Self-Optimizing Wireless Communication Environments Assisted by RIS

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Award Type: JST PRESTO Grant Number JPMJPR21P3

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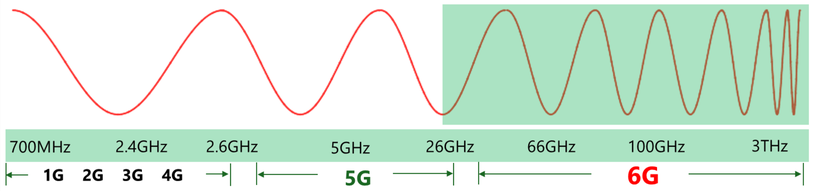
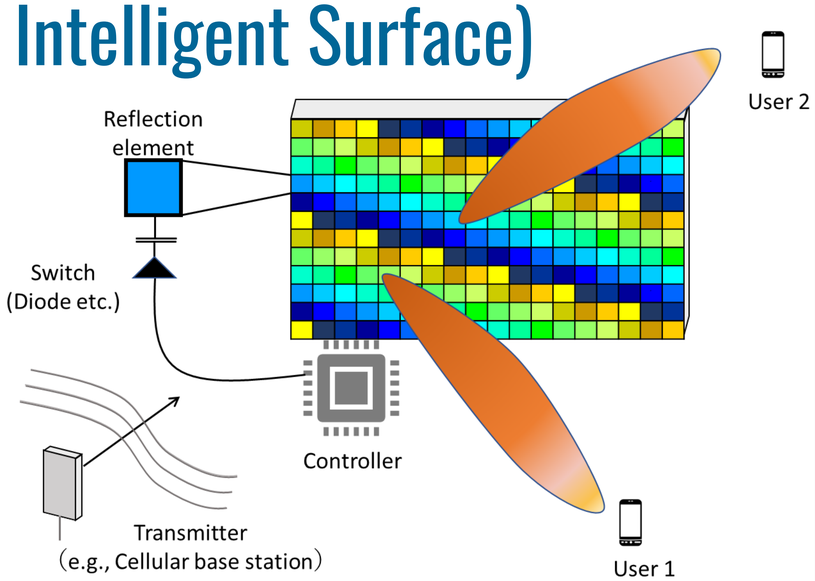
6G Wireless Communications



High frequency bands are expected for 6G:

- ✓ Pros: **a huge amount of transfer data** with wide bandwidths
- ✓ Cons: easily **blocked by obstacles** and a short transmission distance

RIS (Reconfigurable Intelligent Surface)



- ✓ **RIS reflects radio signals** and dynamically controls beamforming to a receiver
- ✓ RIS can expand **communication ranges** and improve **transmission speeds**.
- ✓ Cost & Power: Base station >>RIS

Project Challenge

How to optimize the use of RIS for practice is unknown. Some research issues are:

- ✓ How to **configure parameters of RIS** to maximize the performance (throughput, delay, etc.)
- ✓ What is **the case study of RIS** suitable to be applied?

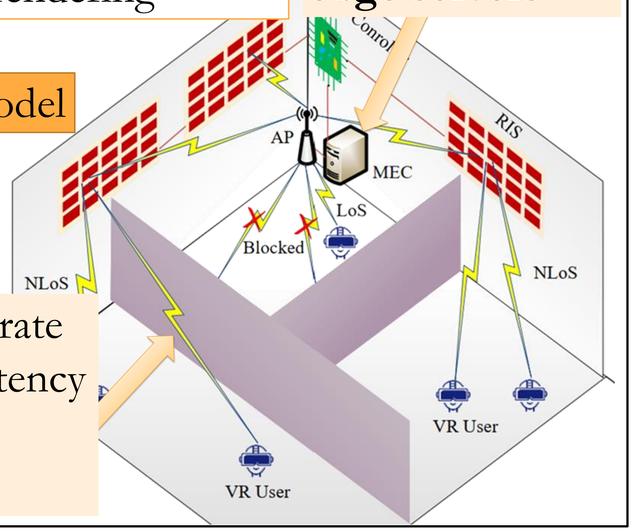
Major Outcome

Y. Ma, K. Ota, M. Dong, "**QoE Optimization for Virtual Reality Services in Multi-RIS-Assisted Terahertz Wireless Networks**," *in IEEE Journal on Selected Areas in Communications (JSAC)*, 2023. (Q1)

VR system requirements:
1. Seamless connectivity
2. Real-timeless
3. High rendering

Real-time processing and low-latency by **edge servers**

System model



High data rate and low latency by **THz networks**

- ✓ **What:** To Maximize QoE of each user
- ✓ **How:** To quantify **objective factor** and **subjective factor** for QoE

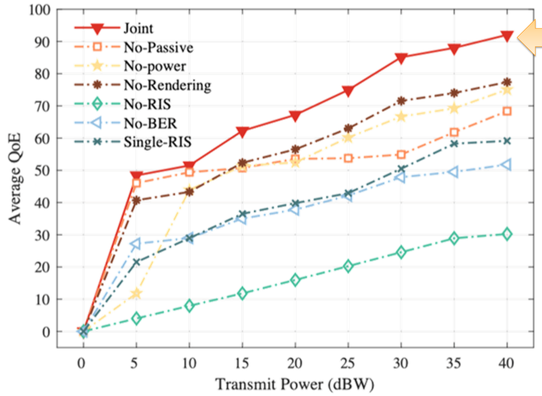
Objective factor

Uplink Bit-Error-Rate Transmission data rate

$$QoE_k = \left(1 - \mathcal{F}_1\left(P_e^k\right)\right) \mathcal{F}_2\left(R_k\right) S_k$$

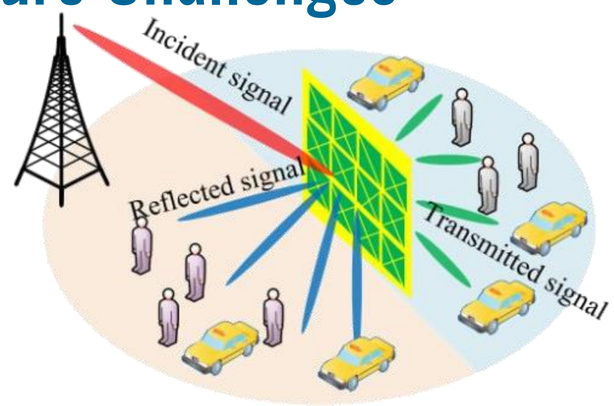
Subjective factor Rendering capacity based on user attention value

Simulation results:



Proposed method achieving the best QoE

Future Challenges



More dynamic and complex situations

- ✓ User high mobility
- ✓ 360° coverage RIS (reflected and transmit)