

Real-Time Digital Twin Assisted Communications

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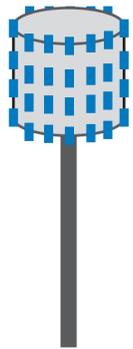
Joint work with my students:

**Gouranga Charan, Umut Demirhan, Yu Zhang, Abdelrahman Taha, Shuaifeng Jiang, Joao Morais,
Tawfik Osman, Shoaib Imran, Hao Luo, Nikhil Srinivas**

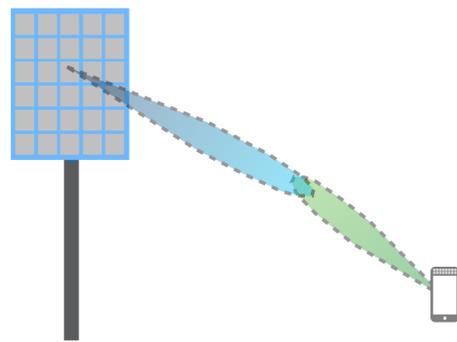
This work was supported in part by NSF (Grant No.1923676 and No. 2048021) and
by Qualcomm, Samsung, Meta, and Remcom

Key trends in wireless communications

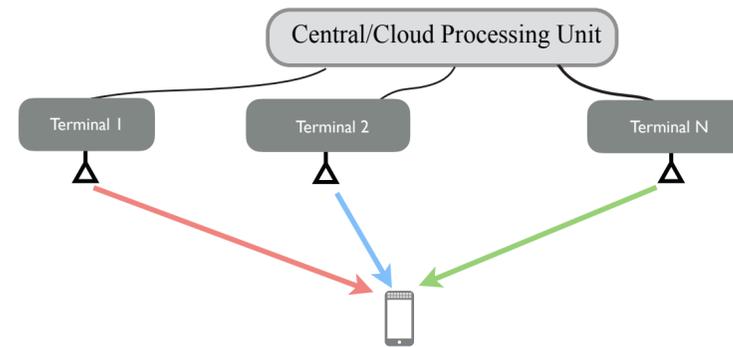
▶ The use of large antenna arrays



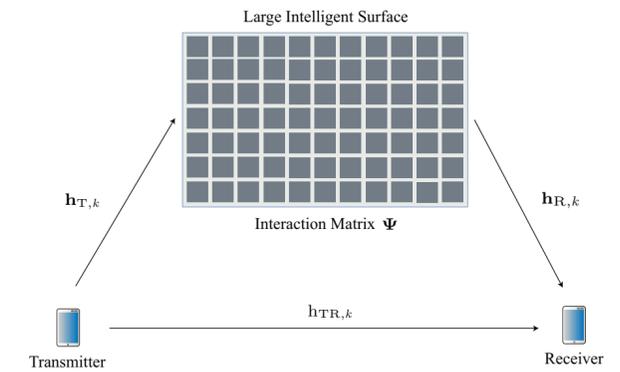
Massive MIMO



mmWave and THz MIMO



Cell-free massive MIMO



Intelligent Surfaces

▶ The increasing dependency on higher frequency bands

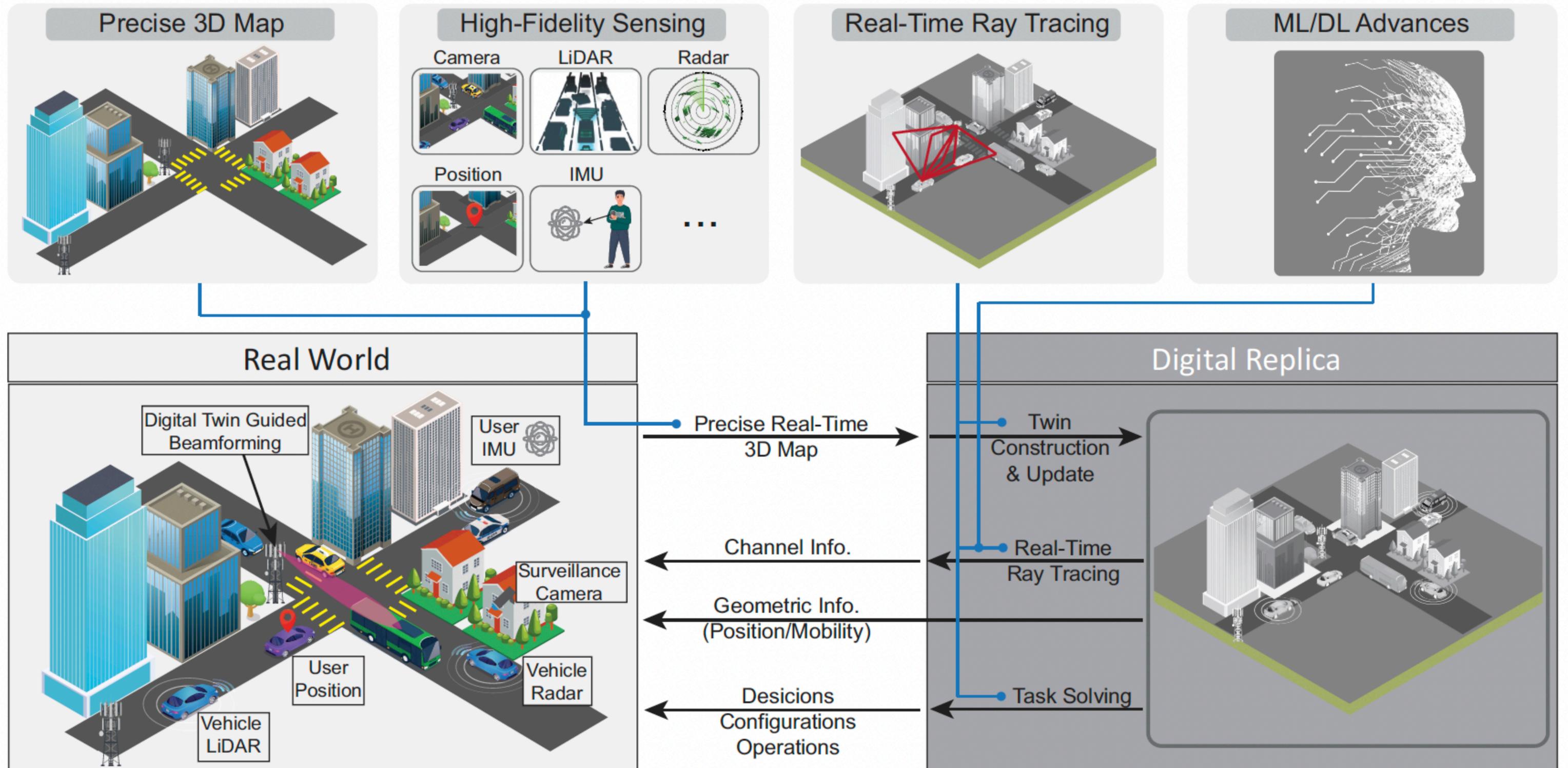


These trends are mainly motivated by achieving higher data rates

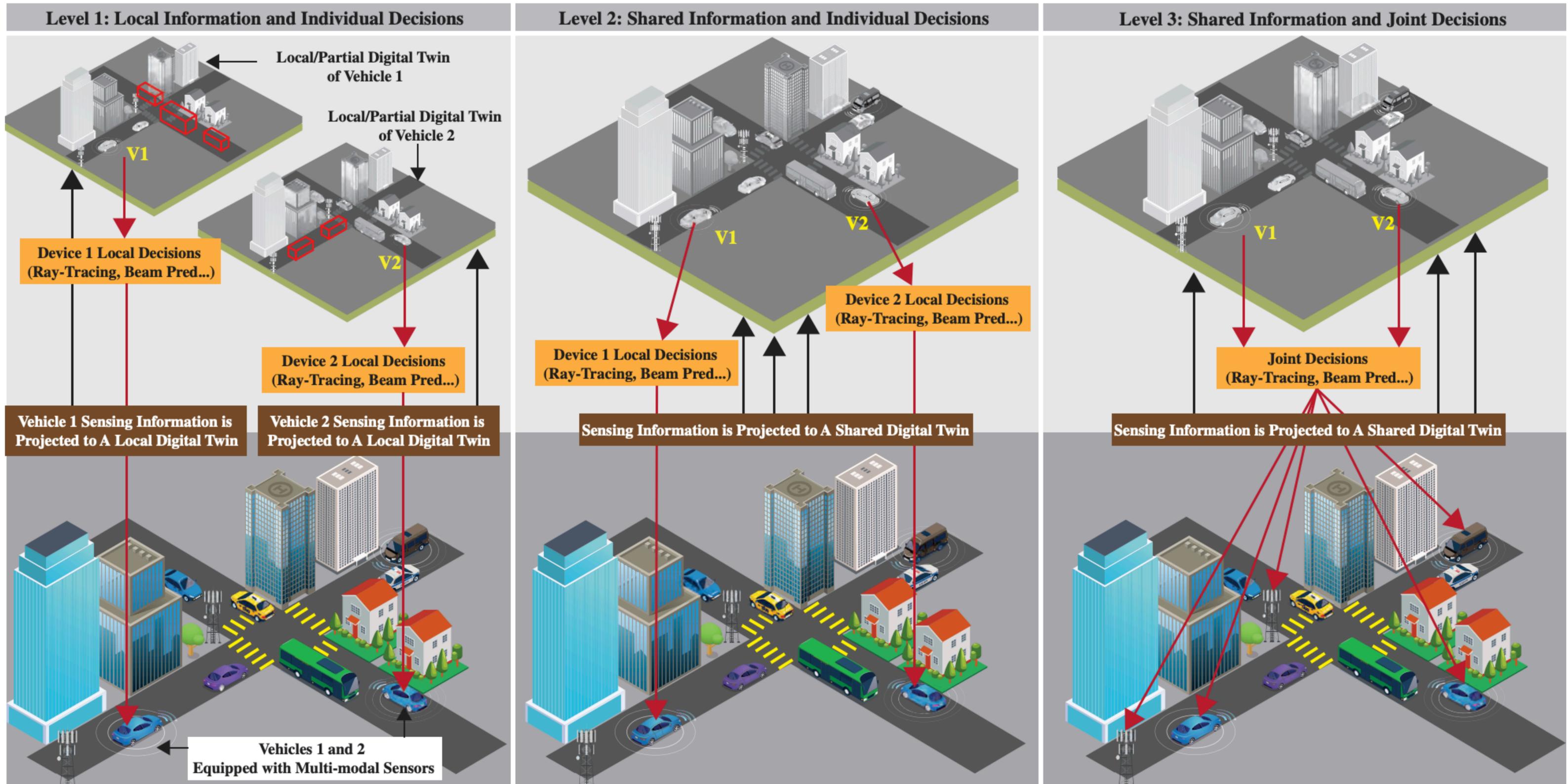
But this leads to other challenges for **mobility**, **reliability**, **latency**, and **energy efficiency**



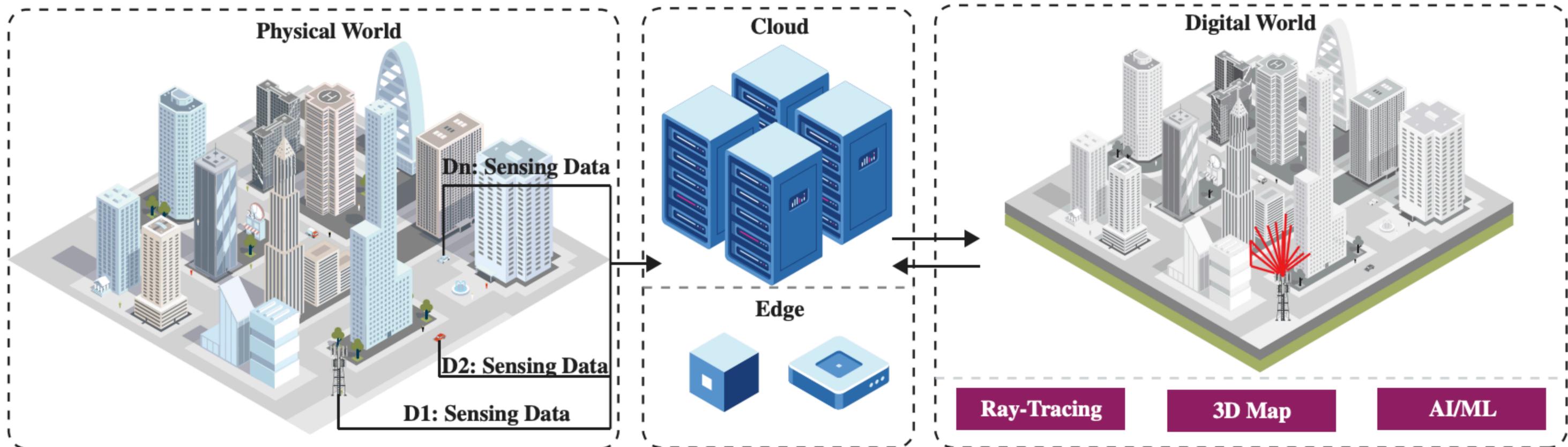
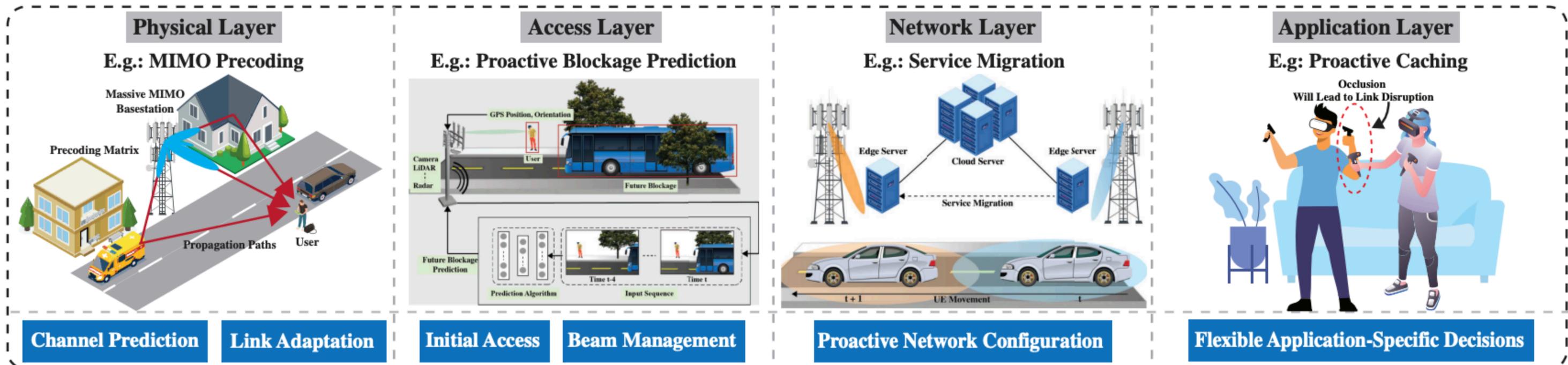
Current technology advances lead to real-time digital twins!



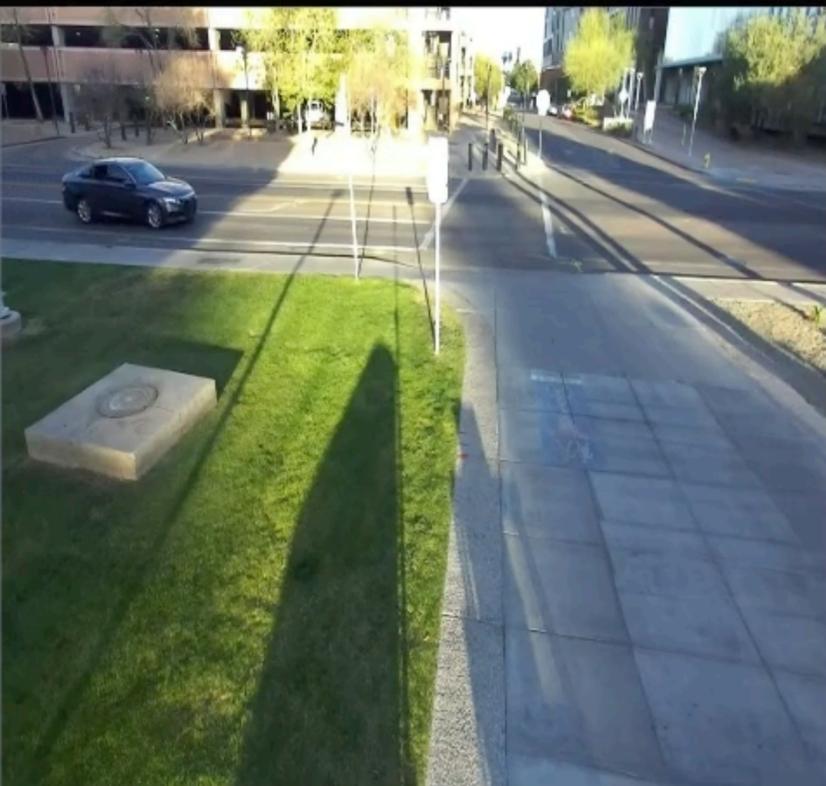
Different sensing/communication coordination levels



Several interesting applications!



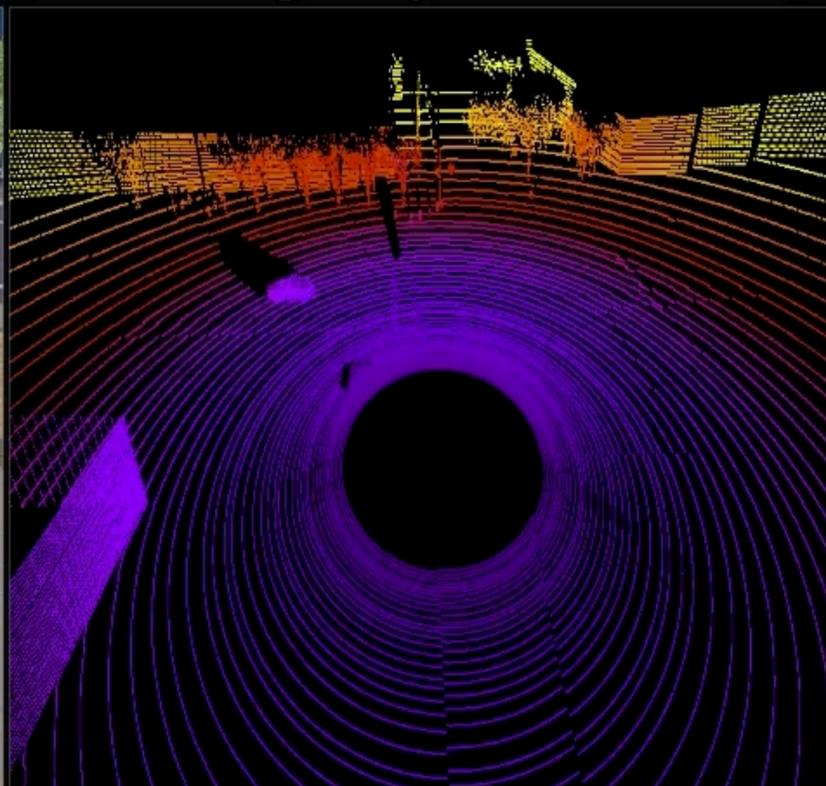
Real-world Camera



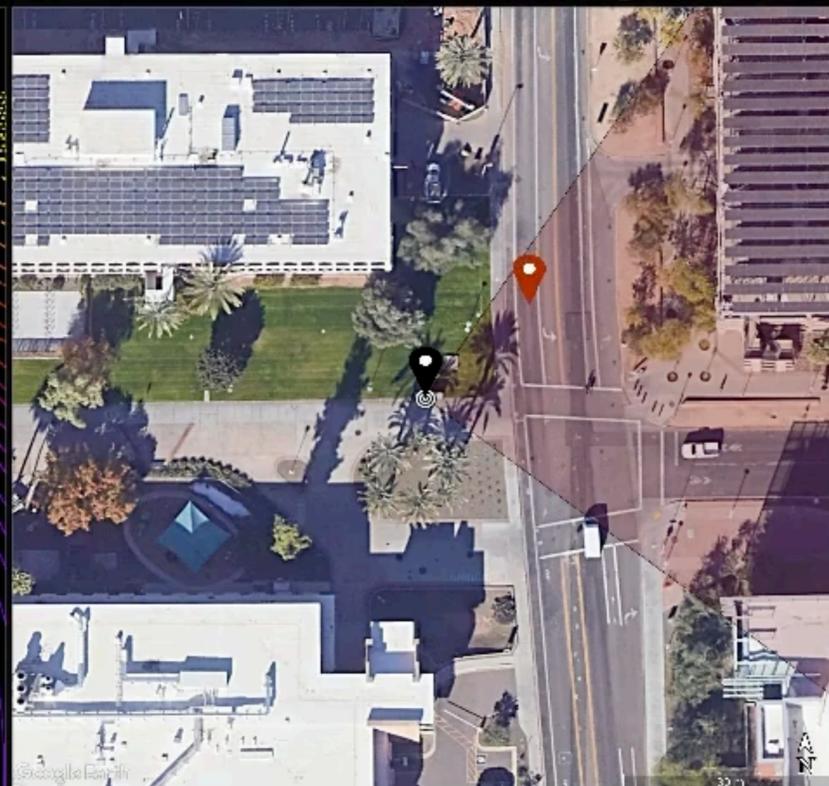
Digital Replica Camera



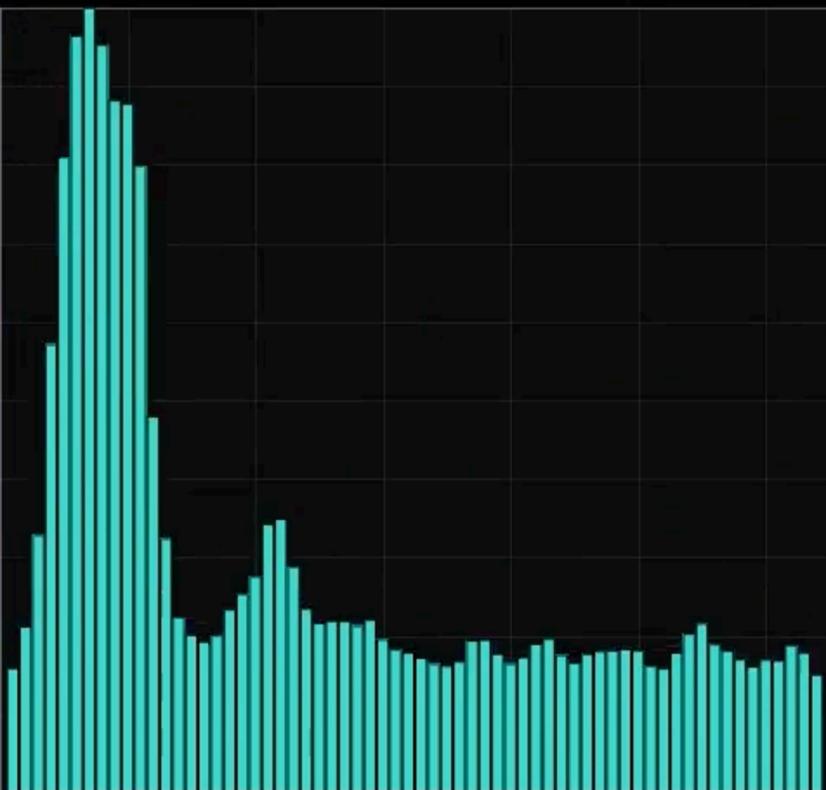
Digital Replica LiDAR



Positions - Satellite Image



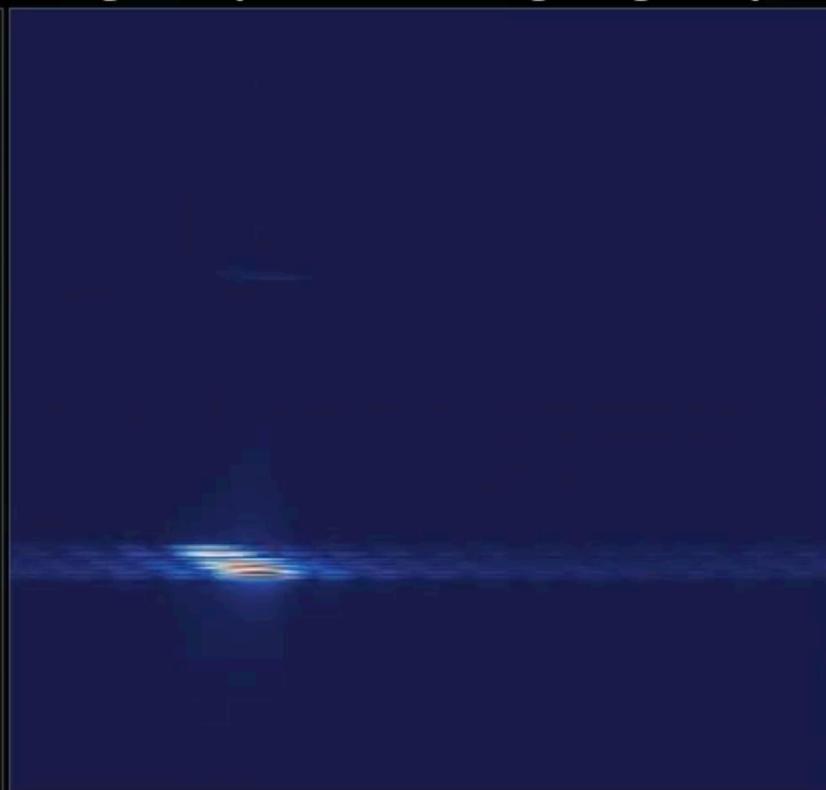
Real-world Beam Power



Digital Replica Beam Power



Digital Replica Radar (Range-Angle Map)



Digital Replica Radar (Range-Doppler Map)

