EdgeRIC: Delivering Realtime RAN Intelligence

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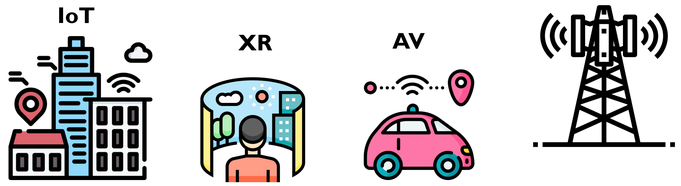
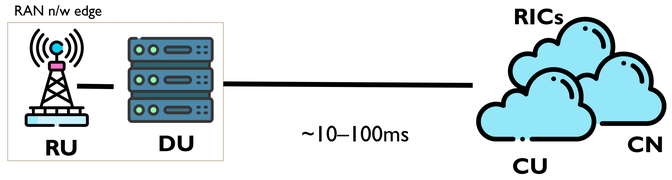
Cellular networks of the future

- Must support highly diverse end users
- Must support widely variable throughput, latency, and reliability requirements
- Cannot be "one-size-fits-all" — application awareness is required



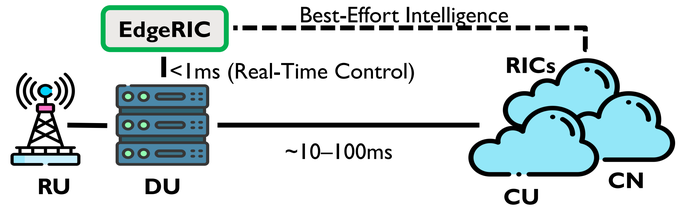
RAN Intelligent Control

- Industry trends towards standardizing open interfaces for radio access networks (O-RAN), enabling RAN intelligent controllers (RICs) for network reconfiguration in the cloud based on unique usage scenarios
- Existing RIC architectures, comprising of the Near Realtime and Non Realtime RICs are hosted in the cloud, suffering at least 50ms latency from the RAN edge, hence cannot support live adaptations to dynamic mobile links



EdgeRIC: Real time RAN Intelligent Control

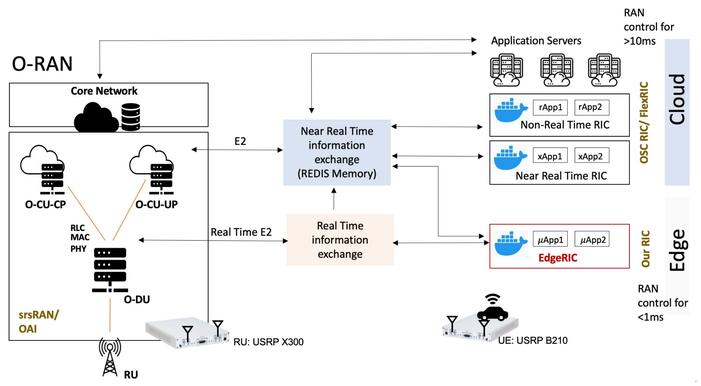
- A real time RIC colocated with the DU at the RAN edge
- Integrate application-aware intelligent control into PHY and MAC, thus enabling unprecedented RAN lower-layer intelligent applications



EdgeRIC: Key Features

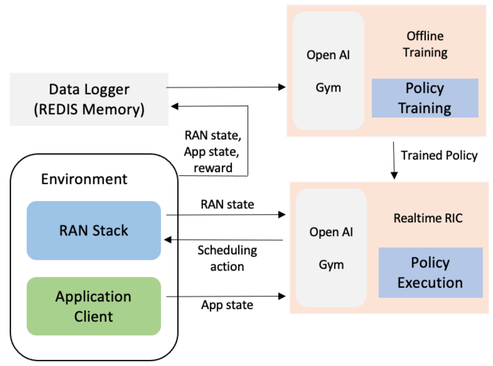
- ORAN compatibility — Consistent with O-RAN messaging standards
- Realtime — Able to access RAN state information and provide control actions at each TTI
- Robustness — Missing or delayed state or control action does not break TTI constraints of the RAN
- Cross-layer Awareness — Able to communicate with applications running on UEs to allow cross layer optimization
- Support for AI/ ML Workflows — support standardized AI/ ML codebases that might require offline, online, simulation or emulation-based data collection and training

O-RAN Platform Architecture with EdgeRIC

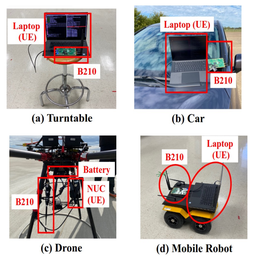


An EdgeRIC µApp: RL based MAC scheduler

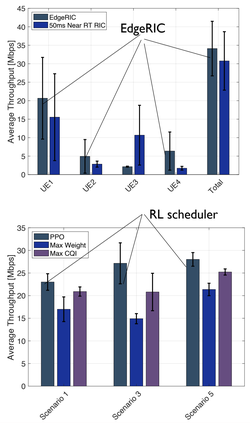
We train an optimized MAC scheduling policy based on reinforcement learning to provide real time intelligent control, the training is performed offline in the Near Realtime RIC



Evaluation: Microbenchmarks



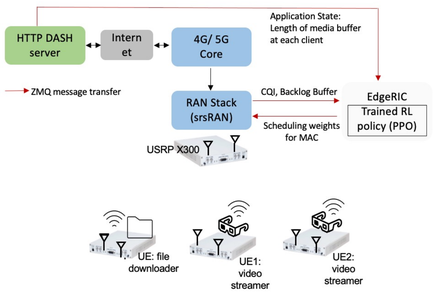
Real world channel (CQI) traces were collected for various mobility scenarios



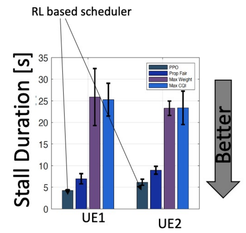
Providing scheduling control in real time indeed supports a higher system throughput

Our RL (PPO) based scheduling control with EdgeRIC improves system throughput by at least 25%

Evaluation: Cross Layer Optimization



Evaluating a video streaming application scenario over cellular networks with real time intelligent MAC scheduling



An application aware real time RL scheduling policy reduces video stalls by almost 60% compared to traditional schedulers

Conclusion

Our work aims at showcasing the potential benefits of real-time RAN control, robust RL-based schedulers and other policies, and application-awareness in NextG networks, via over-the-air demonstrations using multiple software defined radios. Our codebase is fully compatible with the NSF PAWR testbeds.

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Demo video link: https://tinyurl.com/ye28mwb8

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