Deliverable D7.1
Factsheet and Project Presentation

Document Summary Information

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Version	Issue Date	% Complete	Changes	Contributor(s)
V0.1	05/12/2019	0	Initial Deliverable Structure	A. Antonopoulos (CTTC)
V0.2	18/12/19	90	First Draft	George Guirgis (EBOS)

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LIST OF ABBREVIATIONS

Abbreviation	Full Name
5G-PPP	5G Infrastructure Public Private Partnership
AE	Analysis Engine
AI	Artificial Intelligence
CPU	Central Processing Unit
DE	Decision Engine
e2e	End to End
ENI	Experiential Network Intelligence
ETSI	European Telecommunications Standards Institute
GA	Grant Agreement
I/O	Input / Output
LCM	Lightweight Communication and Monitoring
MEC	Multi-access Edge Computing
ML	Machine Learning
MS	Management System
OPEX	Operating Expense
PNF	Physical Network Function
RAN	Radio Access Network
SLA	Service Level Agreement
SoA	Service Oriented Architecture
VNF	Virtual Network Function
ZSM	Zero-touch Service Management

1 Executive summary

This report provides a detailed description of two of the project's main dissemination tools, namely the MonB5G Factsheet and the Project Presentation.

The project presentation contents will be discussed in detail in the following chapters, as it outlines a complete overview of the project, including the timeline and implementation. While the factsheet's contents will be presented in addition to its design concept.

This deliverable **"D7.1 Factsheet and project presentation"** is one of the main outputs of **"Task 7.1: Dissemination and Communication Activities"**, performed within **Work Package 7 "Dissemination, Communication, Standardization and Exploitation".**

The project presentation was created by the Project Coordinator; the **Centre Tecnologic De Telecomunicacions De Catalunya (CTTC)** and was first used in the project's Kick-off meeting at Barcelona, Spain on 3rd and 4th December 2019. Additionally, the factsheet was designed and produced by **eBOS Technologies Ltd**., for the purpose of summarizing the project's highlights and is intended to be used both in soft-copy and printed versions, so as to attract and engage interested stakeholders (at events, exhibitions, etc.).

2 Introduction

This chapter will present the Mapping of the project's outputs to the original grant agreement (GA) components, as well as outline the whole deliverable structure and contents.

2.1 Mapping MonB5G Outputs

The purpose of this section, is to map MonB5G's grant agreement commitments, both within the formal Deliverable and Task description, against the project's respective outputs and work performed.

Table 1: Adherence to MonB5G's GA Deliverable & Tasks Descriptions

MonB5G GA Component Title	MonB5G GA Component Outline	Respective Document Chapter(s)	Justification
TASKS			
Task 7.1 Dissemination and Communication Activities	Further important communication channels will include public project summary, project factsheet.	Chapter 3	Contents description and screenshots from the MonB5G Project's Factsheet are presented.
	A set of tailored presentation materials will also be issued for use by MonB5G experts in their keynote speeches, invited talks and panels at various events and forums	Chapter 4	Outline and detailed contents description are presented.

2.2 Deliverable Overview and Report Structure

Based on the objectives and work curried out under task T7.1, the document starts with the Executive Summary in Chapter 1, followed by the introduction of the document in Chapter 2. Chapter 3, presents the factsheet content and design concept. Chapter 4, presents the outline and detailed contents of the project presentation. Finally, Chapter 5 is the conclusion of this deliverable report.

3 Factsheet

The factsheet was created as a one-page presentation of the project's major data, where key points (outlined below) are emphasized concisely. The purpose of the factsheet is to provide a succinct overview of the project to any potential stakeholder that is possibly interested in the project's topics and/or outcomes, that is presented in a simple and clear design format.

The components of the factsheet are the following: About MonB5G (including purpose, start date, budget, call, duration and number of partners), objectives, experimental platforms, consortium, project management board, and finally the project's website, and social media pages links.

For the design concept of the factsheet, it was modelled after the website. Utilizing the same colour scheme (as of 5G-PPP), whilst using visual components from the website to preserve a harmonious and unified presentation of the concept and key data elements. Maximum font size, minimum text quantity and high contrast of background-to-text were used to ensure easy readability whether in an online or printed form.

Figure 1. MonB5G Factsheet

4 Project Presentation

This chapter will describe the outline and individual contents of the MonB5G Project presentation.

4.1 Objectives

4.1.1 OVERALL OBJECTIVE

Deploying a novel autonomous management and orchestration mechanism framework by heavily leveraging distribution of operations together with state-of-the-art Artificial Intelligence (AI) based mechanisms. The developed system is based on a hierarchical approach that allows the flexible and efficient management of network tasks, while at the same time, introduces a diverse set of centralization levels through an optimal adaptive assignment of monitoring, analysis, and decision-making tasks.

The MonB5G approach focuses on the design of a hierarchical, fault-tolerant, automated data driven network management system that incorporates security as well as energy efficiency as key features, in order to orchestrate a massive number of parallel network slices and significantly higher types of services in an adaptive and zero-touch way.

4.1.2 SPECIFIC OBJECTIVES

O1: Devise a distributed management plane to handle the deployment of a massive number of network slices;

O2: Define network slice service-level KPIs that consider not only a single VNF, but all the network slice components, i.e., VNFs, PNFs and networking components;

O3: Devise data-driven management system components (MS, AE, DE), based on SoA federated learning AI techniques;

O4: By combining the Intent-based policy definition and the cognitive management entities, MonB5G will target multi-domain zero-touch network configuration of sliced B5G networks;

O5: Define decision algorithms tailored to the RAN. The envisioned decisions should allow to update the RAN configuration, when the latter is detected as the root cause of network slice performance degradation or when considered necessary to meet the heterogeneous performance requirements of multiple coexisting slices;

O6: Elaborate advanced security schemes and plans to empower secure smart network slice LCM;

O7: Provide ML-assisted techniques to optimize energy efficiency in all technological domains (i.e., Cloud, RAN, Core and MEC);

O8: Dissemination, standardisation and exploitation of technologies developed in the MonB5G project. Special focus is given to push the solutions regarding the cognitive AE and DE to ETSI ZSM and ENI.

4.1.3 MAPPING OBJECTIVES TO WORK PACKAGES

Objective 1: Distributed management plane to support massive deployment of network slices

Devise a distributed management plane to handle the deployment of a massive number of network slices. To this end, MonB5G will evolve the traditional centralized cloud management system architecture, composed of three main entities: Monitoring System (MS), Analytics Engine (AE) and Decision Engine (DE), towards a

distributed system, where the components will be decomposed and distributed over different technological domains (i.e., RAN, Core, Cloud, MEC).

Related WPs: WP2, WP6

- **KPI – 1.1:** Deliver 3 distributed management entities (i.e., the MS, AE, DE) per technological domain;
- **KPI – 1.2:** Increase the ratio of service management and slice LCM tasks resolved by local AE/DE components;
- **KPI – 1.3:** Reduce the reaction time (time from identification to resolution via appropriate reconfigurations) to a Network Slice malfunction.

Objective 2: Definition of novel end-to-end (e2e) slice Key Performance Indicators (KPIs) and development of AI-based mechanisms for their accurate prediction from multi-level metrics

Define network slice service-level KPIs that consider not only a single VNF, but all the network slice components, i.e., VNFs, PNFs and networking components. MonB5G will devise the mechanisms to monitor sophisticated KPIs, and the data-driven, AI-based algorithms and tools to predict their value, and that also to predict network slice performance. These KPIs will be derived by an aggregation of VNF-level and system-level KPIs (such as CPU, I/O, memory, storage).

Related WPs: WP2, WP3, WP6

- **KPI – 2.1:** Improve network slice performance prediction;
- **KPI – 2.2:** Improve the accuracy of the AE/DE mechanisms for detection of slice performance degradation;
- **KPI – 2.3:** Reduce the number of SLA performance violations.

Objective 3: Data-driven management system based on federated learning

Devise data-driven management system components (MS, AE, DE), based on SoA federated learning AI techniques. These techniques will allow distributed monitoring and learning processes while submitting compressed model updates to a centralized entity, hence significantly reducing overheads.

Related WPs: WP3, WP4, WP6

- **KPI – 3.1:** Significantly reduce the amount of communicated data to the centralized management system;
- **KPI – 3.2:** Support for orders of magnitude more Network Slice Instances (NSIs) with dynamic data-driven reconfiguration;
- **KPI – 3.3:** Optimize the convergence time for the distributed/federated AI algorithms so that it does not exceed that of the centralized solutions;
- **KPI – 3.4:** Generate accurate and reusable data on network slice performance.

Objective 4: Zero touch network configuration

By combining the Intent-based policy definition and the cognitive management entities, MonB5G will target multi-domain zero-touch network configuration of sliced B5G networks. The DE will be configured with Intent-based policies, provided by the slice owner and the network operators, which specify *what* needs to be achieved. This will then be interpreted and optimized by the learning algorithms run at the DE to derive the specific actions per technological domain.

Related WPs: WP4, WP6

- **KPI – 4.1:** OPEX reduction due to the automation of service management;
- **KPI – 4.2:** Reduction in the deployment time of multi-domain services.

Objective 5: DE decisions tailored to the RAN

Define decision algorithms tailored to the RAN. The envisioned decisions should allow to update the RAN configuration, when the latter is detected as the root cause of network slice performance degradation or when considered necessary to meet the heterogeneous performance requirements of multiple coexisting slices. The proposed decisions should consider different dimensions: increase or decrease the allocated resource blocks (RBs), hand off slice users to another cell, migrate some of the network slice RAN-level functions from Centralized Units (CUs) to Decentralized Units (DUs), etc.

Related WPs: WP3, WP4, WP6

- **KPI – 5.1:** Reduce the time to manage the RAN resources dedicated to network slices, particularly for uRLLC (AE and DE are located at the edge);
- **KPI – 5.2:** Improve on slice performance isolation by ensuring the latency and reliability (uRLLC), as well as bandwidth (eMBB) requirements of coexisting slices (measured in terms of related SLA violations and other lower-level metrics);
- **KPI – 5.3:** Reduce the management overhead of the RAN by reducing the monitoring overhead for RAN-level slice resource (and other) reconfigurations.

Objective 6: AI-driven slice security management via robust and efficient trust-based mechanisms

Elaborate advanced security schemes and plans to empower secure smart network slice LCM. MonB5G will provide AI-driven security mechanisms for automatic identification and mitigation of both in-slice and cross-slice attacks. Meanwhile, MonB5G will focus on security issues associated with the operation of the AI techniques themselves.

Related WPs: WP5, WP6

- **KPI – 6.1:** 10x faster identification of security attack/anomaly;
- **KPI – 6.2:** 10x faster attack remediation and reconfiguration in the order of 10s;
- **KPI – 6.3:** False positive rate in attack classification (false classification of events as attacks) below 1%;
- **KPI – 6.4:** E2e slice availability > 99%;
- **KPI – 6.5:** Per slice component availability (probability that the service is available) > 99%;

- **KPI – 6.6:** Slice isolation: <5% performance degradation in application-level terms (throughput, e2e delay) during an attack episode on coexisting slices. Full protection against cross-slice confidentiality and traffic steering attacks at the mobile edge;
- **KPI – 6.7:** Learning robustness: Precision, recall (true positive rate), fall-out (false positive rate), Area Under Curve values above/below specific thresholds vs. specific ratios of misreporting slice components.

Objective 7: AI-driven energy efficient network management

Provide ML-assisted techniques to optimize energy efficiency in all technological domains (i.e., Cloud, RAN, Core and MEC). To this end, we will train Deep Neural Networks with the relevant features per technological domain, while we will also introduce the concept of energy slicing to guarantee the required energy resources across different network parts (e.g., core and RAN) and components (e.g., computational and communication).

Related WPs: WP5, WP6

- **KPI – 7.1:** Improve network energy efficiency by a factor of 10;
- **KPI – 7.2:** Guarantee that the vertical application KPIs and SLA guarantees remain unaffected.

Objective 8: Dissemination, standardization and exploitation of MonB5G

Dissemination, standardization and exploitation of technologies developed in the MonB5G project. Special focus is given to push the solutions regarding the cognitive AE and DE to ETSI ZSM and ENI.

Related WPs: WP7

- **KPI – 8.1:** At least 8 publications per year in top-tier scientific journals and international conferences, such as IEEE ICC, Globecom, Infocom, NOMS, IEEE ComMag/Network, IEEE/ACM ToN;
- **KPI – 8.2:** At least 4 contributions to SDOs such as ETSI MEC, ZSM, INI;
- **KPI – 8.3:** Organization of at least 2 workshops;
- **KPI – 8.4:** At least one demonstration per year, including one at flagship events such as MWC or EuCNC;
- **KPI – 8.5:** At least 5 patents in the context of MonB5G.

4.1.4 KEY PERFORMANCE INDEXES

The Key Performance Indexes (KPIs), are measurements used to evaluate the relative success of particular activities, and will be elaborated in Task 2.1 Business analysis, use-case requirements and KPIs. These novel KPIs will go beyond standard QoS metrics, and will better capture e2e performance for different verticals/applications.

Table 2: KPIs Overview

KPI	Value	KPI	Value
1.1	3 management entities/TD	5.1	Reduce time to manage RAN slices
1.2	Increase the ratio of management tasks by AE/DE	5.2	Improve of slice performance isolation
1.3	Reduce the reaction time to an NS malfunction	5.3	Reduce RAN-oriented overhead
2.1	Improve NS performance prediction	6.1	10x faster attack identification
2.2	Improve accuracy of AE/DE for performance degradation	6.2	10x faster attack remediation and reconfiguration 10s
2.3	Reduce SLA violations	6.3	False positive rate < 1%
3.1	Reduce overhead to the central system	6.4	E2E slice availability > 99%
3.2	Support more NS instances	6.5	Per slice component availability > 99%
3.3	Optimize convergence for AI algorithms	6.6	Slice isolation < 5% degradation
3.4	Derive optimal decisions per TD for self-configuration/self-healing	6.7	Learning robustness (values below specific thresholds)
4.1	OPEX reduction	7.1	Improve EE by a factor of 10
4.2	Reduction in the deployment time of multi-domain services	7.2	Guarantee that the vertical application KPIs and SLA remain unaffected

4.2 Concept

A hierarchical, fault-tolerant, automated data driven network management system that incorporates security as well as energy efficiency as key features, in order to orchestrate a massive number of parallel network slices and significantly more diverse types of services in an adaptive and zero-touch way.

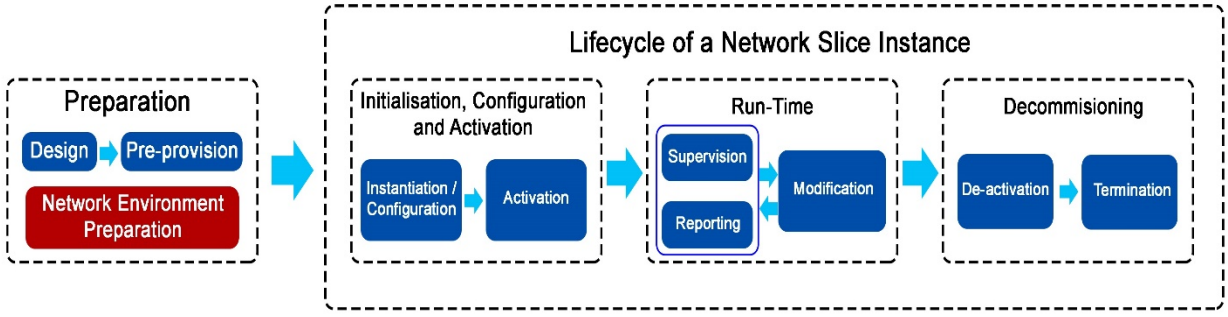

Figure 2. 3GPP network slicing management framework

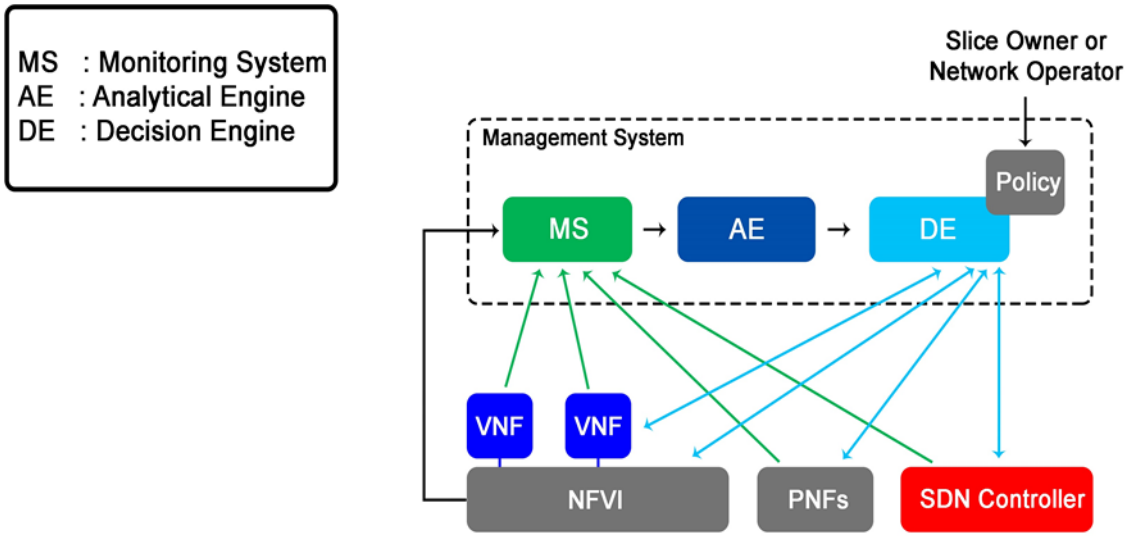

Figure 3. Centralized Management

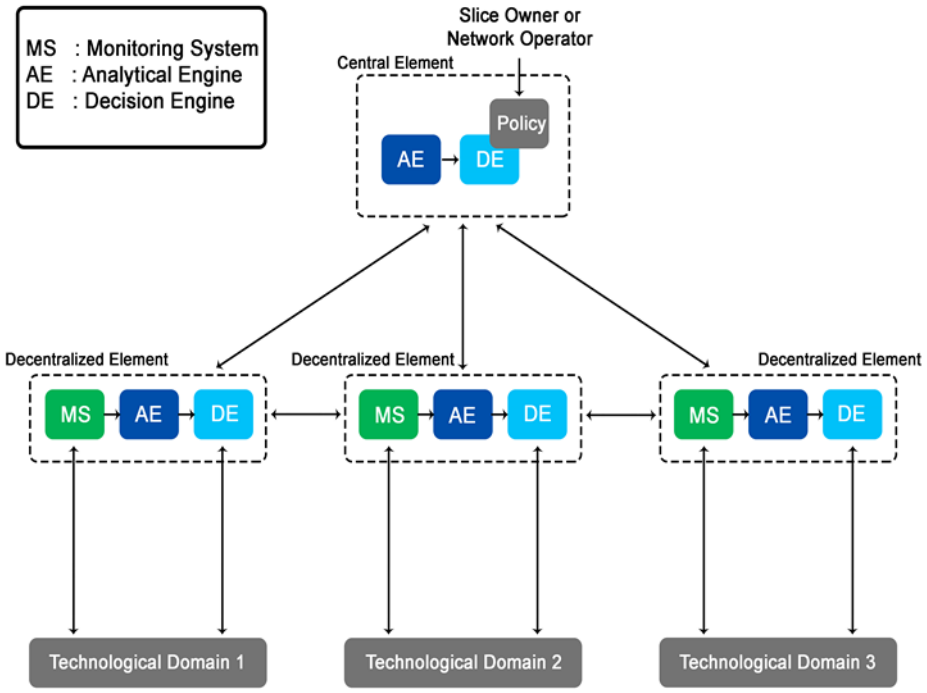

Figure 4. MonB5G Distributed Vision

4.3 Foreseen Architecture

The MonB5G will be created in Work Package 2 WP2: Zero-Touch Distributed Slice Management Architecture, and will be fully explored in details in deliverable D2.1 – 1st release of the MonB5G zero touch slice management and orchestration architecture that is due on month 8, and the final version in deliverable D2.4 - Final release of the MonB5G architecture (including security), that is due on month 24.

- ETSI-compliant interfaces
- Slicing-specific interfaces (5G!Pagoda)
- Internal interfaces

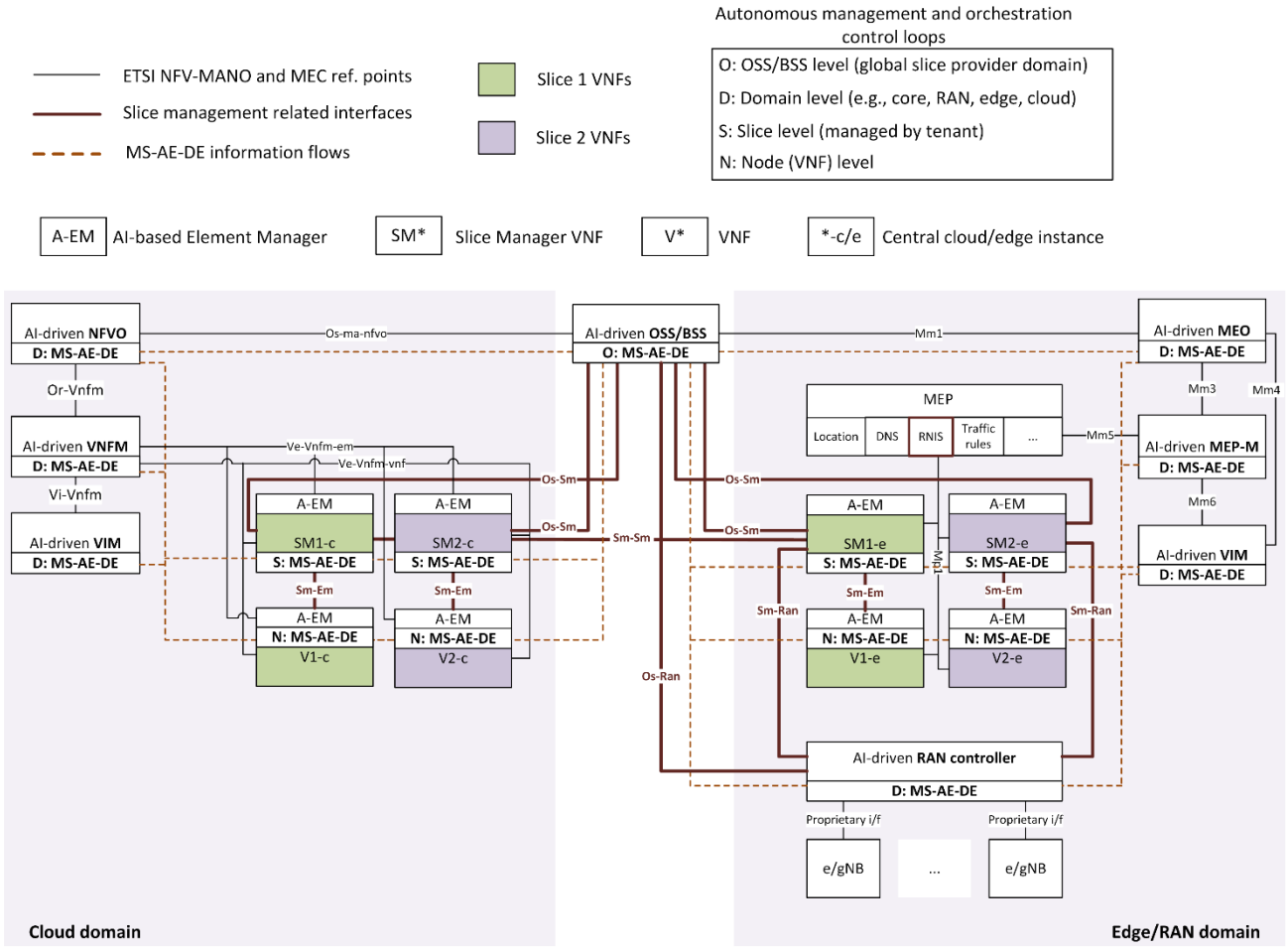

Figure 5. MonB5G Architecture

4.4 Work Plan

The project work plan is driven by an agile development process, using the rich knowledge base of the consortium. Table 3 below lists the work packages, their leader, associated total effort, and their start and end months. While Figure 6 shows the interactions of the work packages, and finally Figure 8 shows the Gantt time schedule.

Table 3: Work Work Packages

WP	Work Package Title	WPL	PMs	Start Month	End Month
1	Project Technical and Administrative Management	CTTC	41	M1	M36
2	Zero-Touch Distributed Slice Management Architecture	ORA-PL	91	M1	M24
3	Distributed Monitoring and Analytics Engine	NEC	97	M4	M32
4	Distributed AI-Driven Decision Engine for Slice Management	EUR	138	M7	M32
5	Security & Energy Enhancement Mechanisms	BCOM	116	M10	M36
6	Integration, Experimentation and Proof-of-Concept (PoC)	IQU	108	M19	M36
7	Dissemination, Communication, Standardization and Exploitation	OTE	78	M1	M36
		Total	669		

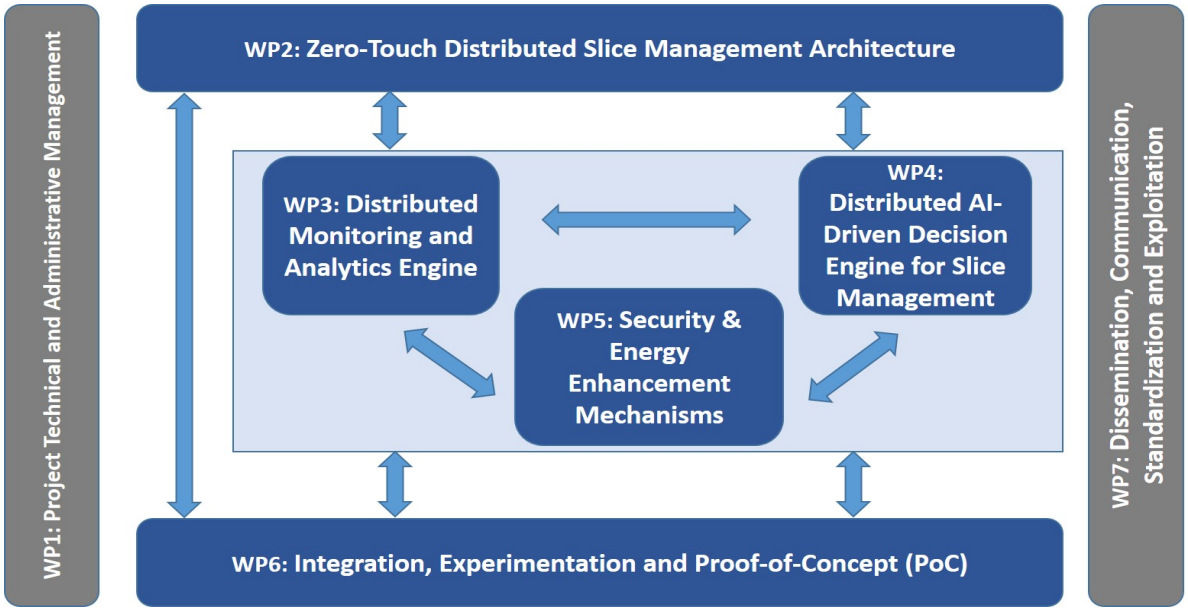

Figure 6. Relations of the Work Packages

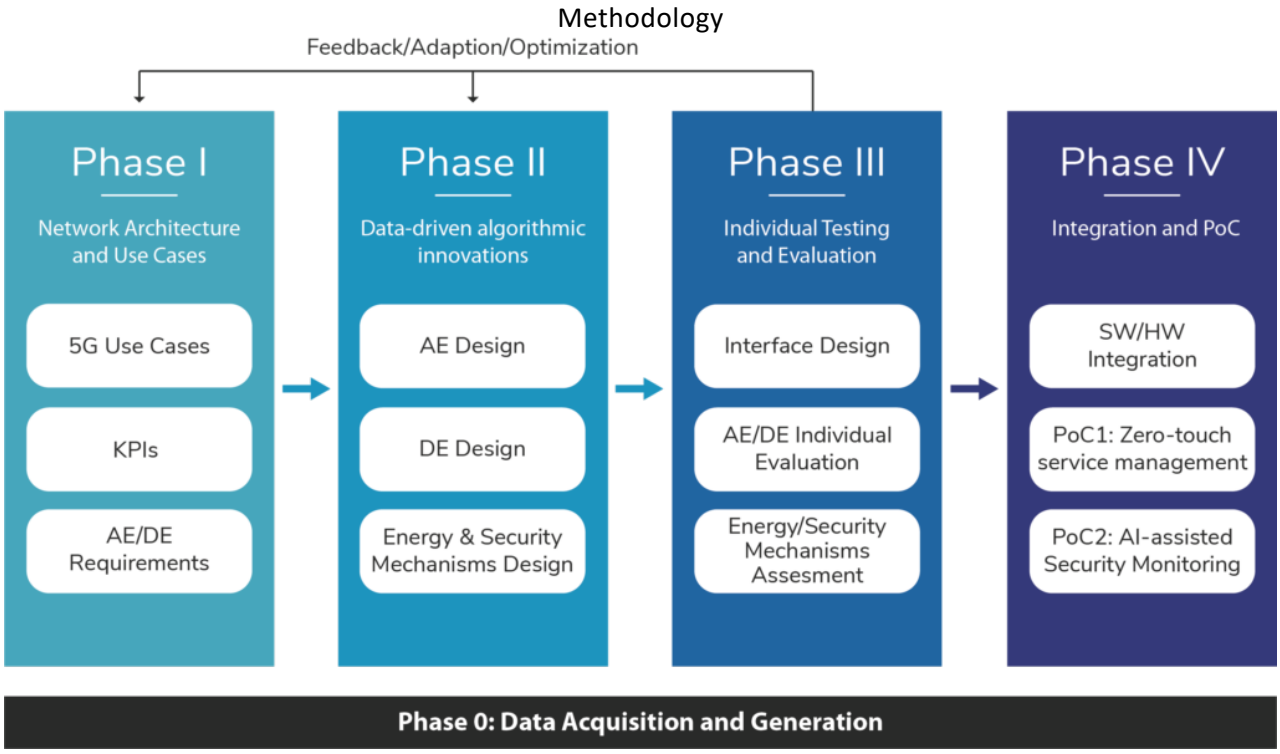

Figure 7. Overall MonB5G technical development strategy and methodology

4.4.1 TIME PLAN

The following Gantt Chart shows the plan of the project.

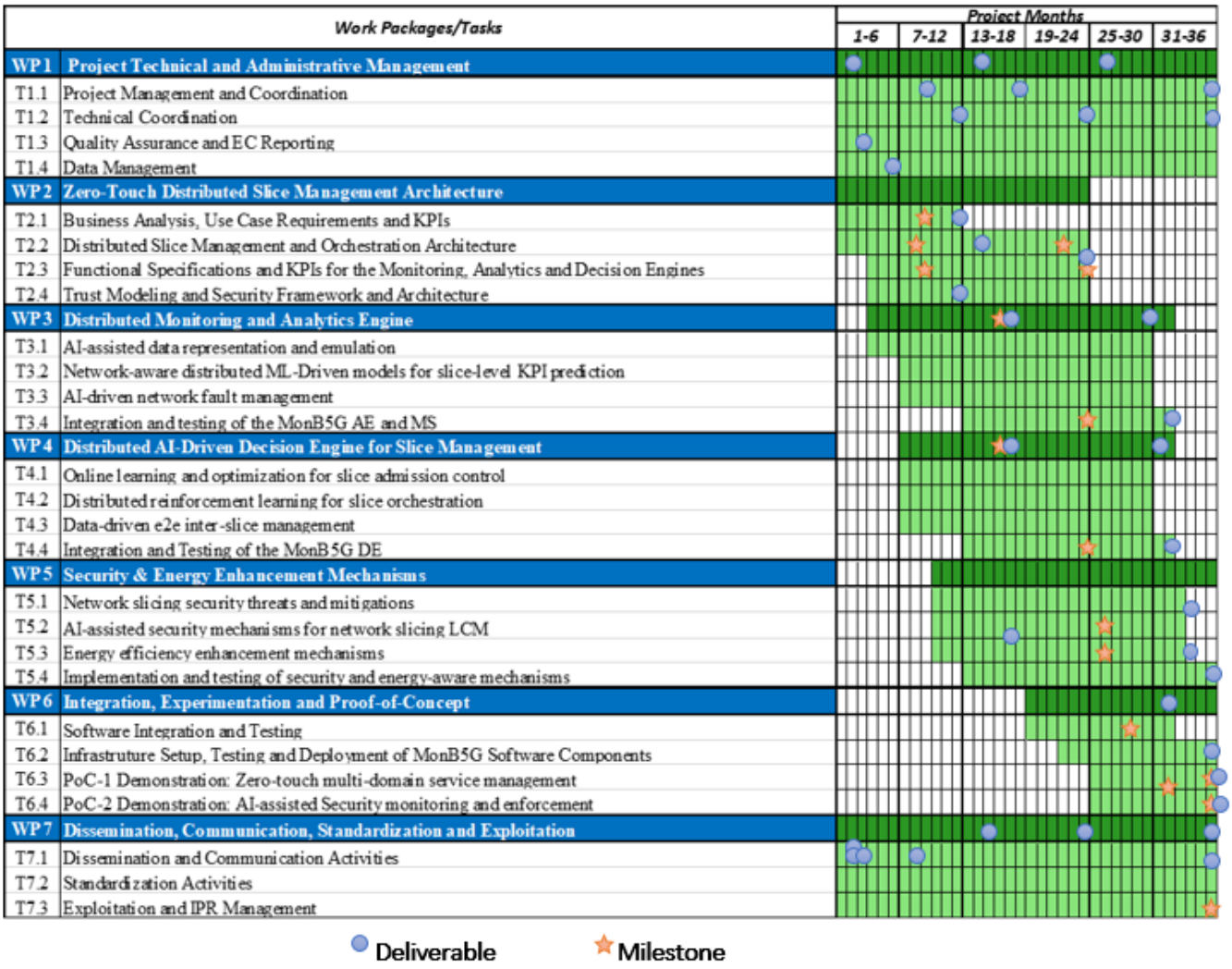

Figure 8. MonB5G Gantt Chart

TOTAL

37 deliverables

16 milestones (3 in Year 1, 6 in Year 2, 7 in Year 3)

4.5 Experimentation

4.5.1 PROOF OF CONCEPT 1

Title: Zero-Touch Network and service management with end-to-end SLAs

Location: Barcelona (CTTC)

- Two (2) Experimental Scenarios:
  - **ES1:** Zero-Touch multi-domain service management with e2e SLAs.
  - **ES2:** Elastic e2e slice management.
- **Key Performance Indicators (KPIs):**
  - Reduce the number of SLA performance violations by **20%.**
  - Improve network energy efficiency by a **factor of 10.**
  - Reducing Static Slicing overhead will result in **30%** higher utilization (will be achieved with dynamic reconfiguration techniques).
  - Compared to Static Slicing, demonstrate the **same or better SLA tolerances (or risk of missing SLAs)** when dynamic slicing techniques are used.
  - **10x** reduction in signaling / monitoring overhead with the use of federation techniques.

4.5.2 PROOF OF CONCEPT 2

Title: AI-assisted policy-driven security monitoring and enforcement

Location: Sophia-Antipolis (EUR)

- Two (2) Experimental Scenarios:
  - **ES1:** Attack identification and mitigation.
  - **ES2:** Robustness of learning algorithms in the face of attacks.
- **Key Performance Indicators (KPIs):**
  - **10x** faster identification of security attack/anomaly.
  - **10x** faster attack remediation and reconfiguration in the order of 10s.
  - End to end slice availability **> 99%.**
  - Per slice component availability **> 99.999%.**
  - Slice isolation: **<5%** performance degradation during attacks on coexisting slices. **Full protection** against cross-slice confidentiality and traffic steering attacks at the mobile edge.
  - False positive rate in attack classification below **1%.**
  - Learning robustness: Precision, recall, fall-out, Area Under Curve values above/below specific thresholds vs. specific ratios of misreporting slice components.

5 Conclusion

This report detailed the deliverable **"D7.1 Factsheet and project presentation"** which is one of the main outputs of **"Task 7.1: Dissemination and Communication Activities"**, performed within **Work Package 7 "Dissemination, Communication, Standardization and Exploitation".** Throughout the report, a detailed description of two of the project's main dissemination tools; the MonB5G Factsheet and the Project Presentation was provided.

The project presentation contents comprised a complete overview of the project, including the timeline and implementation. The factsheet's contents were presented in addition to its design concept. Both tools were created in order to summarize the project's highlights and are intended to be used in soft-copy, as well as printed version, to attract and engage interested stakeholders (at events, exhibitions, etc.). Also, both will be shared on the project's Dissemination and Communication page, upon the approval of this deliverable.