

Welcome!

Unlocking the Power of Edge Computing for CPS November 16, 2018

Workshop Organizers

Kishore Ramachandran, Georgia Tech

&

Anish Arora, OSU

Unlocking the Power of Edge Computing for CPS

- Three sessions (10:25 to 12:20)
 - A: Three talks (8 min each) followed by panel (15 min): Chair: Anish Arora
 - Bob Iannucci, CMU-Silicon Valley, “Network Edge Considered Harmful”
 - Mung Chiang, Purdue/Princeton, “Fog/Edge and Dispersive AI”
 - Mahadev Satyanarayanan, CMU, “Research Challenges in IoT”
 - I: Three talks (8 mins each) followed by panel (15 min): Chair: Bob Iannucci
 - Prashant Shenoy, UMass, “Edge-enabled Utility-preserving Privacy for Data-driven CPS Systems”
 - Bharath Balasubramanian, AT&T, “State Management for Telco’s Edge”
 - Vladimir Kolesnikov, Georgia Tech, “Efficient Crypto Techniques for the Edge”
 - 1: Two talks (8 min each) followed by panel (10 min): Chair: Kishore Ramachandran
 - Aakanksha Chowdhery, Google Brain, “From Cloud to Edge: Advances in Mobile AI”
 - Sanjiv Doshi, CISCO, “Practical approaches to managing, orchestrating and securing cyber-physical systems”
- Breaks between sessions (5 min)
 - Stretch
 - Yoga
- Wrap up panel (12:20 to 12:45)
 - All speakers

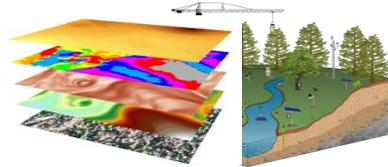
IoT boom: Sensor-rich environment



A Broad Set of IoT Applications



Predictive maintenance



Enable New Knowledge



Agriculture



Smart Grid

Energy Saving (I2E)



Intelligent Buildings



Defense



Industrial Automation



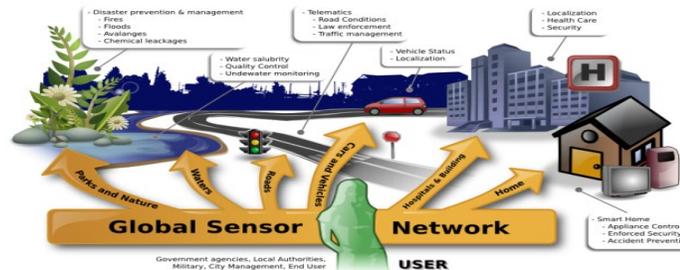
Transportation and Connected Vehicles



Healthcare



Enhance Safety & Security



Smart Home

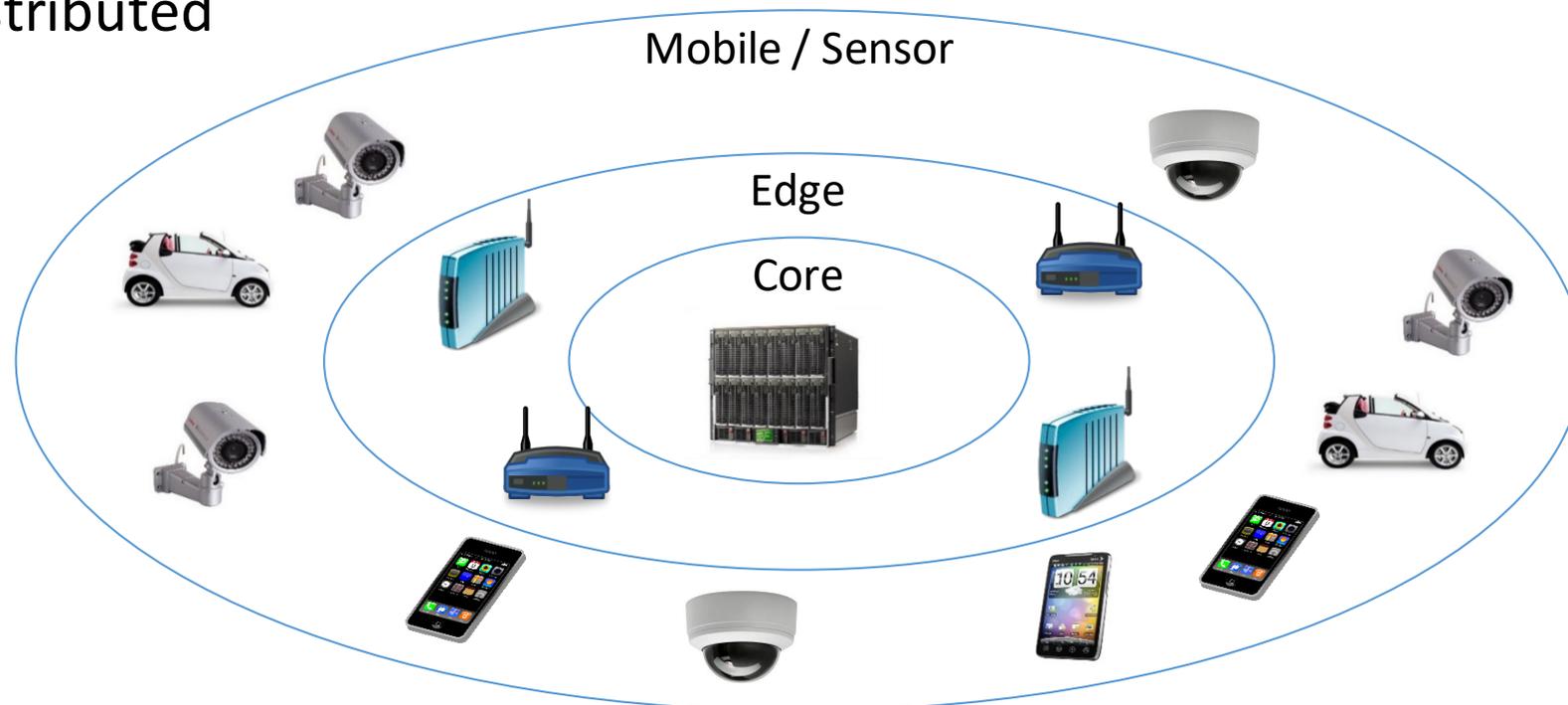
Thanks to CISCO for this slide

Cloud Computing

- Good for web apps at human perception speeds
 - Throughput oriented web apps with human in the loop
- Not good for many latency-sensitive IoT apps at computational perception speeds
 - sense -> process -> actuate
- Other considerations
 - Limited by backhaul bandwidth for transporting plethora of 24x7 sensor streams
 - Not all sensor streams meaningful
 - => Quench the streams at the source
 - Privacy and regulatory requirements

Fog/Edge Computing

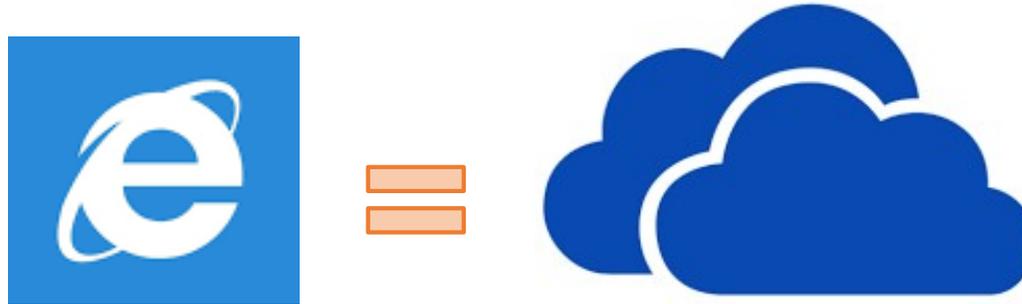
- Extending the cloud utility computing to the edge
- Provide utility computing using resources that are
 - Hierarchical
 - Geo-distributed



Fog/edge computing today

- Edge is slave of the Cloud
 - Platforms: IoT Azure Edge, CISCO Iox, Intel FRD, ...
- Mobile apps beholden to the Cloud

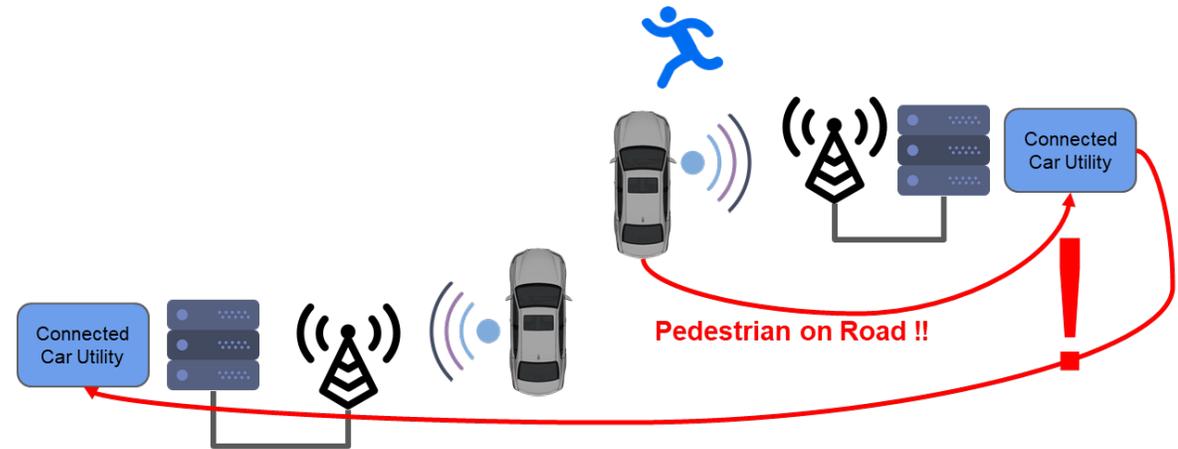
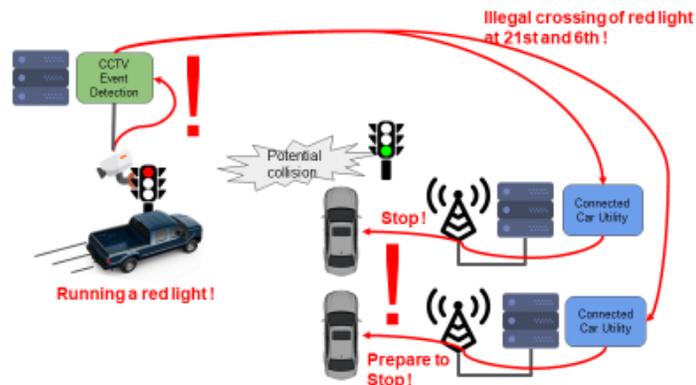
Vision for the future



- Elevate Edge to be a peer of the Cloud
- In the limit
 - Make the Edge autonomous even if disconnected from the Cloud

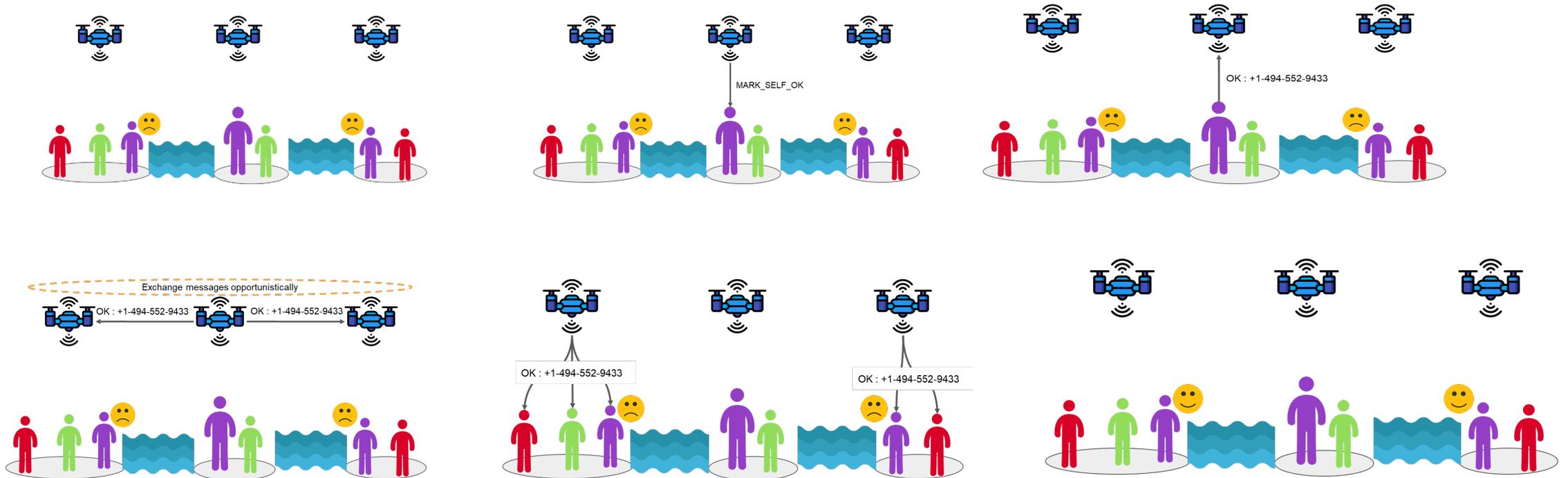
Why = ?

- Interacting entities (e.g., connected vehicles) connected to different edge nodes
- Horizontal (p2p) interactions among edge nodes essential



Why = ?

- Autonomy of edge (disaster recovery)



Challenges for making =

- Need for powerful frameworks akin to the Cloud at the edge
 - Programming models, storage abstractions, pub/sub systems, ...
- Geo-distributed data replication and consistency models
 - Heterogeneity of network resources
 - Resilience to coordinated power failures
- Rapid deployment of application components, multi-tenancy, and elasticity at the edge
 - Cognizant of limited computational, networking, and storage resources

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Questions for each speaker

- What would be a joint research project that cuts across the presentations in your session?
- What are gaps in the presentations in your session that would help make it a holistic joint research effort?

Questions for the attendees

- What are opportunities you see for expanding your own research through the presentations you are hearing?
- What are the gaps in the set of presentations today that we need to fill for large synergistic group efforts?