Collaborative Research: CCRI: New: CoMIC: A Collaborative Mobile Immersive Computing Research Infrastructure for Multi-user XR

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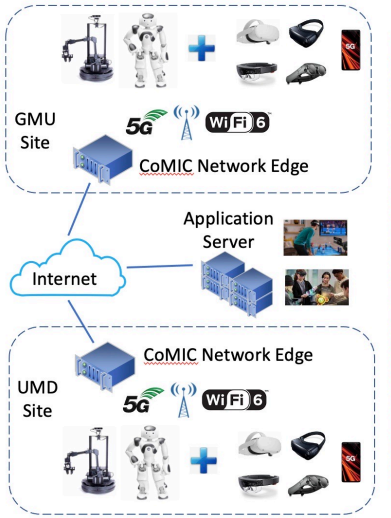
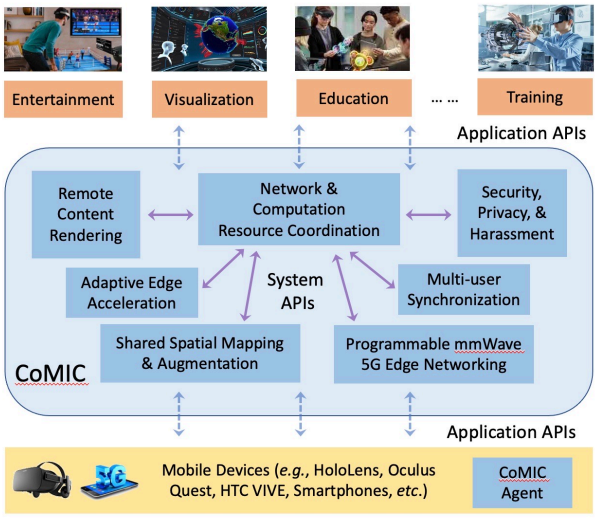


Hardware Infrastructure



Software Infrastructure

Software Framework

- ✓ Enabling agile, cross-layer, and resilient interfaces for high-speed and low-latency immersive content delivery with programmable mmWave 5G edge
- ✓ Adaptively offloading computation-intensive XR (extended reality) tasks to GPU-accelerated edge servers for reducing end-to-end latency and improving user experience
- ✓ Synchronizing interactions of geographically distributed users to create a common perspective within a collaborative session
- ✓ Pre-rendering immersive content in a scalable fashion at the edge based on predicted 6DoF (six degrees of freedom) motion to alleviate on-device computation overhead
- ✓ Ensuring smooth collaborations among users in a collision-free manner by sharing spatial maps with local scene geometry and semantics
- ✓ Protecting users from security threats and preserving privacy in the shared environment (*e.g.*, privacy-preserving authentication and harassment prevention)
- ✓ Coordinating network and computation resources shared by heterogeneous devices with a global view of the entire ecosystem, ultimately boosting user experience

Motivations

- ✓ Software Framework: no software framework with commonly used building blocks to design and implement multi-user XR applications
- ✓ Testbeds: no remotely accessible and programmable testbed to test, evaluate, and benchmark multi-site, multi-user XR systems
- ✓ Tools, Resources, and Datasets: lack of commonly used tools, resources, and datasets for building and evaluating multi-user XR applications

Testbed

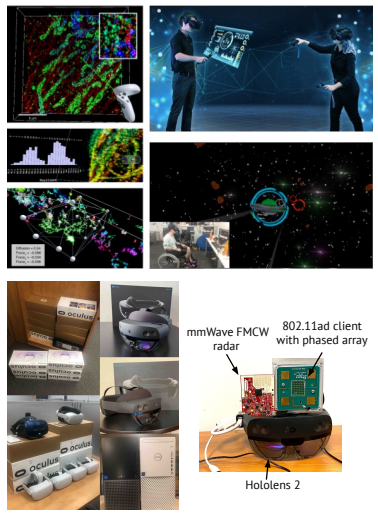
- ✓ XR devices: headsets such as Hololens 2 and HTC VIVE and smartphones
- ✓ Robots: NAO Power V6 Robot and LoCoBot for reproducible experiments
- ✓ mmWave edge networks: 60 GHz 802.11ad/ay WiFi and 28 GHz 5G NR cellular
- ✓ Servers: network edge and hosting applications

Tools

- ✓ Remote controllers of XR devices and robots
- ✓ Remote controller of mmWave 5G edge networks
- ✓ Testbed customizer
- ✓ Collectors of KPIs (key performance indicators)
- ✓ XR content creators
- ✓ Web portal for user requests and service provisioning

User Services

- ✓ Download CoMIC system software, along with tools, and set up your own multi-site testbed
- ✓ Access CoMIC remotely to develop and evaluate immersive applications or build your own components
- ✓ Connect your own site with GMU's CoMIC site
- ✓ Visit in person both GMU and UMD sites



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References:
Bo Han, Parth Pathak, Songqing Chen, and Lap-Fai Yu. CoMIC: A Collaborative Mobile Immersive Computing Infrastructure for Conducting Multi-user XR Research. To appear in IEEE Network Magazine.
Bo Han, Songqing Chen, Joel Martin, Parth Pathak, Amitabh Varshney, Hong Xue, Lap-Fai Yu, Jie Zhang, and Xiaoquan Zhao. Immersive Computing: Vision, Infrastructure, and Use Cases (Invited Paper). In Proceedings of IEEE CIC 2023.

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