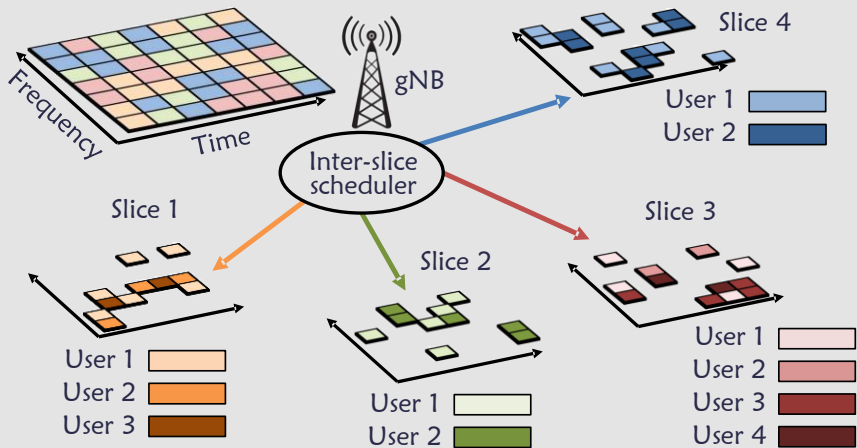


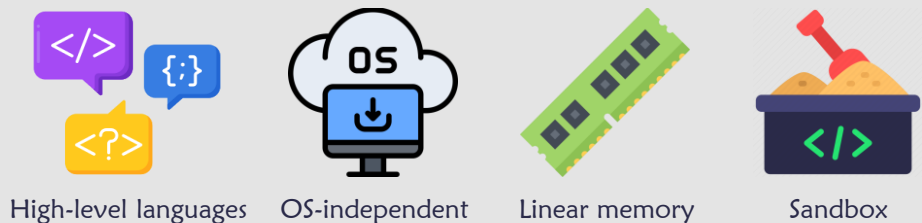
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1 Introduction and Background

- 5G RAN Slicing and its challenges:
 - Resource isolation and scheduling of different metrics
 - Slice tenants may differ from network operators



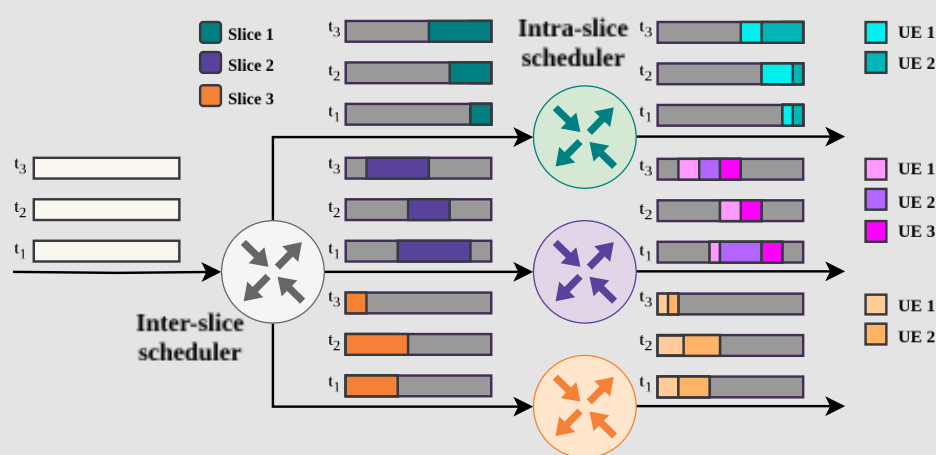
- WebAssembly (WASM): Portability, efficiency, and security



- SliceGuard runs the slice schedulers as WASM modules:
 - Easier development in multiple high-level languages
 - Unique executable across the network
 - On-the-fly update for new components
 - Secure and reliable execution of third-party code

2 Two-Level Scheduler

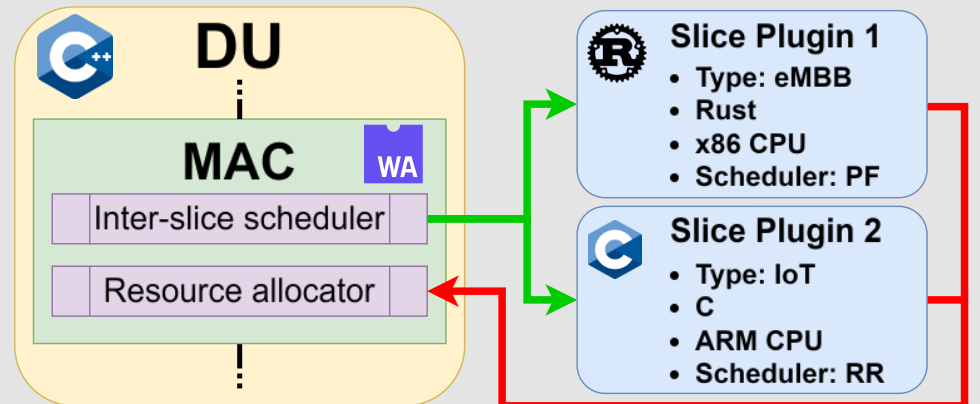
- Two-levels scheduler:
 - Inter-slice scheduler: Divides resources among slices
 - Intra-slice scheduler: Divides resources among users subscribed to the same slice
- Three types of slices:
 - Low latency slices
 - Guaranteed bit rate slices
 - Best effort slices



- Low Latency (LL) slices:**
 - Timestamp packets when placed in queues
 - Reserve resources to meet latency requirements
- Guaranteed Bit Rate (GBR) slices:**
 - Track throughput with a moving average
 - Compute priority weights using a logistic curve
- Best Effort (BE) slices:**
 - Assign remaining resources after LL and GBR allocations

3 WASM-Based Scheduler System

- Network operators control the inter-slice scheduler
 - Run the same code across the shared infrastructure
- Slice tenants control the intra-slice scheduler
 - Customize resource allocation within the WASM modules



- Main advantages:
 - Ensure security between the operators and tenants
 - Avoid recompiling the entire stack during update rollouts
 - Execute the same code across the whole network (Independent of hardware or software)

4 Demonstration

- Our testbed: A cloud gaming server and a 5G system



- Slicing for cloud gaming:
 - Compare single-slice and multi-slice setups
 - Highlight the need for dynamic slicing
- WASM capabilities:
 - Show on-the-fly updates and fault isolation
 - Demonstrate the capabilities of WASM modules

	GBR slice	BE slice	BE slice
Step 1	✓	✓	Idle
Step 2	✓	⊘	iPerf
Step 3	✓	BE → GBR	iPerf
Step 4	✓	✓	iPerf
Step 5	✓	BE ← GBR	iPerf
Step 6	✓	⊘	iPerf