Transportation
Cisco Connected Roadways

Smarter, Safer, Faster

Transportation and Cities

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Pushing intent based networking to the IoT edge

Typical Customer IoT Journey

Connecting "Things"

Remote Monitoring and Control

Data Driven Business Outcomes

- Cross-Domain Correlation & Actions
- Digital Twin

Secure connectivity is the foundation for every IoT deployment

Journey to a Digital Network Architecture

We are here

Digital–ready infrastructure
Secure foundation
Programmability
Virtualization

Policy-based automation
Business policy
Translation
Segmentation

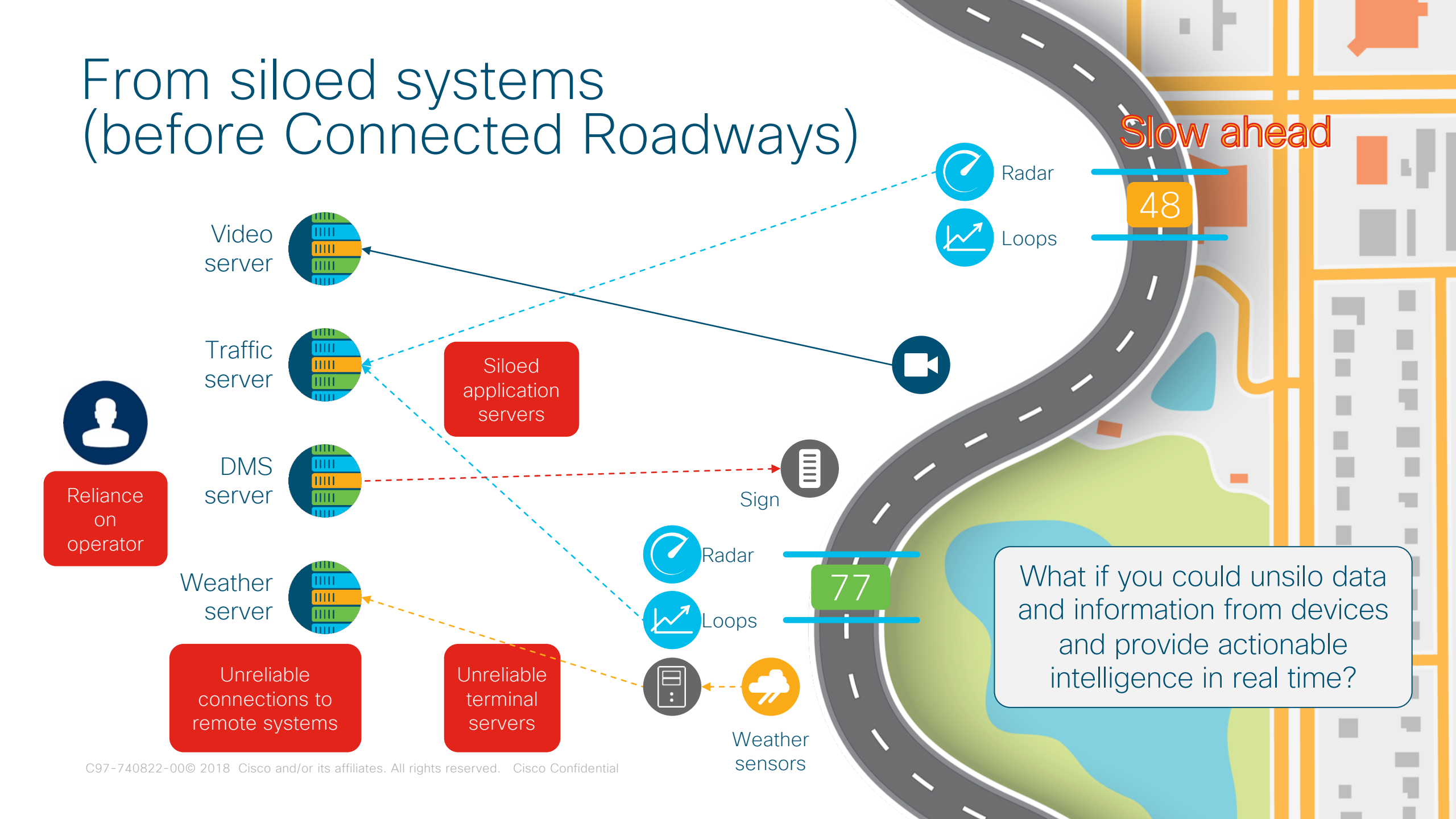
Analytics and assurance
Everything as a sensor
Telemetry
Historical and real-time

Machine learning and AI
Policy validation
Predictive
Self-healing

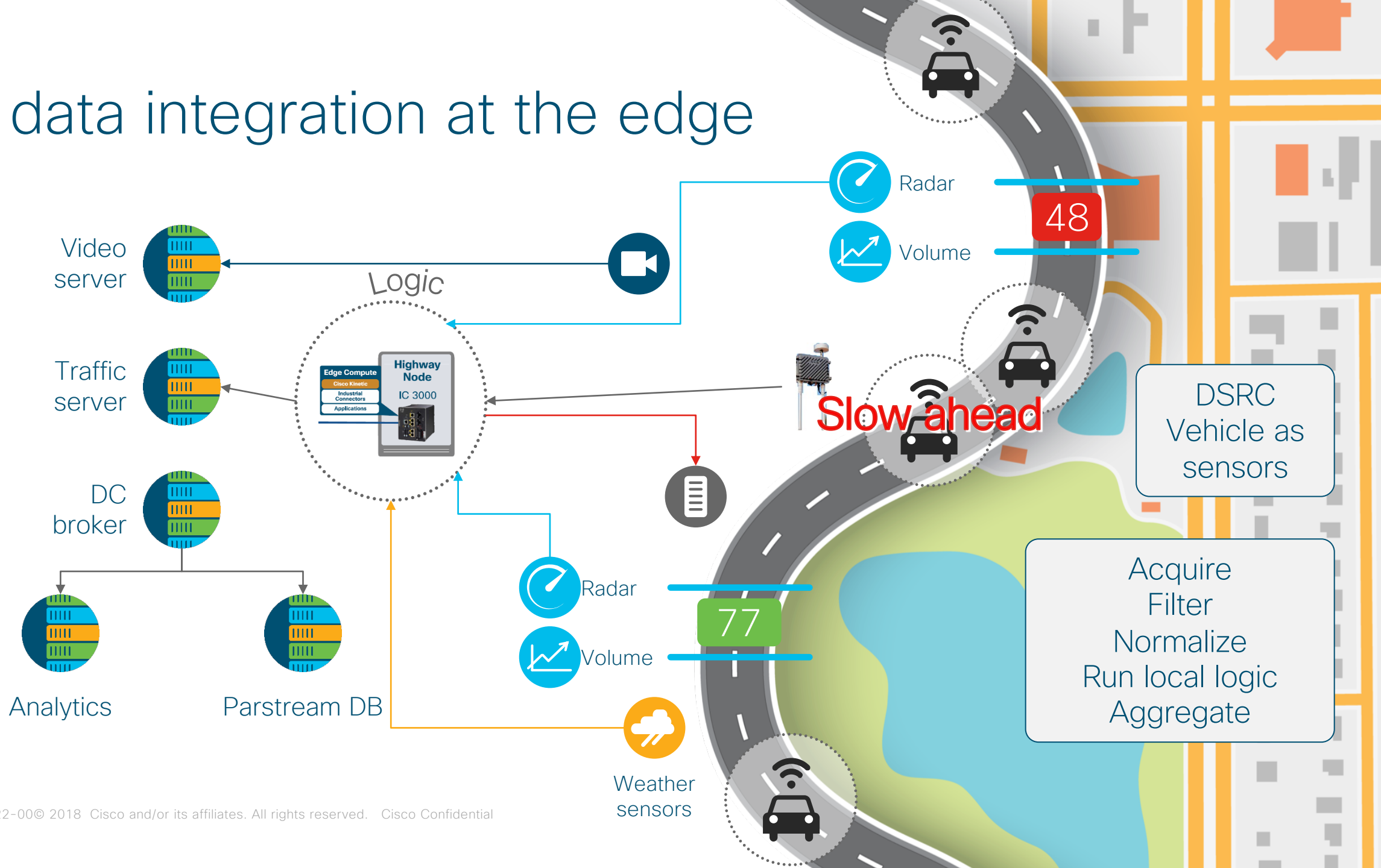
Intent-based networking
Constantly learning
Constantly adapting
Constantly protecting

Scaling (via cloud) →

From siloed systems (before Connected Roadways)



To data integration at the edge



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

Real world example

Edge Processing

Reduces data storage by 857% with 10% sampling

Flags interesting data upon receipt

Requires 1/10th the data transmission

Applies context at edge all data is verified

Duplicate entries are removed

Zero latency in edge analytics results

Without Edge

All 19 TB/day will need to be de-dupped

All 19TB/day will need to be analyzed for location to validate GPS for context

All 19TB/day will need to be parsed for "important" information

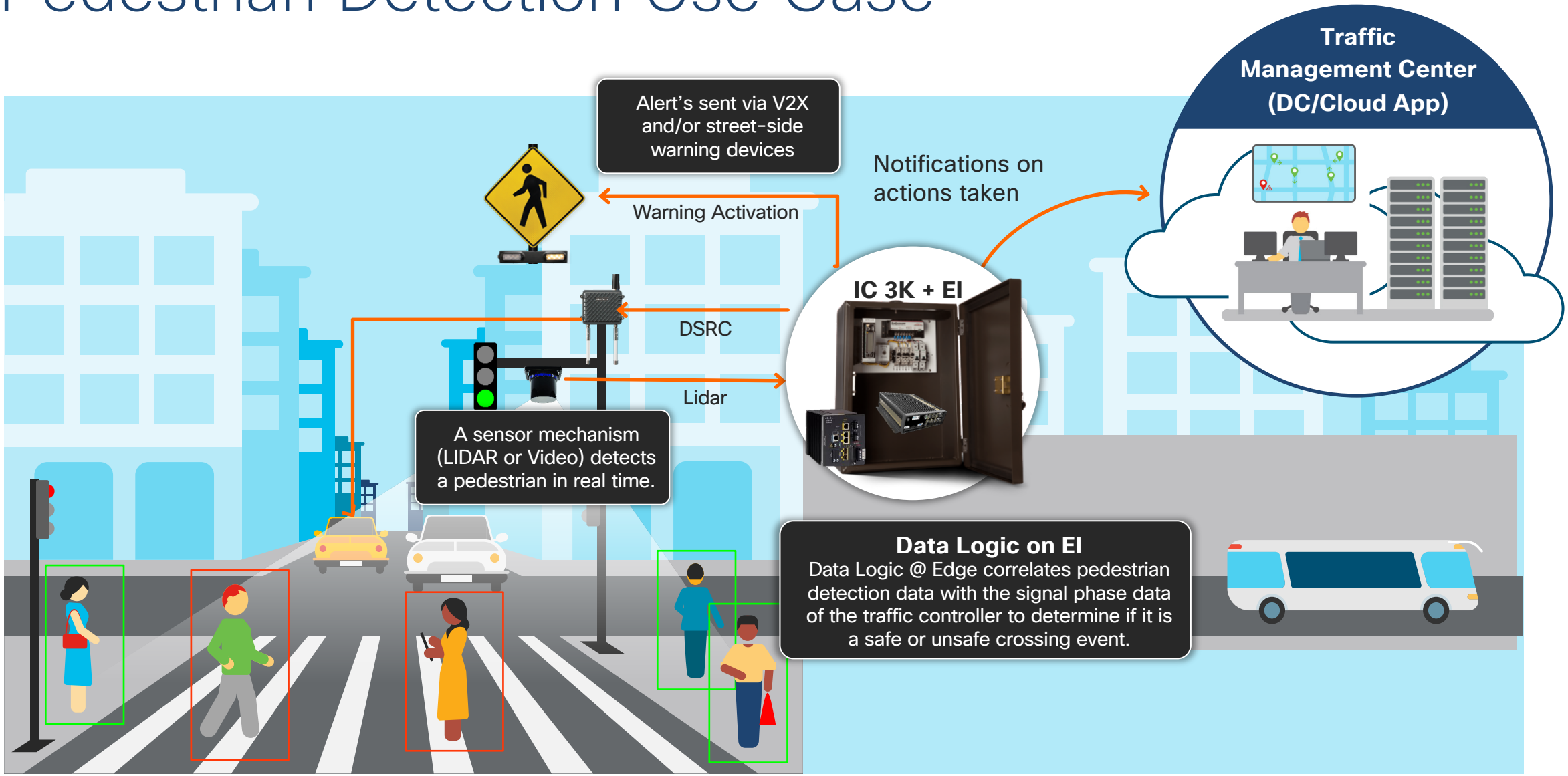
Analytics will have to parse 19TB/day to develop baseline sampling

Extended latency for analytics results

	car/d/lane	lanes	%m/s Bleed	%m/s Dup	SampleRt	Alert%	Gigabytes/day/mile	Miles	Total Terabytes/day	Total Terabytes/year	Petabytes/year
No Edge Processing											
Pure/nobleed/nodup	66.00	8.00	0%	0%	0%	3%	109.49	100.00	10.95	3,996.24	4.00
10% Bleed/10% Dup	66.00	8.00	10%	10%	0%	3%	131.38	100.00	13.14	4,795.49	4.80
30% Bleed/20% Dup	66.00	8.00	30%	20%	0%	3%	164.23	100.00	16.42	5,994.36	5.99
50% Bleed/40% Dup	66.00	8.00	50%	30%	0%	3%	197.07	100.00	19.71	7,193.24	7.19
Edge Processing											
Pure/nobleed/nodup	66.00	8.00	0%	0%	10%	3%	14.23	100.00	1.42	519.51	0.52
10% Bleed/10% Dup	66.00	8.00	1%	0%	10%	3%	15.33	100.00	1.53	559.47	0.56
30% Bleed/20% Dup	66.00	8.00	3%	0%	10%	3%	17.52	100.00	1.75	639.40	0.64
50% Bleed/40% Dup	66.00	8.00	5%	0%	10%	3%	19.71	100.00	1.97	719.32	0.72

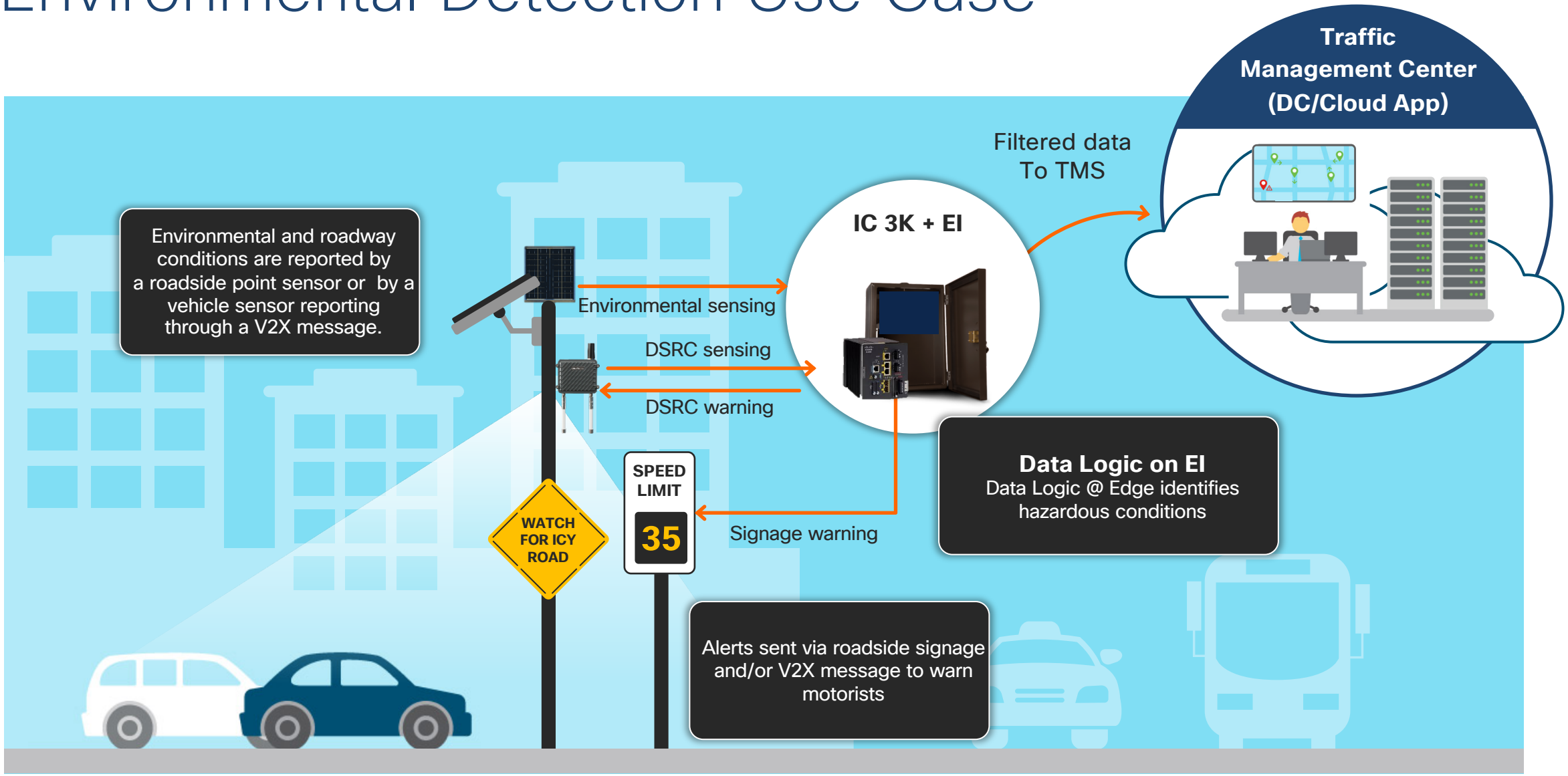
Emerging Use Cases

Pedestrian Detection Use Case

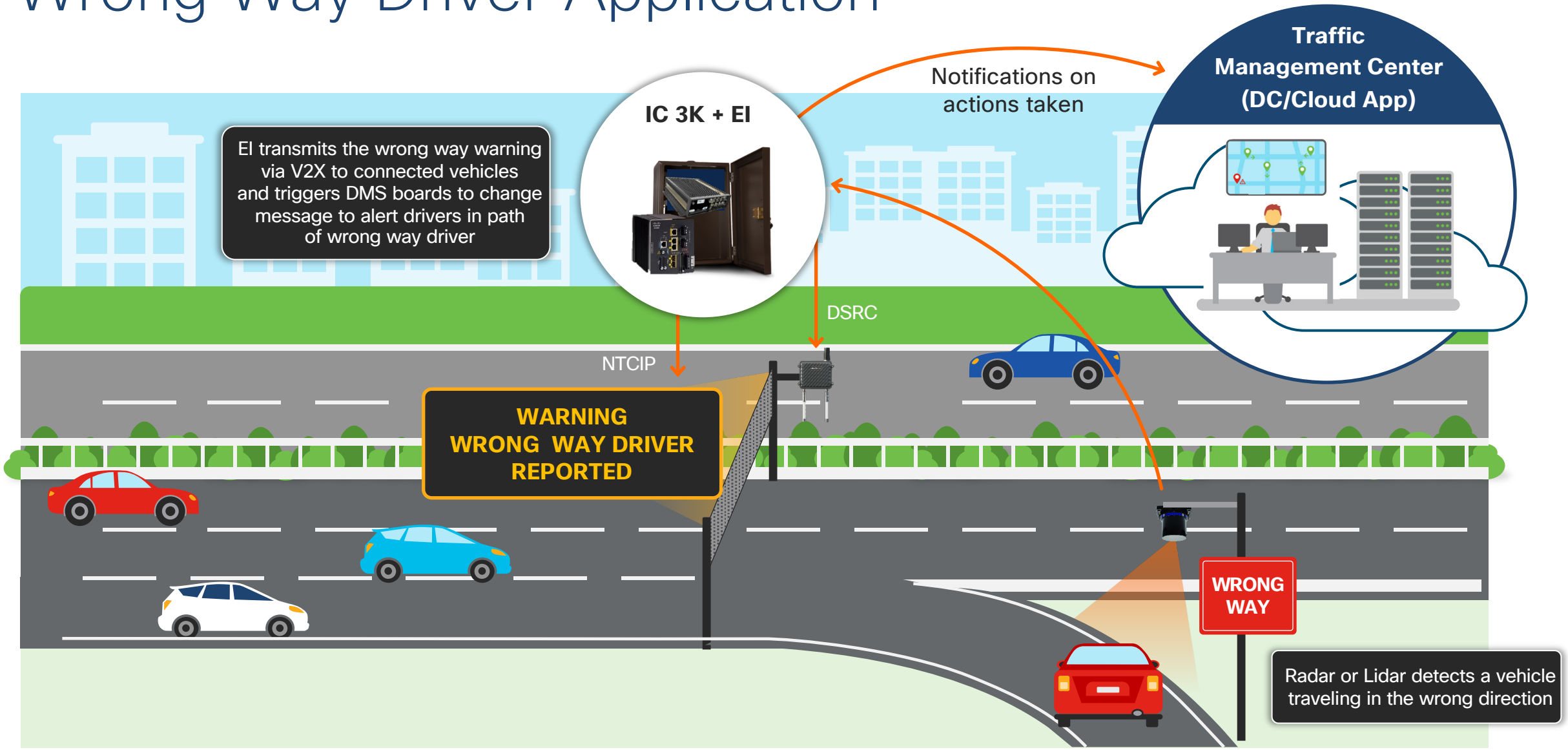


Vehicle as a Sensor Use Case

Environmental Detection Use Case



Wrong Way Driver Application



Questions?