5G SAMITEA

5G Sofia Airport Mobile PrIvate NeTwork PowEred by A1

D4.1 Networks deployed - Year 1

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Executive Summary

This document provides a comprehensive overview of the approved, completed, ongoing, and planned activities related to the 5G SAMITEA Mobile Private Network (MPN), at Vasil Levski Sofia International Airport. It summarizes the work carried out during the first operational year of the project (2025), with particular emphasis on the design, deployment, and integration of network infrastructure and associated services. In addition, it outlines the progress achieved to date, highlights key milestones, and describes forthcoming actions that will further enhance the functionality, reliability, and performance of the private 5G network within the hospital environment.

Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

TERM	DESCRIPTION
3GPP	The 3rd Generation Partnership Project
4G	4th generation
5G	5th generation
DC	Data Center
E2E	End-to-End
EC	European Commission
ENB/ENODEB	E-UTRAN Node B (Evolved Universal Terrestrial Radio Access Network Node B)
ETSI	European Telecommunications Standards Institute
EU	European Union
GHZ	Gigahertz
GNB/GNODEB	gNodeB – 5G Base Radio Access Network Node
HLD	High-Level Design
IMS	IP Multimedia Subsystem
IOT	Internet of things
KPI	Key performance indicator
LTE	Long Term Evolution
NSA	Non-Stand-Alone
MPN	Mobile Private Network
PLMN	Public Land Mobile Network
PU	Public
RAN	Radio Access Network
SA	Stand-Alone
TETRA	Terrestrial Trunked Radio
VM	Virtual machine
WP	Work Package

1. Introduction

1.1. Purpose of the deliverable

Deliverable D4.1 “Networks Deployed – Year 1” directly addresses one of the key objectives of the 5G SAMITEA project by documenting the activities undertaken during the initial deployment phase of the 5G Private Network. It provides a detailed account of the MPN Core, RAN, Transport networks and MCPTT solution implementation, infrastructure rollout and the technical and operational considerations guiding these activities.

This deliverable has been prepared within the framework of Work Package 4 (WP4) and incorporates comprehensive information on the deployment efforts led by A1 concerning the mobile private network infrastructure. It further highlights the technical achievements accomplished during the second half of 2025 upon the commencement of Task 4.1 “Network deployment, configuration and testing”, to enable a robust, secure, and operational 5G private network environment within the airport setting.

D4.1 builds upon the work performed in WP3 for the network design and in particular on Deliverable D3.1 “Network Planning,” translating the low-level planning framework into concrete, installation-level specifications, and actionable implementation details.

The full scope of WP4 activities will be covered and reported in D4.2 Networks deployed - Year 2, which will be issued upon the conclusion of WP4 at M25.

The dissemination level of D4.1 is public (PU) and hence will be used publicly to inform all interested parties about the installations that took place for the 5G SAMITEA project and the upcoming deployment activities.

1.2. Structure of the document

The main structure of this deliverable can be summarized as follows:

- Section 2 presents the actual status of the 5G SAMITEA E2E network deployment. It is separated into specific subsections, that provide descriptions and images of the locations in the Airport and the corresponding installations in terms of Packet core, IMS core, Radio and Transport domains, illustrating design infrastructure and topology specific solutions.
- Finally, Section 3 concludes with a review of what has been achieved in terms of network deployment in the 1st year of the project and suggests what is coming next.

2. 5G SAMITEA Network Deployment

5G SAMITEA will provide a purpose-built 5G private wireless network to support the Sofia International Airport operations. The project will cover indoor (terminals, operations facilities) and outdoor (apron, perimeter) areas in Sofia International Airport, Bulgaria. Sofia airport has become an external border for Schengen. This is significant for security related purposes and adds value to the 5G SAMITEA project deliverables.

Airport Mobile Private Network is a dedicated enterprise network that allows interconnection of people and things at Airport premises using state of the art 5G NSA/SA technology, enabling new applications, supporting business-critical services with a local network on their premises, providing a secure, reliable, and high-available connectivity and differs from a public mobile network by providing private reserved coverage that is subject to agreed resources and local, protected data flow. Moreover, passengers and airport employees will also benefit from the dedicated 5G base station coverage and EDGE cloud and the upgraded services offered by the 3GPP Rel. 16 and 17 [1] features to be delivered by the project's deployments. Currently there is poor mobile network coverage, and a dated TETRA system is used for operational purposes and handling critical situations. 5G SAMITEA's paradigm will thus boost local innovation enabling 5G mm Wave - as well as IoT-based technologies (i.e. mobility and security sensor-based monitoring-like approaches and infrastructure, AGVs/robots automating tasks) to create a safer and more efficient environment for travellers and employees alike.

In scope of the deliverable are the network deployment during the first year of the Airport Mobile Private Network solution, based on the HPE Aruba Networking Private 5G Core as Mobile Edge Core, A1BG Shared RAN concept, Transport network and Monitoring and Performance management approach.

2.1. Airport MPN Core Network Deployment Status

Airport MPN Mobile Core network is designed to fully support the 5G Industry 4.0 vision. The architecture enables the parallel operation of LTE (4G), 5G NSA (Non-Standalone) and 5G SA (Standalone) core functions within a unified deployment. It is implemented as a combo-box model based on the HPE ANW P4/5G (Combo) Core[1], integrating containerized network functions (CNFs) across dedicated virtual machines and built on commercial off-the-shelf (COTS) hardware.

The A1BG Telco Data Center is the hosting platform where Airport MPN solution in terms of hardware and applications will be hosted privately. This platform provides a highly standardized VMware layer, enabling the hosting of multiple applications on the same hardware. This approach makes the Airport MPN solution deployment cost-effective and flexible, accommodating additional use cases and future scenarios. Placing the Airport MPN Core instance close to the customer's location is crucial for enabling ultra-low latency use cases. Additionally, energy autonomy can be achieved by integrating the Airport MPN Core with the A1BG Telco Data Center power supply backup infrastructure, ensuring that all local services remain operational during a blackout scenario.

HPE ANW P5G provides a complete Mobile Core Network (MCN) software solution and stands out in the mobile industry with its LTE/5G cellular connectivity platform that is engineered for use by mobile operators while also addressing the self-service and integration needs of enterprise, public safety and other vertical markets users. HPE ANW P5G provides a Mobile Core Network (MCN) software solution that conforms to 3GPP specifications.

The HPE ANW P5G Platform is available in different hardware configurations, addressing different requirements for network capacity or use cases.

1 https://www.hpe.com/emea_europe/en/aruba-networking-private-5g.html

The Airport MPN solution is hosted on the HPE Hardware platform DL360 and DL20. Where the DL360 offers the powerful “Base” hardware platform for multiple Mobile Private network applications, brings the DL20 the “lightweight” entry into the Airport MPN backup setup. The Hardware platform is built only on 1U rackservers, which are fitting in A1 Telco Data center.

The reliable HPE ProLiant DL20 Gen11 server delivers a compact and versatile server with blending performance, reliability, and manageability, and provides unique enterprise-class capabilities at a Mobile Private Networks.

Figure 1: Airport MPN Light HW configuration – DL20 GEN11

The Light option is based on the HPE ProLiant DL20 GEN11 Server. The solution is equipped with one Intel XEON E-2436 Processor with 6 Cores and 2.9 GHz clock rate. In addition, with the 32 GB RAM and the redundant 4 port 10/25 GB Network Card the server offers a powerful entry solution of Airport MPN backup setup. Table 1 below shows the detailed HW configuration of Airport MPN Light version.

Table 1: Airport MPN Light HW configuration summary

Hardware	Light Configuration
Server Model	DL 20 GEN11
CPU	1 x Intel Xeon E-2436 2.9 GHz 6 core
RAM	64 GB (4 x 16GB)
NIC	2 x 10/25Gb 4-port SFP28
Storage	4 x 960G NVMe RI SFF BC U.3ST
	V2 MV SSD + 4 x 1.92TB SATA RI SFF BC MV
Virtualization	VMWare ESXi

5G SAMITEA Production MPN’s Hardware is part of the Base HW configuration and aims to be easily replicable, reproducible, and configurable, having at the same time the configuration best practices, scalability and security requirements needed for an Enterprise and Mission Critical network.

All HPE ANW P5G Platform configurations are based on HPE ProLiant Gen11 servers, equipped with either VMWare ESXi or Proxmox VE hypervisor. The networking is based on Layer 3 switches.

The HPE ProLiant DL360 Gen11 server is a rack-optimized, 1U 2P solution that delivers exceptional compute performance, upgraded high-speed data transfer rate, and memory depth at 2P compute capability.

Powered by 4th and 5th Gen Intel® Xeon® Scalable Processors with up to 64 cores, 8 TB of memory, and 20 EDSFF drives as well as increased memory bandwidth and high-speed PCIe Gen5 I/O.

The HPE ProLiant 360 Gen11 server is engineered to optimize Campus Network Edge deployments with a cloud operating experience, built-in security, and optimized performance for workloads to drive your business forward.

Figure 2: Airport MPN Base HW configuration – HPE DL360 Gen11

The production Airport MPN Base configuration option is based on the HPE ProLiant DL360 GEN11 Server. The solution is equipped with one Intel XEON Gold 6442Y Processor with 24 Cores and 2.6 GHz clock rate. In addition, with the 196 GB RAM and the redundant 4 port 10/25 GB Network Card the server offers a powerful medium solution of a MPN Core Deployment. Table 2 below shows the detailed HW configuration of the production Airport MPN Base version.

Table 2: Airport MPN Base HW configuration summary

Hardware	Base Configuration
Server Model	HPE ProLiant DL360 Gen11
CPU	1 x Intel Xeon Gold 6442Y (2.6GHz / 24-core)
RAM	192 GB (6 x 32GB)
NIC	2 x 10/25Gb 4-port SFP28
Storage	4 x 960G NVMe RI SFF BC U.3ST
	V2 MV SSD + 4 x 1.92TB SATA RI SFF BC MV
Virtualization	VMWare ESXi

The following figures depict the local deployment of MPN servers within the Telco Data Center.

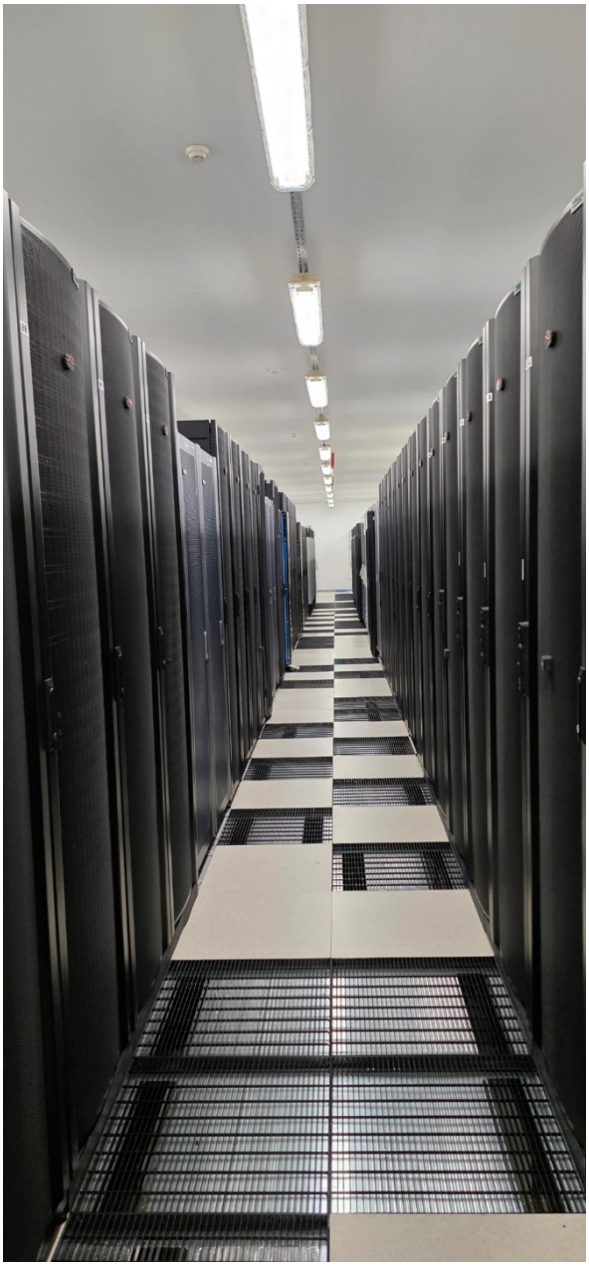

Figure 3: A1 Telco Data Center in Sofia

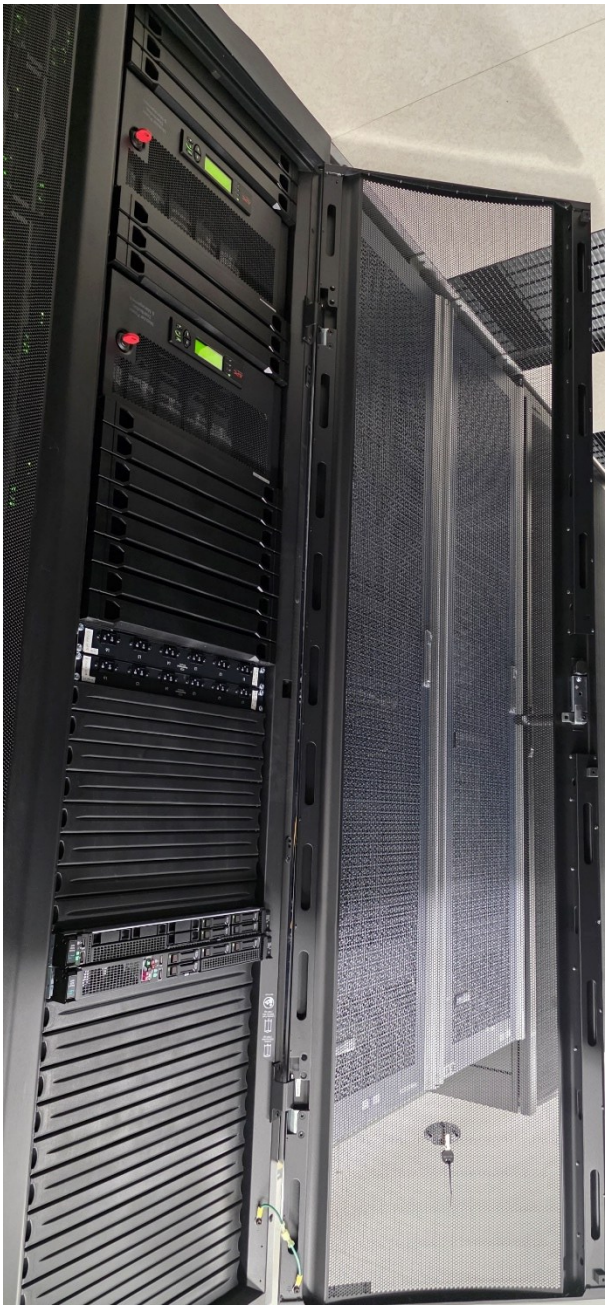

Figure 4: MPN Prod and Backup HW installations in Telco DC

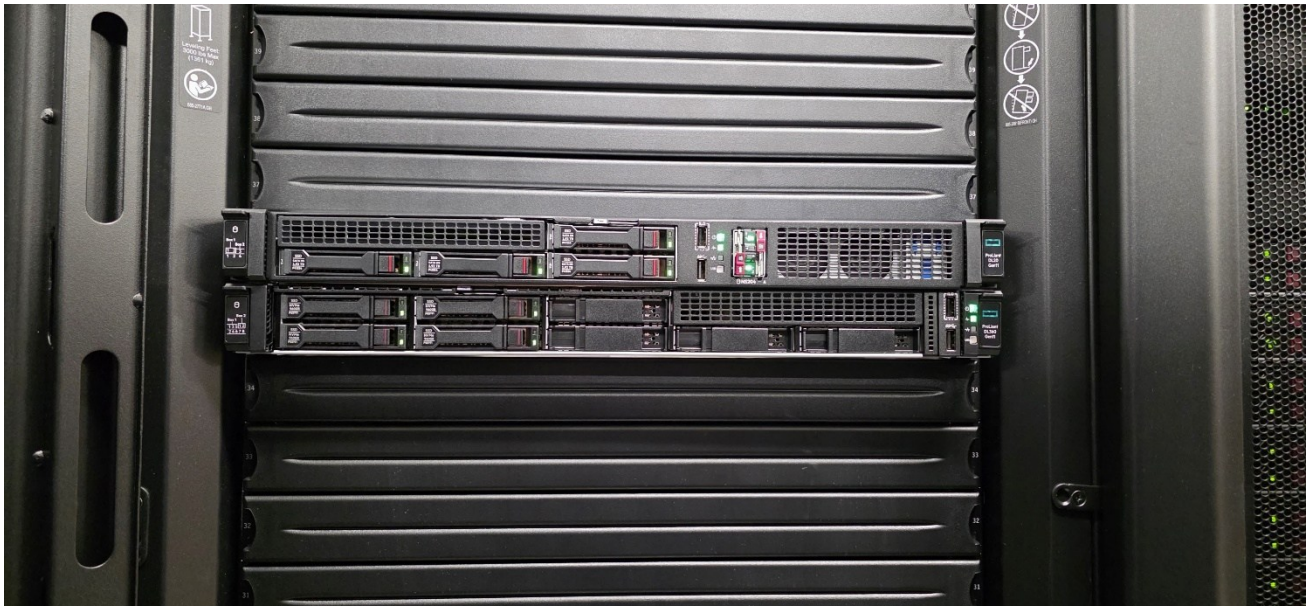

Figure 5: MPN Base HW configuration – HPE DL360 Gen11

2.2. Mission Critical Push-to-Talk (MCPTT) communication solution

Mission Critical Push-to-Talk (MCPTT) as part of 5G SAMITEA scope is based on Alea Mission Critical Push-to-Talk (MCXPTT) solution, designed to provide both standard Push-to-Talk (PTT) and mission-critical communication capabilities.

The solution will be integrated within the Sofia Airport ANW P5G Mobile Private Network (MPN) once its deployment is completed.

2.3. Radio Network Architecture Deployment Status

The A1BG RAN network serves as the key and secure entry point into the Airport MPN Network Edge. The installation of new RAN sites and upgrades of existing ones are necessary due to the high bandwidth demand to support the transmission of high-definition video feeds and real-time data essential for surveillance cameras and its operations. The enhanced bandwidth of 5G ensures seamless, high-quality video streaming and swift data transfer, critical for efficient monitoring and surveillance within the airport premises. As part of project 5G rollout, A1BG will deploy a high capacity 5G mmWave network across the airport environment. The planning process for new RAN sites and upgrades of existing ones is ongoing at the time of writing the deliverable.

The new DAS system will improve indoor coverage and capacity at Sofia Airport. The DAS system should provide coverage in all public areas of Sofia airport – Terminal 2, as well as additional, requested by the airport management, staff only areas (e.g. Baggage), in Departures, Arrivals, and gate areas.

DAS design and planning activities and processes are ongoing at the time of writing the deliverable.

The Sofia Airport MPN follows the Multi-Operator Core Network (MOCN) sharing architecture as defined by 3GPP, in which only the RAN is shared in 4G and 5G systems. The RAN MOCN feature for 4G and 5G systems enables the use of more than one PLMN ID (i.e. with different network codes (MNC)) and thus RAN resources within a single cell, eNodeB or gNodeB is managed by PLMN-IDs. This approach ensures efficient utilization of

network resources while maintaining distinct identities for public and private networks. The RAN site serving the Airport Mobile Private Network will simultaneously broadcast two PLMN-IDs, enabling parallel operation of both the A1BG public and Airport private network domains: PLMN-ID 284-01 for the A1BG Public Network and PLMN-ID 284-02 for the Airport Private Network. This dual broadcast ensures that both networks can operate simultaneously and efficiently, providing robust connectivity for both public and private users.

Some test configurations of the MOCN functionality were performed to verify feature capabilities and to evaluate and prepare the appropriate setup for production implementation, once the RAN network deployment (including new and upgraded sites) is completed. Part of the MOCN feature configuration parameters in the test environment is depicted in Figures 6, 7, and 8.

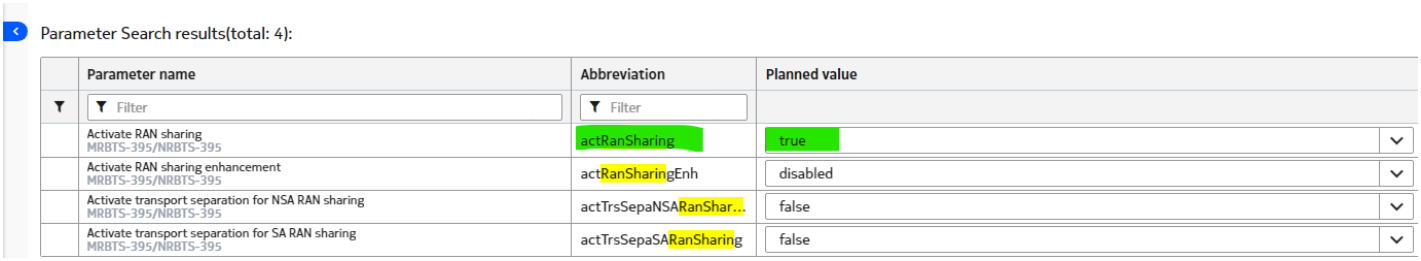

Figure 6: RAN Sharing functionality activation

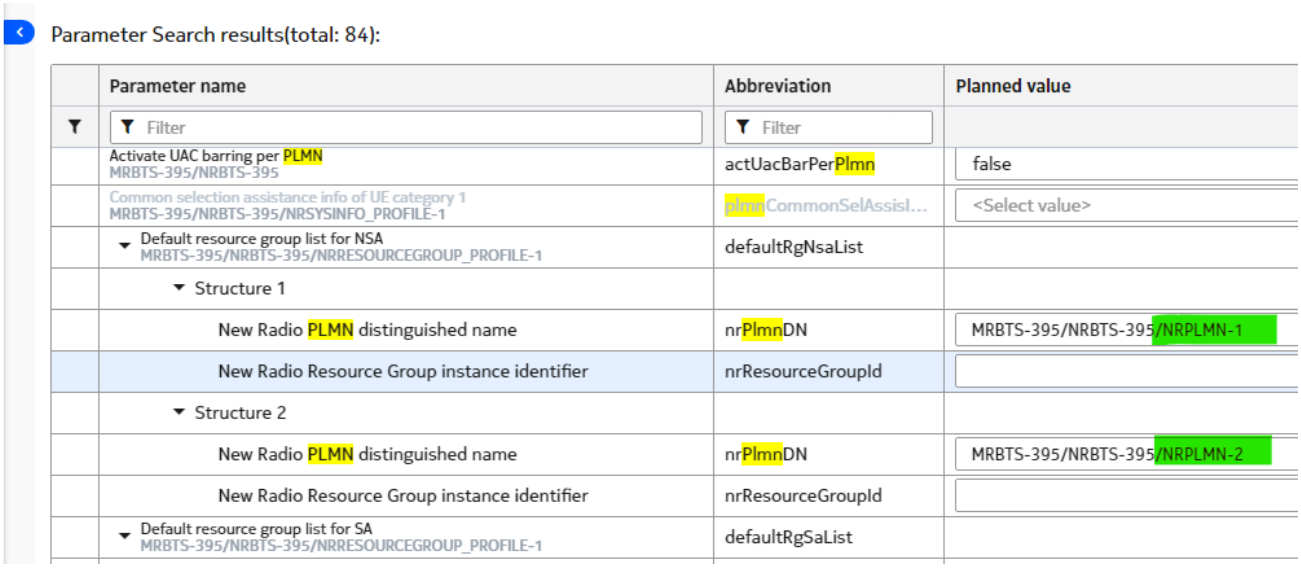

Figure 7: MPN and Public Networks PLMN distribution

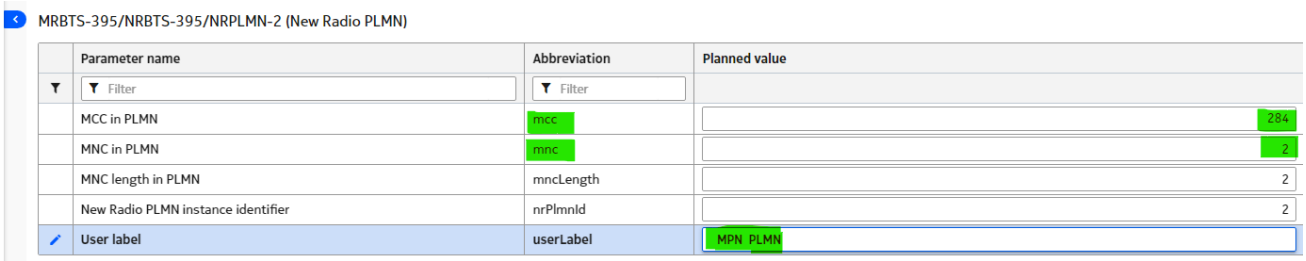

Figure 8: Airport MPN PLMN allocation

2.4. Transport Network Architecture and Design

The Transport Network serves as the backbone interconnecting all logical and physical components within the Sofia Airport 5G MPN deployment — including the RAN sites, Network Edge (MPN Core), and the A1BG Core Network. It provides the high-capacity, low-latency, and resilient IP connectivity necessary for Non-Standalone (NSA) and Standalone (SA) 5G operations, as well as MOCN-based multi-PLMN traffic segregation.

As described in D2.2, the Airport MPN Core consists of multiple virtual machines (VMs). These VMs connect to the transport network in a manner similar to physical machines. The main difference is that MPN VMs use virtual network adapters and virtual switches to establish connectivity with physical networks. The MPN virtual switches, referred to as vSwitches, are used to ensure connectivity between MPN virtual machines as well as between the virtual environment and the physical A1BG transport network. Each MPN vSwitch utilizes redundant physical network adapters (also known as NICs – Network Interface Controllers) on the ESXi host to connect to the physical MPN IP transport network. Figure 9 illustrates the basic principle of vSwitch functionality in VMware.

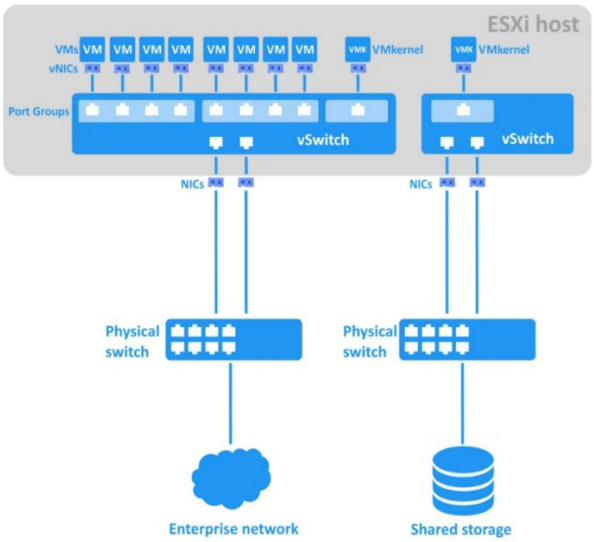

Figure 9: VMware vSwitch Principle

The Airport MPN solution is designed to have a standard, easily replicable, networking configuration. The ANW P4/5G (Combo) Core Unified Network Platform architecture minimizes the integration points with the MPN network by including L3 switches in the solution. The L3 switches are the separation points between the private Mobile Core Network and the external network.

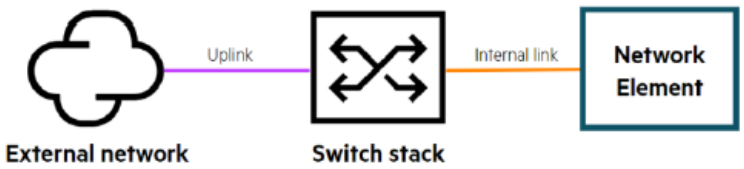

Figure 10: NorthSouth (Uplink) as opposed to EastWest (Internal Link) interfaces

Only the NorthSouth network interfaces are exposed towards the external network, using dedicated uplink interfaces terminated on the L3 switches. The ANW P4/5G (Combo) Core Unified Network Platform network design leverages an L3 switching architecture implemented by the two switches and will be integrated with

Nokia 7250 IXR[2]. The 7250 product family, including the 7250 IXR-s platform, is specifically designed for access and aggregation use cases in mobile convergence and mission-critical enterprise environments.

Pictures of the Transport network deployment are not available yet, because the required equipment and cabling are under installation process at the time of writing the deliverable.

2.5. Monitoring and Performance Platform Deployment Status

The monitoring and performance management platform will enable users to track the status of Airport MPN solution through real-time key performance indicators (KPIs), allowing for quick verification of system performance and review of essential operational statistics.

Pictures of the Monitoring and Performance Platform deployment are not available yet, because the required activities and processes for its configuration are ongoing at the time of writing the deliverable.

2 https://www.nokia.com/ip-networks/7250-interconnect-router/

3 Conclusions

The partial 2025 deployment of the 5G SAMITEA MPN demonstrates the establishment of a robust, high-performance communications infrastructure capable of supporting advanced operational, and transport-oriented applications.

Based on the design related deliverables, deployment of MPN solution and integration with RAN and Transport domains will follow in 2026 so that the 5G SAMITEA network will provide enhanced coverage, increased capacity, improved reliability, and low-latency connectivity across all designated areas.

This deployment not only meets current operational requirements but also establishes a scalable, future-ready platform, ensuring seamless support for evolving technological demands and next-generation digital airport services.

4 References

[1] 3GPP TS 22.261 version 16.14.0 Release 16, 5G; Service requirements for the 5G system https://www.etsi.org/deliver/etsi_ts/122200_122299/122261/16.14.00_60/ts_122261v161400p.pdf