

SHOWCASE 4

INTERWORKING AND AGGREGATION OF MULTIPLE RADIO ACCESS TECHNOLOGIES (RAT)

GOALS

- Integrate three heterogeneous RATs in a single base station/access point
- Experimentation platform is starting point for research and optimization of RAT interworking techniques across all OSI layers

CHALLENGES

The integration of several RATs in one node is computationally demanding

- NI PXI real-time controller hardware with Linux RT operating system allows optimization of process scheduling
- Hardware acceleration implemented with FPGA-based NI USRP-RIO SDR

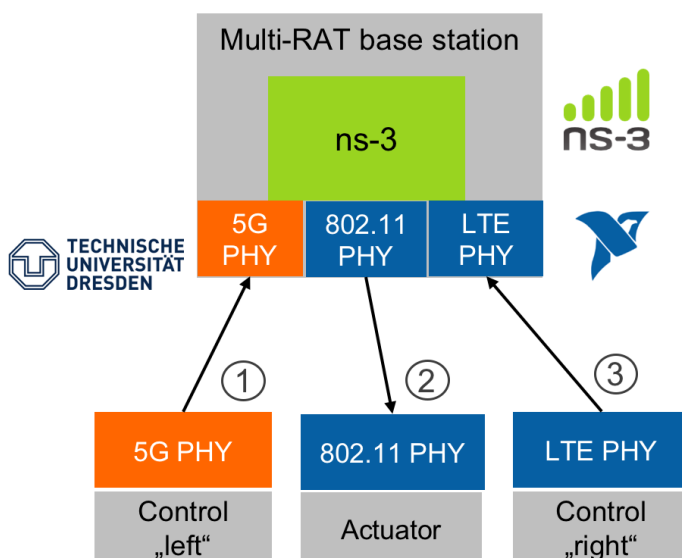
RAT interworking experiments require higher layers functionality

- Network simulator ns-3 contains models for LTE and Wifi protocol stacks

The connection between PHY (on FPGA) and MAC (on CPU) has RAT-dependent throughput and latency requirements.

- NI L1-L2 API is a way of MAC-PHY designed with these requirements in mind

CONCEPT



- One multi-RAT base station including a 5G, LTE and WiFi link running on an NI PXI controller

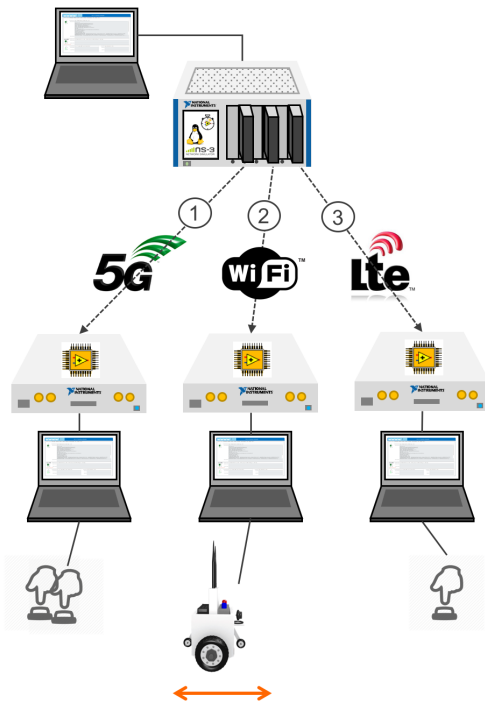
- Three physically separated terminals each running a selected RAT on an NI USRP device

- Mobile robot connected via WiFi can be controlled by “virtual” buttons through 5G and LTE link

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DEMO SET UP



1. Either of the two buttons connected to the 5G or LTE link can be used to control the moving direction of the robot
2. Control information is sent from the 5G and LTE terminals to the centralized base station
3. Base station coordinates packets and forwards control information to the actuator through WiFi link.
4. Robot moves according to the direction information

RESULTS

- First live demo showcasing a 5G/LTE/WiFi Multi-RAT system running on real-time SDR platform
- Application represents industrial use case of a remotely controlled mobile robot

INNOVATION

- Presented multi-RAT platform is relevant in scenarios like factory floor automation and communication. In such environments, each machine might come from a different vendor and each vendor might utilize a different RAT
- Aggregating, managing and interworking of RATs is an important topic of ongoing research for the operators of such factories

IMPACT

- Outside of ORCA, researchers might not have multiple, open and fully modifiable RATs at their disposal.
- The platform developed in SC4 saves time for researchers by providing a head start for RAT interworking experiments across all layers, without the need to invest significant effort in setting up and then integrating the individual PHY links