

# Driving Business & Technology Transformations of the Future



Flash Memory Summit

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# Smart Cities and Autonomous Mobility

Smart Cities expected to be a \$1.5T market by 2020

1.3M people moving to cities every day

8B+ hrs US stuck in traffic; 17-hrs/day finding a parking spot

80% of people living in cities exposed to air quality levels > WHO limits

2.5M autonomous cars in US by 2023

# IoT



**By 2025, global worth of IoT tech is projected at \$6.2B**

**IoT connected devices expected to surpass mobile in 2018**

**75% of leaders have a more favorable view of IoT than just two years ago**

# 5G & Multi-access Edge Compute (MEC)



\$12.3T of global economic output by 2035  
and supports 22M jobs worldwide

5G networks expected to generate \$533B in  
US GDP and \$1.2T in consumer benefits

# AI, Computer Vision, AR and VR

A man in a blue hoodie and jeans is sitting on a wooden floor, wearing a VR headset. He is interacting with several architectural blueprints that are overlaid on a wall. The blueprints are framed in different colors: a large one on the left in teal, one in the center in cyan, and one on the right in red. The man's hands are raised, as if he is touching or manipulating the virtual blueprints. The background is a plain white wall.

**15% of businesses use AI today but 31% plan to add it in next year**

**22.4M Americans are virtual reality users**

**72% of business leaders believe AI is a fundamental business advantage**



# Robotics and Drones

**By 2020, \$127B estimate of worth of drone industry**

**By 2020, 30% of smart cities' ambient care application will be robotics based**

**Law enforcement drone use increased by 82%**

# Security, Data and Privacy

**978M people in 20 countries lost money to  
cybercrime last year**

**1,579 total number of publicly disclosed data  
breaches in 2017**

**Seamless transfer of data could be 40% of IoT  
application value**

**85% of citizens are willing to share personal data  
in exchange for improved municipal services**

A group of people are working at laptops in a modern office setting. The image is dimly lit, with the primary light source coming from the laptop screens. In the foreground, a woman with long dark hair is seen from the side, focused on her laptop. Next to her, a man is also working on a laptop. In the background, another person is visible, looking at a laptop. The overall atmosphere is one of collaborative work and technology use.

# Big Changes in Large Distributed Systems

Conventional wisdom – faster connectivity (5G), leads to centralized compute and storage

Key drivers challenging conventional wisdom:

- 1) IoT, ML, AI
- 2) Privacy, Availability, Cyber Security
- 3) Emergence of Vision Systems and their data
- 4) Latency-sensitive use cases - VR/AR, Autonomous, Drones

Result: Latency is "king", computation at the edge is critical



# Huge, Positive, Implications for Flash



Computing and storage at every node in the network from cloud all the way to remote IoT sensors

Major cloud platforms are moving to support distributed cloud

Data will be pre-processed, anonymized, early and often

Video will be processed at the sensor to minimize latency

Massive increase in the square miles of silicon dedicated to flash memory

# Vehicle to Infrastructure Use Case



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# M2M Communication Key to Safe Autonomous Operation

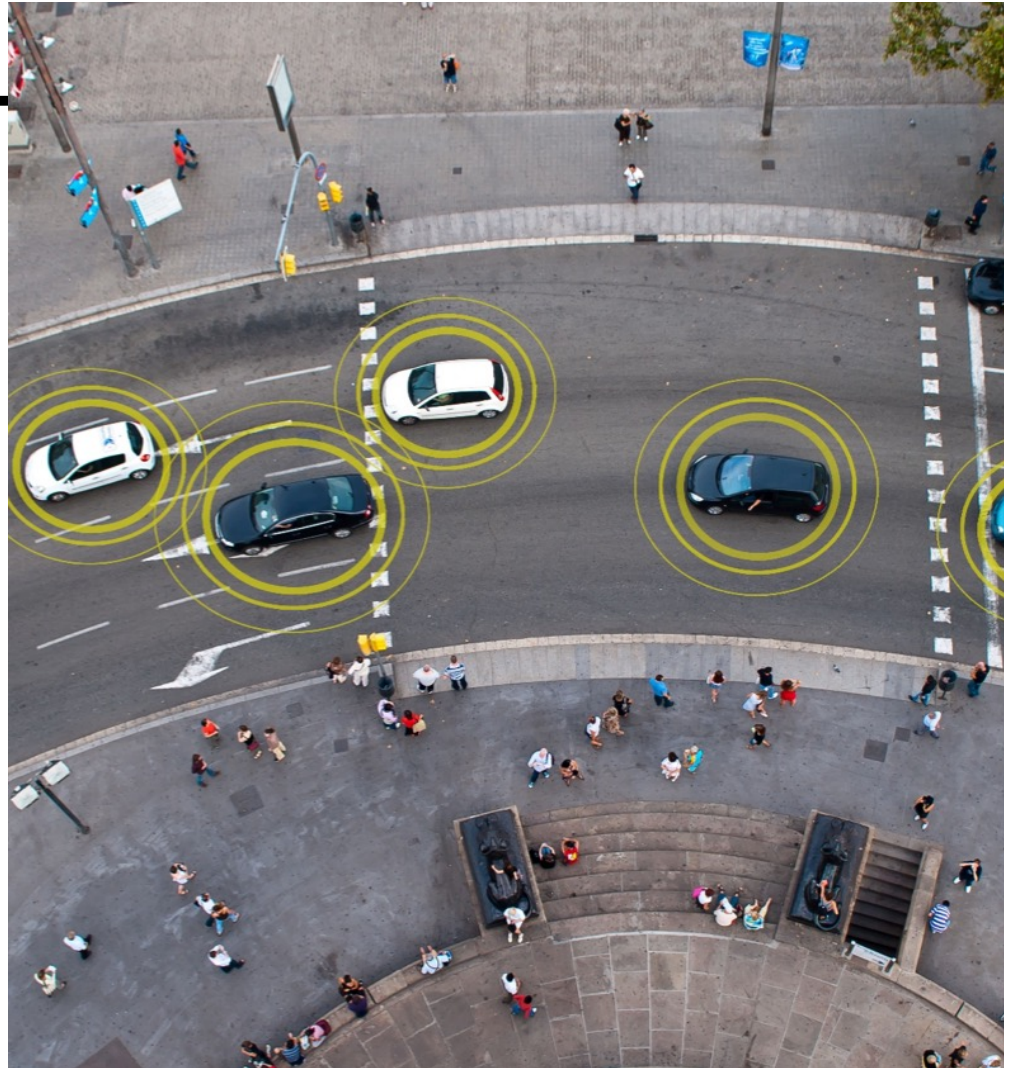
**\$80B**

Spent to date  
by industry on AV

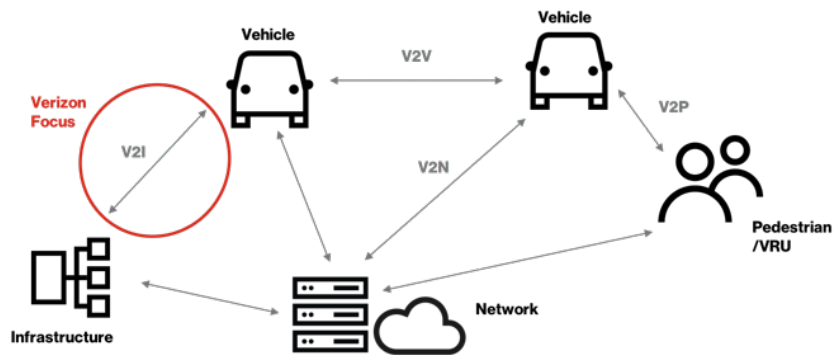
**V2X**

DOT concluded will save  
4.5M crashes/yr, 81% of all multi-  
vehicle, unimpaired crash types

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# V2I is Biggest Opportunity Beyond Connectivity

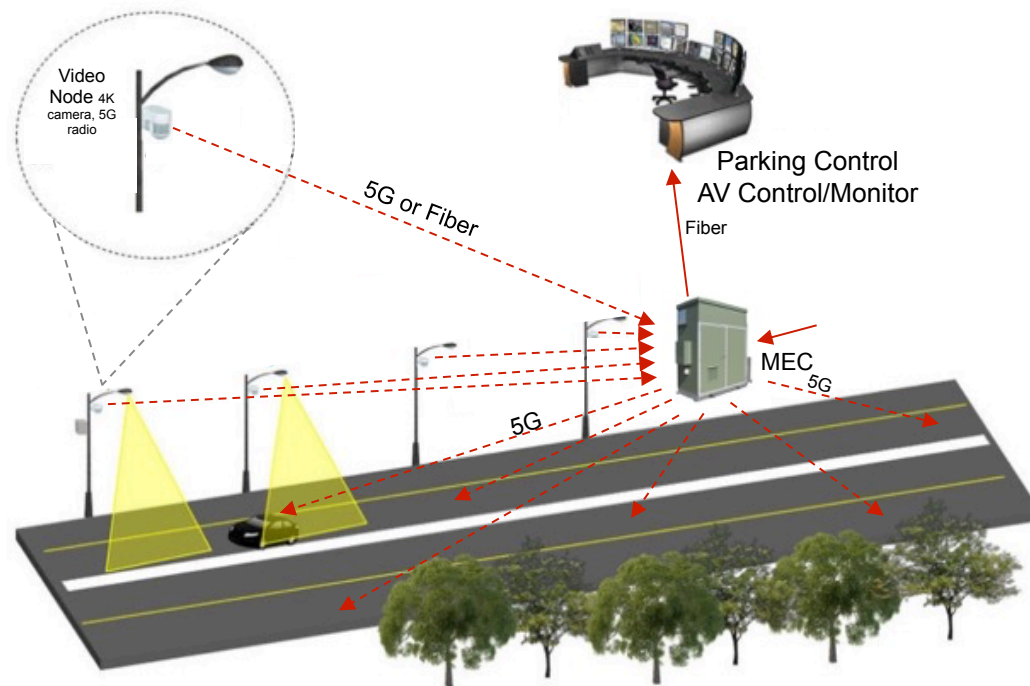


## V2I utilizes Verizon assets

- Dense, ubiquitous network
- Sensors (road, video fusion, signaling)
- Smart City platform
- Edge Computing (MEC)



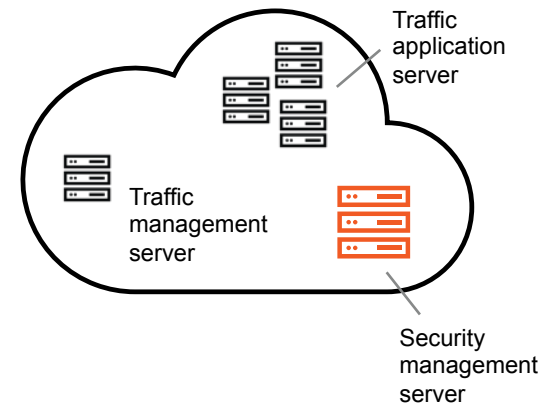
# 5G/MEC V2I Use Case



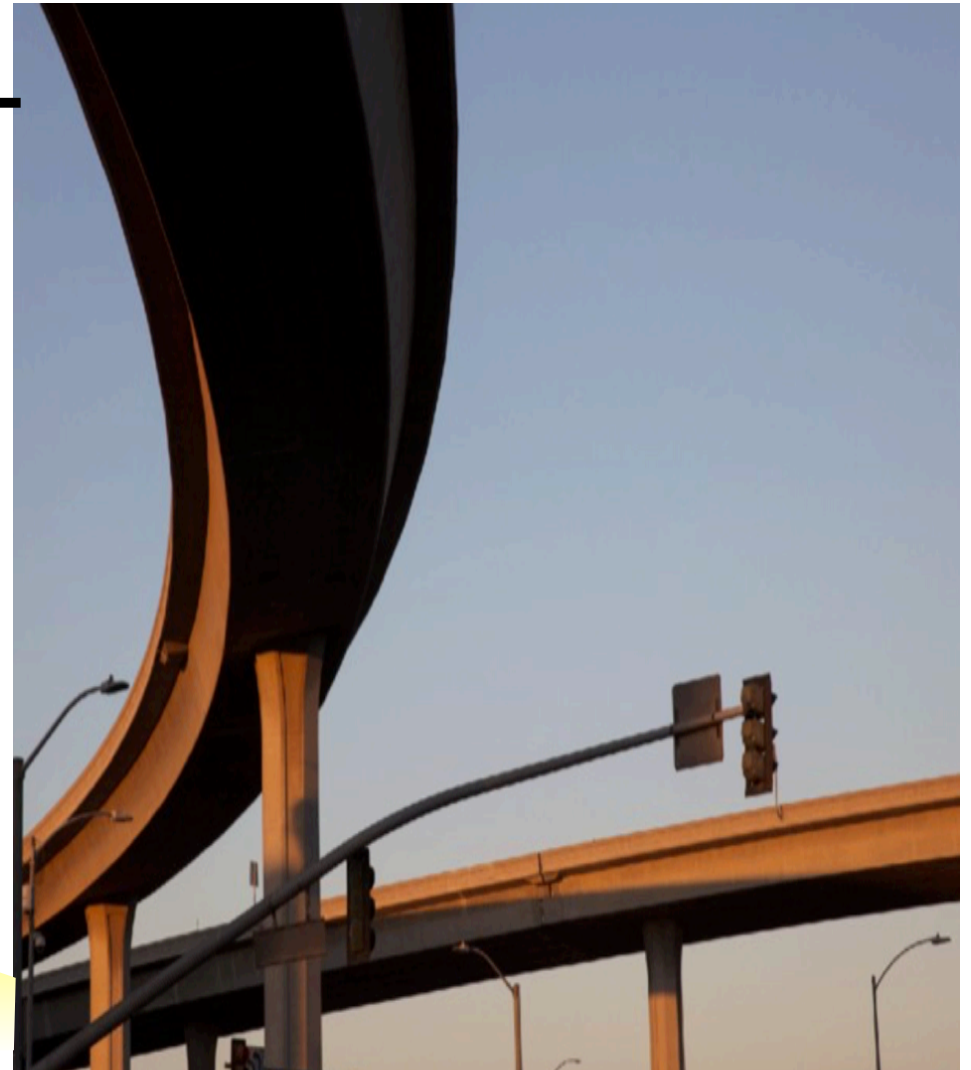
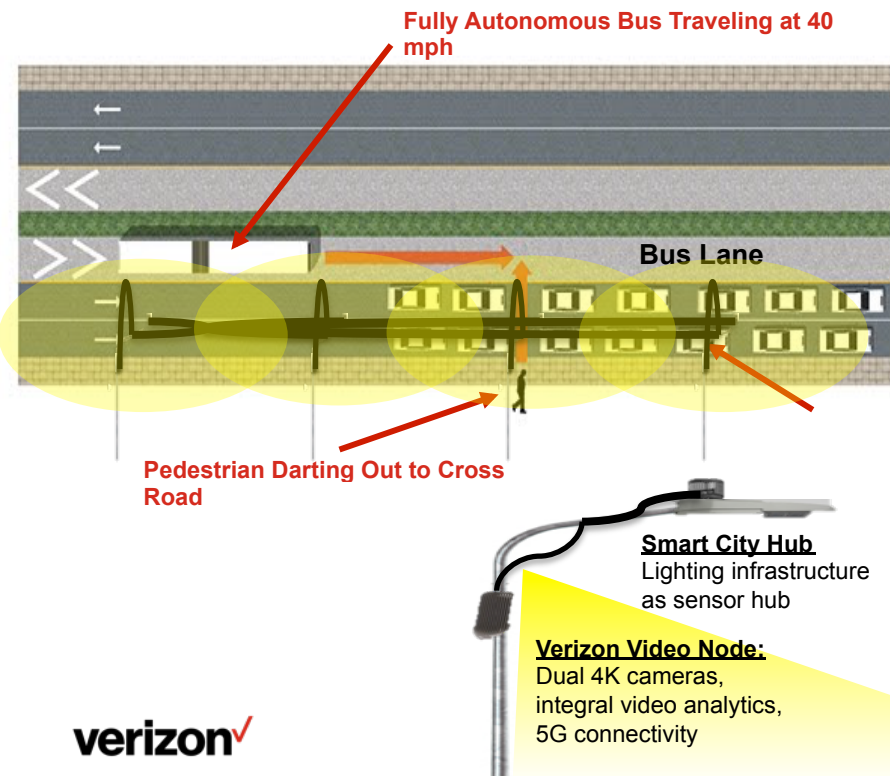
**Vehicle-to-MEC through 5G**

**Video-based sensor fusion delivers location of non-AV vehicles, pedestrian data, “see around corners”, obstructions**

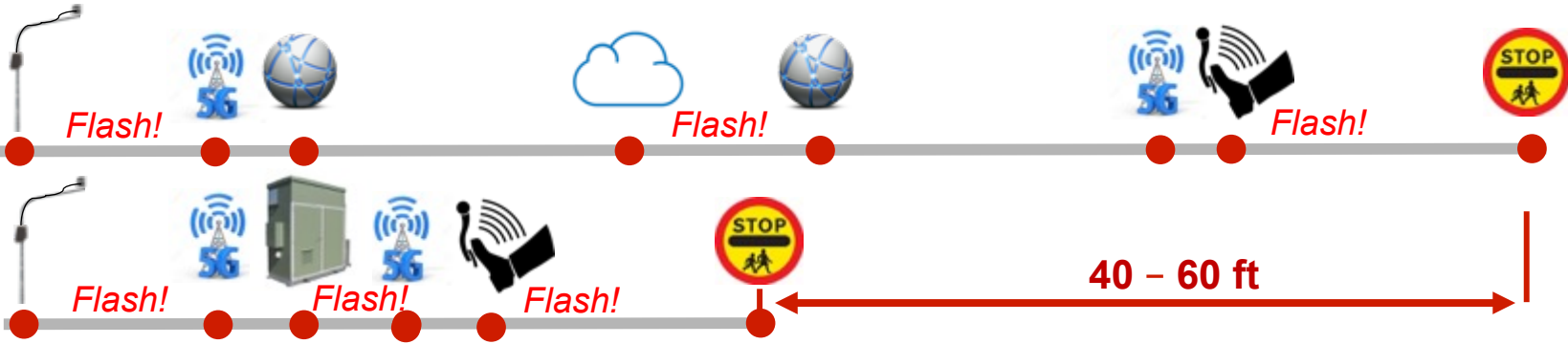
**Enables Real-Time HD Mapping**



# Situational Awareness



# 5G/MEC/Flash Technology Can Help to Save Lives



# Re-Thinking the Future of Flash

**Square miles of Flash silicon will increase; discrete Flash chip count may not**

**Flash memory must be integrated into systems architecture early**

**IoT device lifetime must approach 10+ years of heavy use (speed, # of writes)**

**Flash vendors must come to understand use cases in detail (app embedded flash & use case driven business models)**

## MEC Flash Facts

19,522 - Cities in the US

5 - Avg #MEC Locations/city

97,610 - MEC's

300 - TB Flash/MEC

30 Quintillion bytes - MEC Flash



# Technology Revolutions Lead to Business Model Revolutions



# Revolutionizing Relationships

A group of business professionals are seated around a wooden table in a meeting room. A man with grey hair, wearing a light blue suit and a striped tie, is speaking and gesturing with his hands. He is looking towards a woman with dark hair who is listening intently. To the right, another man in a dark suit and a woman with grey hair in a light-colored blazer are also listening. On the table, there are water bottles, a coffee cup, and some papers. The background is a blurred office environment with large windows.

**Dynamically changing ecosystem**

**Long-term customer relationships**

**Deeper relationships focused on co-creation & joint development**

**Transforming customer value proposition & go-to-market**

# Skate To Where The Puck Will Be

**Transforming research  
and development**

**Software plays increasing  
role in hardware**

**“Design In” privacy &  
cyber security**

**Future proofing technology**



# Building for the Future

A photograph of a construction site at dusk. The sky is a deep blue with some light clouds. Several tower cranes are visible, their silhouettes and lights standing out against the sky. In the foreground, there are dark silhouettes of buildings under construction, including what looks like a large cylindrical structure. The overall scene is one of active construction in the evening.

Flawless execution will be a key differentiator in these new businesses

New complex integration of multiple partners required

Long-term investment needed to seed the market and scale

A group of diverse students, including boys and girls of various ethnicities, are gathered around a laptop. They are all smiling and looking at the screen, suggesting a collaborative learning environment. The background is a bright, modern classroom or library setting with large windows.

# Digital Inclusion & Economic Development

**The Homework Gap: 70% of teachers assign homework requiring access to broadband**

**5M households with school-age children with no bandwidth**

**IoT could constitute 11% of the global economy by 2025**

**We don't wait  
for the future.**

**We build it.**



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