Faysal Aziz

5G RedCap

Linux Cellular Networking and Advanced Modem Integration

FA-0013 · one-day

DevOps, Cloud & Infrastructure

Introduction

Modern embedded systems, industrial IoT platforms, routers, gateways, and edge computing solutions increasingly rely on seamless integration between Linux operating systems and LTE/5G cellular technologies. As operators transition towards 5G Standalone (SA) networks and 3GPP Release 17 introduces Reduced Capability (RedCap) devices, engineers must understand not only cellular networking fundamentals but also Linux networking, modem management, IPv6 adoption, dual-SIM architectures, and practical troubleshooting techniques.

This intensive one-day technical workshop provides participants with the knowledge required to design, deploy, integrate, and troubleshoot Linux-based cellular networking solutions using current industry practices and emerging technologies. Recent developments in 3GPP Release 17 and Release 18 have expanded RedCap capabilities for industrial IoT, wearables, gateways, and edge devices, making this knowledge increasingly relevant for modern deployments.

The course is delivered by an instructor with **over 30 years of industry experience**, using practical, real-world implementation techniques and deployment scenarios that reflect current industry requirements rather than purely academic concepts.

Learning outcomes

Upon completion of this course, participants will be able to:

- Understand LTE and 5G network architecture from a Linux integration perspective.
- Explain the principles and deployment considerations of 5G RedCap technology.
- Configure Linux systems for LTE and 5G cellular connectivity.
- Understand IPv4/IPv6 dual-stack networking in cellular environments.
- Integrate cellular modems within Linux using common modem management frameworks.

- Understand Dual SIM Dual Standby (DSDS) architecture involving physical SIMs and eSIM technologies.
- Configure routing and network services for Linux-based cellular devices.
- Perform structured troubleshooting of modem, IP, routing, and connectivity issues.

Prerequisites

- Basic Linux command-line experience
- Fundamental TCP/IP networking knowledge
- Familiarity with IPv4 networking
- Basic understanding of LTE or mobile networking concepts is beneficial but not mandatory

Training outline

1. Introduction to Modern Cellular Networking

Evolution from LTE to 5G

1. LTE architecture overview
2. 5G Non-Standalone (NSA)
3. 5G Standalone (SA)
4. User equipment architecture
5. Cellular network components

Linux in Cellular Networking

1. Embedded Linux platforms
2. Industrial gateways
3. IoT edge devices
4. Router and appliance deployments

2. LTE and 5G RedCap Fundamentals

Overview of 3GPP Release 17

1. Introduction to RedCap
2. Design objectives

3. Device capability reductions
4. Performance characteristics
5. Target applications

RedCap Deployment Considerations

1. Supported network architectures
2. Device classes
3. Power efficiency
4. Network compatibility
5. Migration from LTE
6. Current ecosystem and industry adoption
7. Introduction to Release 18 eRedCap enhancements

3. Linux Cellular Modem Integration

Cellular Modem Architecture

1. USB and PCIe modems
2. Cellular interfaces
3. AT command fundamentals
4. QMI architecture
5. MBIM architecture

Linux Modem Frameworks

1. ModemManager
2. NetworkManager
3. libqmi
4. libmbim
5. PPP considerations

Modem Initialization

1. Device detection
2. SIM initialization
3. APN configuration

4. Registration procedures
5. PDP context establishment
6. Connection verification

4. IPv4 and IPv6 Networking in Cellular Environments

IPv6 Fundamentals

1. Address architecture
2. Global addressing
3. Link-local addressing
4. Prefix delegation

Dual-Stack Networking

1. IPv4 and IPv6 coexistence
2. Cellular operator implementations
3. APN considerations
4. Address assignment mechanisms
5. DNS configuration

Linux IPv6 Configuration

1. Interface configuration
2. Routing tables
3. Neighbor Discovery
4. Default gateway management
5. Connectivity validation

5. Dual SIM Dual Standby (DSDS) and eSIM Technologies

DSDS Architecture

1. Operational principles
2. Active versus standby behaviour
3. Network registration
4. SIM selection strategies

eSIM Fundamentals

1. Embedded UICC architecture
2. Profile management
3. Remote SIM provisioning concepts
4. eSIM lifecycle

SIM Management

1. Physical SIM integration
2. eSIM coexistence
3. Failover considerations
4. Network switching
5. Operational best practices

6. Linux Network Configuration and Routing

Network Interface Configuration

1. Interface management
2. IP address assignment
3. Routing configuration
4. DNS management

Cellular Routing

1. Default routes
2. Multiple network interfaces
3. Route metrics
4. Policy-based routing concepts
5. Failover strategies

Network Services

1. DHCP interactions
2. Static addressing
3. Firewall considerations

4. NAT concepts
5. Connectivity verification

Indicative Duration

1 Day (Instructor-Led Technical Workshop)

Disclaimer

This training outline is intended as a representative guideline for the proposed course content. The sequence, emphasis, depth, and coverage of individual topics may be modified, expanded, consolidated, or reordered by the trainer to accommodate participant backgrounds, technical objectives, available time, technology updates, and operational requirements without prior notice.

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