



The Missing Connection: The Promise of V2X Connectivity

Larry Head, November 17, 2023



Where were you when you first learned about connected vehicles?
(also called V2X, V2V, V2I, C-V2X, LTE-V2X,....)

What year?

Me?

2004 Austin, TX

I sat next to Michael Maile from Mercedes

What was discussed?

V2V and V2I communications (DSRC) and SPaT

It is going to save lives; lots of lives!

VII is the future!

It was Cool!

I had always wanted the cars to have conversations with the traffic signals – and now we were going to do it in a big way and

The **automakers** were sitting at the table with us.....

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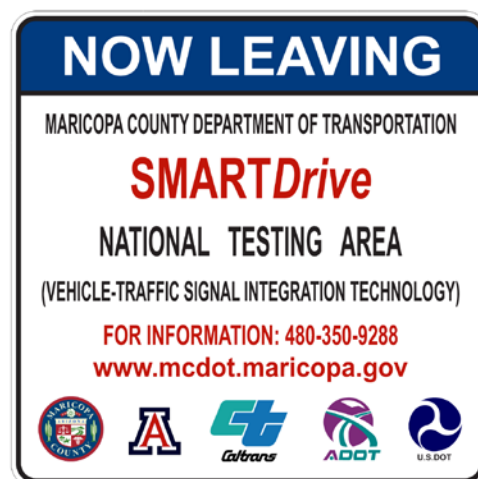


MCDOT SMARTDrive ProgramSM

How can new Connected Vehicle (CV) technology applications enhance traffic signal operations, incident management and traveler information?

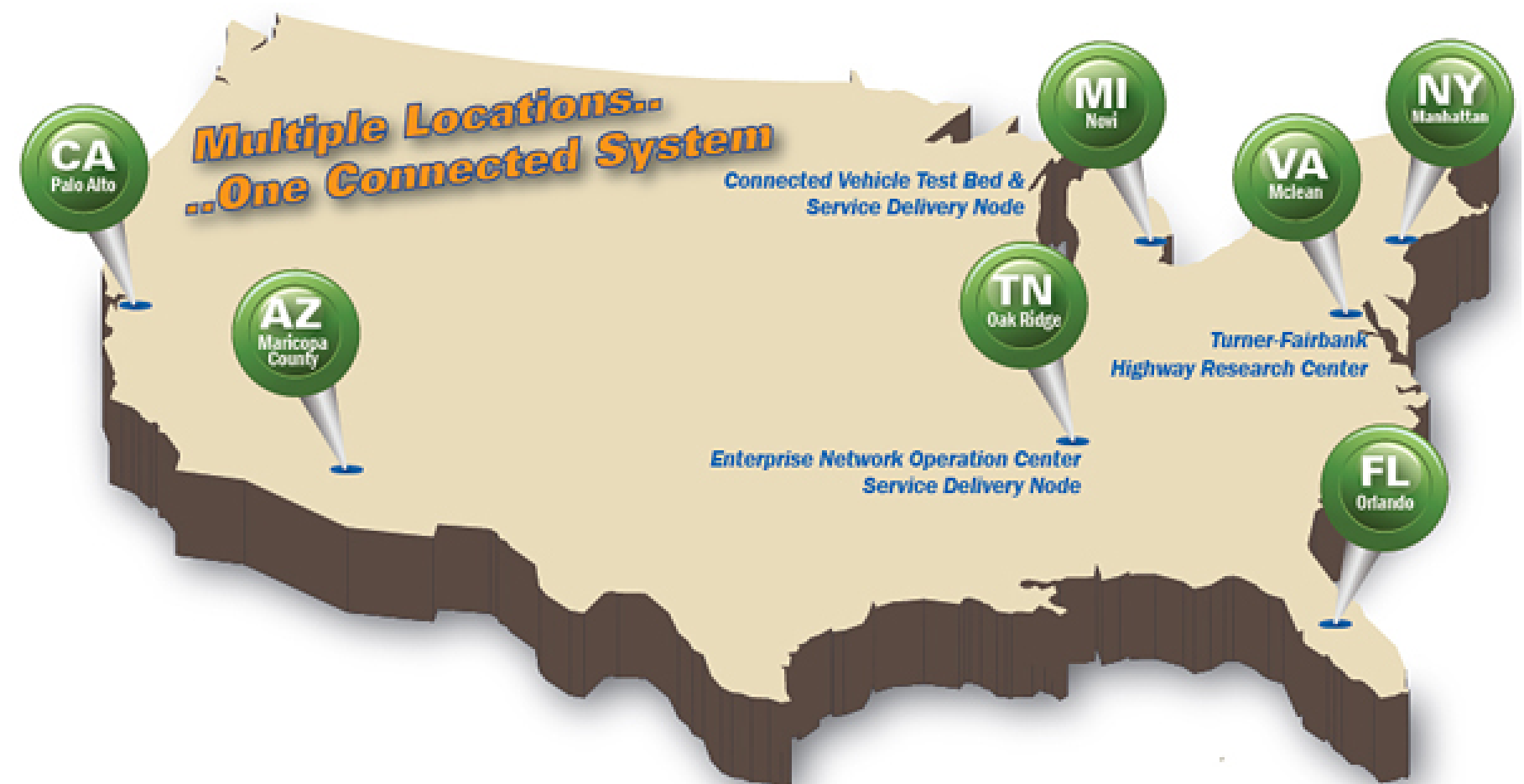


MCDOT
SMARTDrive
Program



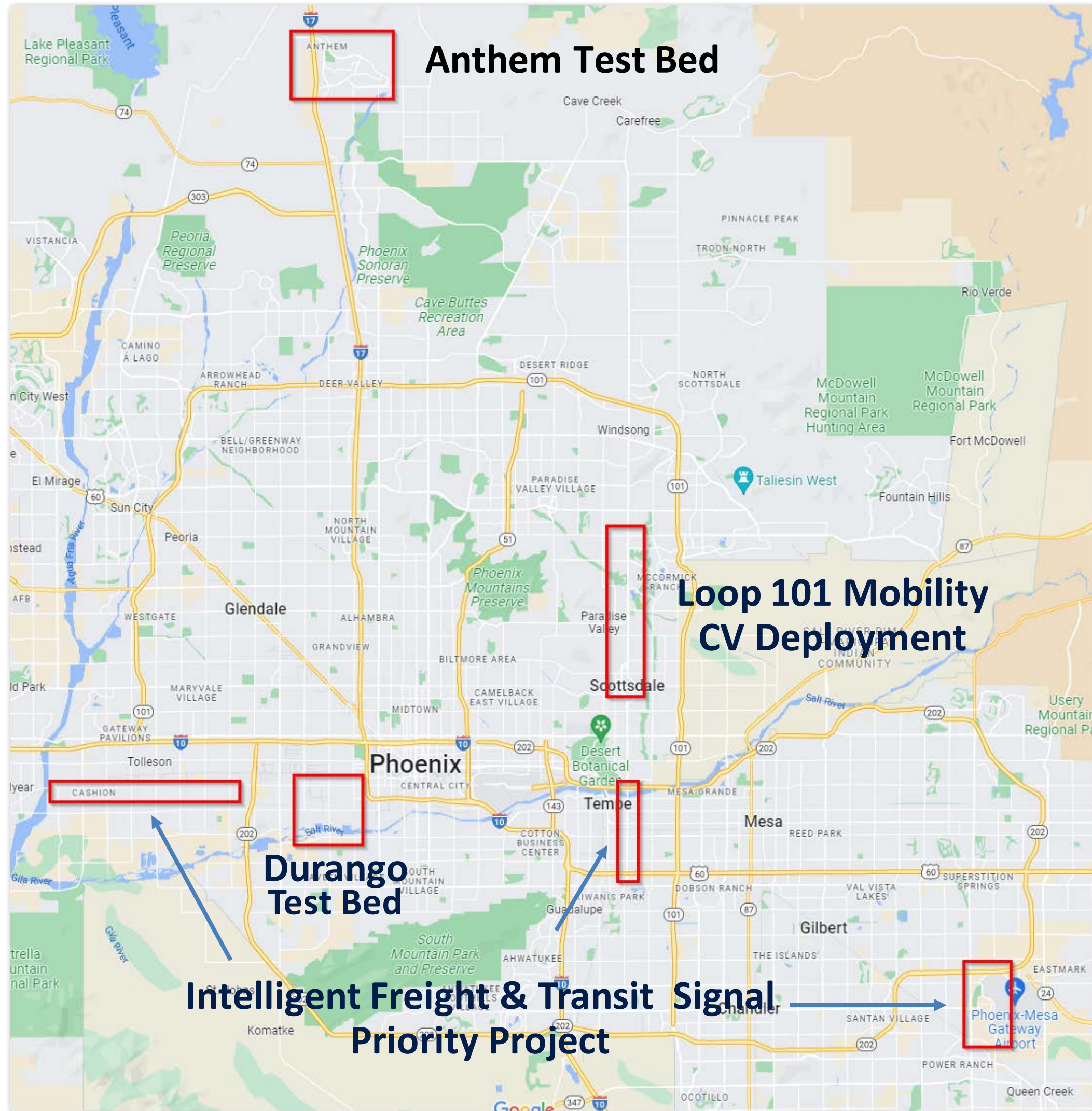
MARICOPA
COUNTY

**Connected
Vehicle** TEST BED



ADOT

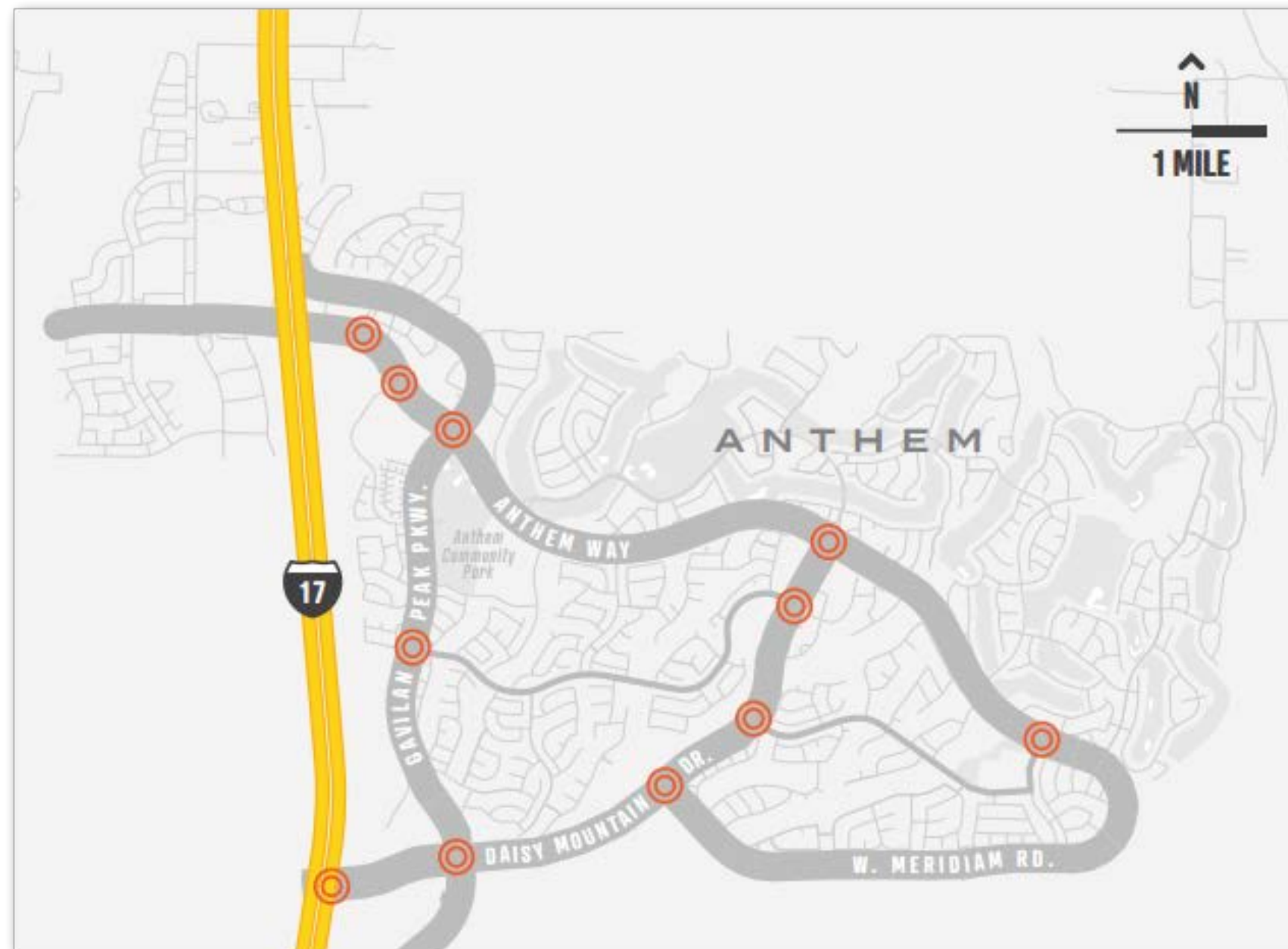

THE UNIVERSITY
OF ARIZONA



Anthem Connected Vehicle Test Bed



DSRC Installations:
11 Intersections
1 Interchange



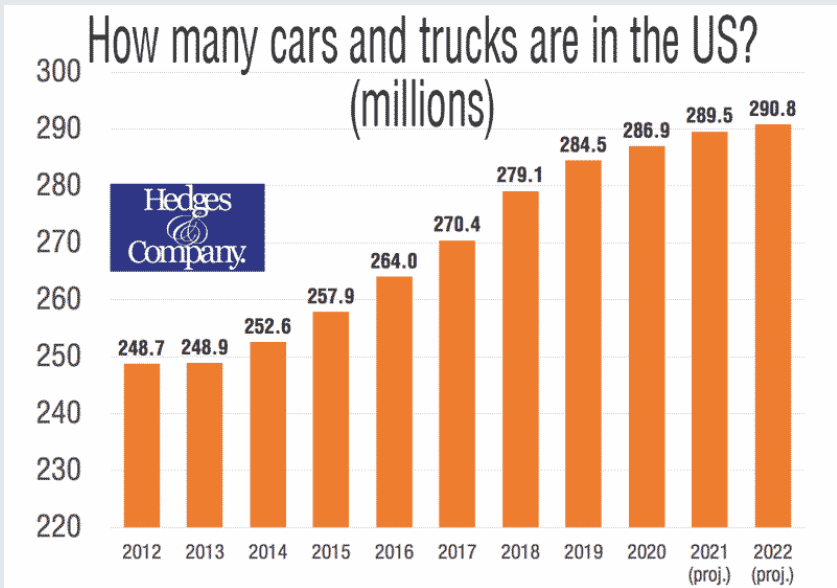
Let's think about it....

How many vehicles today?

How many traffic signals?

What is the population of the US

290.8M Vehicles (2022)



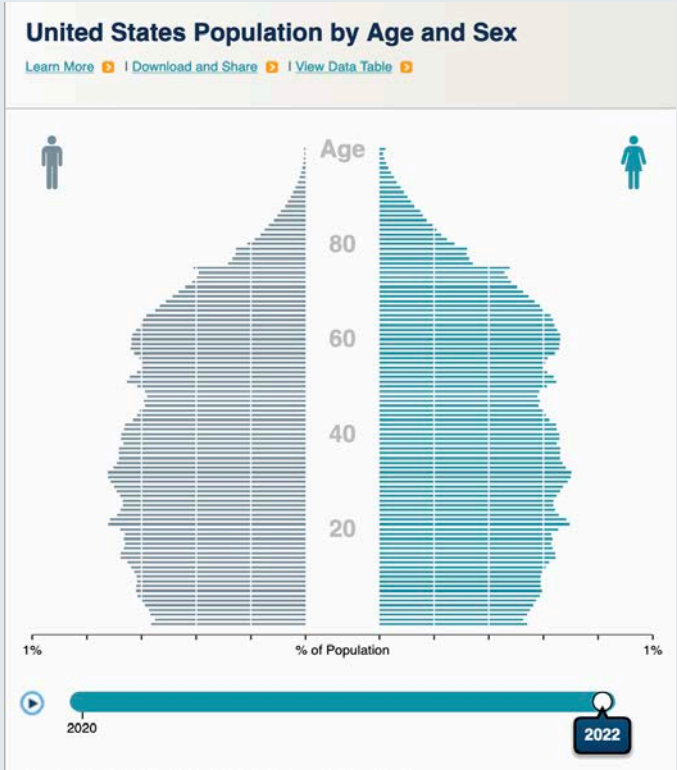
0.000294%

330,000 Signals (USDOT)

City	Traffic signals	Sq. mi. of land	Signals per sq. mi.	People per sq. mi. (2010)	Signals per 1,000 people
Washington, DC	1,652	61.4	26.06	9,317	2.89
Los Angeles	4,114	468.7	8.78	7,545	1.16
New York City	12,460	302.6	41.18	26,953	1.53
Queens, NY	3,119	109.2	28.56	20,554	1.39
Chicago	3,035	227.2	13.36	11,868	1.13
Boston	845	48.4	17.46	13,321	1.31
San Francisco	1,193	46.87	25.45	17,246	1.48
Atlanta	946	131.8	7.18	3,154	2.28

0.94%

331.9M (2021)



The promise to save lives depends on significant market penetration.

We are at 0.000294% - very unlikely two connected vehicles will interact, much less be in a crash condition (e.g., conflict).

We need to move faster....

There has been some progress:

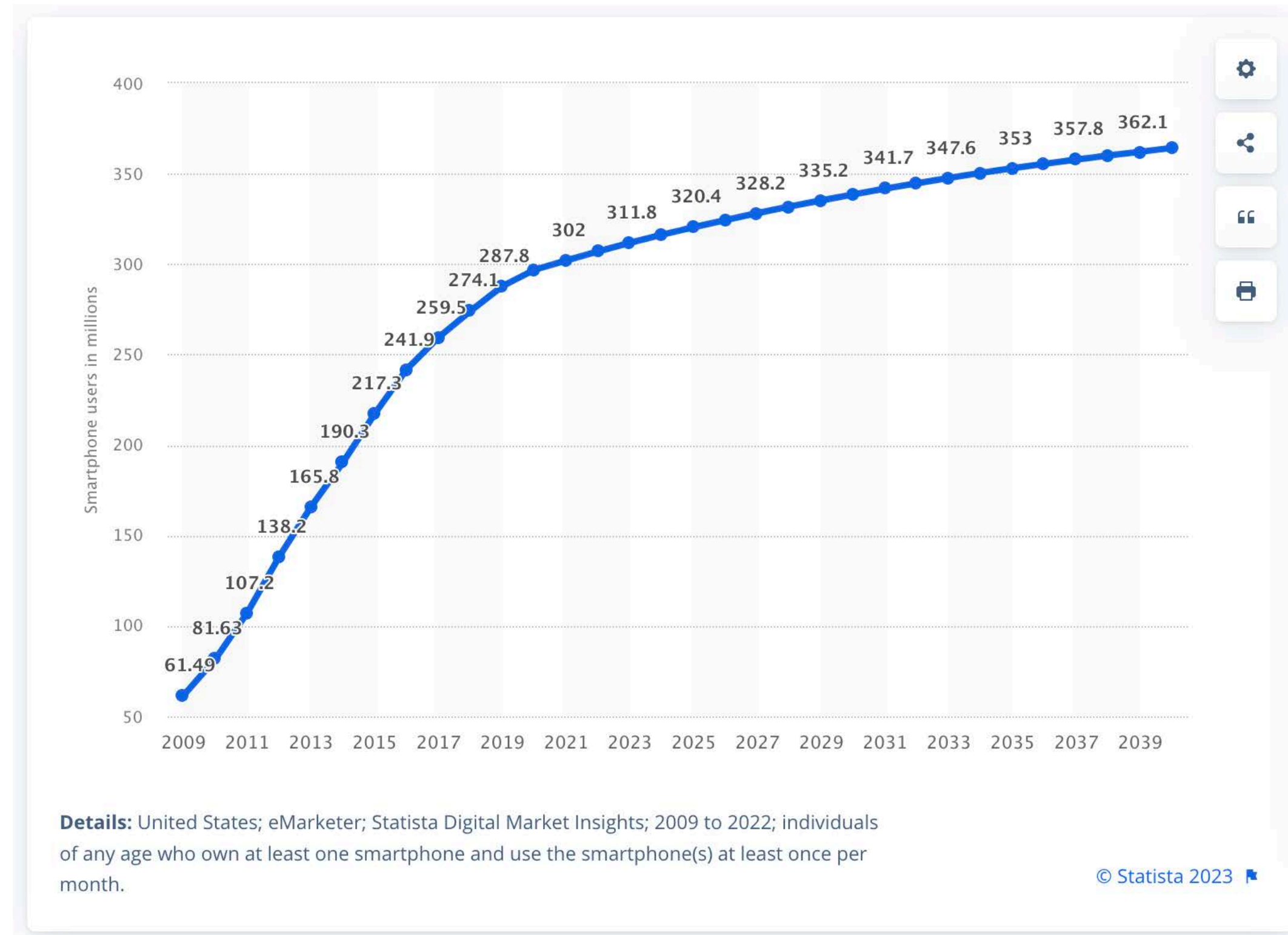
- Rulemaking
- Standards
- Testing and Proof of Concepts



What's missing?

The Connection!

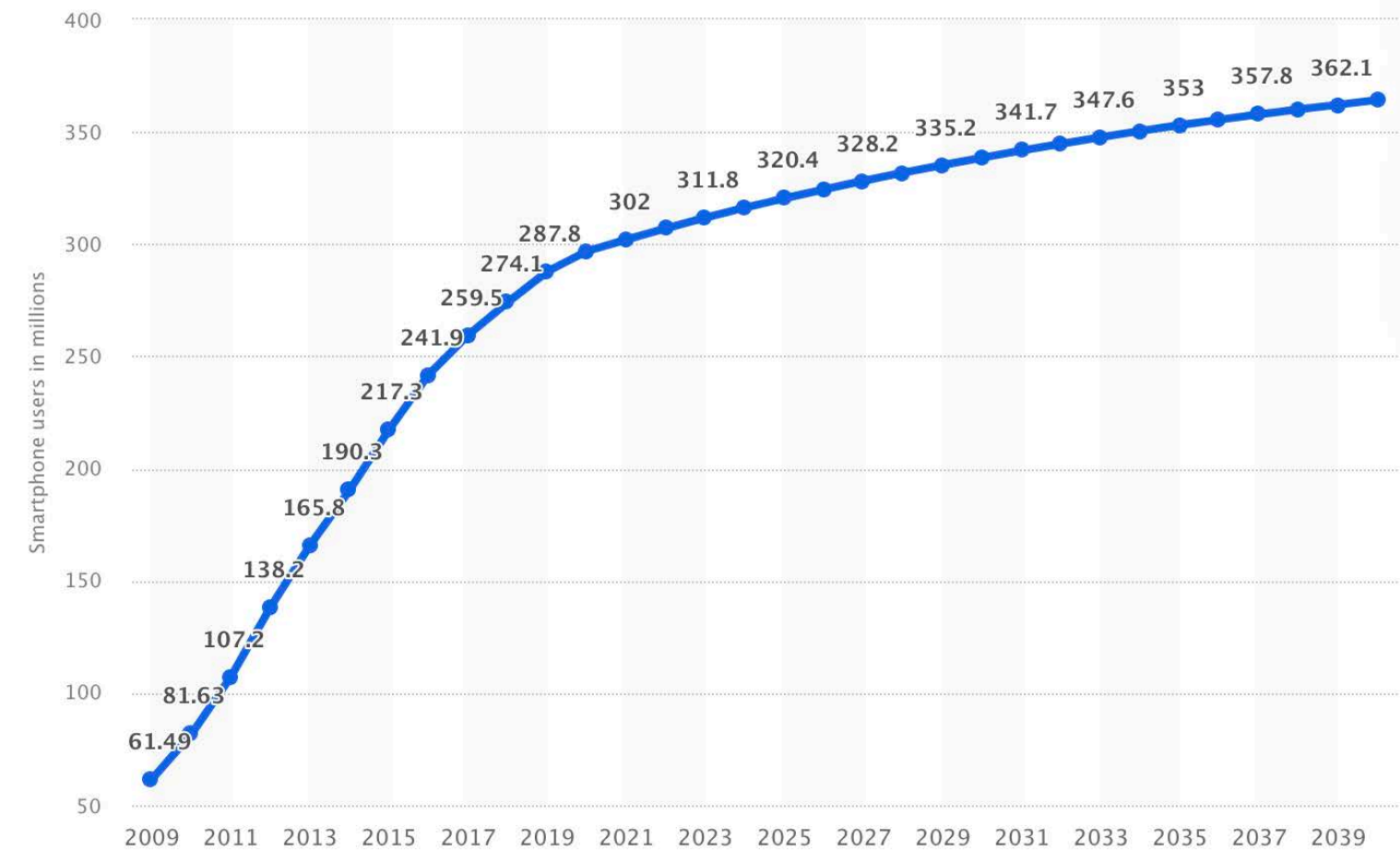
What other wireless communications has been growing?
Cellular. Smartphones.



Let's try it.....!!

Pros – market penetration

Cons – location accuracy,
latency (but very
acceptable for our
apps), app adoption,
power concerns

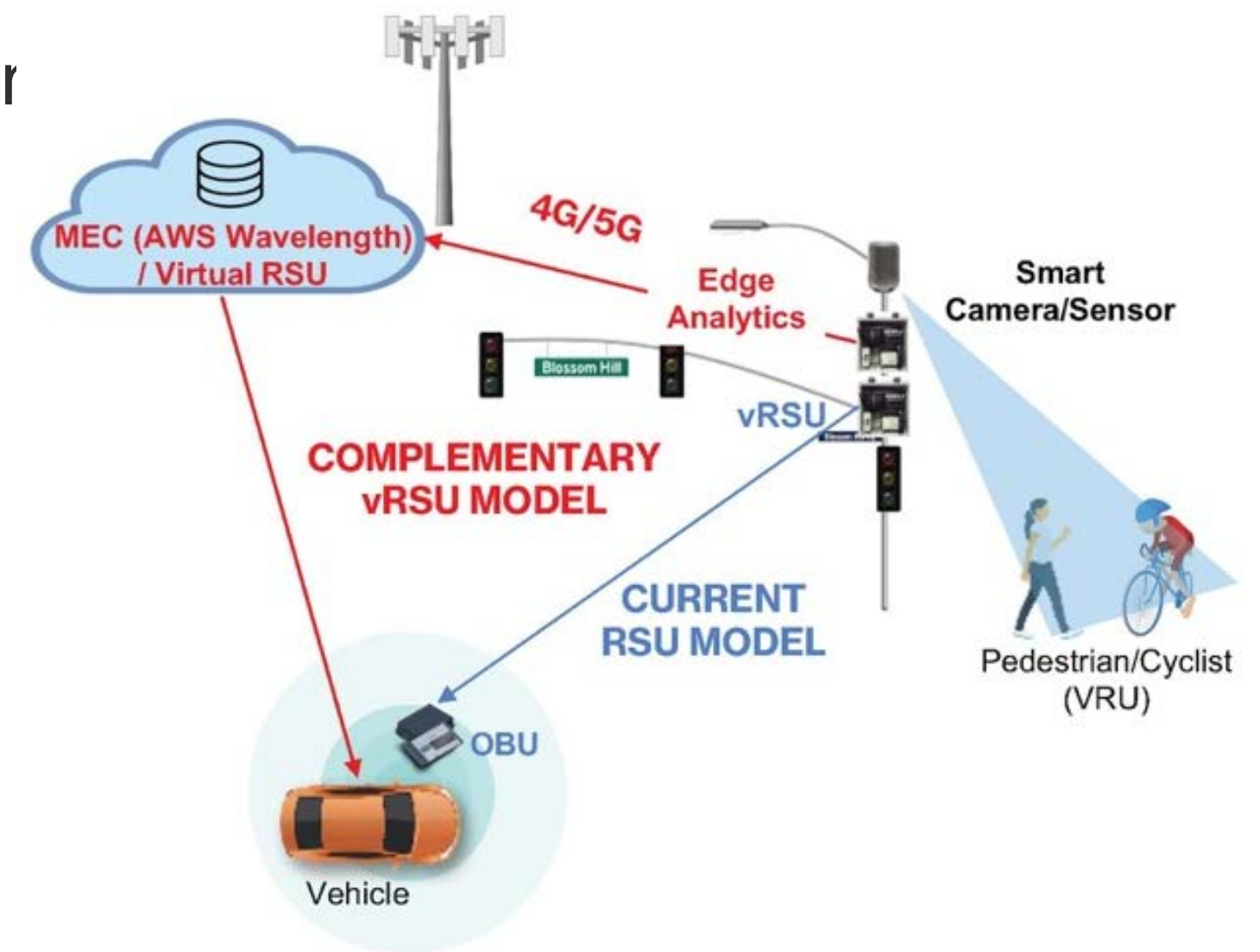


Details: United States; eMarketer; Statista Digital Market Insights; 2009 to 2022; individuals of any age who own at least one smartphone and use the smartphone(s) at least once per month.

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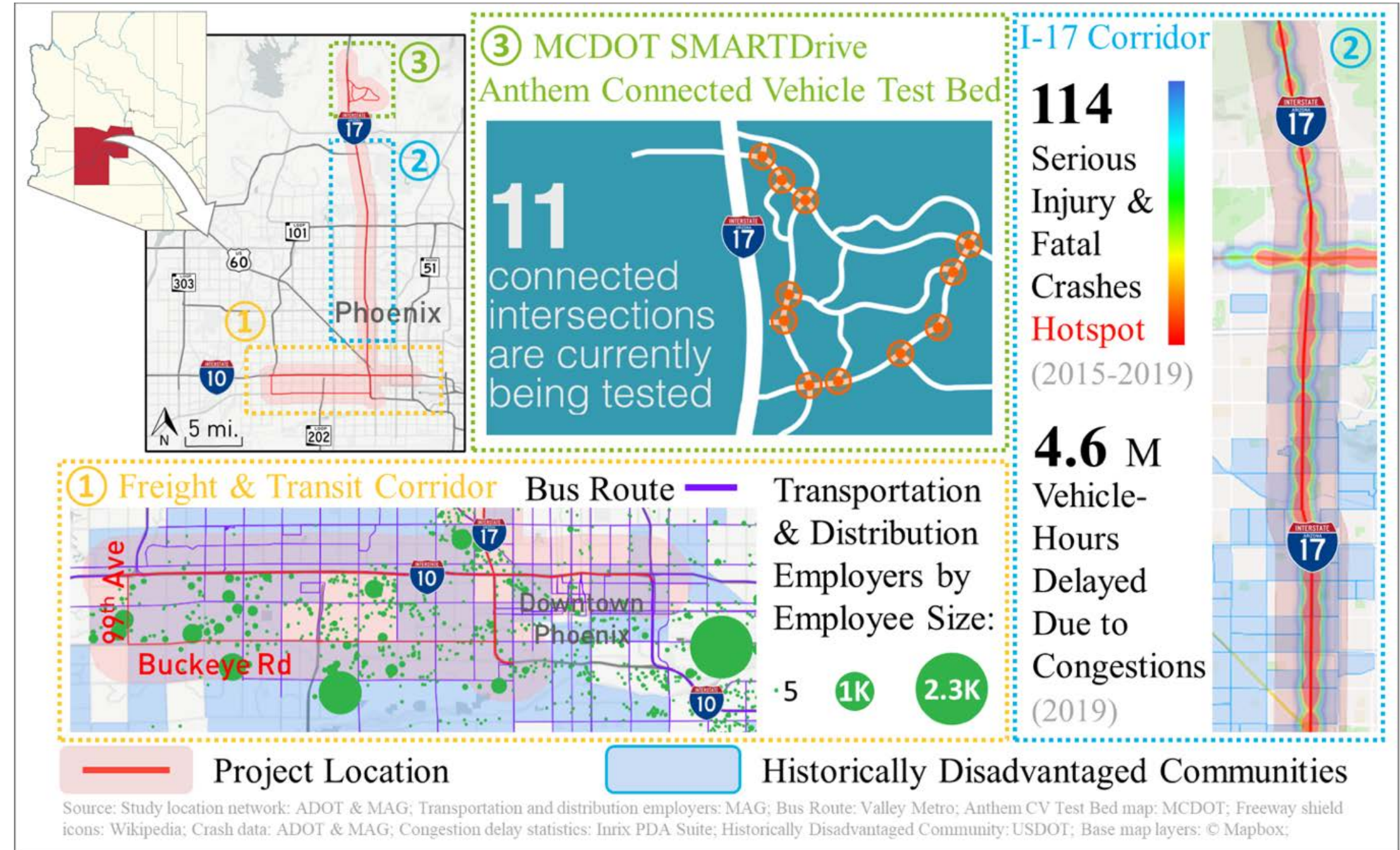
DRIVE Arizona: Digitizing Roadways with Innovative V2X Ecosystems for a safe, inclusive Arizona

- \$1.75M USDOT SMART Grant
- Led by the Arizona Commerce Authority, building on work done by ADOT, MAG, MCDOT, and UArizona
- Demonstrate CV Applications using 4G/5G cellular systems:
 - Back of Queue warnings
 - Work Zone warnings
 - Transit Signal Priority
 - Vulnerable Road User warnings
- Virtual RSUs and smartphone-based apps



DRIVE Arizona: Digitizing Roadways with Innovative V2X Ecosystems for a safe, inclusive Arizona

Deployment area includes over 60 miles of freeway and arterial streets and will include at least 1,000 public fleet vehicles



Closing Comments

- V2X will be required for many safety applications
- Cellular (4G/5G/6G...) can provide significant market penetration and opportunities for mobility and safety
- Verizon, AT&T, T-Mobile, and others (American Tower) are experts at providing these technologies - let's let them do it!
- We need a business model that works for all parties

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Thank you

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