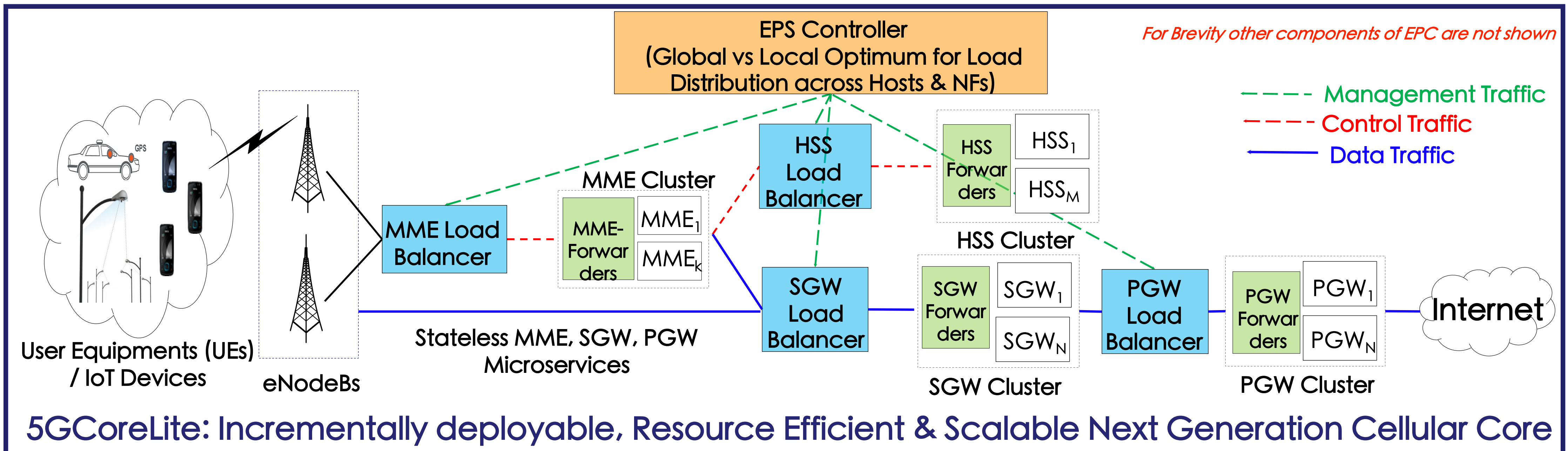# 5GCoreLite: Scalable and Resource Efficient Next Generation Cellular Packet Core

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5GCoreLite: Incrementally deployable, Resource Efficient & Scalable Next Generation Cellular Core

5G Cellular Core Requirements

1. Flexibility
2. Scalability
3. Elasticity
4. Incrementally deployable
5. 3GPP Compliance
6. Cost Effective
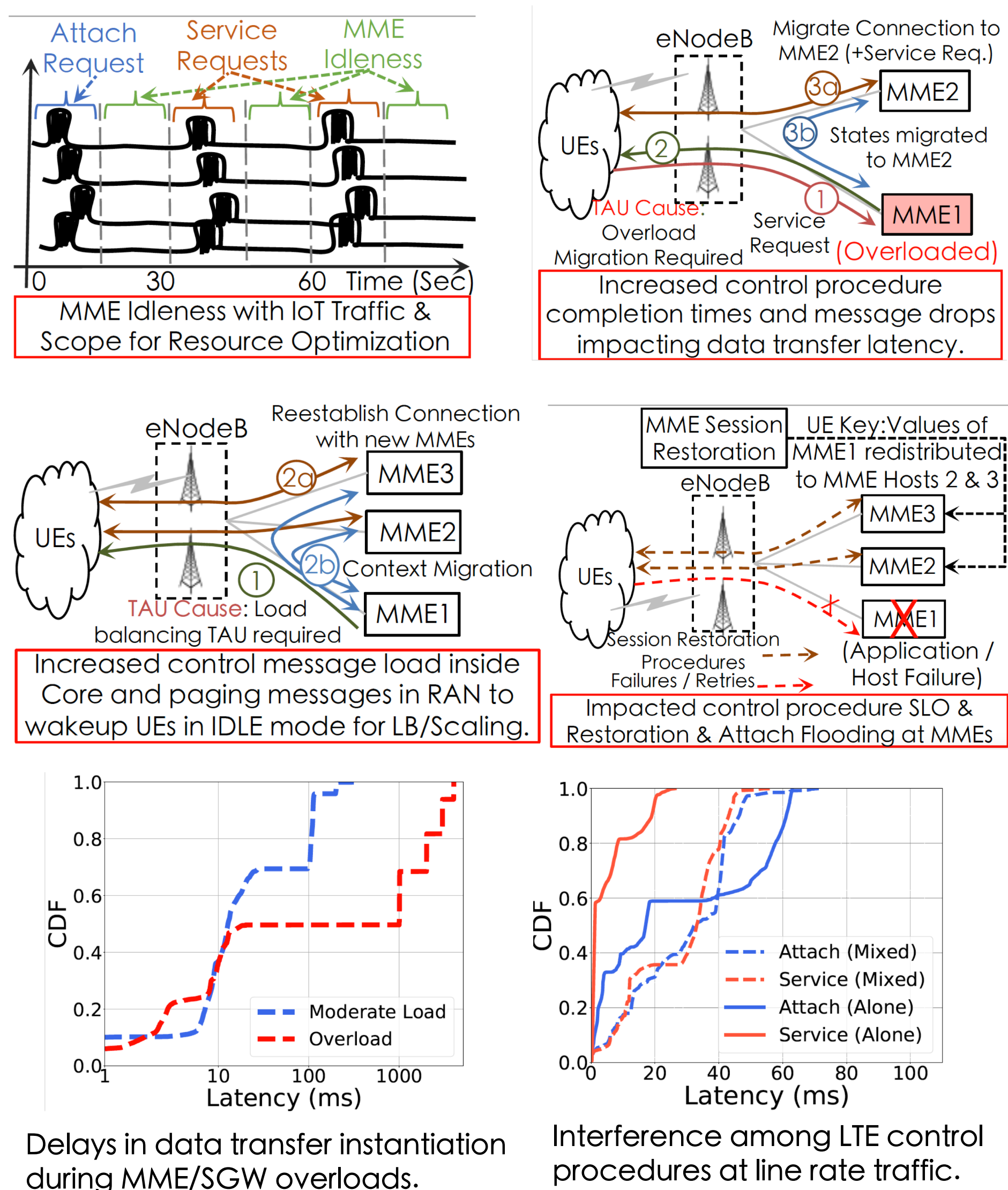
Limitations of Traditional Cellular Core

MME Idleness with IoT Traffic & Scope for Resource Optimization

Increased control procedure completion times and message drops impacting data transfer latency.

Increased control message load inside Core and paging messages in RAN to wakeup UEs in IDLE mode for LB/Scaling.

Impacted control procedure SLO & Restoration & Attach Flooding at MMEs

Delays in data transfer instantiation during MME/SGW overloads.

Interference among LTE control procedures at line rate traffic.

Figure 1: Experiments demonstrating the limitations of existing control and data plane design with DPDK-based industrial-grade prototype.

Our Approach

1. Traffic Aware scheduling for efficient resource allocation

2. Multi-level Adaptive SLO-aware Load balancing
   - Inter & Intra-host LB
   - Global vs local optimizations
   - Viable Host Selection & Optimum NF Selection

3. Microservice (NF) prioritization

4. Statelessness & functionally Decomposed microservices
   - E.g. Attach, Service, Mobility request MME and so on.

5. Slicing for resource Isolation

Skewed Load Balancing

Figure 2: Slice and SLO-aware Load balancing illustrated with MME

$getviableHost$ (primary, replicas, sliceID, CPU_{NF}, $QueueSize_{NF}$)
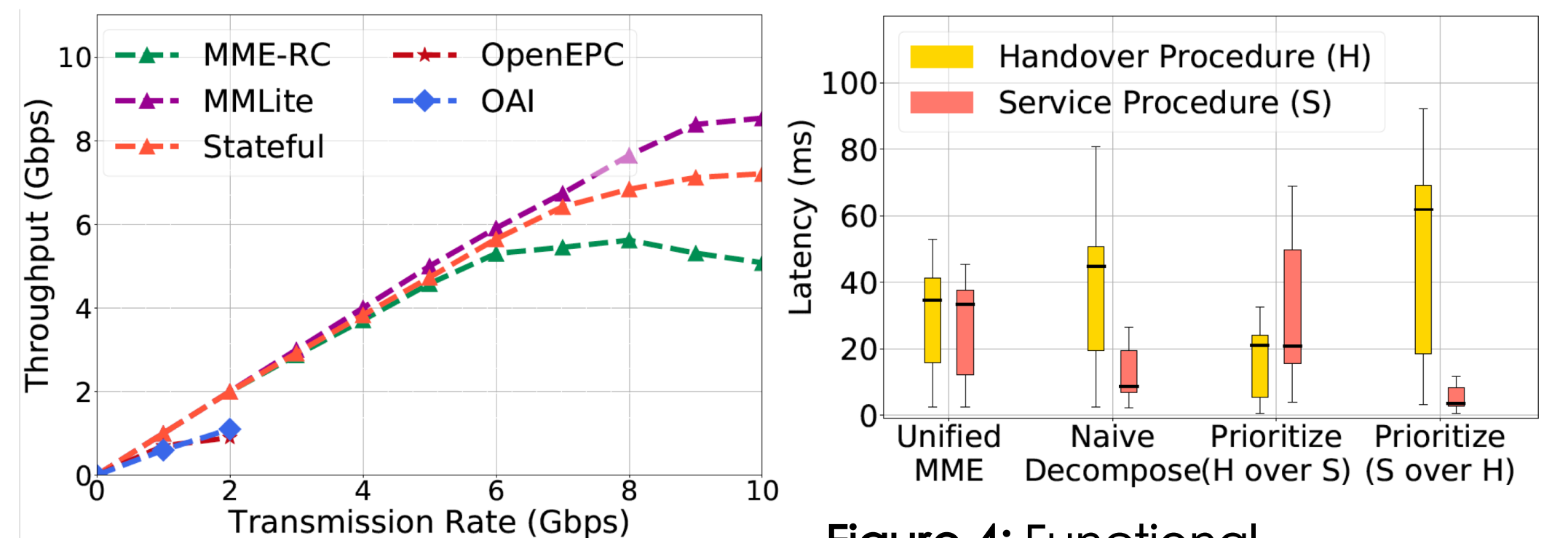
Preliminary Evaluations

Figure 3: Throughput of different MME prototypes.

Figure 4: Functional decomposition & prioritization of control procedures at line rate.
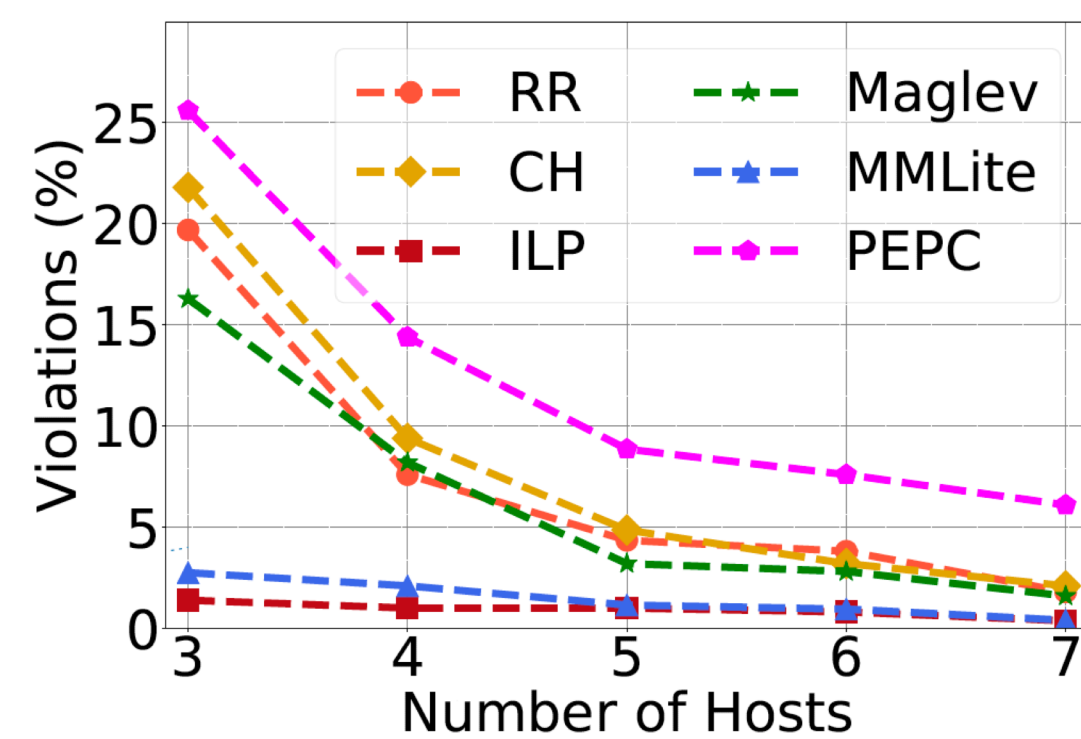
Figure 5: SLO violations for different number of hosts for different LB Schemes
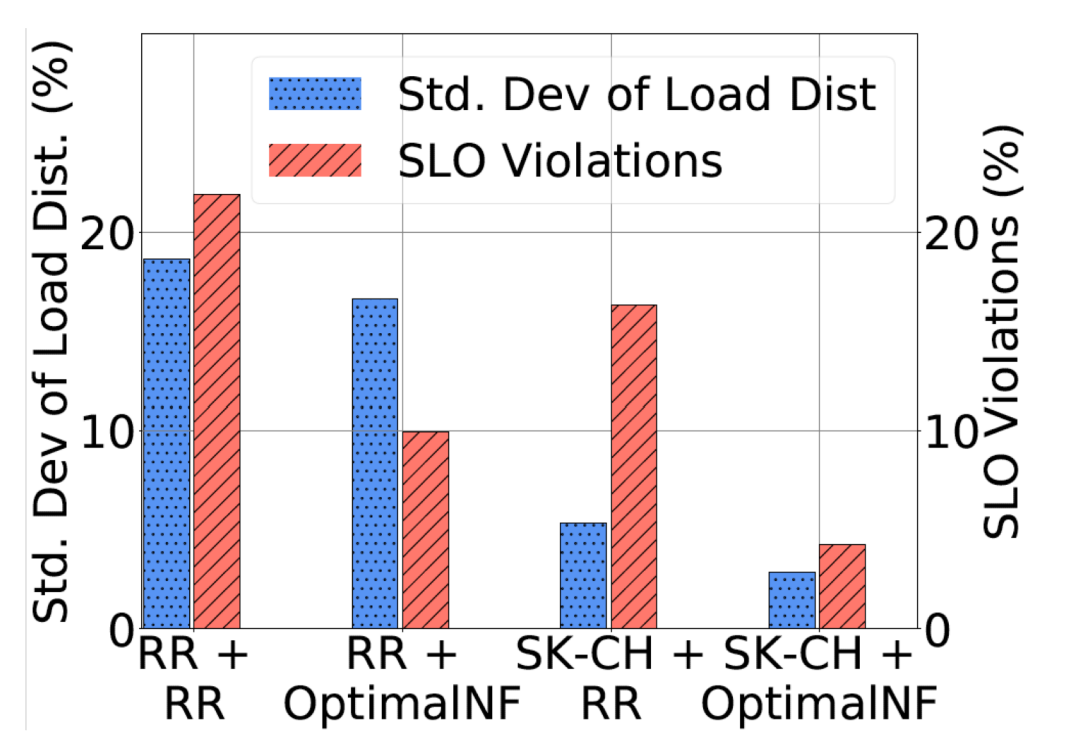
Figure 6: Performance of MME with different inter- and intra-host LB.

Preliminary Work

Scalable and Resource Efficient Control Plane for Next Generation Cellular Packet Core. Vasudevan Nagendra, Arani Bhattacharya, Anshul Gandhi, and Samir R. Das. 2019. In SOSR '19: ACM Symposium on SDN Research, April 03–04, 2019, San Jose, CA. ACM, New York, NY, USA.

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