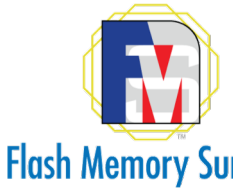


Memory Requirements for Edge Computing in IoT applications

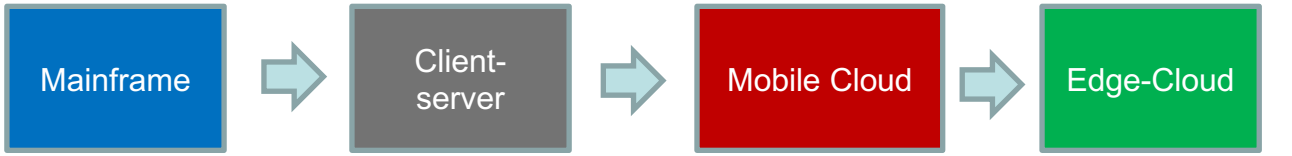
The Role of "Autonomous Edge ™"

Nabil G. Damouny

Flash Memory Summit; Santa Clara, CA
August 6-8, 2019

Flash Memory Summit

Evolution of computing … Cloud to Edge



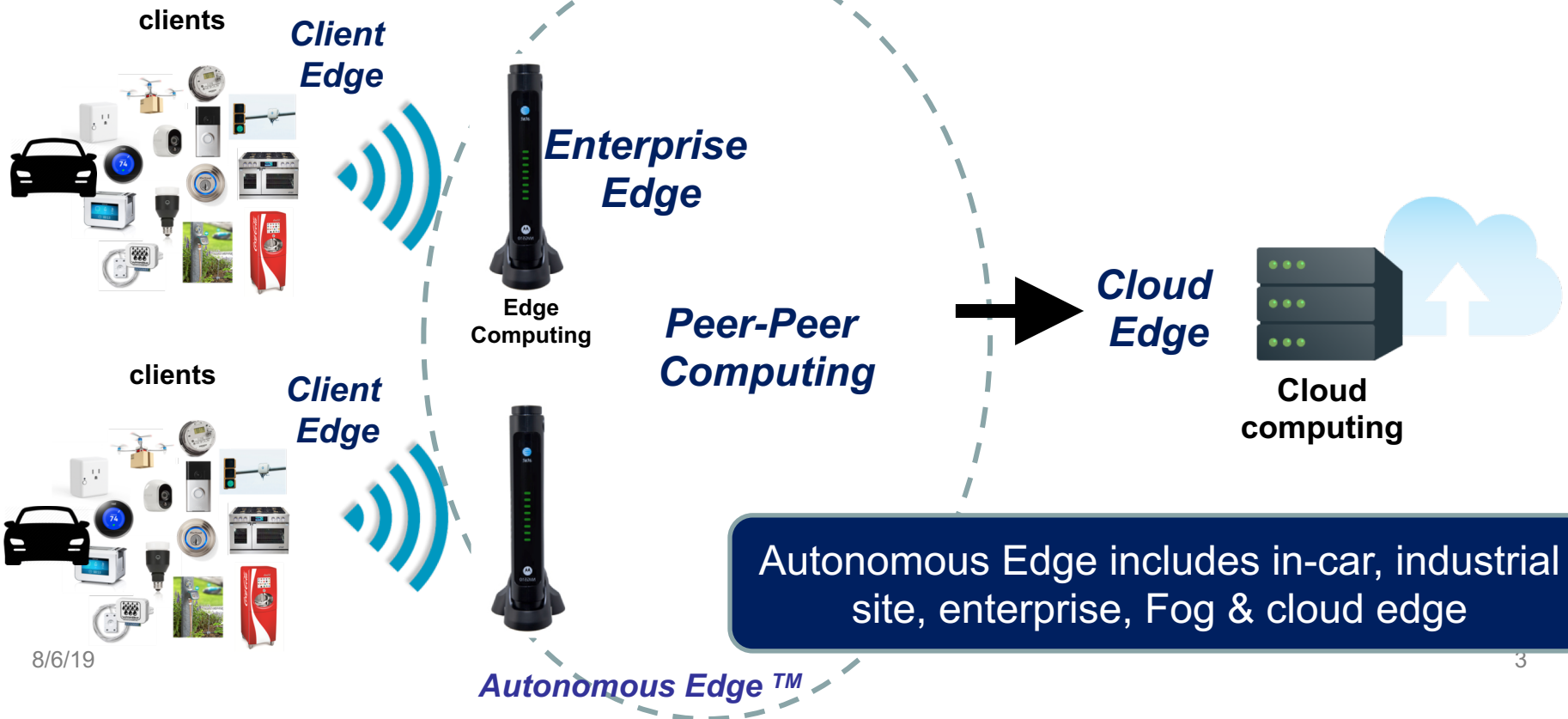
’60’s – 70”s	’80’s – 00”s	’05 – 20”s	2020”s
10M people	2B people	7B people	Trillions (things)

The rise of Edge Computing … Driven by:

- Latency of the network and the amount of information
- Car: Data center on wheels. Drone: DC on wings
- Real-time data processing need to be done where data is collected
- Sensor data explosion will give rise to processing at the Edge.

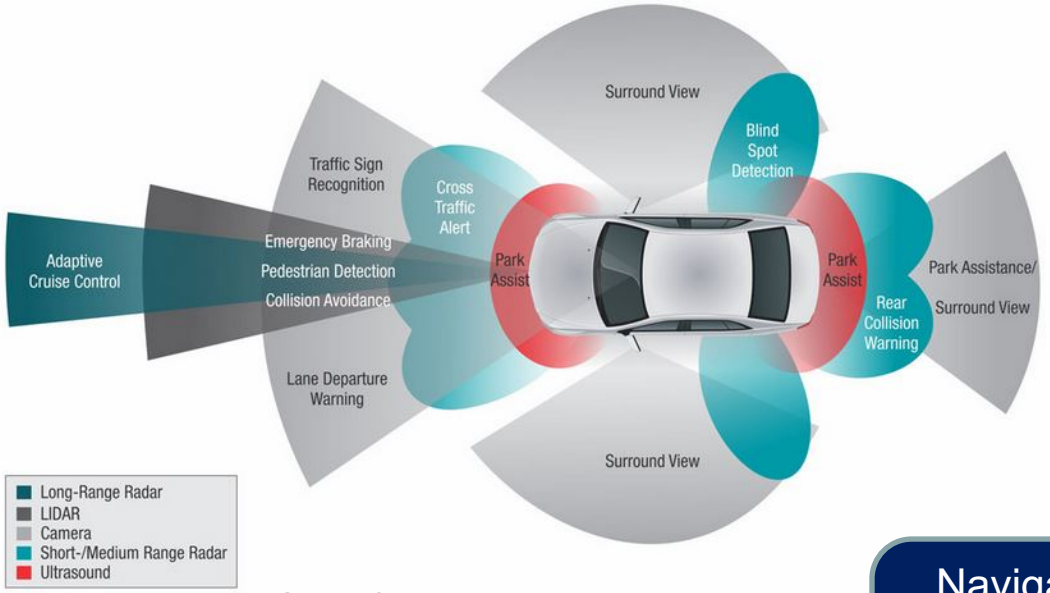
Evolution to Edge Computing, as Front-end to Cloud Computing

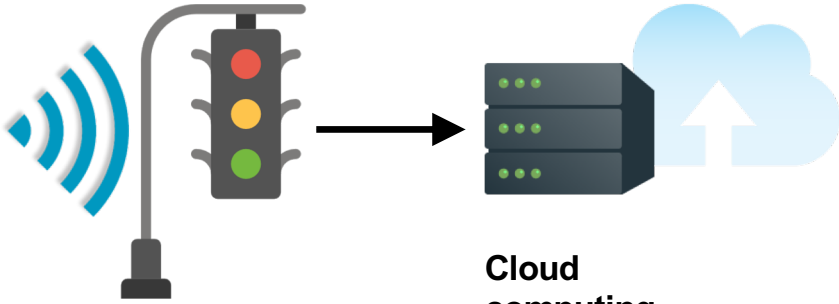
Processing at the Edge



Autonomous Edge includes in-car, industrial site, enterprise, Fog & cloud edge

Autonomous Driving (Many in-car Sensors)





Smart Traffic Lights)

Cloud computing

Good for object recognition
Can also detect motion, range

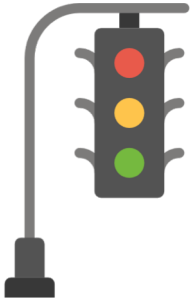
Particularly useful in poor lighting or bad weather (rain/snow/fog)

Navigation of self-driving cars – Using sensors and onboard analytics, cars are learning to recognize obstacles and react to them appropriately using Deep Learning.

Source: Linley Group

Benefits of Autonomous Edge ™ Computing

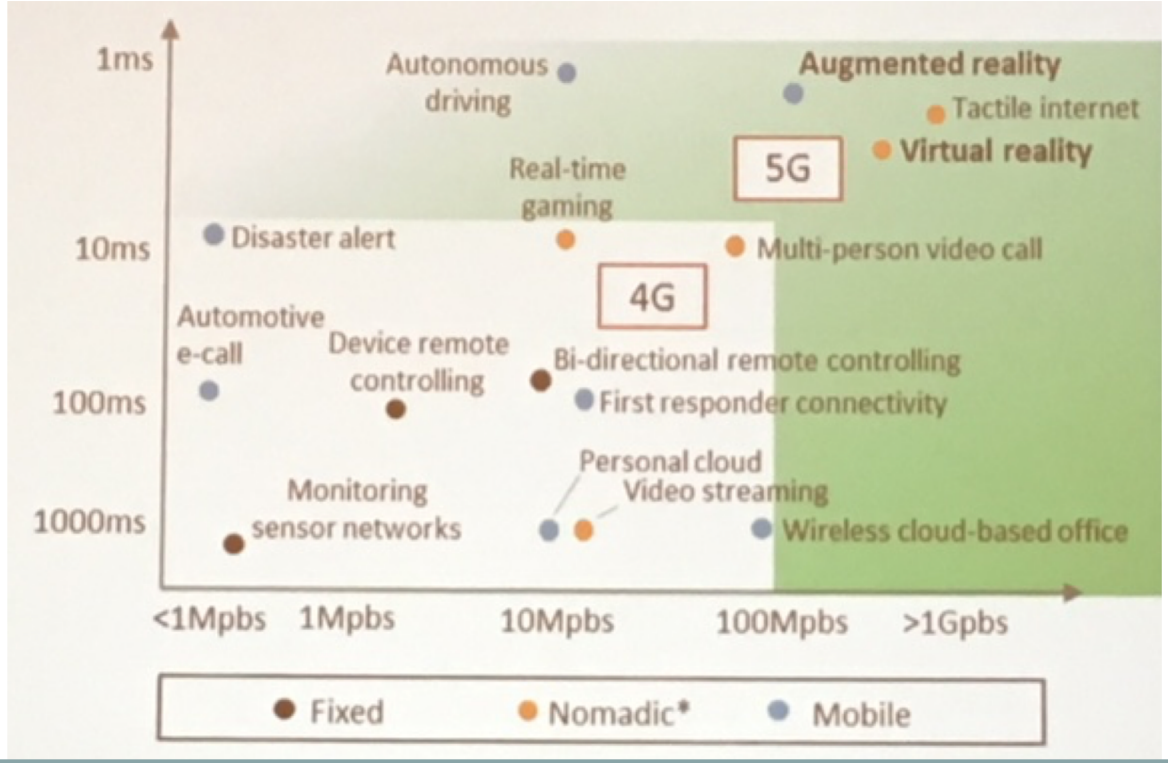
- Low-Latency
- High Throughput
- Data Reduction
- Context Awareness
- Security
- Isolation
- Compliance



Autonomous Edge is ideal for real-time applications. Most processing is done at the Edge, with relying on the cloud for big data

Bandwidth & Latency by Use Case…Emergence of 5G

Flash Memory Summit



5G

5G enables New Use Cases – E.g. Autonomous Driving, VR and AR

Source: 3GPP

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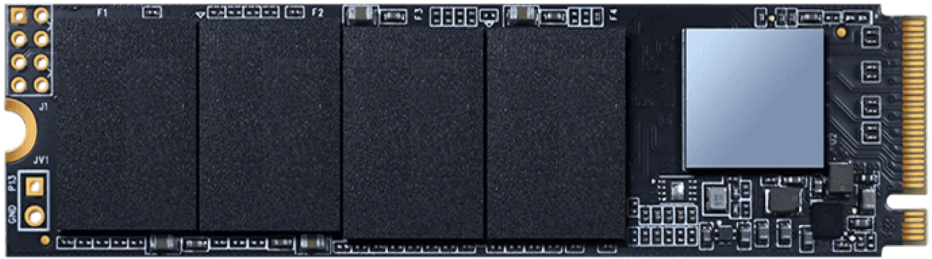
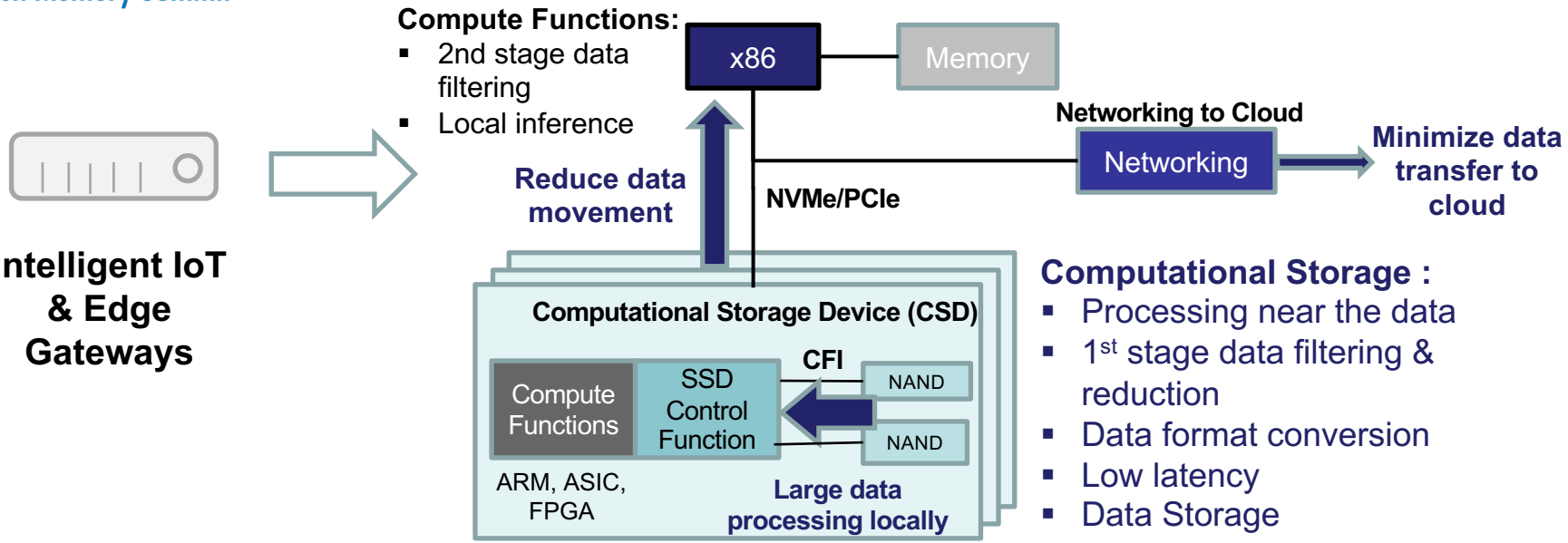
Memory Requirements at the Edge

- Small Form Factor
- Power Loss Protection
- Extended temperature range
- High Endurance & Reliability
- Self health management
- End-to-end data security and protection
- Local in-storage processing.



More stringent requirements to support
Edge deployments and use cases. In-storage processing a plus

Intelligent Edge Gateway with Computational Storage



CSD at the Edge performs 1st stage data processing, filtering and reduction, before transferring data to DC and/or Cloud

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Summary & Call To Action

- Pay attention to the rise of Autonomous Edge ™ Computing:
  - Complements cloud computing
  - Key for real-time applications
  - IoT & autonomous driving
  - Best implemented with Computational Storage
- Reduce latency; more reliability; increase security
  - For data-driven applications
- Memory architecture plays a key role
  - E.g. Computational storage

Autonomous Edge ™ is a growing area supporting self-driving cars and IoT. Memory architecture plays a key role