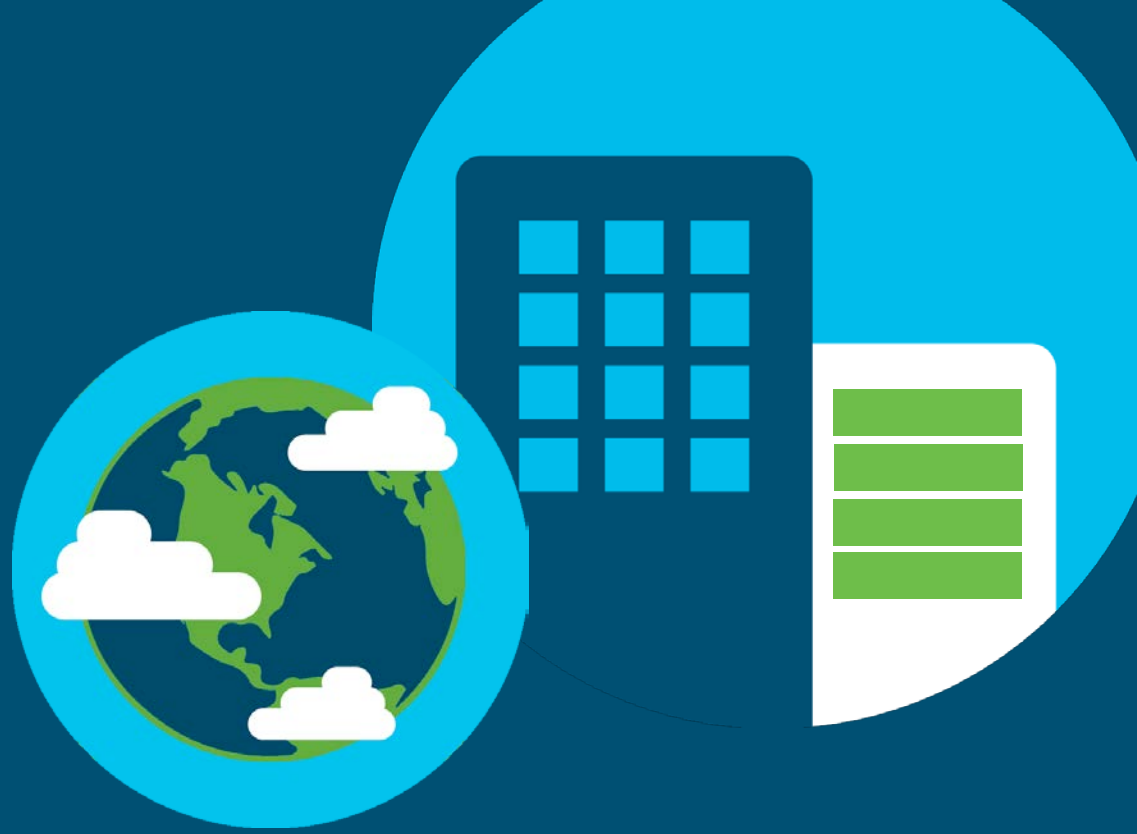
SMART+CONNECTED COMMUNITIES



Smarter, safer, greener:

Smart cities start with a digital foundation

Michelle Maggiore, PE, Cisco

TNCs – Uber and Lyft

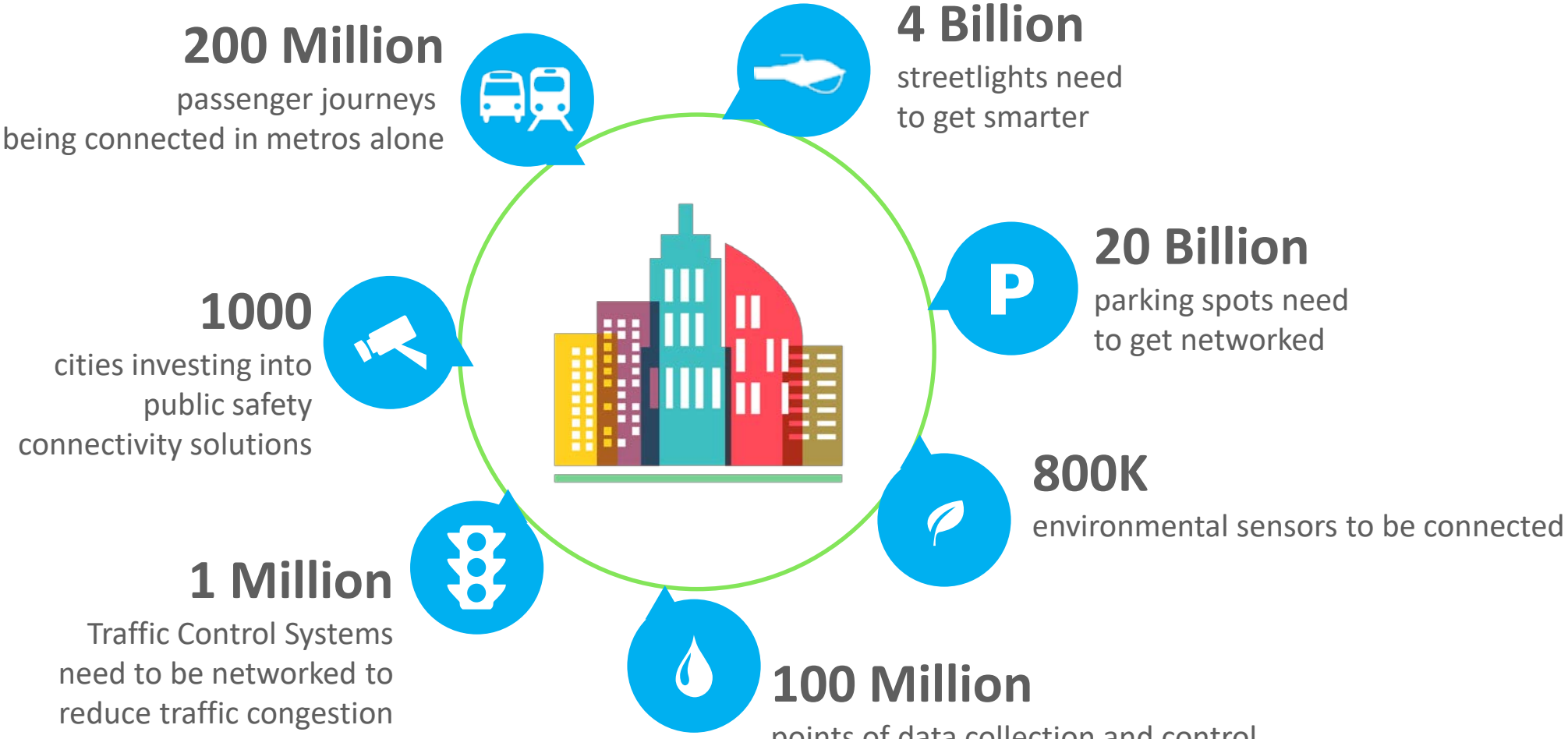
Connected Vehicles

Automated Vehicles

Today's disruption is digital and required the City of Las Vegas to adapt

What makes a city smart?

Data makes a city smart



Data also highlight concerns

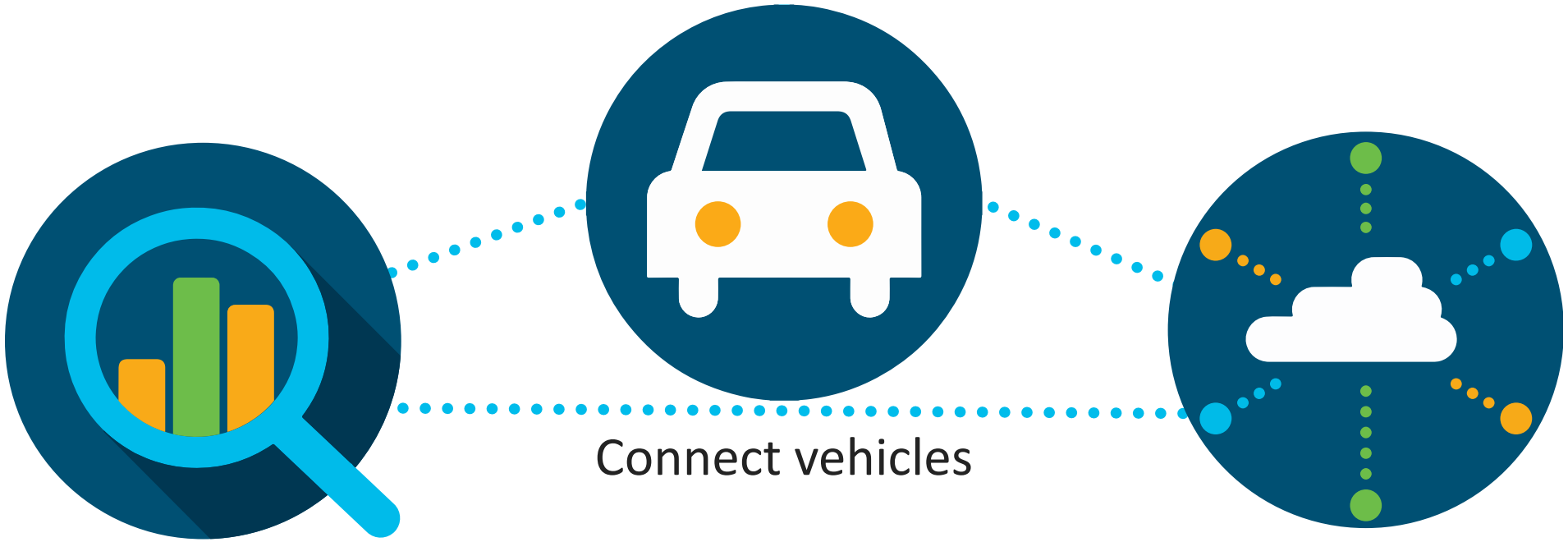
- Since 2014, traffic fatalities increased by 22%
- Traffic fatalities have become the number one killer of teenagers in the U.S., more than four times that of opioids and medical conditions
- 6,000 pedestrians were killed by motor vehicles in 2017
- 78 people were struck by vehicles and killed in Clark County, Nevada in 2017

Steel posts near Aria, Las Vegas Blvd, to protect pedestrians

Best laid plans

- Increasing the safety and security of the transportation system,
- Increasing the accessibility and mobility of transportation options,
- Supporting the economic vitality of Southern Nevada,
- Protecting the immediate environment surrounding the transportation system,
- Integrating all transportation modes, and
- Preserving the existing transportation system.

Technology can unlock data to address concerns



Develop actionable insights from data

Connect vehicles

Reduce response time and/or respond in real-time

Las Vegas is driving to digital to address challenges

Traditional Trends

- Mobility, with a focus on the physical connections between modes
- Single-occupant vehicles, and households with more than one vehicle
- Congestion
- Traffic volume sensors
- Resurfacing pavement
- TMC-dependent analytics
- Intelligent Transportation Systems (ITS)

Digital Trends

- Access, with a focus on opportunities to interact with data
- Shared mobility/ Transportation Network Companies (TNCs)
- Digitization
- Vehicle as a sensor
- Laying fiber
- Internet of Things (IoT)
- Edge and fog computing

Foundational technologies enable

1
Public Safety

"Eliminate Fatalities"

2
Transportation

"Improve Travel Time Reliability"

3
Economic Development

"Grow North Florida"

4
Economic Mobility

"Provide Ladders of Opportunity"

5
Sustainability

"Reduce Greenhouse Gas Emissions"

INTEGRATED DATA EXCHANGE

EDGE COMPUTE

SHARED INFRASTRUCTURE: Network, Storage, Compute, Collab., Cloud

Livin’ on the edge: The power of real-time data processing

Acquisition

- Acquire millions of messages per second

Filtering

- Determine what messages are meaningful
- Generate baseline sampling

Normalization

- Work across standards, DSRC J2735-2016, DSRC J2735-2009, NTCIP

Apply logic and analytics

- Logic based on rules
- Analytics through microservices

Aggregation

- Apply aggregation policy for data, sampled, alerts, and so on

Benefits

- Quicker
- Allows for automation*
- More reliable

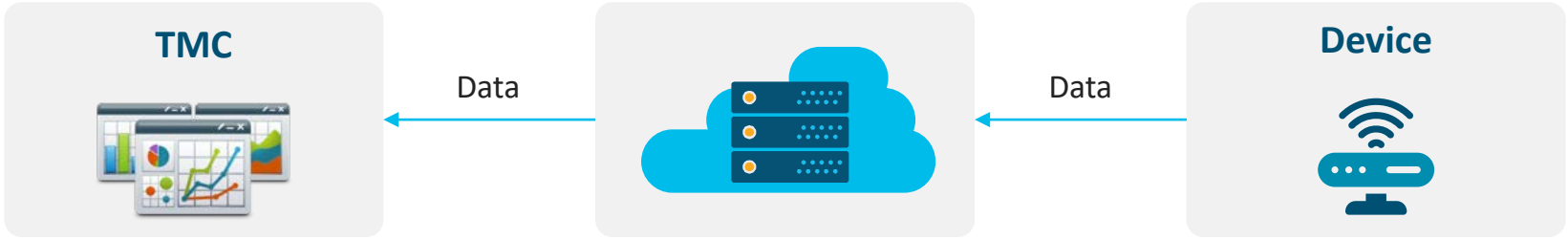
“We found that Cisco was a partner for us, providing a solution based on Cisco Kinetic, and thus we got a more layered architecture.”

— Gerard Avontuur, Program Manager, Rijkswaterstaat (RWS)

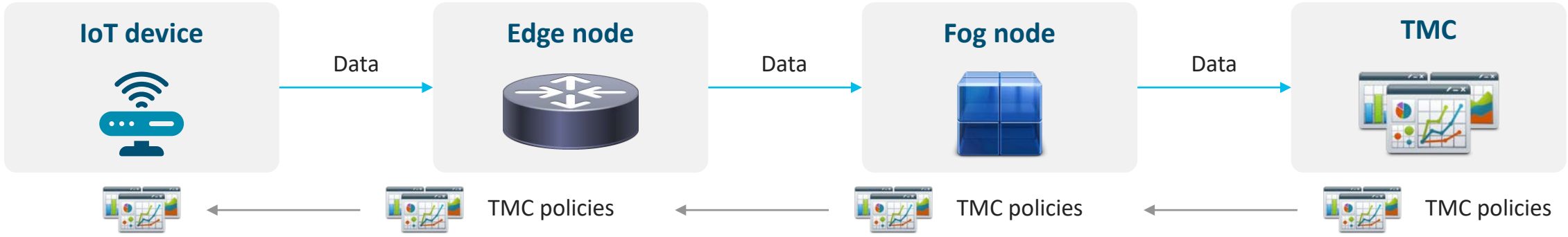
** Decisions can be automated based on agency preferences*

Driving intelligence to the edge

Traditional: Deliver data to the Traffic Management Center (TMC) to make centralized decisions



Decentralized: Analyze data in the "right" place by distributing data and decentralizing decision support



Analyzing data closer to the IoT device allows for real-time transportation use cases;
data is then sent to the TMC for additional analytics

Edge intelligence makes V2I actionable

- Using DSRC as an example,10 packets are transmitted per second
- Cisco is agnostic to the type of V2I communications; we focus on unpacking critical information from DSRC (or future V2I technologies) at the network edge to make decisions

BSM.pcap

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	e2:73:0d:2f:cd:4b	Broadcast	SAE J2735 (2014) Protocol	145	basicSafetyMessage-D
2	0.098532	e2:73:0d:2f:cd:4b	Broadcast	SAE J2735 (2014) Protocol	145	basicSafetyMessage-D
3	0.198099	e2:73:0d:2f:cd:4b	Broadcast	SAE J2735 (2014) Protocol	145	basicSafetyMessage-D
4	0.265450	e2:73:0d:2f:cd:4b	Broadcast	SAE J2735 (2014) Protocol	149	basicSafetyMessage-D
5	0.298233	e2:73:0d:2f:cd:4b	Broadcast	SAE J2735 (2014) Protocol	149	basicSafetyMessage-D
6	0.398115	e2:73:0d:2f:cd:4b	Broadcast	SAE J2735 (2014) Protocol	149	basicSafetyMessage-D

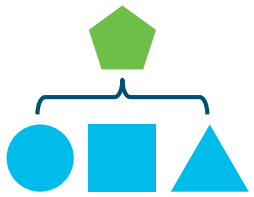
```
▾ IEEE 1609.3
    WSMP version: 2
    PSID: 0x00000000
    Transmit power: 24
    Rate: 12
    Channel: 172
    WAVE element id: WAVE Short Message (128)
    WSM Length: 101
    Wave Short Message
▾ SAE J2735 (2014) Protocol
  ▾ BasicSafetyMessage
      msgID: basicSafetyMessage (2)
      blob1: 546b6afd143778193ab6f3ce7d69d9023e19160000e34c04...
    ▾ blob1: 546b6afd143778193ab6f3ce7d69d9023e19160000e34c04...
        msgCnt: 84
        id: 6b6afd14
        secMark: 14200
        lat: 42°19'40.1963"N (42.3278323)
        long: 83°03'51.0131"W (-83.0641703)
        elev: 57.4 m (0x023e)
        accuracy: 19160000
        speed: Trans: unavailable, Speed: 16.88 m/s | 60.77 km/h (58188)
        heading: 15.1000° (1208)
        angle: unavailable (127)
        accelSet.lon: -7.1900 m/s^2 (-719)
        accelSet.lat: unavailable (2001)
        accelSet.vert: unavailable (-127)
        accelSet.yaw: 0.0000°/s (0)
        brakes: f000
        width: 184cm, 1.84m
        length: 497cm, 4.97m
      ▾ safetyExt
          events: eventHardBraking (128)
        › pathHistory
        › pathPrediction
      ▾ status
        ▾ vehicleData
            height: 0
          ▾ bumpers
              frnt: 0
              rear: 0
```

Frame (frame), 149 bytes — Packets: 601 · Displayed: 601

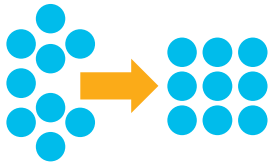
Journey to a smart city

Foundation → **Edge Compute** → **Use Cases**

Digital network foundation



Collect, normalize and deliver data to relevant applications

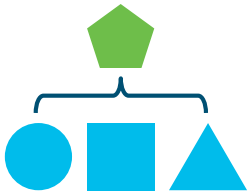


Improve safety, mobility, and other citizen services

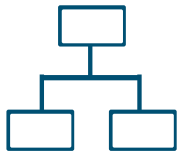
Start by connecting and securing sensors in a validated, secure foundation

Building the Foundation

Digital network foundation



- The digital network provides a communications foundation for Smart Cities, and incorporates mobility use cases for early deployments
- The digital network foundation is built on Cisco's industry leading network portfolio and tested using the Cisco Validated Design (CVD) process for Connected Roadways: https://www.cisco.com/c/dam/en_us/solutions/industries/docs/trans/connected-roadways-cvs.pdf



Ethernet

Industrial Ethernet

Wi-Fi

Industrial Wi-Fi

Cellular

IoT Gateways

LoRa

LoRa GW
Network Server

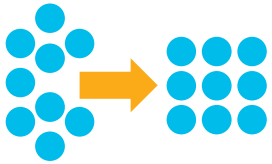
RF-Mesh

Metering & DA
CGR

Use edge compute to normalize data

Cisco Kinetic™

Collect and normalize sensor data using Cisco Kinetic



- Kinetic Edge Fog Module (EFM) software provides the ability to add applications to network infrastructure – this means that use cases can be added to scale the Connected Roadways foundation
- Edge compute allows for real-time and predictive applications throughout and across agencies and modes

“CV and ITS deployments should be aligned with agency performance standards and holistic data requirements so that DOTs can leverage data sources across the organization.”

— USDOT JPO

Scale infrastructure by adding use cases

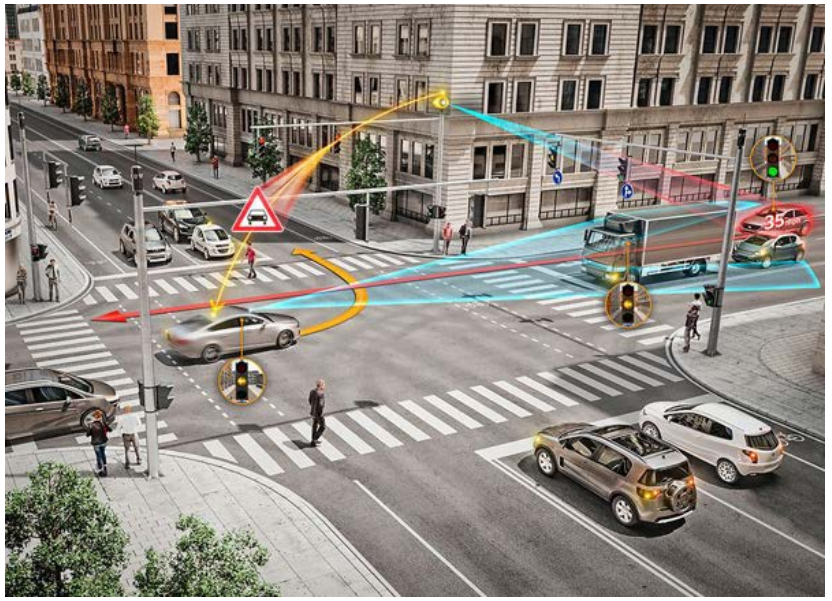
Use cases

Connected corridor use cases:

- **Smarter roadways, highways, and interstates:**
  Connect transportation corridors to vehicles and other IoT sensors using Cisco® hardware, software, and Dedicated Short-Range Communications (DSRC)/ future V2X cellular devices for safety, congestion, and performance management

Intelligent intersection use cases:

- **Smarter traffic signals and city streets:**
  Connect transportation arterials to vehicles using Cisco hardware, software, and DSRC/ future V2X cellular devices for Signal Phase and Timing (SPaT) and other safety applications



** Build use cases from hardware and software using Cisco Customer Experience (CX) services*

In Las Vegas, technology is improving safety and operational efficiency

Use cases deployed to date

- Vehicle as a sensor, including DSRC integration
- DSRC to communications Signal Phase and Timing (SPaT) and MAP (in development)
- Pedestrian tracking, preemption, and safety using LiDAR

Outcomes

- Enhanced data from connected and non-connected vehicles
- Improved response times with real-time insights
- Improved traffic/pedestrian safety

Connected vehicles send current road conditions

Data is quickly processed to actionable insights

Traffic systems and driver alerts are deployed to improve safety

City of Las Vegas DSRC dashboards

City of Las Vegas

Use cases deployed to date:

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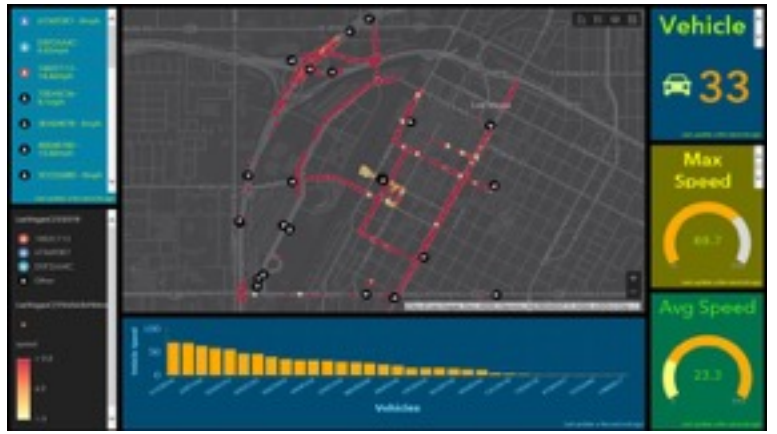
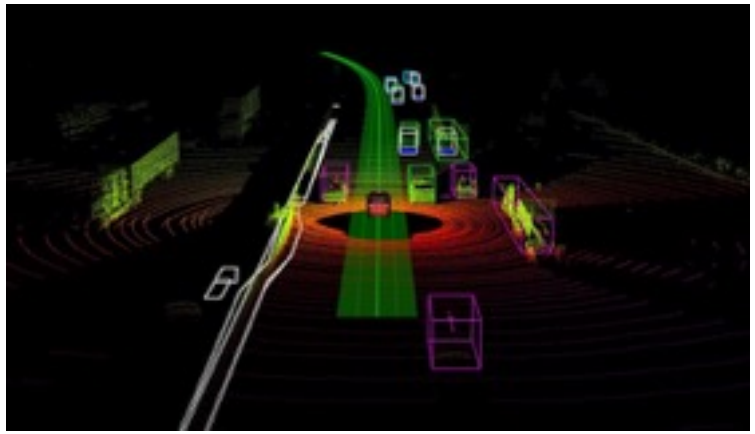
SPaT



LiDAR



ESRI dashboard

Thank You!


CISCO