Chair of Communication Networks

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TUM

Investigating Roaming User-Plane Security in a 4G/5G Combo-Core

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1 Overview

Mobile networks have evolved significantly over the years—from older generations like 2G, 3G, and 4G to the latest 5G technology. Each generation brings new features and changes in how data is handled and secured.

In older networks (2.5G to 4G), a special type of firewall called a **GTP-Firewall** was used to protect both the control signals (which manage the connection) and the actual user data (like videos or messages). These firewalls could see and filter all the traffic because it was sent in a readable format.

With 5G, things are changing. The control signals now use a different protocol (HTTP/2), and the user data might be encrypted using IPSec. This makes it harder for traditional firewalls to inspect and secure the traffic in the same way.

To address this, a new function called **IPUPS** was introduced in the 5G standard. It helps secure user data but works differently—it does not allow the same kind of visibility as the old firewalls. This is fine in a pure 5G network, but it becomes tricky when 4G and 5G are combined in one system, especially when users move between the two (a process called handover).

This research internship will explore how to combine the old and new approaches to security in a way that works smoothly in a mixed 4G/5G network. The goal is to understand the challenges and propose solutions that ensure both security and performance.

2 Objectives

1. Analyze the architectural and security differences between legacy GTP-Firewalls and the 5G IPUPS function.
2. Investigate the implications of HTTP/2-based CP and IPSec-protected UP on traffic inspection and security enforcement.
3. Design a hybrid model that enables secure and efficient CP and UP handling in a 4G/5G Combo Core.
4. Evaluate the model in terms of:
   - Handover performance (4G $\leftrightarrow$ 5G)
   - Security (visibility, integrity, confidentiality)
   - Operability and maintainability
5. Compare the hybrid model with standalone 5G and legacy 4G implementations.

3 Prerequisites

- Interest in mobile network security and interworking between generations.
- Motivation to explore and analyze complex network functions.

Additional points that are beneficial but not required:
- Basic understanding of mobile core networks, especially GTP, UPF, and 5G Core architecture.
- Familiarity with network protocols such as HTTP/2.

4 Further Information

This research internship is done in an open collaboration with Deutsche Telekom Technik GmbH and a follow-up Master Thesis is encouraged.