

Topics for theses (Bachelor, Master, also projects)

General information

Important, please note the following conditions if planning to work on one of the projects or theses:

- For the documentation, the Word template can be found at [Template engl.](#) or [Template ger.](#) which must be used. The template contains all the necessary information for formatting the document.
- The processing takes place in the laboratory for telecommunication networks.

Various Topics

Implementation and Evaluation of a Babel-based Wireless Mesh Network using CORE and EMANE (Thesis)

- Theoretical background: Wireless Mesh Networks, Babel, EMANE
- Setting up CORE with EMANE being enabled/installed
- Configuration of a multi-channel wireless mesh network within CORE with EMANE
- Enforcing the routing protocol Babel with FRR within the network
- The analysis of the behaviour of Babel within the emulated network
- CORE: <https://github.com/coreemu/core>
- CORE-Documentation: <https://coreemu.github.io/core/>
- EMANE-Wiki: <https://github.com/adjacentlink/emane/wiki>
- EMANE: <https://github.com/adjacentlink/emane>
- EMANE-Tutorials: <https://github.com/adjacentlink/emane-tutorial>
- EMANE in CORE: <https://coreemu.github.io/core/emane.html>
- FRR Babel user guide: <https://docs.frrouting>
- **Contact:** Gregor Frick – frick@e-technik.org

Emulation and evaluation of coexisting IPv4 and IPv6 networks in CORE for demonstration purposes (Thesis)

The task is to emulate different mechanisms for the parallel use of IPv4 and IPv6 in CORE for demonstration purposes. Different networks are to be connected with each other as well as different hosts through one network. In Addition, different services should be accessible through all of the networks.

- Create interconnected IPv4 and IPv6 networks in CORE
- Hosts should be able to communicate with each other through another network, IPv4 hosts through IPv6 or vice versa (tunnelling)
- Hosts from the different networks must also be able to communicate with each other.
- Create services in the different networks, like HTTP, FTP and SIP
- The services should be reachable through every part of the networks
- Implementation of various mechanisms so that these networks can communicate with each other:
 - * Dual-Stack
 - * Translation (NAT64)
- CORE: <https://github.com/coreemu/core>
- **Contact:** Alexander Seng - seng@e-technik.org

Create LCX containers with different services for reuse in CORE networks

(Project)

- Create LCX Containers with different network services, like DNS, DHCP, HTTP, FTP, SIP etc.
- The containers should be usable in the CORE network emulator to deploy the corresponding services flexibly.
- It should be possible to reuse these containers in different emulated core networks
- CORE: <https://github.com/coreemu/core>
- **Contact:** Alexander Seng - seng@e-technik.org

Topics on 5G/6G

Commissioning of the Amarisoft 5G System with the Inclusion of an Outdoor Antenna

(Project/Thesis)

- Setting up and testing the Amarisoft 5G system
- Measuring the signal strength on the campus area
- Integration of user equipment, e.g. smartphones or IoT devices
- Amarisoft [Callbox Classic](#)
- AW2S [Remote RadioHead](#)
- **Contact:** Prof. A. Lehmann – lehmann@e-technik.org

Analysis and implementation of the Flexible RAN Intelligent Controller (FlexRIC)

(Project/Thesis)

- Analyzation of FlexRIC functionalities
- Implement a simulation and emulation environment for testing
- Test with SDR cards
- Test O-RAN Alliance compliant E2 node Agent emulator
- Openairinterface [MOSAIC5G Project](#)
- GitLab: <https://gitlab.eurecom.fr/mosaic5g/flexric>
- **Contact:** Prof. A. Lehmann – lehmann@e-technik.org

Implementation of 5G Core Network using Openairinterface Network Exposure Function (NEF)

(Project/Thesis)

- Implementation of Openairinterface 5G Core Network (CN), including NEF
- Implementation of extended NEF functionalities/capabilities regarding 3GPP Releases
- Testing of implemented NEF functionalities/capabilities (northbound and southbound interfaces)
- Openairinterface [OAI 5G CN](#)
- GitLab: <https://gitlab.eurecom.fr/oai/cn5g>
- **Contact:** Prof. A. Lehmann – lehmann@e-technik.org

Interworking of Network Functions (NFs) from various Open Source 5G Core Networks (CNs) (Project/Thesis)

- Implementation and Integration of NFs from various Open Source 5G CNs
- Design integration tests
- Design interworking tests
- Testing of interworking
- Openairinterface [OAI 5G CN](#)
- [Open5GS](#)
- [Free5GC](#)
- **Contact:** Prof. A. Lehmann – lehmann@e-technik.org

Implementation and Integration of Network Data Analytics Function (NWDAF) (Project/Thesis)

- Implementation of NWDAF, possibly of existing Open Source solution
- Integration into an Open Source 5G Core Network, e.g. [Open5GS](#) or [Openairinterface](#)
- Testing of NWDAF functionalities
- **Contact:** Prof. A. Lehmann – lehmann@e-technik.org

Analysis of Development and Provisioning of 5G Digital Twins (Project/Thesis)

- Analyzation of possible 5G Digital Twin solutions
- Analyzation of development and provisioning concepts for 5G Digital Twin solution
- A prototype implementation of a 5G Digital Twin solution
- **Contact:** Prof. A. Lehmann – lehmann@e-technik.org

Further Topics on 5G/6G

Integration of a Special Purpose Network (SPN) in the Amarisoft 5G System (Project/Thesis) **Contact:** Alexander Seng - seng@e-technik.org

Investigation of Network Slicing in the Amarisoft 5G System (Project/Thesis) **Contact:** Alexander Seng - seng@e-technik.org

Connecting a Special Purpose Network (SPN) to a 5G System using UERANSIM and Open5GS (Project/Thesis) **Contact:** Alexander Seng - seng@e-technik.org

Connecting a Special Purpose Network (SPN) to a 5G System with UERANSIM and Open Air Interface System (Project/Thesis) **Contact:** Alexander Seng - seng@e-technik.org

Investigation of Network Slicing in Open Air Interface System (Project/Thesis) **Contact:** Alexander Seng - seng@e-technik.org

Development of a highly available 5G/6G SPN Gateway (mesh connection to the inside and outside) (Project/Thesis) **Contact:** Gregor Frick – frick@e-technik.org

Concepts for Communication in Special Purpose Networks (SPNs) with special regard to Bit Rates and Availability

(Project/Thesis) **Contact:** Gregor Frick – frick@e-technik.org

Development of a Special Purpose Network (SPN) for the Realization of high availability based on IEEE 802.11/MESH/Bluetooth

(with Bluetooth-based smart sensor networks and mesh WLAN networks; among others with Raspberry Pi)

(Project/Thesis) **Contact:** Gregor Frick – frick@e-technik.org

Concept and Prototypical Realization for Distributed Computing in Special Purpose Networks (SPNs) considering Extreme Edge Computing (also considering edge, fog and cloud computing)

(Project/Thesis) **Contact:** Gregor Frick – frick@e-technik.org

Concept and Prototype Realization for Intra-Network Slicing in Special Purpose Networks (SPNs) based on WLAN and Bluetooth Subnets

(Project/Thesis) **Contact:** Alexander Seng - seng@e-technik.org

Concept for Orchestration in SPNs connected via 5G/6G Networks (including consideration of APIs, security, blockchain)

(Project/Thesis) **Contact:** Gregor Frick – frick@e-technik.org