An Experimental Study of Multi-RAT Systems

Andreas Bäuml (SEEMOO, TU Darmstadt), Clemens Felber, and Walter P. Nitzold (NI Corp., Austin, TX, USA)

Objectives & System Overview

- **Obj1**: Definition of evaluation scenarios
- **Obj2**: Implementation of required features/logic
- **Obj3**: Exp. analysis of multi-RAT communication

![Overview of the setup from network and hardware perspective](image)

Experimental Analysis

TCP Throughput (byte/s) of LTE PHY under different channel conditions.

TCP Throughput (byte/s) of fully switched LWA mode (WiFi PHY) under different channel conditions.

Multi-RAT Scheduling Algorithm

Testbed Implementation

- Based on multi-RAT demo application
- Implemented additional packet merging at UE (PDCP reordering missing)
- Implemented feedback mechanism for LTE & WiFi latency, throughput measured at UE at (via CQI feedback)
- Implemented simplistic threshold-based multi-RAT scheduler

Scheduler Pseudocode

```plaintext
1 use wifi initially;
2 if (wifi & (wifi_jitter > threshold || wifi_latency > threshold || wifi_throughput < threshold)) then
3   switch to lte and wait 2 seconds;
4 if (lte & (lte_jitter > threshold || lte_latency > threshold || lte_throughput < threshold)) then
5   switch to lte and wait 2 seconds;
6 goto 2;
```

Observed throughput, latency and jitter for our simplistic multi-RAT scheduling algorithm

---

1 This work was conducted within ORCA-RAT project funded through the open call for experiment under EU H2020 ORCA (agreement No 732174)
2 [https://github.com/ni/NI-ns3-ApplicationSample](https://github.com/ni/NI-ns3-ApplicationSample)