

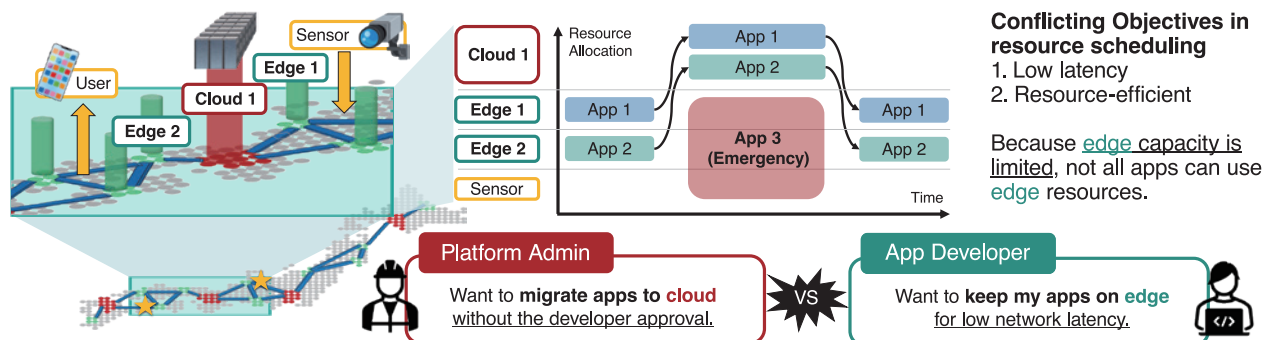
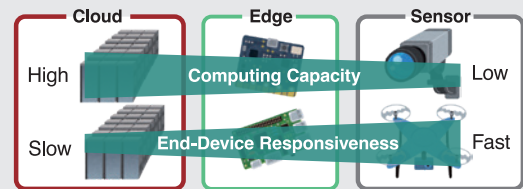
Mitigating Resource Constraints for Flexible Scheduling in Cloud-Edge Continuum

Resource Scheduling in Cloud-Edge Continuum Computing Platform

Cloud-Edge Continuum Computing (CECC) is a unified computing platform for seamless data processing on **Cloud-Edge** resources.

- **Cloud** has high **computing capacity** with slow responsiveness to end devices.
- **Edge** has a few computing capacity and **close to end devices**.

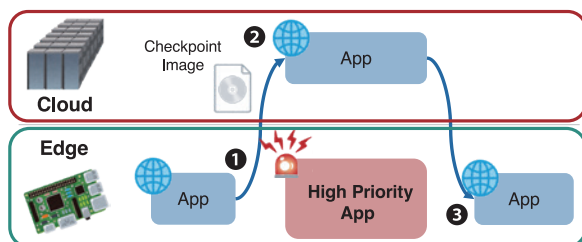
Resource scheduler in CECC platform intelligently utilizes both the cloud and edge resources based on required latency and resource availability.



- Leveraging **Checkpoint-Restore functionality** to enable container migration in heterogeneous system.
- Applying **Deterministic Networking** to mitigate additional latency and guarantee reliable data transfer.

Container Migration with Checkpoint-Restore

Checkpoint and Restore is a technique that saves a process into an image file and restores it later. **It allows an application container to be suspended without having to restart the entire process.**



When the **edge** cluster is unavailable, some apps are forcibly migrated to the nearest **cloud** cluster to free resources on the **edge** to run higher-priority apps.

- 1 The scheduler collects process information into a checkpointing image and transfers to the **cloud** cluster.
- 2 The scheduler restores the process on a **cloud** node.
- 3 When **edge** resources become available, the app is automatically migrated back to the **edge** cluster.

Deterministic Networking (DetNet)-Assisted Data Transfer

DetNet is a protocol suite for latency-guaranteed network over Ethernet. **In DetNet, packets are delivered in time, resulting in the data transfer time become predictable.**

After migrating applications to the **cloud**, communication latency increased, resulting in large 99th percentile latency.



Packets experience queuing delays at each switch.
→ DetNet manages it across all switches and reduce latency.

Adaptive rate limiting relaxation

When rate limits are temporally unbalanced, DualCBS [RTNS25] notifies via packet marking and **relaxes the rate limits of subsequent switches.**

