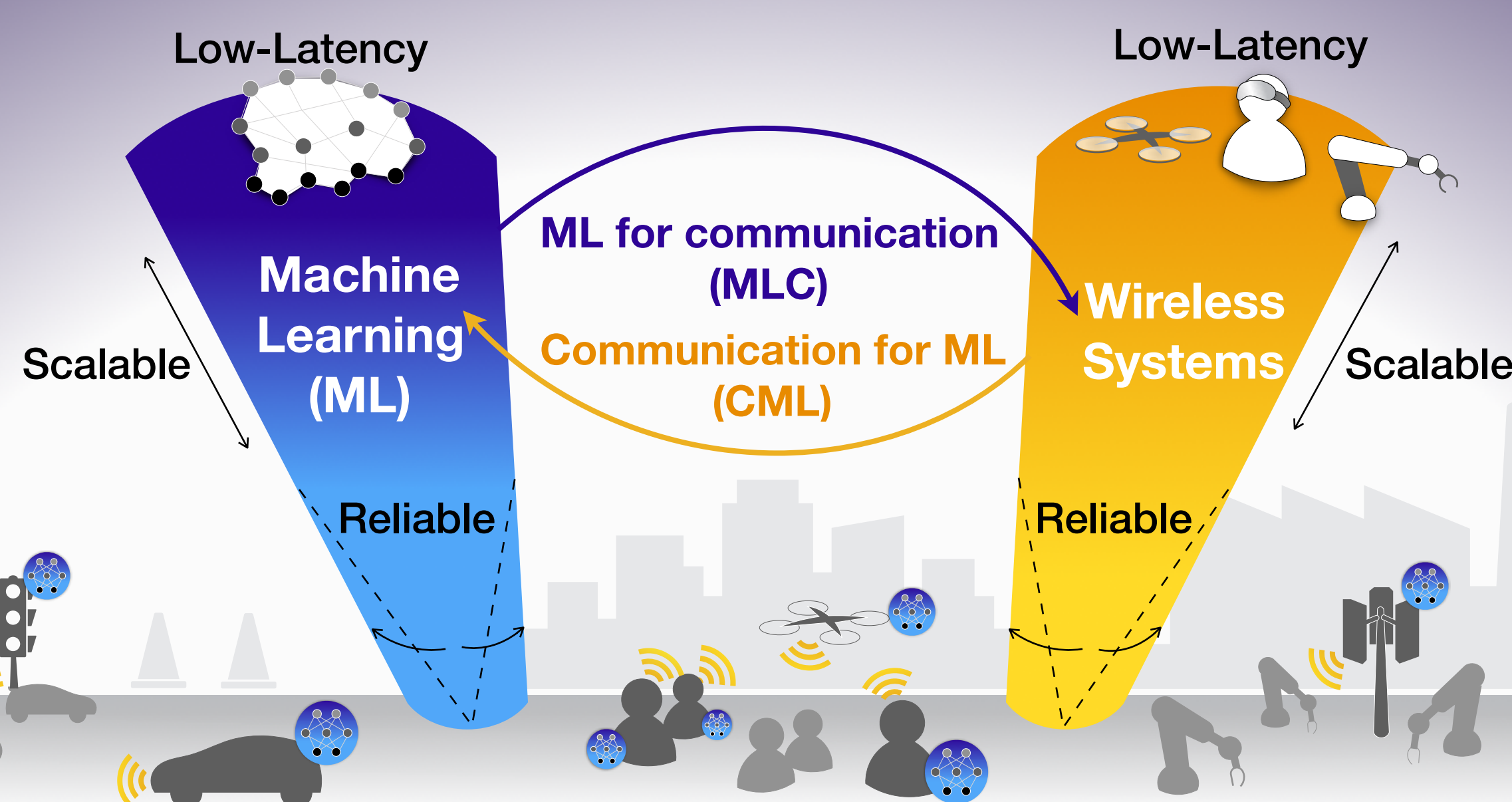
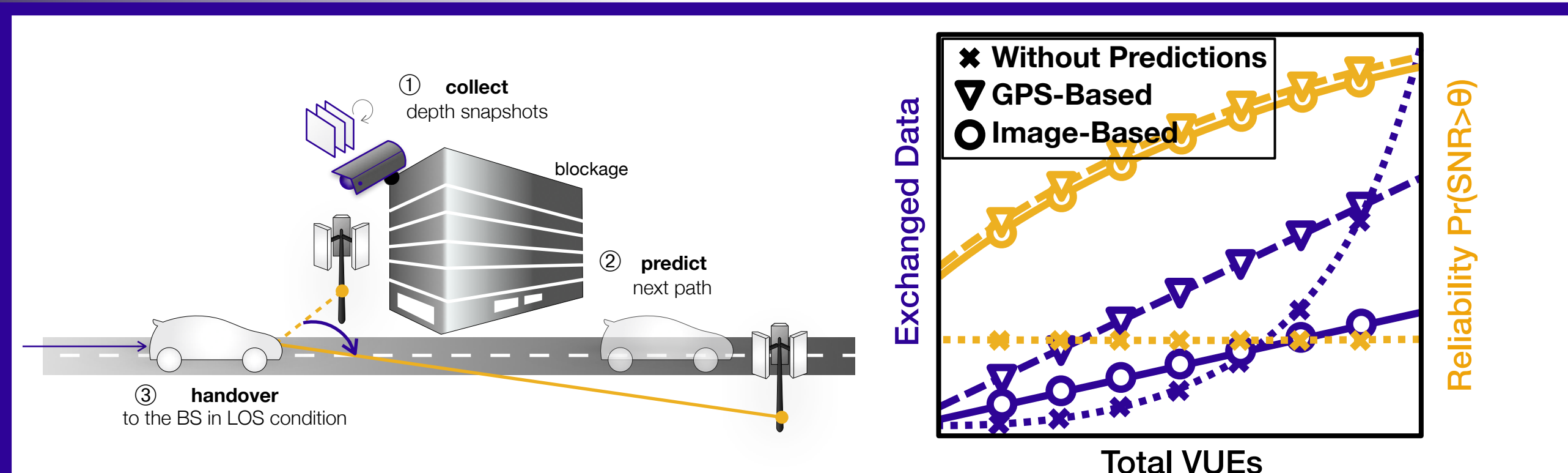


Intelligent Connectivity and Networks

Jihong Park, Sumudu Samarakoon, Anis Elgabri, Mohammed S. Elbamby, Chen-Feng Liu, Trung Kien Vu, Hamid Shiri, Mohamed K. Abdel-Aziz, Mounssif Krouka, Hamza Khan, Mojtaba Jahandideh, Abanoub M. Girgis, and Mehdi Bennis
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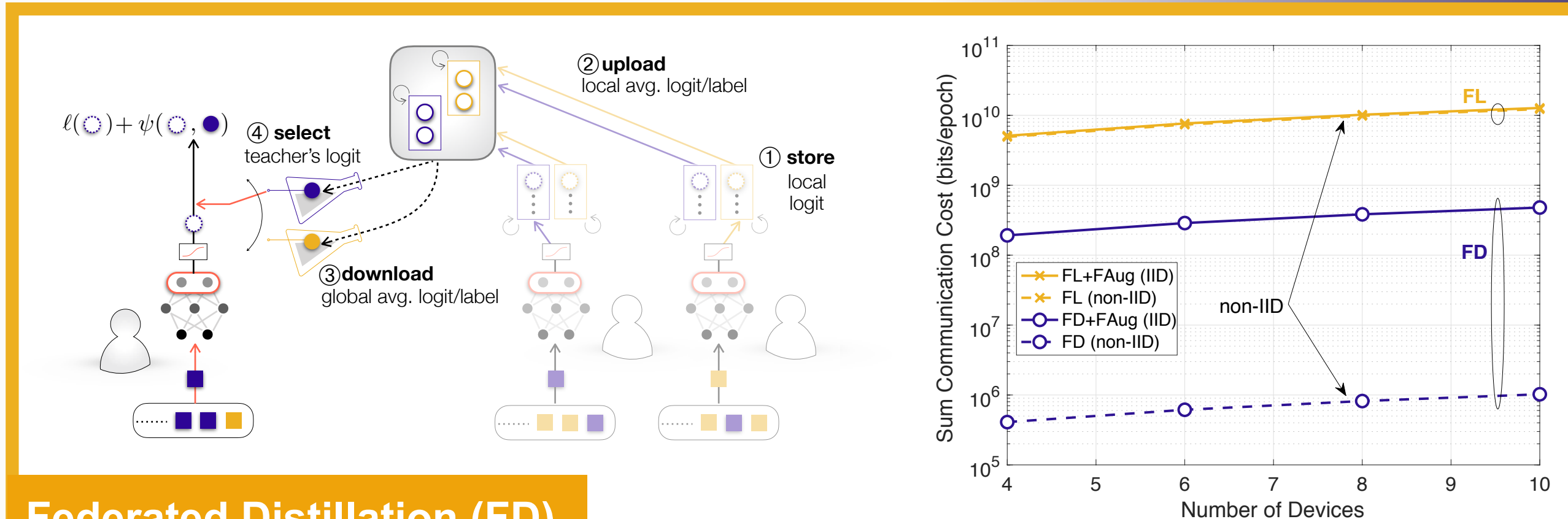


Connectivity



Depth-Aided Mobility Prediction for mmWave Handover

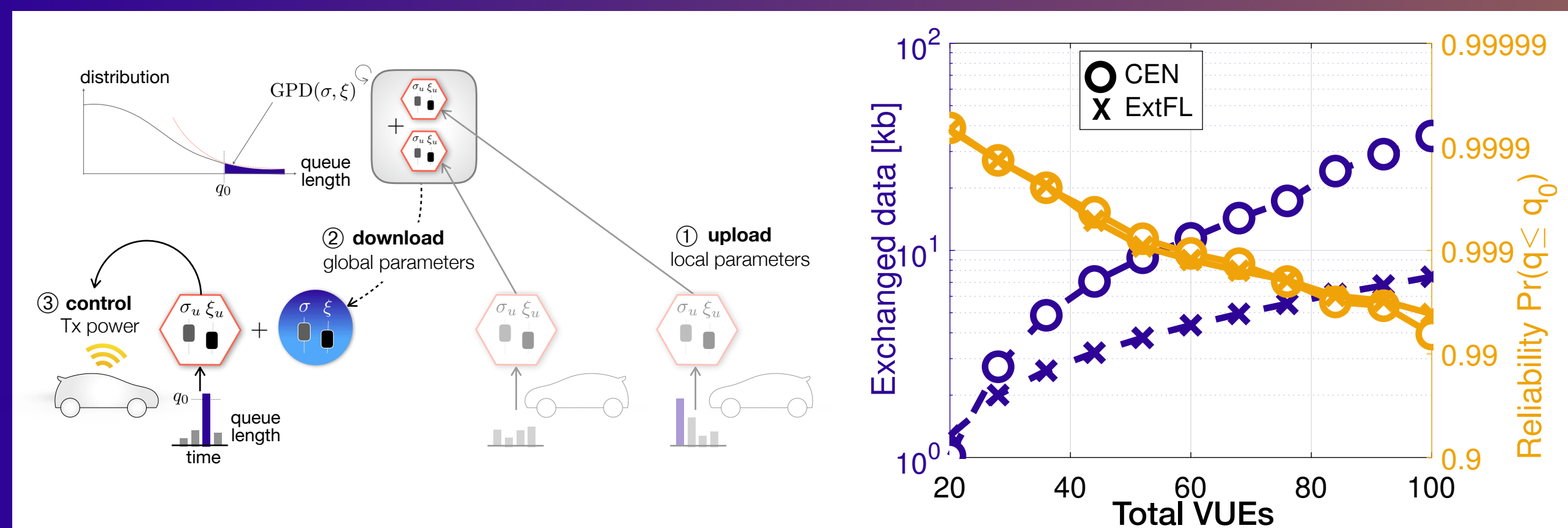
- Next paths of vehicle user equipments (VUEs) are predicted using **depth-camera images**, thereby **proactively handing over** to the mmWave BSs in LOS conditions
- Multiple vehicles' paths are concurrently predicted using the same images



Federated Distillation (FD)

- FD** exchanges local neural network (NN) **model output** for collectively training a global NN
- Compared to **federated learning (FL)** exchanging **model parameters**, FD yields 26x smaller communication payload size, enabling distributed ML with deep NNs

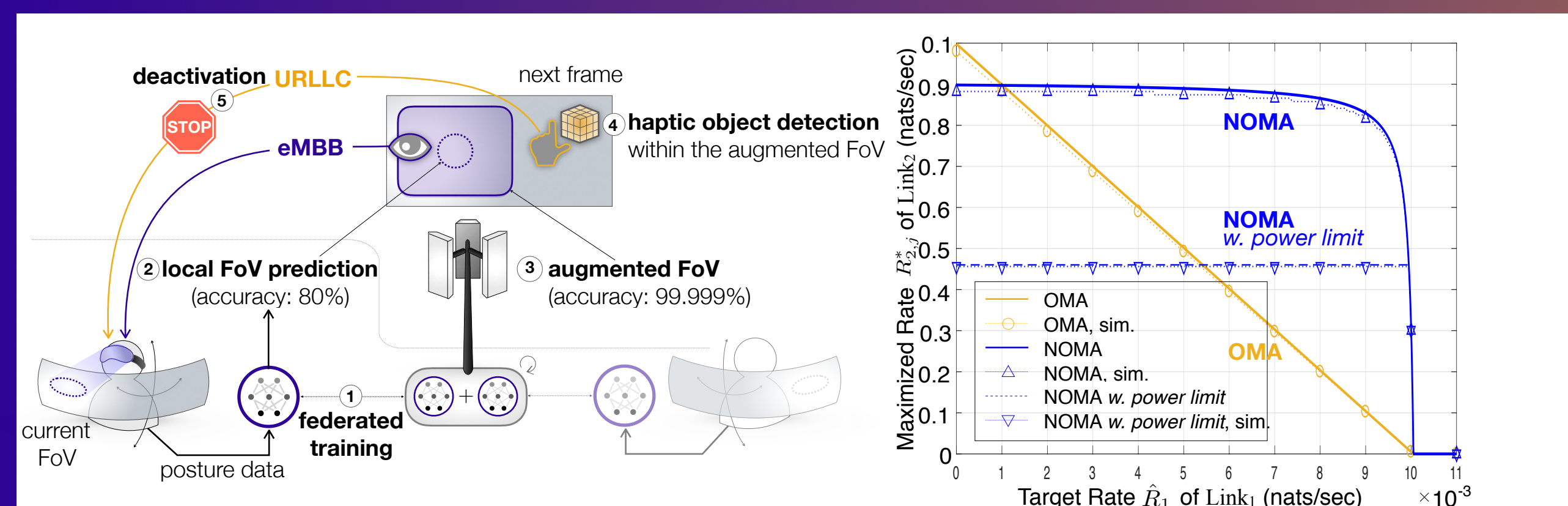
MLC/CML



Extreme Queue Length FL for Vehicular URLLC Power Control

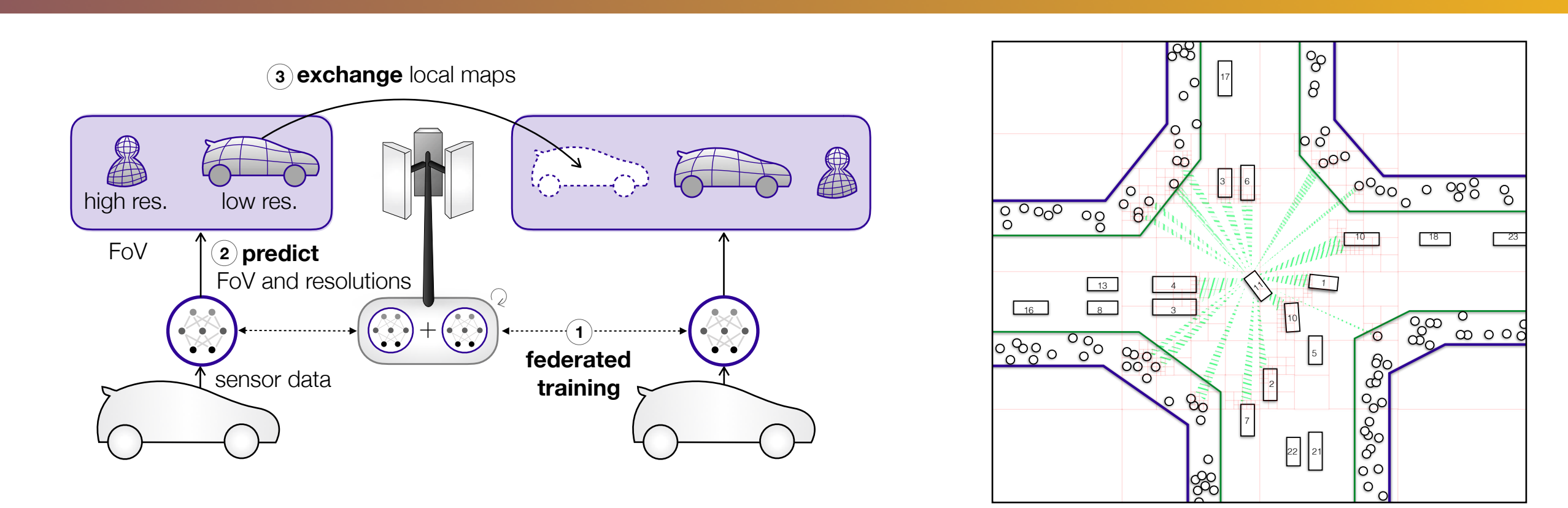
- Objective:** Minimize uplink power while ensuring short queue length with high probability
- Following **extreme value theory (EVT)**, an extremely large queue length is characterized by the shape and scale parameters of the generalized Pareto distribution (GPD)
- Utilizing **FL with EVT (ExtFL)**, VUEs collectively predict the GPD parameters
- ExtFL reduces communication overhead while achieving the same queue length reliability, compared to a centralized direct queue length distribution exchanging baseline (CEN)

Perception



Visuo-Haptic Perceptual Slicing based on Field-of-View (FoV) Prediction

- Visuo-haptic** VR traffic is supported via **eMBB-URLLC** links with OMA/NOMA
- URLLC is deactivated if haptic objects do not exist within the next predicted FoV

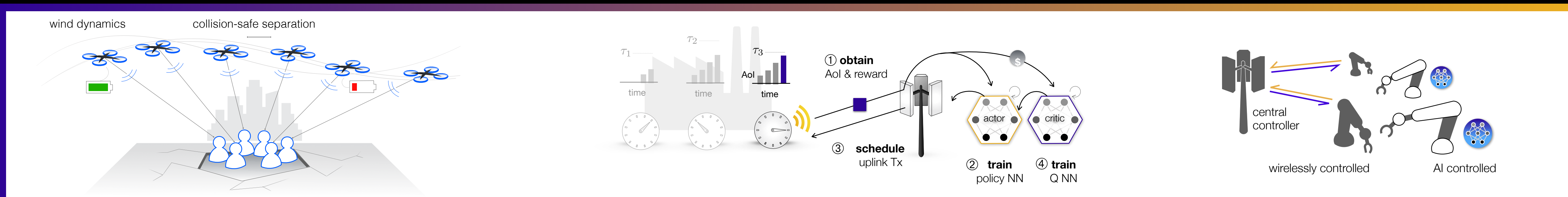


Vehicle-Human Perceptual Dynamic Map with FoV and Resolution Prediction

- Vehicles collectively build a dynamic map by exchanging local maps in real time
- The **FoV** and object **resolutions** of each local map are predicted via FD based on **vehicle-human perception and actuation ranges**

E2E Intelligent Systems

Control



Massive UAV Control via Mean-Field Game (MFG)

Multi-Sensor Control based on Age-of-Information (AoI)

Real-Time Collaborative Robot Control

- [1] J. Park, S. Samarakoon, and M. Bennis, "Wireless Network Intelligence at the Edge," *submitted to PIEEE*
 [2] E. Jeong, S. Oh, H. Kim, J. Park, M. Bennis, and S.-L. Kim, "Federated Distillation and Augmentation under Non-IID Private Data," *presented at NeurIPS 2018 MLPD*
 [3] S. Samarakoon, M. Bennis, W. Saad, and M. Debbah, "Distributed Federated Learning for Ultra-Reliable Low-Latency Vehicular Communications," *submitted to TCOM*
 [4] J. Park and M. Bennis, "URLLC-eMBB Slicing to Support VR Multimodal Perceptions over Wireless Cellular Systems," *in Proc. GLOBECOM 2018*
 [5] C. Perfecto, J. Del Ser, and M. Bennis, "Millimeter-Wave V2V Communications: Distributed Association and Beam Alignment," *JSAC, 2017*
 [6] H. Kim, J. Park, M. Bennis, and S.-L. Kim, "Massive UAV-to-Ground Communication and its Stable Movement Control: A Mean-Field Approach," *in Proc. SPAWC 2018*
 [7] A. Elgabri, H. Khan, M. Krouka "Reinforcement Learning Based Scheduling Algorithm for Optimizing Age-of-Information in Ultra Reliable Low Latency Networks," *to be presented at ICC 2019*