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TRANSPORTATION RESEARCH BOARD

TRB Webinar: Designing and Implementing Smart Cities

October 28, 2021

1:00- 2:30 PM Eastern

@NASEMTRB
#TRBwebinar

PDH Certification Information:

- 1.5 Professional Development Hours (PDH) – see follow-up email for instructions
- You must attend the entire webinar to be eligible to receive PDH credits
- Questions? Contact Beth Ewoldsen at Bewoldsen@nas.edu

#TRBwebinar

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.

RCEP

REGISTERED CONTINUING EDUCATION PROGRAM

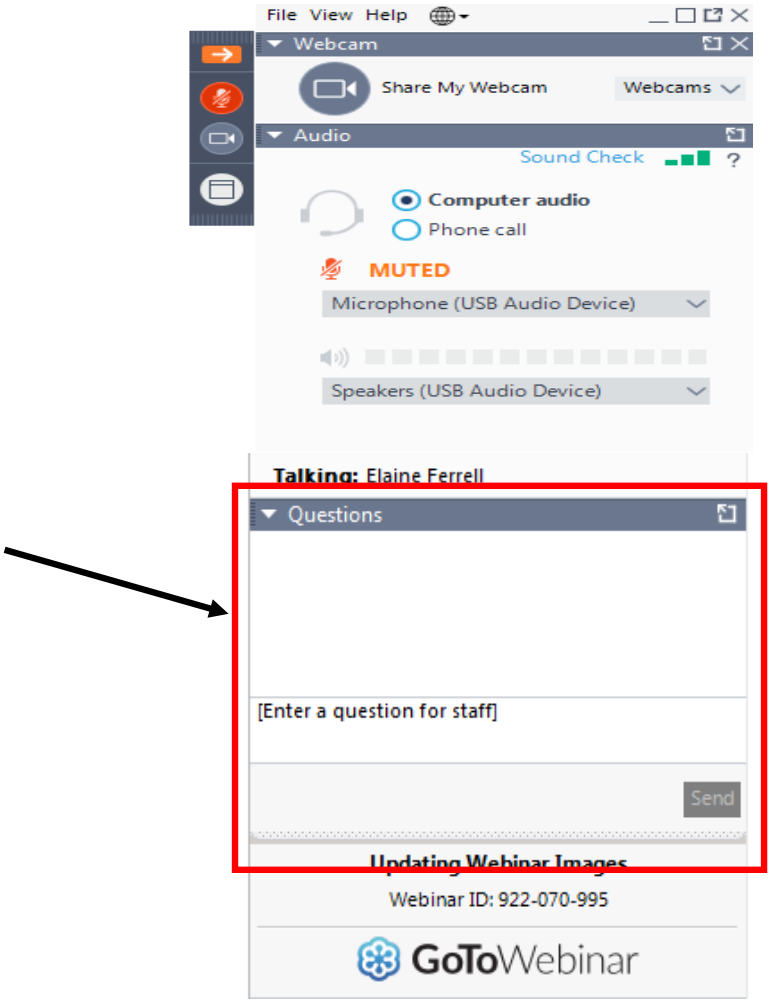
Learning Objectives

- Identify key lessons in Smart City deployment and obstacles to avoid
- Evaluate outcomes for investments
- Discuss how to collect and analyze data for transportation and other urban management needs

#TRBwebinar

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



#TRBwebinar

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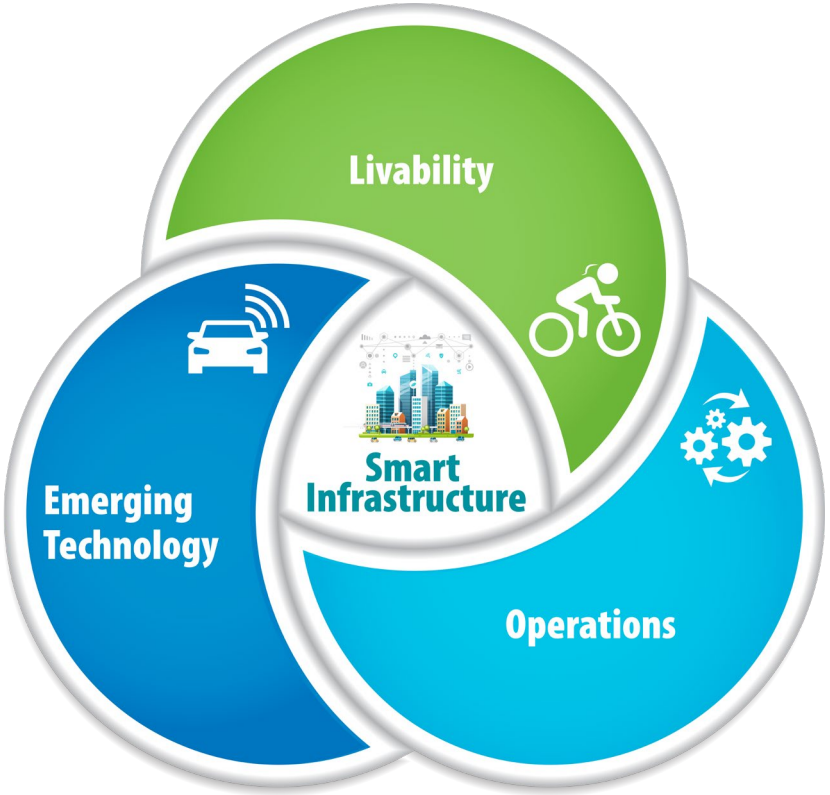
Designing and Implementing Smart Cities



Thank you to AED20 – Committee including Mike Fontaine, Angshuman Guin, Jinghua Xu, Zak Patterson, Robert Kluger, and Wang Zhang for your assistance for organizing this webinar!

Learning objectives

1. Identify key lessons in Smart City deployment and obstacles to avoid
2. Consider how to evaluate outcomes for investments – safety, efficiency, cost savings etc.
3. Discuss how to collect and analyze data for transportation and other urban management needs

Six Keys to Designing & Implementing Smart ^ Cities

& Trustworthy

Charlie Catlett
Senior Research Scientist, Discovery Partners Institute,
University of Illinois System
Senior Computer Scientist, Argonne National Laboratory
Visiting Scientist, Mansueto Institute, University of Chicago

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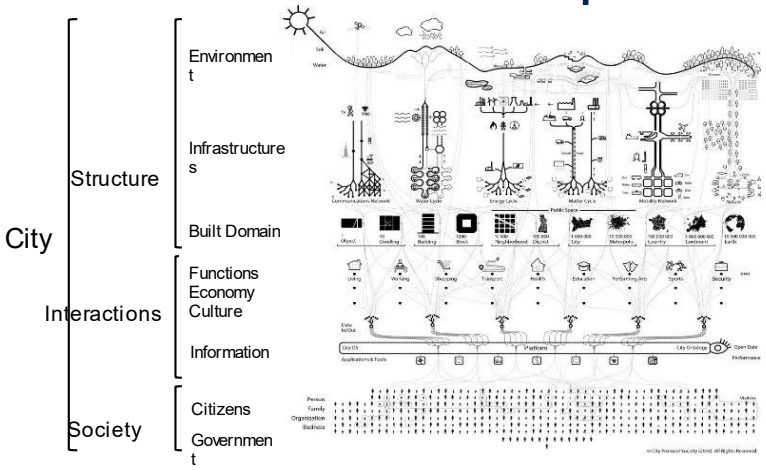
October 28, 2021

catlett@anl.gov

1. Cities are not Computers



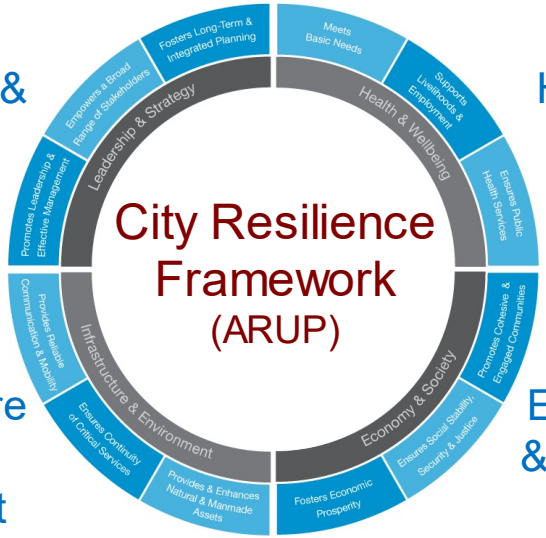
City Anatomy: A Framework to Support City Governance, Evaluation and Transformation

Leadership & Strategy

Health & Well Being

Infrastructure & Environment

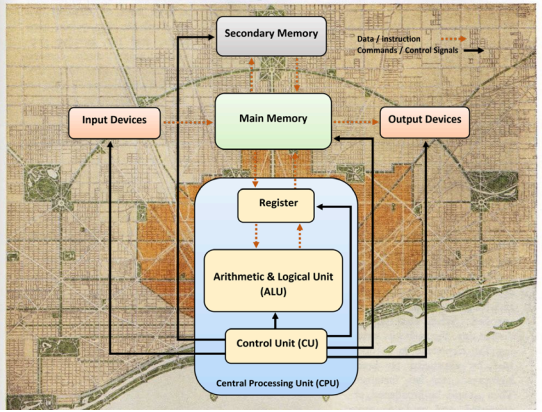
Economy & Society



City Aspirations: A Framework to evaluate resilience.

Ultimately this view leads to the city as a computer, and thus in need of an operating system.

But an operating system is about control--this is not a recipe for a thriving city.



*The City Resilience Framework was developed by **ARUP** with support from the Rockefeller 100 Resilient Cities Program (Arup, 2014).*

The City Anatomy was developed by Vicente Guallart, Chief Architect of the City of Barcelona, and Manel Sanromà, Barcelona Chief Information Officer, as the basis for the City Protocol Society (circa 2012).

Safety and Community Interest

- Resident and community group requests.
- Computer Vision R&D (multiple universities).
- Vision Zero Chicago, CDOT, Argonne Nat'l Lab.
- Ravenswood Theater.
- Fleets & Facilities Management.
- Lane Technical High School computer science program.

Traffic and Growth

- Chicago Park District.
- Chicago North Branch Framework.
- Pullman National Monument.
- Dept. of Planning & Development
- Illinois DOT and CMAP.

Environment, Water, and Energy

- Bronzeville Community Smart Grid (IIT, ComEd).
- Flood Detection R&D (Northwestern University)
- Climate, weather, and air quality (Argonne Nat'l Lab).

Public Health and Well-Being

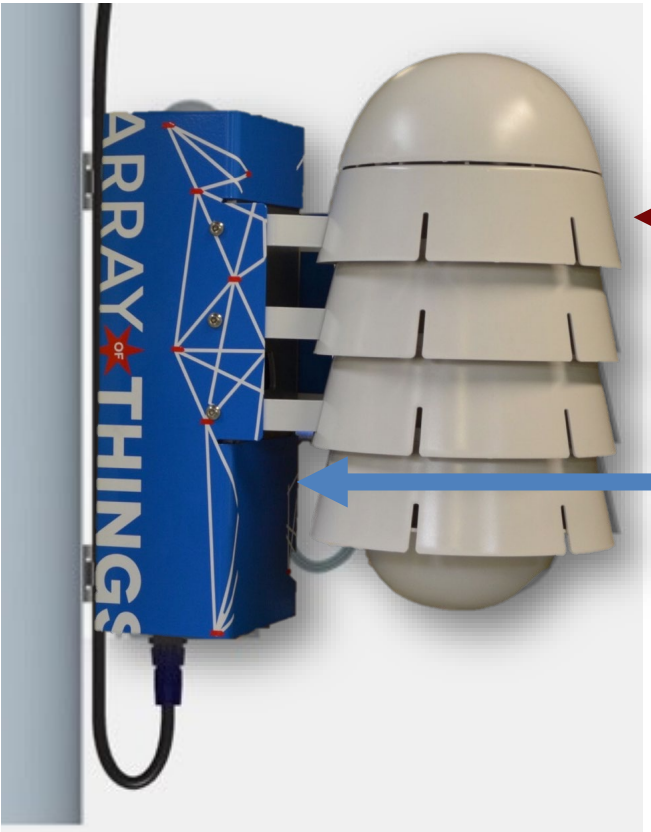
- Lower West Side (Pilsen, McKinley Park, Little Village) air quality R&D.
- Aging and Poverty Study (University of Chicago)
- Department of Public Heath and University Partners (air quality).

- Research test nodes.

2. Community-Driven is Key to Success

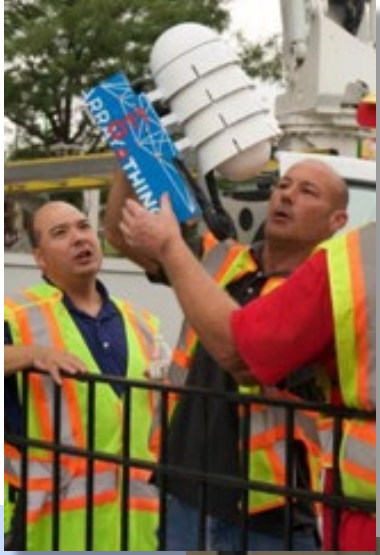
(and make sure to engage youth!)

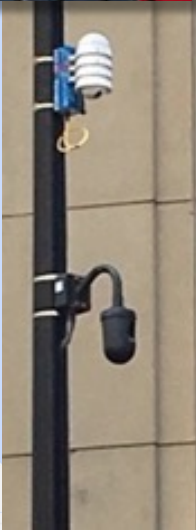
3. Technology driven by needs—not vice versa



Environmental and Air Quality Sensors

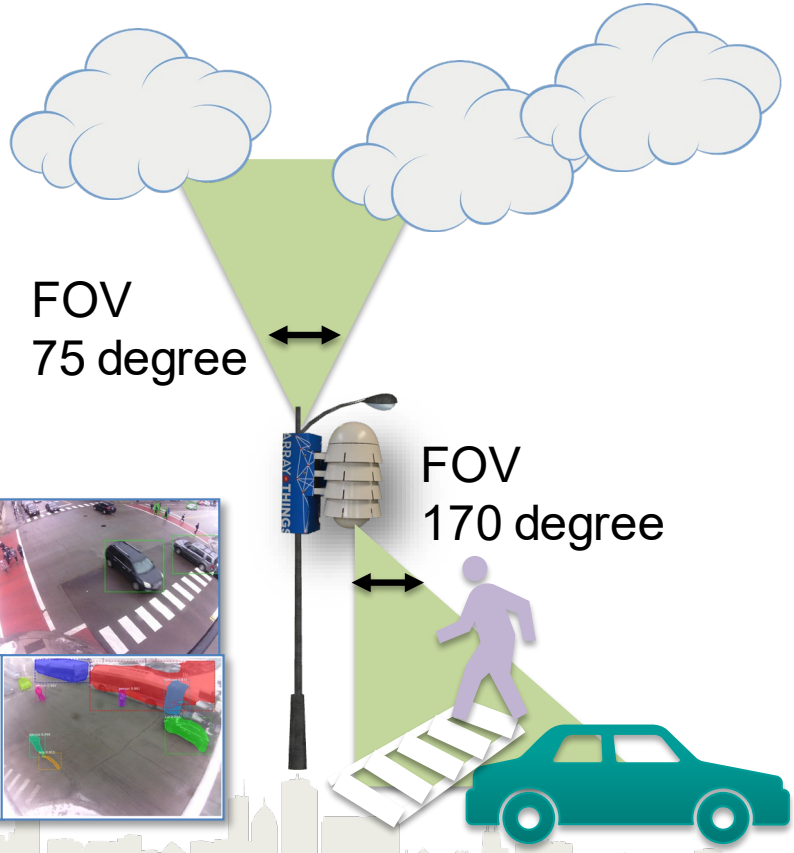
"Software-Defined Sensors"





4. Engage the community with Privacy as a Core Driver

1. Pre-approved apps*
   (finite list, openly published and updated)
2. Delete images after processing
3. Publish pre-approved measurements
4. **Accountability**
   ("trust us" is not an acceptable privacy policy)



4. Engage the community with Privacy as a Core Driver

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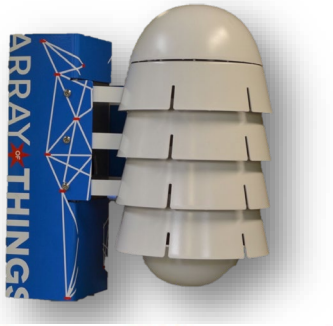
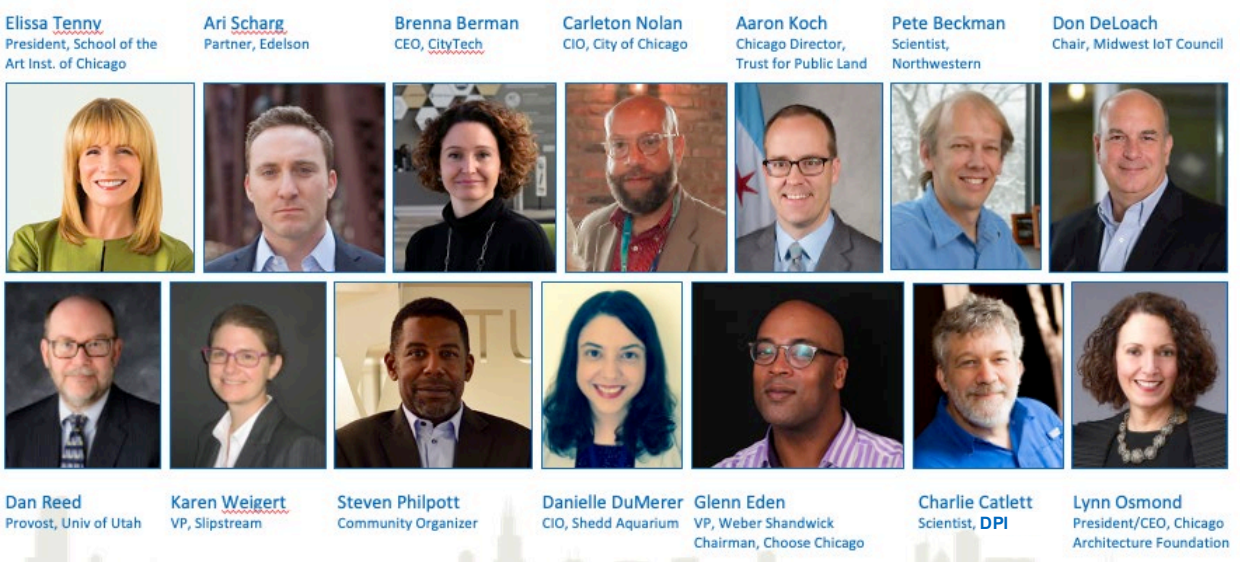




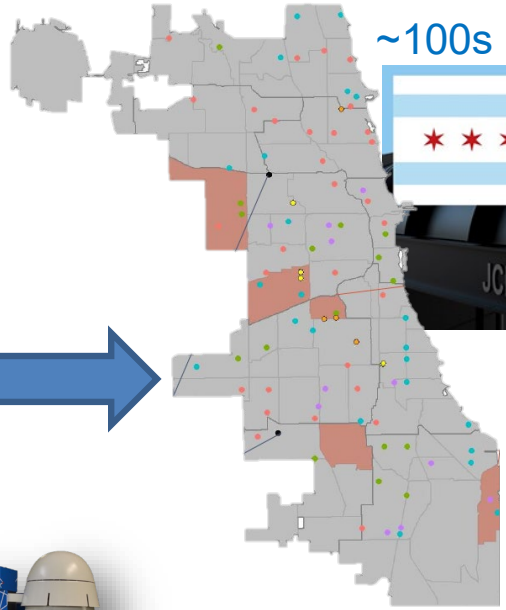
Software-Defined Sensors

Example:

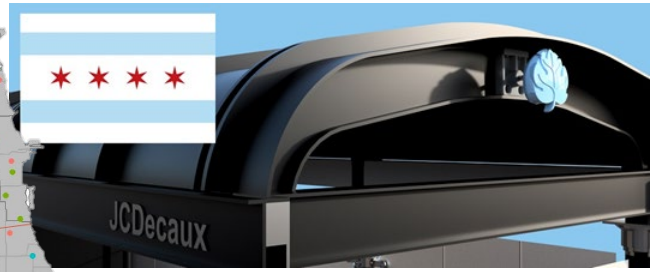
1. Count
   i. pedestrians,
   ii. street crossers,
   iii. crosswalk users;
2. Save walking paths

Pedestrian Flow: **Mike Papka**, Argonne National Laboratory and Northern Illinois University, **Pratool Bharti** (Northern Illinois University), and **David Koop** (Northern Illinois University)

5. Community groups bring important perspectives and expertise.



~100s of Low-Cost Sensors



~10's Edge-AI Nodes

6. Make the data legible!

www.SageContinuum.org

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Program Overview

Complete Trip - ITS4US Deployment Program

- A USDOT Multimodal Deployment effort, led by ITSJPO and supported by OST, FHWA and FTA
- Supports multiple large-scale replicable deployments to address the challenges of planning and executing all segments of a complete trip

Vision

*Innovative and integrated **complete trip deployments** to support seamless travel for all users across **all modes**, regardless of **location, income, or disability***

Program Goals

Spur high-impact integrated Complete Trip deployments nationwide

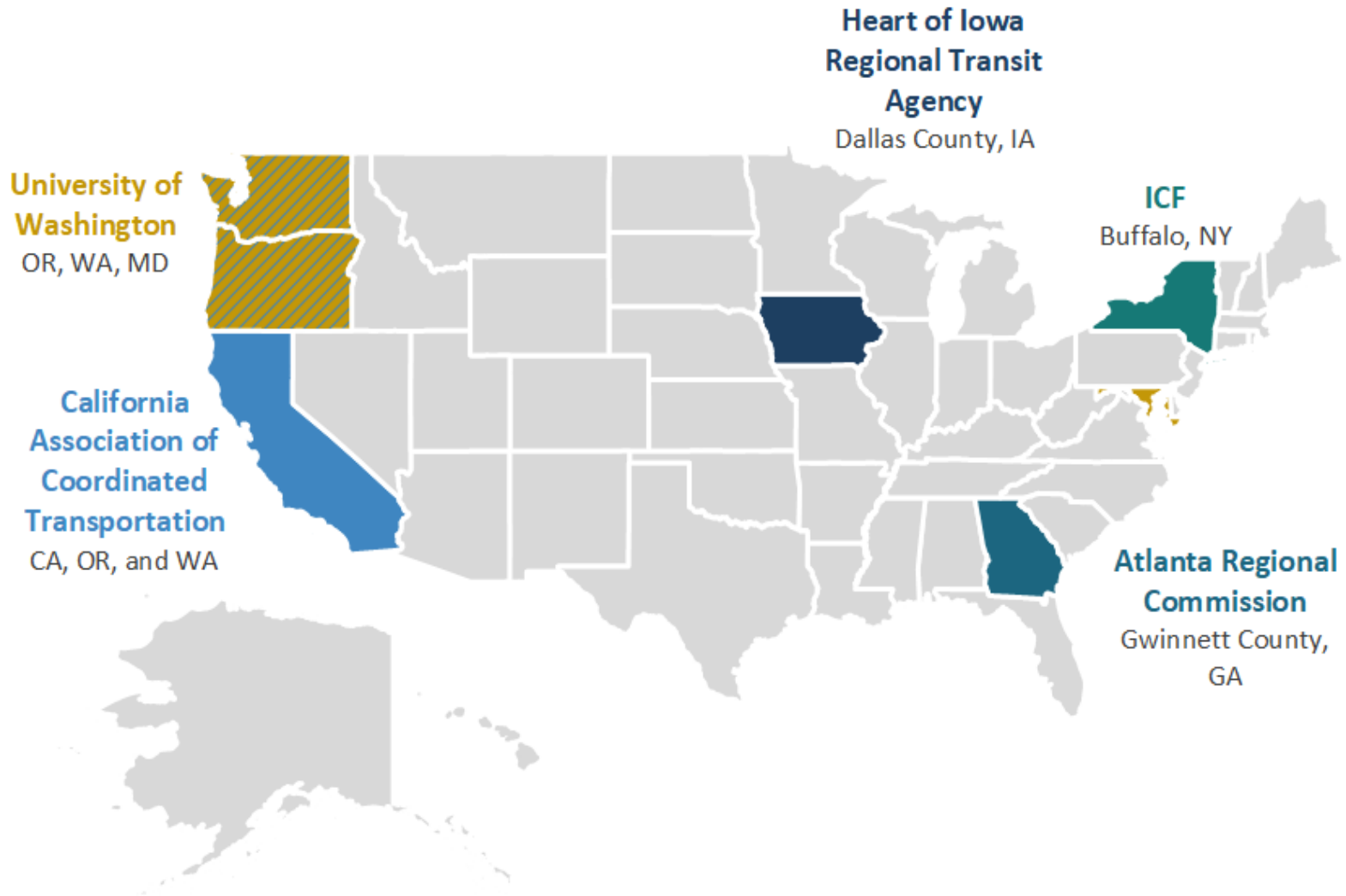
Identify needs and challenges by populations

Develop and deploy mobility solutions that meet user needs

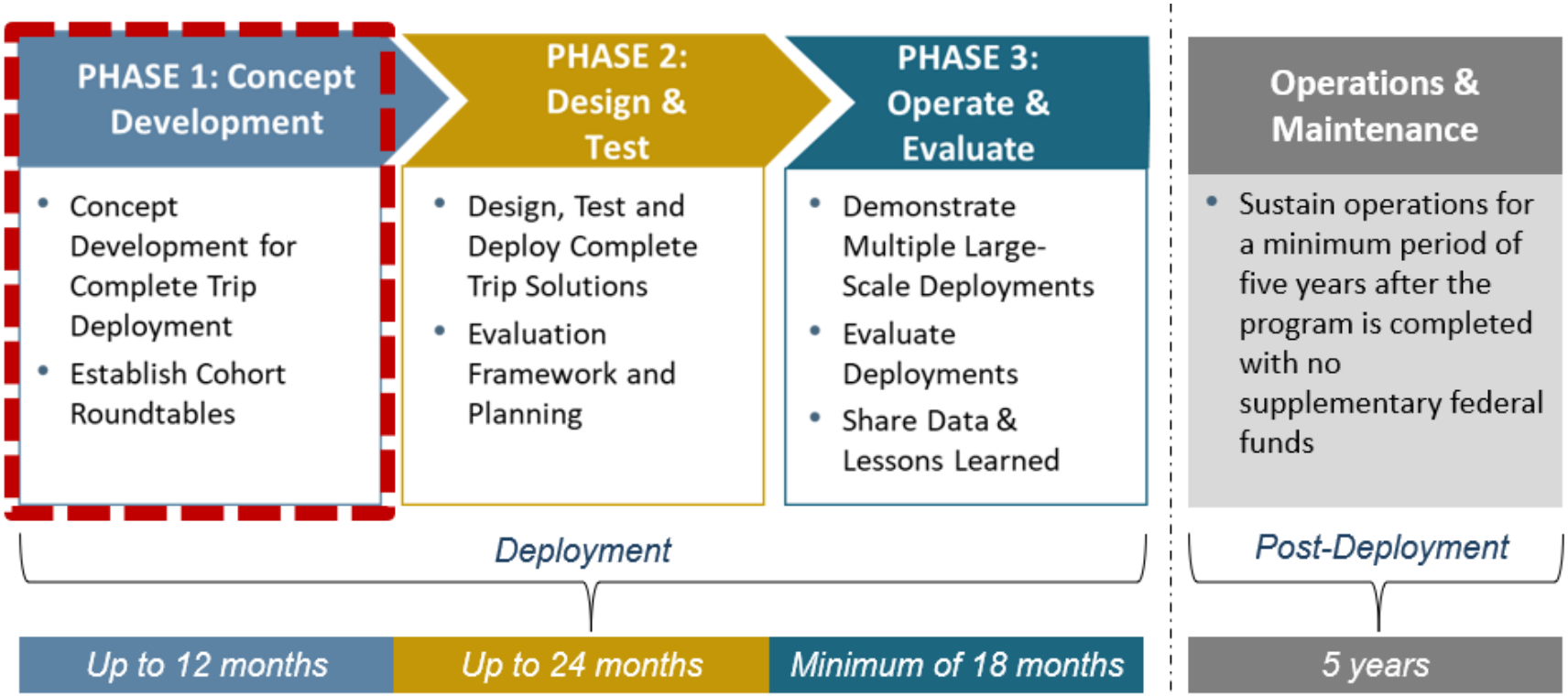
Measure impact of integrated deployments

Identify replicable solutions and disseminate lessons learned

Complete Trip Phase 1 Awardees



Deployment Phases



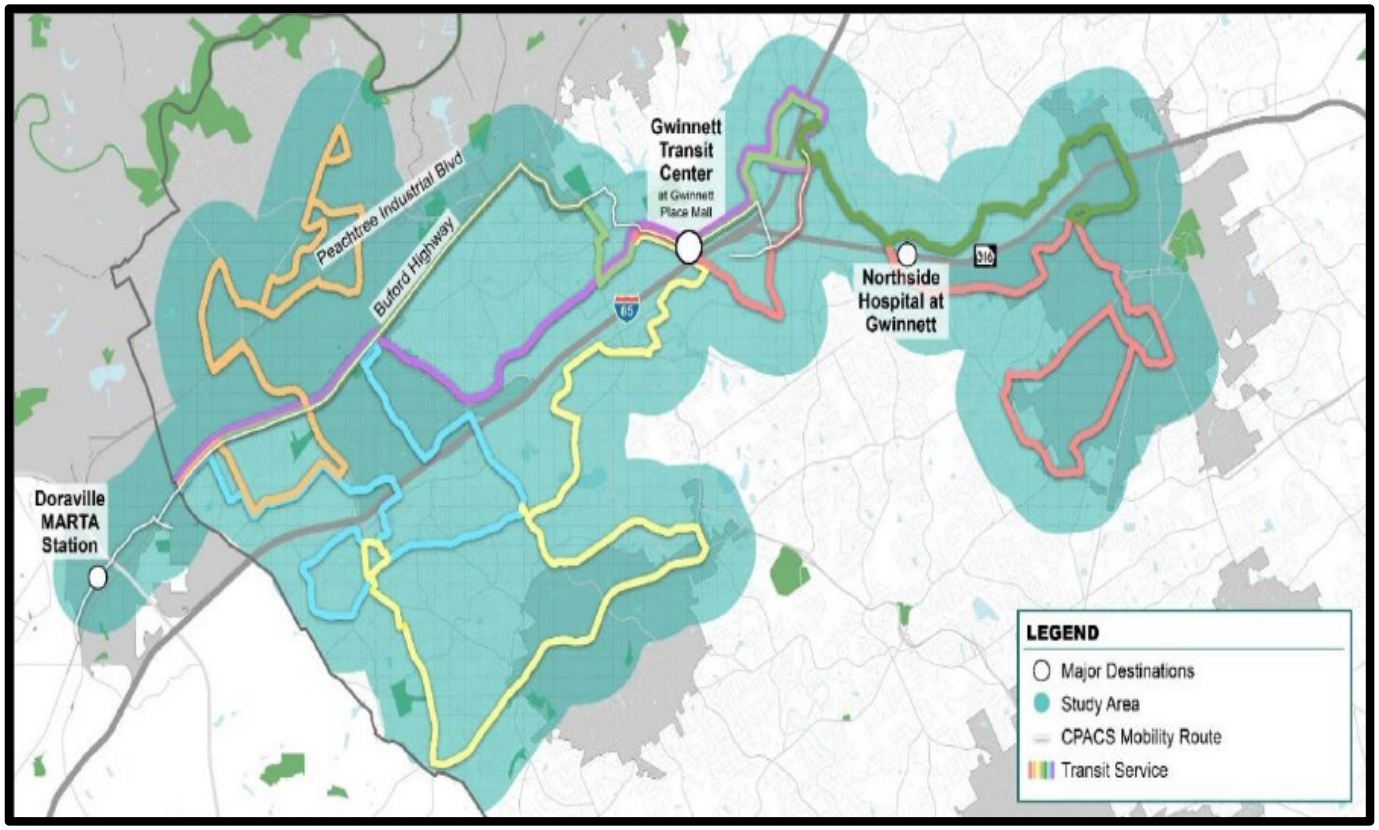
Key Phase 1 Tasks & Deliverables

- User Needs Summary – complete
- Concept of Operations – complete
- Data Management Plan – complete
- Safety Management Plan – complete
- Performance Measurement Plan – complete
- System Requirements Specification Document – complete
- Enabling Technology Readiness Assessment – complete
- Human Use Approval Summary – underway
- Participant Training & Stakeholder Education Plan – underway
- Institutional, Partnership, & Financial Plan – underway
- Outreach Plan – underway
- Systems Engineering Management Plan – not started
- Deployment Readiness Summary – not started

Gwinnett County Site Orientation & Key Challenges

Project Site - Gwinnett County

- Richly diverse area
- 280,000 residents
- Major transit hubs
- Suburban land use
- Wide and high-speed roadways
- Inconsistent pedestrian infrastructure



Underserved Populations

Population Type	Project Site Population	Pop. in Project Site	Gwinnett County Population	Gwinnett Pop. in Project Site
People with Disabilities (non-institutional)	16,802	6.0%	32,032	52.5%
Older Adults (Age 65+)	19,435	7.0%	78,898	24.6%
Low-Income (Individual Poverty)	53,223	19.1%	107,267	49.6%
Veterans	8,602	3.1%	37,850	22.7%
Limited English Proficiency Households	14,098	15.1%	24,069	58.6%
Zero-Vehicle Household	4,921	5.3%	9,467	52.0%
Total Population	278,572	100%	889,954	31.3%
Total Households	93,158	100%	283,256	32.9%

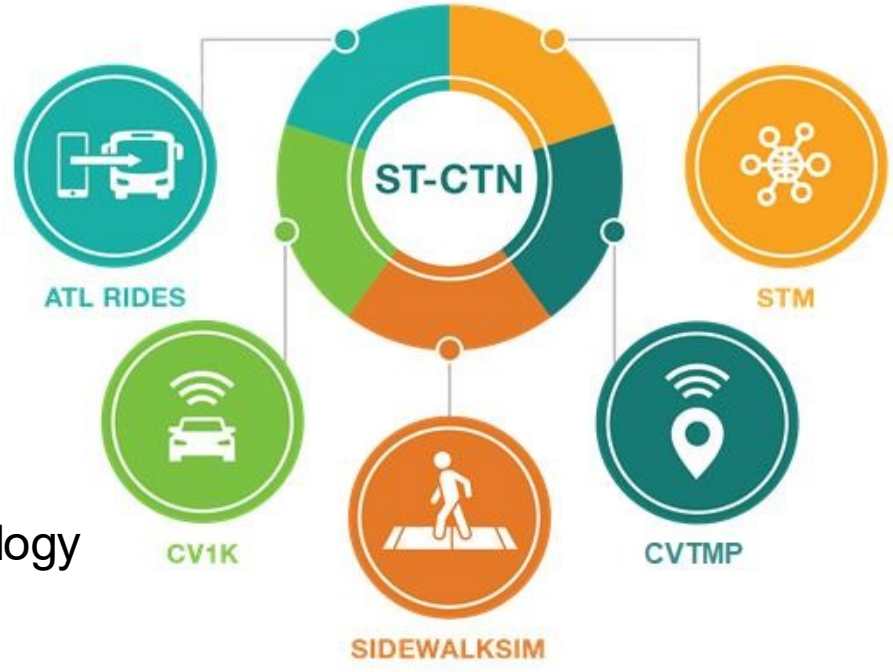
Source: American Community Survey (2017)

Challenges

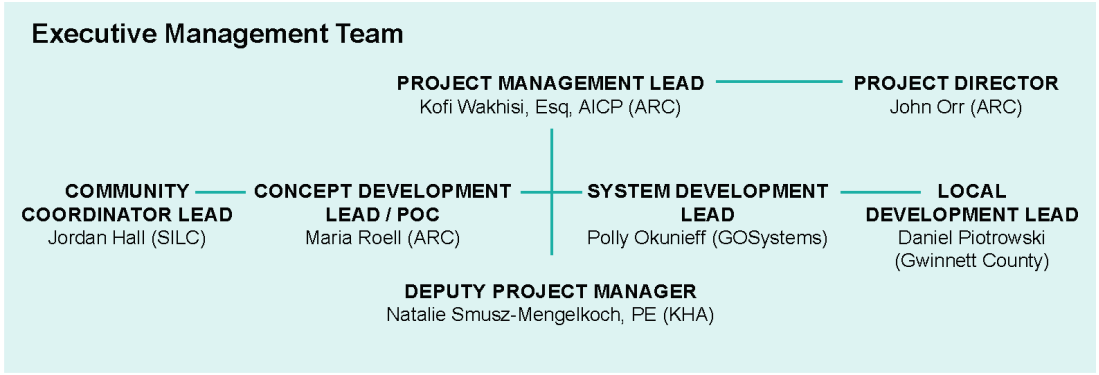
- Challenge 1 – Users' lack of knowledge inadequate pedestrian infrastructure can lead to lengthy detours or inaccessibility.
- Challenge 2 – Lack of transit reliability and added exposure while waiting.
- Challenge 3 – Difficult to recognize and avoid potential conflicts. Lack of visibility to drivers.

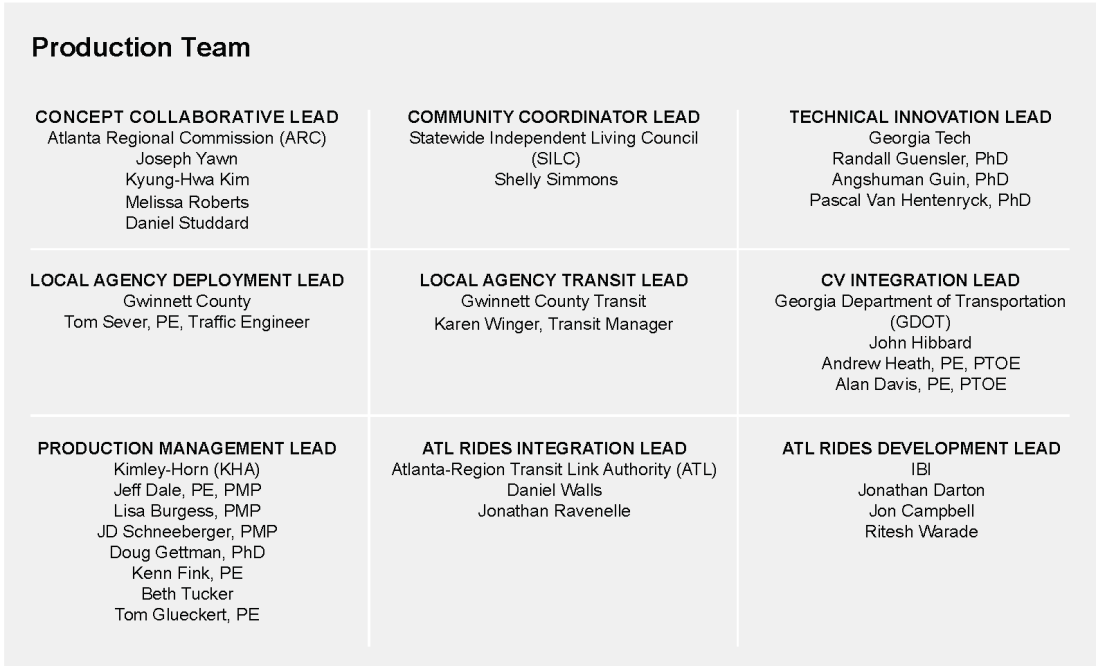
Integrated Solution

- ATL Rider Information and Data Evaluation System
- Connected Vehicle Regional Deployment Program
- Sidewalk Inventory Tools
- Gwinnett Connected Vehicle Technology Master Plan
- Space-Time Memory Platform



Project Team and Partners

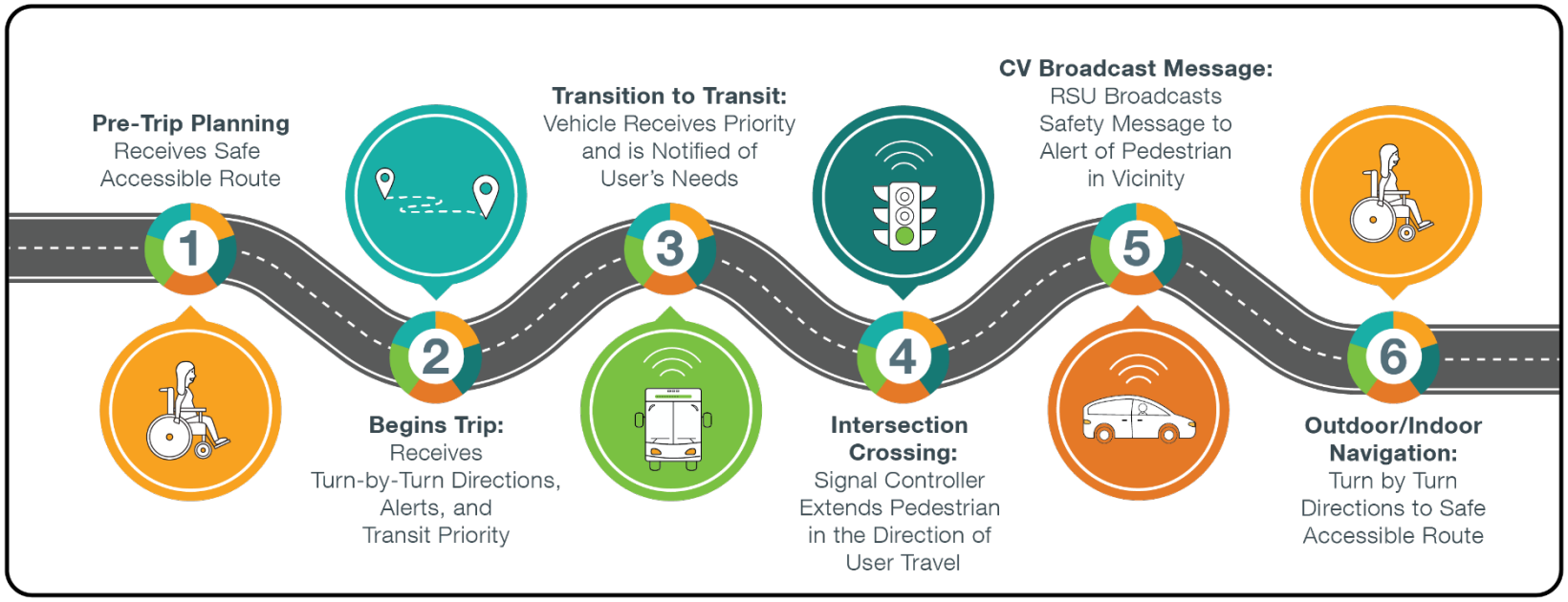




- ARC – Lead
- Gwinnett County
- GDOT
- ATL
- GA Statewide Independent Living Council
- Georgia Tech
- Kimley-Horn
- GO Systems and Solutions
- IBI

Deployment Concept Overview

Use Case – Wendy's Complete Trip



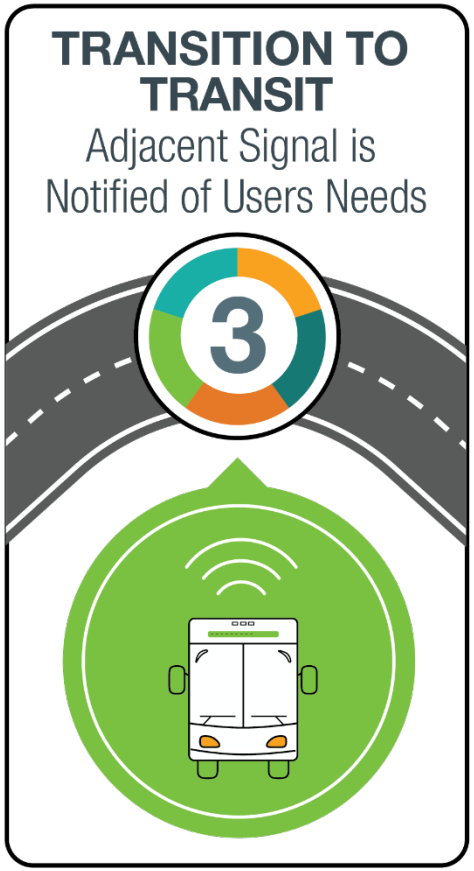
Use Case – Wendy's Complete Trip

- Step 1 – The traveler plans for and receives a safe accessible route.
  - Traveler provides origin and destination.
  - Traveler creates a trip or user profile with preferences and abilities.

Use Case – Wendy's Complete Trip

- Step 2 – The traveler begins their trip.
  - Receives turn by turn directions.
  - Alerts.
  - Remote pedestrian activation.
  - Can trigger transit signal priority (TSP) if the user has difficulty standing for long periods or is sensitive to weather conditions.

Use Case – Wendy's Complete Trip



- Step 3 – The traveler transitions to transit.
  - The transit vehicle receives priority and is notified of users' needs.
  - TSP can be triggered if the bus is running behind schedule due to a longer boarding time needed by a user.

Use Case – Wendy's Complete Trip

- Step 4 – The traveler crosses the intersection.
  - The traveler can receive additional pedestrian crossing time to cross the intersection.

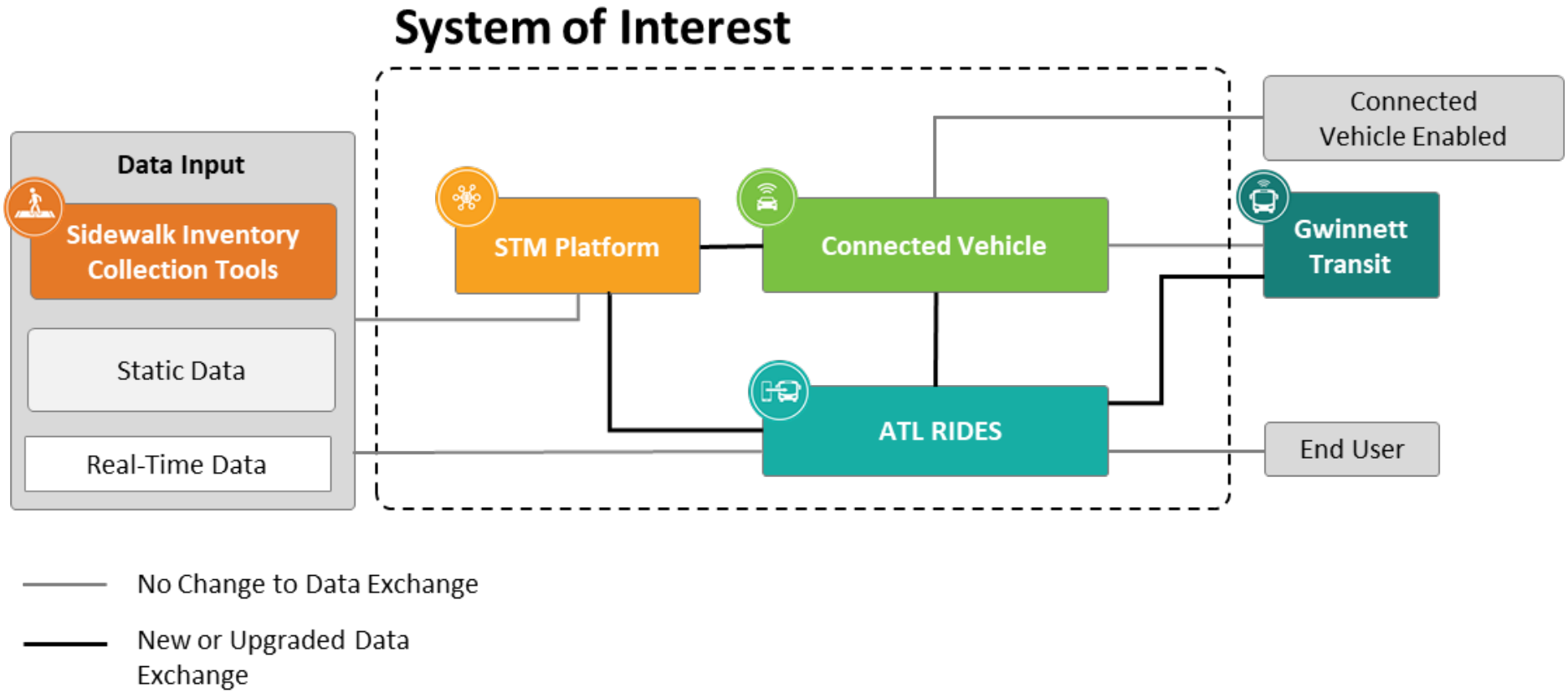
Use Case – Wendy's Complete Trip

- Step 5 – The travelers' presence sends a message to connected vehicles.
  - Roadside units (RSUs) broadcast a safety message to alert connected vehicles of pedestrians/bicyclists in the vicinity.

Use Case – Wendy's Complete Trip

- Step 6 – Outdoor/indoor navigation.
  - The traveler is provided with turn-by-turn directions to a safe accessible route.

Integrated Solution – Context Diagram



User Needs Summary

End User Needs

1 Pre-Trip Planning

- Personalized trip information that accommodates their preferences and abilities.
- The ability to customize their App accessibility features to accommodate their abilities.

2 Begin Trip

- Support services during trip planning and traveling based on their preferences and abilities.
- To receive personalized information and alerts during their trip in a way that is accessible to them.

End User Needs

3 Transition to Transit

- The ability to communicate with transit infrastructure and transit vehicle operators to ensure adequate time to board or alight a transit vehicle based on their abilities.

4 Intersection Crossing

- The ability to communicate with infrastructure and CVs at signalized crosswalks beyond the currently existing push buttons.

End User Needs

5 CV Broadcast Message

- The ability to remotely request transit service while waiting or traveling to a transit stop.
- The ability to alert CVs to their presence at marked crossings and transit stops.

6 Outdoor/Indoor Navigation

- Accurate information to successfully navigate indoor spaces.

Reporting

- The ability to provide feedback on infrastructure and services.

Stay Connected

Kofi Wakhisi, ARC

Project Management Lead

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Louisville:
Smart City Journey

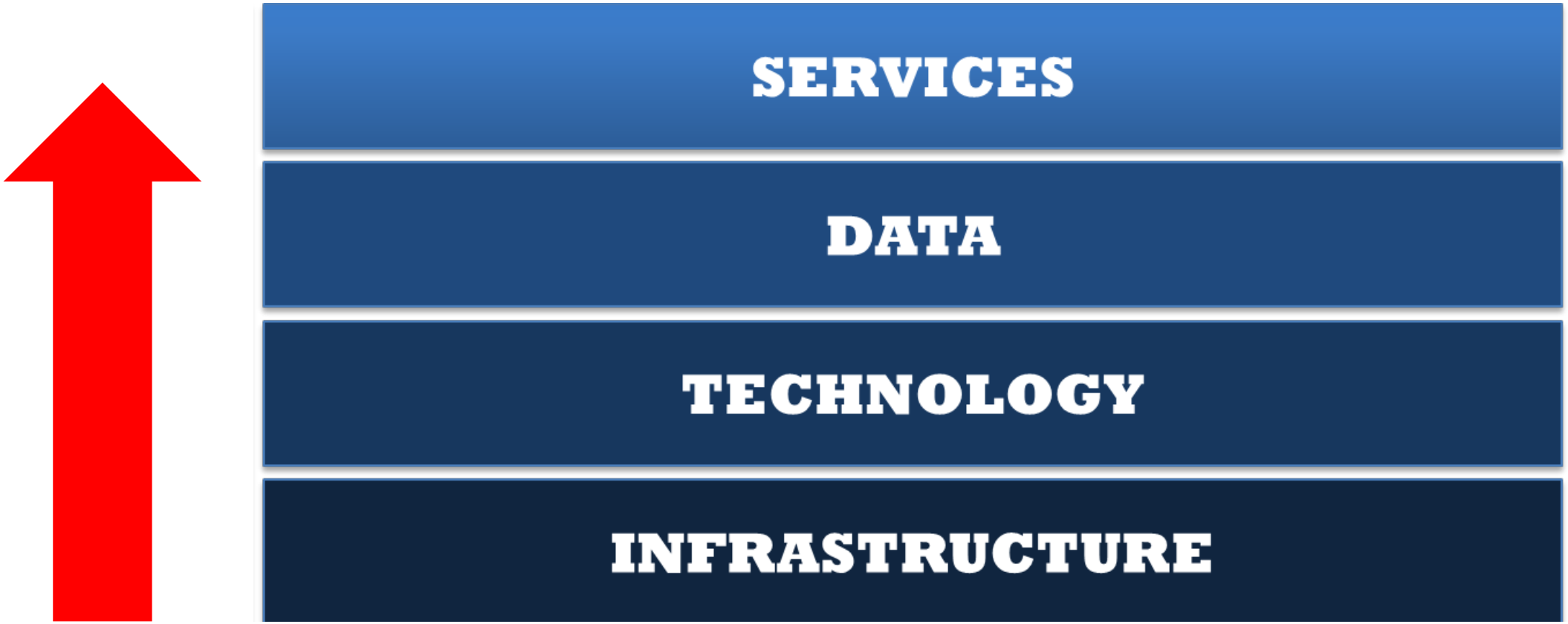
Ed Blayney
Civic Innovation & Technology
Louisville Metro, Kentucky
10/28/2021

Louisville's Smart City

Finding new ways to use big data and innovative technologies to better serve our residents

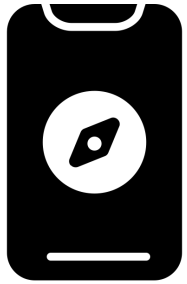
Smart City Playbook: smart.louky.city

Smart City Platform



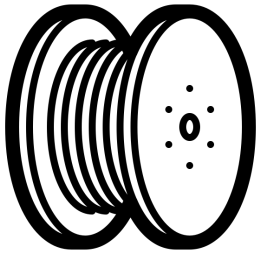
Program Highlights – Transportation

Dixie
Highway BRT



Waze Warp
Open Source

Scooter
Open Data



LFIT
Muni Fiber

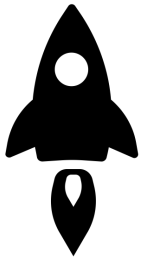
Level of Effort

1

Experiment

- Individual - High
- Org - Low

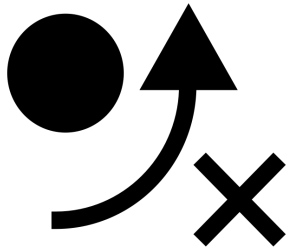
2



Pilot

- Individual - High
- Org - Med

3



Game Changer

- Individual - Med
- Org - High

4

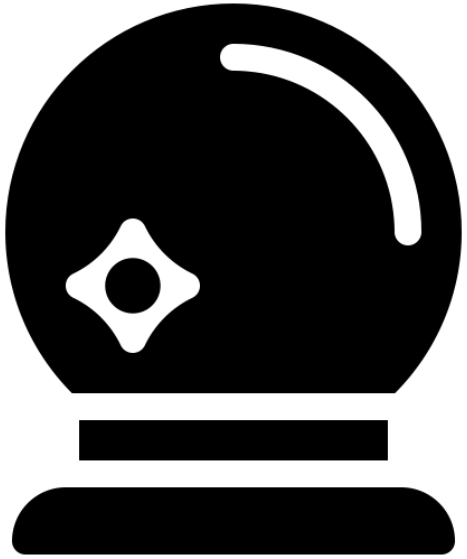
Operationalization

- Individual - Low
- Org - High

Evaluation

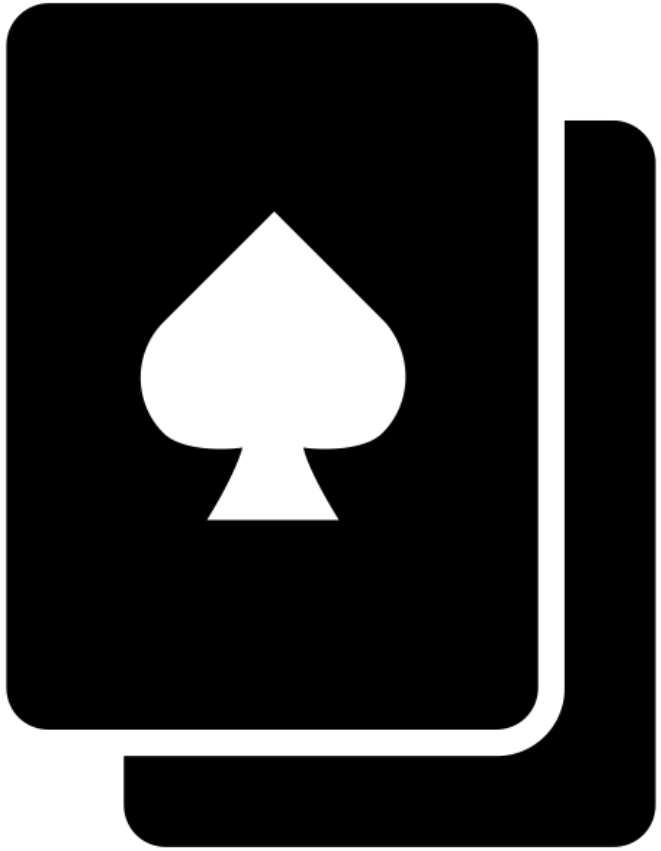
Lessons Learned

Change Management



Risk Sharing

Hold’em or Fold’em



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listen. think. deliver.

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- *December 8:* **TRB Virtual Careers in Motion Networking Fair**

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Register for TRB's Annual Meeting!

Register now for our January meeting! ***There will be no onsite registration this year.***

https://bit.ly/TRBAM2022registration

#TRBAM

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