle Environment (CVE)
 - Smart Street Lighting
 - Transit-Pedestrian Collision Avoidance System
 - Integrated Data Exchange (IDE)
 - Common Payment System
 - Multimodal Trip Planning Application
 - Smart Mobility Hubs
 - Mobility Assistance for People with Cognitive Disabilities
 - Connected Electric Automated Vehicles
 - Delivery Zone Availability
 - Enhanced Parking Permit
 - Event Parking Management
 - Truck Platooning
 - Oversize Vehicle Routing
 - Interstate Truck Parking Availability
-

CONNECTED AND AUTOMATED VEHICLES CAN BENEFIT THE DISABLED



DEVELOPING THE ATTRI APPLICATIONS



Wayfinding and Navigation:



CITY COLLEGE OF
NEW YORK



ABLELINK



PATHWAYS
SOLUTIONS



TRX SYSTEMS



Pre-Trip Concierge and Virtualization:



ABLELINK



Safe Intersection Crossing:



CARNEGIE MELLON UNIVERSITY

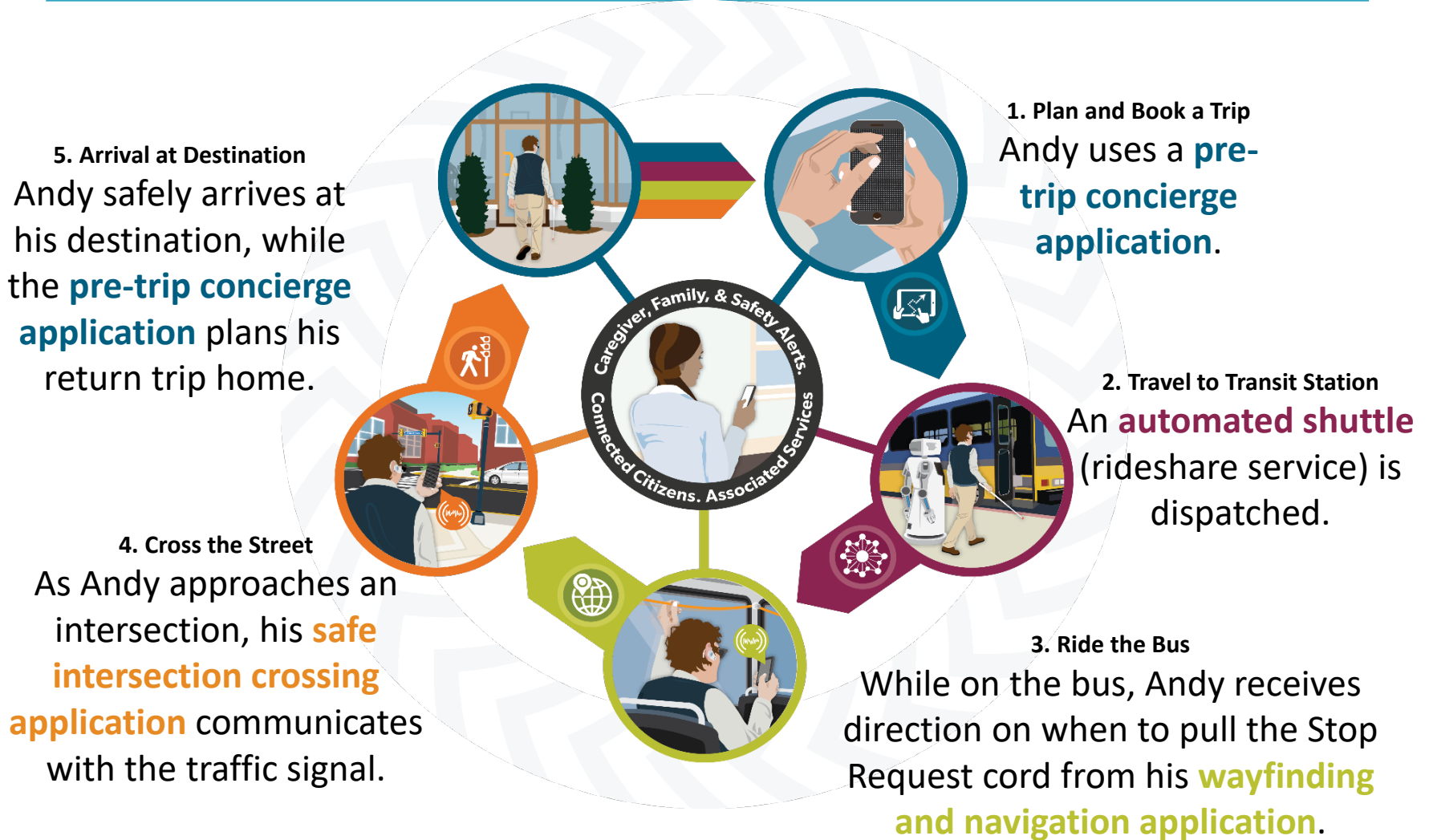


Robotics and Automation:

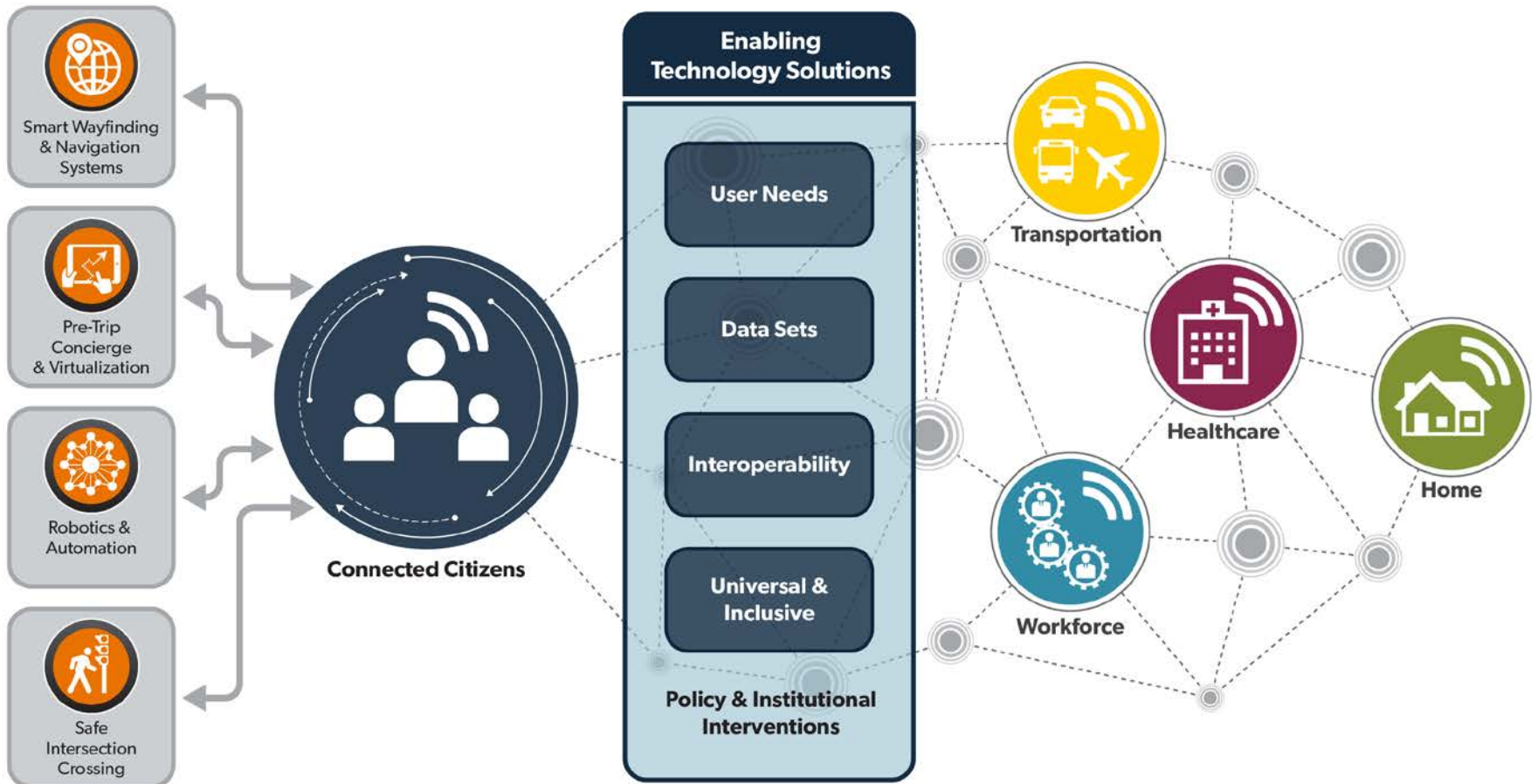


CARNEGIE MELLON UNIVERSITY

TO ENABLE THE COMPLETE TRIP

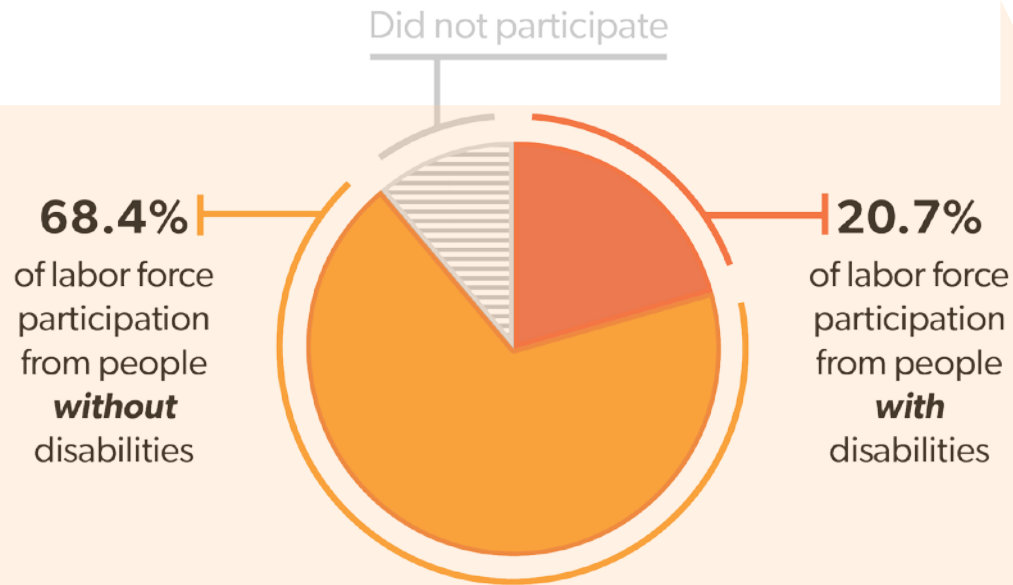


ATTRI AND OTHER POSSIBILITIES



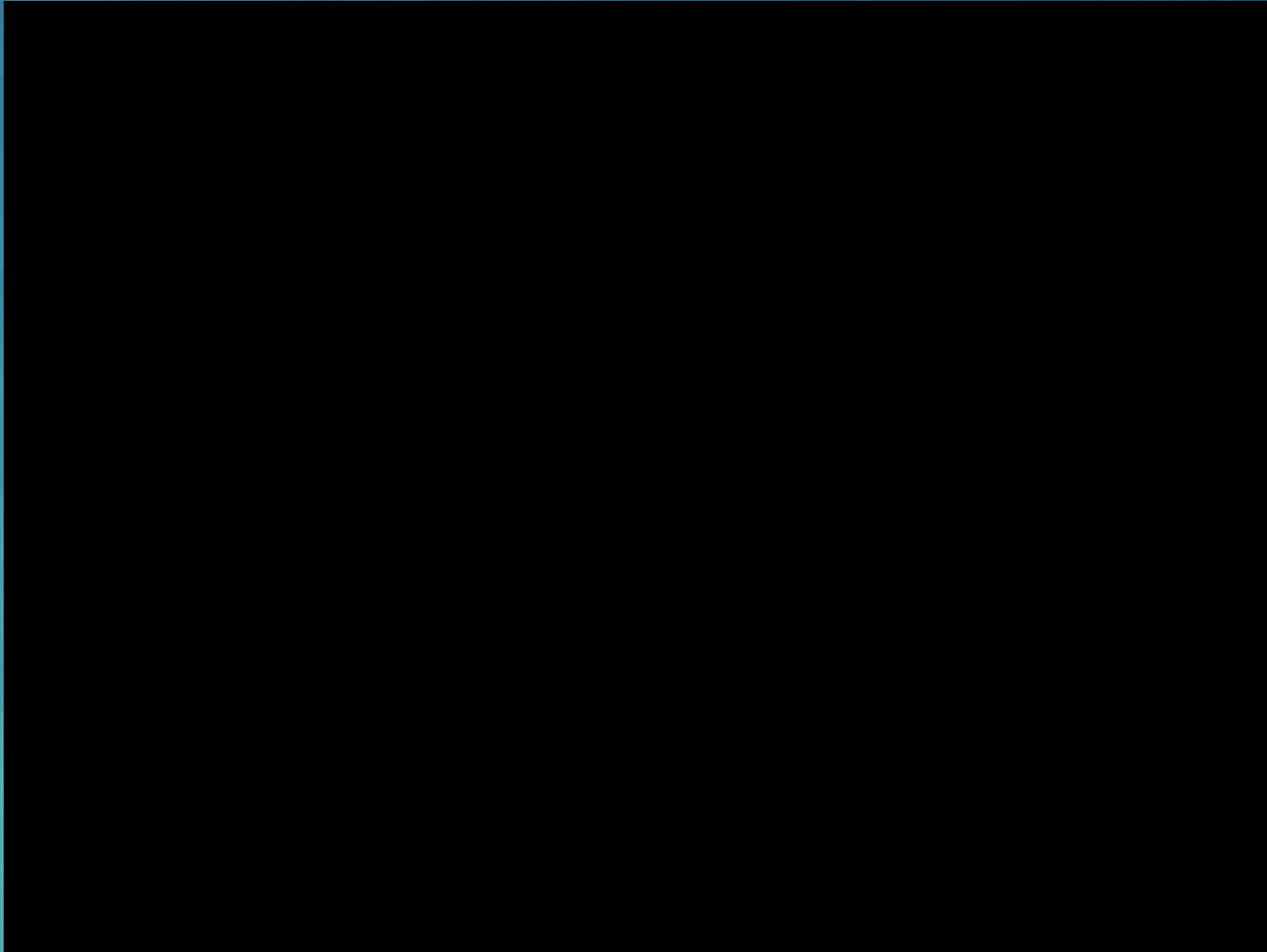
THE IMPACT ON EMPLOYMENT

February 2018 Disability Employment Statistics Ages 16 years and over



Reduced barriers to the mobility of people with disabilities could result in a positive impact to GDP of 0.6%, valued at around ***\$460 billion***

CONNECTED VEHICLE ANIMATION





QUESTIONS?

FOR MORE INFORMATION

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