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SUCCESS-6G: EXTEND – DEVISE - VERIFY

WP1 Deliverable E2

Interim Activity Report I

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Disclaimer

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Executive Summary

This document provides a comprehensive summary of the progress of tasks and activities in the coordinated SUCCESS-6G project (subprojects: EXTEND, DEVISE, VERIFY) from the start of the project until September 2023. For each subproject, summary reports are organized per work package (WP) and per associated consortium member. Besides reporting on the technical work, the Deliverable summarises management-related aspects.

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1 Progress on technical work and achievements

This section provides a summary of the technical work performed by each partner in the corresponding Work Packages (WPs) of each subproject.

1.1 SUCCESS-6G-EXTEND: Summary and progress towards project objectives

1.1.1 WP2: Use cases, Requirements and Key Performance Indicators

	Partner	Progress
WP2: SUCCESS-6G-EXTEND	CTTC	CTTC has actively contributed to the definition of the use cases and user stories, their objectives, and overall goals. An initial identification of the key performance indicators for each use case has been also performed. Moreover, a description of the technical innovations expected to be developed in the context of the use cases has been elaborated, aiming to map CTTC activities to the project roadmap. The aforementioned information has been reported in Deliverable E5, where CTTC has acted as lead editor of several sections.
	CELLNEX	CELLNEX, as leader of A3 activity and E5 deliverable, has led several workshops to define the two use cases that would be experimented during the project, and the related user stories, procedures, service requirements, technological innovations, etc. As a result of this sessions, every partner has been able to provide specific contributions to deliverable E5, including also the documentation of facilities and resources that will support the deployment of the project. An initial list of indicators has also been identified, prior to the definition of the relevant KPIs that would be validated by the project. As partner, CELLNEX has contribute to identify V2X network functionalities, technologies and innovations related to support both vehicular use cases and the assessment of the network KPIs.
	IDNEO Technologies	IDNEO has actively participated in defining the two use cases to be carried out within the project, by establishing the requirements, constraints, and procedures to be implemented from the vehicle side for their proper development. In addition to that, an architecture for the implementation of the Over-The-Air updates use case has been proposed, along with the OBU characteristics that will be deployed to enable V2X communications for vehicle condition monitoring and automated software updates for the vehicle, all of them with robust V2X connectivity. All these contributions result from the various activities and meetings organized by CELLNEX, focusing on the elaboration of the Deliverable E5 involved in this WP2. The definition of different KPIs for each use case is still pending, as it requires further analysis and alignment with all the partners.
	Optare Solutions	Optare Solutions has participated in the definition of the use cases of the project where it is involved, by setting the description of the different main and alternate flows of the cases. The flows described have been summarized in illustrative flow diagrams. Also, Optare Solutions has described the innovations that will be accomplished during the project, such as the techniques that will be developed in Machine Learning to assess, reconstruct and impute missing

		information. The main contributions have been reported in Deliverable E5.
	Nearby Computing	Nearby Computing has actively participated in the discussions and the meetings for the definition of the use cases and the underlying interfaces. The edge infrastructure provision and orchestration, as well as the various innovations in this domain (e.g., 5G core orchestration and distributed UPF deployment) have been identified. The main contributions have been reported in Deliverable E5.

Table 1: WP2: SUCCESS-6G-EXTEND progress summary per partner.

1.1.2 WP3: Data-empowered Solutions for Robust V2X Connectivity

	Partner	Progress
WP3: SUCCESS-6G-EXTEND	CTTC	Investigation of a variety of imputation methods for the reconstruction of missing data patterns. Preliminary analysis on benchmark datasets has been performed. Missingness pattern generation so far relies on synthetic dropouts which are achieved by uniformly selecting space-time points for occlusion. Exploration of alternative imputation methods relying on physics-informed neural networks is underway.
	Nearby Computing	Preliminary work on the ground-truth building, based on compute-related data collection for the training of AI algorithms. As a first step, we are planning to provide cloud data, available through various online sources (e.g., data from Google cluster).

Table 2: WP3: SUCCESS-6G-EXTEND progress summary per partner.

1.1.3 WP4: Real-time Supervision and Health Prediction for Vehicles

	Partner	Progress
WP4: SUCCESS-6G-EXTEND	CTTC	Configuration of the monitoring software solution for V2X predictive diagnostics. This modular and containerized end-to-end tool is expected to be properly tuned to provide actionable insights for the real-time performance of vehicular condition monitoring with the aid of user-friendly customized dashboards.
	CELLNEX	CELLNEX has started the preparation of the Castellolí infrastructure to be used for the use cases. Initial discussions with 5G network core supplier have been carried on planning future evolutions that would be required to support the validation of the project use case.
	IDNEO Technologies	IDNEO has initiated the software development for car data acquisition based on the requirements described in the Deliverable "*E5: Use Case Description, Service Requirements, and Key Performance*." It is expected that up to 35 vehicle sensors will be transmitted, enabling an accurate monitoring for car fault prediction. To date, IDNEO has shared some samples of the captured vehicle data with CTTC, and there are plans for further advancements in these tasks in the upcoming months.
	Optare Solutions	Optare Solutions has started to internally discuss the required AI / ML algorithms that will be designed to accomplish the development requirements.
	Nearby	Initial discussions and demos of the NearbyOne tool to highlight the

	Computing	requirements of the orchestrator so to ensure that AI algorithms will be able to run at the edge for localized data processing and quick decision-making regarding the real-time condition of vehicles.

Table 3: WP4: SUCCESS-6G-EXTEND progress summary per partner.

1.1.4 WP5: Seamless Connectivity for Vehicular Software Updates

	Partner	Progress
WP5: SUCCESS-6G-EXTEND	CTTC	CTTC has proposed and detailed the necessary use cases and requirements to design the edge-specific orchestration architecture for dynamic vehicular software upgrades. This is essential to address potential connectivity failures and re-provision on-the-fly the automation of updates.
	CELLNEX	CELLNEX has started the preparation of the Castellolí infrastructure to be used for the use cases. Initial discussions with 5G network core supplier have been carried on to plan future evolutions that would be required to support the validation of the project use case.
	IDNEO Technologies	IDNEO has developed an architecture for Over-The-Air updates, based on the main principles of security, efficiency, scalability, and interoperability. that have been shared, presented, and discussed within the consortium. It is required further development for its implementation.
	Nearby Computing	Demo presentation about the web dashboard of the orchestrator and the requirements for the services to be onboarded. The compliance of the services with these specifications will enable the edge-specific orchestration of dynamic upgrades, patching and re-provisioning on-the-fly for automation of software updates and application lifecycle management.

Table 4: WP5: SUCCESS-6G-EXTEND progress summary per partner.

1.1.5 Deviations

In overall, the WP activities and tasks are progressing as planned. In WP2, the consortium is currently advancing on the definition of the key performance indicators and service level requirements for each use case. Once this activity is completed, Deliverable E5 will be updated in its final form (originally submitted on Aug. 31st).

1.2 SUCCESS-6G-DEVISE: Summary and progress towards project objectives

1.2.1 WP2: Use cases, Requirements and Key Performance Indicators

	Partner	Progress
WP2: SUCCESS-6G-DEVISE	CTTC	CTTC has actively contributed to the definition of the use cases and user stories, their objectives, and overall goals. An initial identification of the key performance indicators for each use case has been also performed. Moreover, a description of the technical innovations expected to be developed in the context of the use cases has been elaborated, aiming to map CTTC activities to the project roadmap. The aforementioned information has been reported in Deliverable E5, where CTTC has acted as lead editor of several sections.

	CELLNEX	CELLNEX, as leader of A3 activity and E5 deliverable, has led several workshops to define the two use cases that would be experimented during the project, and the related user stories, procedures, service requirements, technological innovations, etc. As a result of this sessions, every partner has been able to provide specific contributions to deliverable E5, including also the documentation of facilities and resources that will support the deployment of the project. An initial list of indicators has also been identified, prior to the definition of the relevant KPIs that would be validated by the project. As partner, CELLNEX has contribute to identify V2X network functionalities, technologies and innovations related to support both vehicular use cases and the assessment of the network KPIs.
	IDNEO Technologies	IDNEO has actively participated in defining the two use cases to be carried out within the project, by establishing the requirements, constraints, and procedures to be implemented from the vehicle side for their proper development. In addition to that, an architecture for the implementation of the Over-The-Air updates use case has been proposed, along with the OBU characteristics that will be deployed to enable V2X communications for vehicle condition monitoring and automated software updates for the vehicle, all of them with cybersecurity technics for a secure V2X communications. All these contributions result from the various activities and meetings organized by CELLNEX, focusing on the elaboration of the Deliverable E5 involved in this WP2. The definition of different KPIs for each use case is still pending, as it requires further analysis and alignment with all the partners.
	Optare Solutions	Optare Solutions has participated in the definition of the use cases of the projects where it is involved, by setting the description of the different main and alternate flows of the cases. The flows described have been summarized in illustrative flow diagrams. Also, Optare Solutions has described the innovations that will be accomplished during the project, such as the techniques that will be developed in Machine Learning to detect and mitigate malicious attacks. The main contributions have been reported in Deliverable E5.
	Nearby Computing	Nearby Computing has actively participated in the discussions and the meetings for the definition of the use cases and the underlying interfaces. The edge infrastructure provision and orchestration, as well as the various innovations in this domain (e.g., 5G core orchestration and distributed UPF deployment) have been identified. The main contributions have been reported in Deliverable E5.

Table 5: WP2: SUCCESS-6G-DEVISE progress summary per partner.

1.2.2 WP3: Detection, Identification and Mitigation of Malicious V2X Attacks

	Partner	Progress
WP3: SUCCESS-6G-DEVISE	CTTC	A systematic and comprehensive review of the most relevant security enhancements to date has been performed with an in-depth classification of V2X attacks according to key security and privacy requirements. The methodology followed proposes a taxonomy of security mechanisms based on their proactive/reactive defensive approach, which helps identify strengths and limitations of state-of-the-art countermeasures for V2X attacks. In addition, we have investigated the potential of emerging security approaches leveraging artificial intelligence tools to meet security objectives. More information can be found in our recent journal paper: - *R. Sedar, C. Kalalas, F. Vazquez-Gallego, L. Alonso, J. Alonso-Zarate, "A Comprehensive Survey of V2X Cybersecurity Mechanisms and Future Research Paths," in IEEE Open Journal of the Communications Society, Early Access, January 2023.* Moreover, a data-driven ensemble framework which jointly leverages clustering and reinforcement learning to detect misbehaviours in unlabelled vehicular data has been also developed. Detection assessment using an open-source V2X dataset reveals meaningful performance trends for various attacks. While most attacks can be effectively detected, detection may be curtailed for certain misbehaviour types due to partly inaccurate clustering and erratic activity of the attacker over time. Performance comparison against benchmark detectors reveals the robustness of our approach in the presence of potentially inconsistent or mislabelled training data. The real-time detection capabilities of our framework are also explored to evaluate its practical feasibility in mission critical V2X scenarios. More details can be found in our recent conference paper: - *R. Sedar, C. Kalalas, P. Dini, J. Alonso-Zarate, F. Vazquez-Gallego, "Misbehavior Detection in Vehicular Networks: An Ensemble Learning Approach", in Proc. of IEEE Global Communications Conference 2022 (IEEE Globecom '22), Rio de Janeiro, Brazil, December 2022.*
	Nearby Computing	Preliminary work and discussions on achieving uninterrupted service provisioning in untrusted V2X environments through integration with the NearbyOne orchestration.

Table 6: WP3: SUCCESS-6G-DEVISE progress summary per partner.

1.2.3 WP4: Secure Message Exchange for Condition Monitoring of Vehicles

	Partner	Progress
WP4: SUCCESS-6G-DEVISE	CTTC	Aligned with the activities performed in WP3 (and reported in Table 6), our proposed enabler can guarantee the semantic correctness of vehicular data exchanged among V2X entities in the presence of malicious behaviours. Ongoing work will aim to shed light on the detection performance under a diverse set of adversarial attacks.
	CELLNEX	CELLNEX has started the preparation of the Castellolí infrastructure to be used for the use cases. Initial discussions with 5G network core supplier

		have been carried on planning future evolutions that would be required to support the validation of the project use case.
	IDNEO Technologies	IDNEO has initiated the software development for car data acquisition based on the requirements described in the deliverable "*E5: Use Case Description, Service Requirements, and Key Performance*." It is expected that up to 35 vehicle sensors will be transmitted, enabling an accurate monitoring for car fault prediction. To date, IDNEO has shared some samples of the captured vehicle data with CTTC, and there are plans for further advancements in these tasks in the upcoming months including cybersecurity technics for secure messages exchanged.
	Optare Solutions	Optare Solutions has started to internally discuss the required AI / ML algorithms that will be designed to accomplish the development requirements.
	Nearby Computing	Preliminary work and initial discussions with service and network infrastructure providers on ways to prevent and mitigate threats/attacks in the edge domain to ensure secure connectivity for condition monitoring data.

Table 7: WP4: SUCCESS-6G-DEVISE progress summary per partner.

1.2.4 WP5: Secure Service Development and Provisioning

	Partner	Progress
WP5: SUCCESS-6G-DEVISE	CTTC	CTTC has proposed and detailed the necessary use cases and requirements to design the architecture for instantiating virtual security functions. Thus, by exploiting secure edge provisioning empowered by AI-driven capabilities, the threat risk for software updates can be further minimized.
	CELLNEX	CELLNEX has started the preparation of the Castellolí infrastructure to be used for the use cases. Initial discussions with 5G network core supplier have been carried on planning future evolutions that would be required to support the validation of the project use case.
	IDNEO Technologies	IDNEO has developed an architecture for Over-The-Air services updates, based on the main principles of security, efficiency, scalability and interoperability, that have been shared, presented and discussed within the consortium. It is required further development for its implementation.
	Nearby Computing	Preliminary work on zero-touch orchestration to automate the provision, configuration, and installation of all elements in the edge stack in a secure manner.

Table 8: WP5: SUCCESS-6G-DEVISE progress summary per partner.

1.2.5 Deviations

In overall, the WP activities and tasks are progressing as planned. In WP2, the consortium is currently advancing on the definition of the key performance indicators and service level requirements for each use case. Once this activity is completed, Deliverable E5 will be updated in its final form (originally submitted on Aug. 31st).

1.3 SUCCESS-6G-VERIFY: Summary and progress towards project objectives

1.3.1 WP2: Use cases, Requirements and Key Performance Indicators

	Partner	Progress
WP2: SUCCESS-6G-VERIFY	CTTC	CTTC has actively contributed to the definition of the use cases and user stories, their objectives, and overall goals. An initial identification of the key performance indicators for each use case has been also performed. Moreover, a description of the technical innovations expected to be developed in the context of the use cases has been elaborated, aiming to map CTTC activities to the project roadmap. The aforementioned information has been reported in Deliverable E5, where CTTC has acted as lead editor of several sections.
	CELLNEX	CELLNEX, as leader of A3 activity and E5 deliverable, has led several workshops to define the two use cases that would be experimented during the project, and the related user stories, procedures, service requirements, technological innovations, etc. As a result of this sessions, every partner has been able to provide specific contributions to deliverable E5, including also the documentation of facilities and resources that will support the deployment of the project. An initial list of indicators has also been identified, prior to the definition of the relevant KPIs that would be validated by the project. As partner, CELLNEX has contribute to identify V2X network functionalities, technologies and innovations related to support both vehicular use cases and the assessment of the network KPIs.
	IDNEO Technologies	IDNEO has actively participated in defining the two use cases to be carried out within the project, by establishing the requirements, constraints, and procedures to be implemented from the vehicle side for their proper development. In addition to that, an architecture for the implementation of the Over-The-Air updates use case has been proposed, along with the OBU characteristics that will be deployed to enable V2X communications for vehicle condition monitoring and automated software updates for the vehicle, all of them with efficient computation for a V2X communications. All these contributions result from the various activities and meetings organized by CELLNEX, focusing on the elaboration of the Deliverable E5 involved in this WP2. The definition of different KPIs for each use case is still pending, as it requires further analysis and alignment with all the partners.
	Optare Solutions	Optare Solutions has participated in the definition of the use cases of the projects where it is involved, by setting the description of the different main and alternate flows of the cases. The flows described have been summarized in illustrative flow diagrams. Also, Optare Solutions has described the innovations that will be accomplished during the project, such as the decentralized training models driven by federation learning techniques. The main contributions have been reported in Deliverable E5.
	Nearby Computing	Nearby Computing has actively participated in the discussions and the meetings for the definition of the use cases and the underlying interfaces. The edge infrastructure provision and orchestration, as well

		as the various innovations in this domain (e.g., 5G core orchestration and distributed UPF deployment) have been identified. The main contributions have been reported in Deliverable E5.

Table 9: WP2: SUCCESS-6G-VERIFY progress summary per partner.

1.3.2 WP3: Addressing V2X Channel Impairments with Over-the-air Computing

	Partner	Progress
WP3: SUCCESS-6G-VERIFY	CTTC	Initial investigation of simple coding methods to improve the error/distortion protection of over-the-air computation under imperfect and realistic channel conditions.
	Nearby Computing	Preliminary work on the interface between the network and the orchestrator so to achieve channel-aware service orchestration for V2X applications.

Table 10: WP3: SUCCESS-6G-VERIFY progress summary per partner.

1.3.3 WP4: Predictive Vehicle Diagnostics with Distributed Learning

	Partner	Progress
WP4: SUCCESS-6G- VERIFY	CTTC	Preliminary investigation of efficient computing methods leveraging the distributed nature of V2X for predictive diagnostics. The focus so far has been on collaborative transfer learning solutions where distributed computation can be efficiently performed by leveraging semantic relatedness metrics. Ongoing work is expected to be submitted as a journal article.
	CELLNEX	CELLNEX has started the preparation of the Castellolí infrastructure to be used for the use cases. Initial discussions with 5G network core supplier have been carried on planning future evolutions that would be required to support the validation of the project use case.
	IDNEO Technologies	IDNEO has initiated the software development for car data acquisition based on the requirements described in the deliverable "*E5: Use Case Description, Service Requirements, and Key Performance*." It is expected that up to 35 vehicle sensors will be transmitted, enabling an accurate monitoring for car fault prediction and diagnostics. To date, IDNEO has shared some samples of the captured vehicle data with CTTC, and there are plans for further advancements in these tasks in the upcoming months including cybersecurity technics for secure messages exchanged.
	Optare Solutions	Optare Solutions has started to internally discuss the required AI / ML algorithms that will be designed to accomplish the development requirements.
	Nearby Computing	Preliminary work on the monitoring (observability) system of the edge orchestrator to ensure unattended provisioning and condition monitoring of vehicle components.

Table 11: WP4: SUCCESS-6G-VERIFY progress summary per partner.

1.3.4 WP5: Automated Software Updates for Vehicles

	Partner	Progress
WP5: SUCCESS-6G- VERIFY	CTTC	CTTC has proposed and detailed the necessary use cases and requirements to design the architecture for zero-touch orchestration of container-based solutions that will ensure the automatic reconfiguration of vehicular on-board units with an efficient usage of computational resources, while adapting to V2X network topology changes.
	Cellnex	CELLNEX has started the preparation of the Castellolí infrastructure to be used for the use cases. Initial discussions with 5G network core supplier have been carried on planning future evolutions that would be required to support the validation of the project use case.
	IDNEO Technologies	IDNEO has developed an architecture for Over-The-Air automated software updates, based on the main principles of security, efficiency, scalability, and interoperability, that have been shared, presented and discussed within the consortium. It is required further development for its implementation.
	Nearby Computing	Initial discussions and demonstrations of the NearbyOne tool. The requirements for the containerization of services have been provided, while a dedicated environment for the project has been created in AWS. The next steps in this activity will include the cloud-native (container) application management for efficient use of computational resources.

Table 12: WP5: SUCCESS-6G-VERIFY progress summary per partner.

1.3.5 Deviations

In overall, the WP activities and tasks are progressing as planned. In WP2, the consortium is currently advancing on the definition of the key performance indicators and service level requirements for each use case. Once this activity is completed, Deliverable E5 will be updated in its final form (originally submitted on Aug. 31st).

2 Progress on Dissemination, Standardisation and Exploitation

2.1 Summary

The following SUCCESS-6G related publications have been accepted:

1. R. Sedar, C. Kalalas, F. Vazquez-Gallego, L. Alonso, J. Alonso-Zarate, "**A Comprehensive Survey of V2X Cybersecurity Mechanisms and Future Research Paths**," in IEEE Open Journal of the Communications Society, Early Access, January 2023.
2. R. Sedar, C. Kalalas, P. Dini, J. Alonso-Zarate, F. Vazquez-Gallego, "**Misbehavior Detection in Vehicular Networks: An Ensemble Learning Approach**", in Proc. of IEEE Global Communications Conference 2022 (IEEE Globecom '22), Rio de Janeiro, Brazil, December 2022.
3. J. Camargo, E. Coronado, W. Ramirez, D. Camps, S. Sanchez Deutsch, J. Perez-Romero, A. Antonopoulos, O. Trullols, S. Gonzalez-Diaz, B. Otura, G. Rigazzi, "**Dynamic Slicing Reconfiguration for Virtualized 5G Networks Using ML Forecasting of Computing Capacity**", Computer Networks, to appear, 2023.
4. M. Dalgitsis, N. Cadenelli, M. A. Serrano, N. Bartzoudis, L. Alonso, A. Antonopoulos, "**NSFaaS: Network Slice Federation as a Service in Cloud-native 5G and beyond Mobile Networks**", IEEE NFV-SDN 2023, 7-9 November 2023, Dresden, Germany
5. C. Manso, R. Vilalta, L. Gifre, R. Casellas, R. Martínez, R. Muñoz, "**Introducing End-to-End Location Awareness in Packet-Optical Networks**", European Conference on Optical Communications, Glasgow (UK), 2023.

Besides the accepted journal and conference papers, several outreach activities have been performed by SUCCESS-6G partners. Miquel Payaró (CTTC) participated as invited speaker at the EuCNC'23 workshop "The Role of AI in Edge 6G topologies": https://www.eucnc.eu/programme/workshops/workshop-2/.

The goal of this workshop was to discuss the close synergy between Artificial Intelligence (AI) and edge computing, as two key enabling technologies shaping 6G, and identify the roadmap for more holistic, sustainable, and future-proof design of AI- and edge-enabled solutions. Miquel provided the talk "*Experimental validation of edge-hosted AI/ML approaches in B5G/6G networks"* where, among other activities, he presented a 1-slide summary of the SUCCESS-6G project, highlighting the relevance of edge computing in the two vehicular use cases developed in the project.

SUCCESS-6G was also presented by Nearby Computing and CTTC in the recent edition of the Mobile World Congress (MWC) which took place in Barcelona.

2.2 Deviations

No deviations from the original workplan have been identified.

3 Project management and administrative issues

3.1 Summary

In all three subprojects, Project Management (WP1) has taken care of the administrative tasks, quality assurance, management of risks, technical management of each subproject and organisation of technical activities. The smooth advancement of project activities and their overall coordination, ensuring participation from all project partners, contractual matters and the provision of collaborative tools are examples for that.

The kick-off meeting of the coordinated SUCCESS-6G project was successfully held on 16th May 2023 organised by CTTC in Barcelona. The main objective was to get a common understanding on how the overall goals can be achieved in each subproject, and to plan on the way to start with concrete joint activities. Subsequent plenary conference calls have followed to exchange status updates, facilitate coordination on deliverable contributions, discuss the technical activities but also to early identify any potential issue or risk materialising.

A Management Handbook and Quality Plan has been prepared (E1) as a practical guideline to facilitate the management of the project for all SUCCESS-6G participants. It defines and elaborates all contractual rules and management procedures, e.g., for Deliverable production. It also provides information regarding project tools, quality assurance and project reporting procedures.

3.2 Deviations

Until the end of this reporting period, the project has achieved all Deliverables and milestones according to the original planning.

4 Status of Deliverables and milestones

The preparation of Deliverables has been monitored and quality checks have been performed. All project Deliverables and milestones due in the reporting period have been reached. Details are given below.

Subproject	Deliverable No.	Deliverable Title	Lead Beneficiary	Planned due date	Submitted
EXTEND/DEVISE /VERIFY	E1	Management Handbook and Quality Plan	CTTC	31/01/2023	31/01/2023
EXTEND/DEVISE /VERIFY	E2	Interim activity report I	CTTC	30/09/2023	30/09/2023
EXTEND	E5	Use case description, service requirements, and key performance indicators	CELLNEX	31/08/2023	31/08/2023
DEVISE	E5	Use case description, service requirements, and key performance indicators	CELLNEX	31/08/2023	31/08/2023
VERIFY	E5	Use case description, service requirements, and key performance indicators	CELLNEX	31/08/2023	31/08/2023

Table 13: Deliverable status - due in the reporting period

The table below provides an overview of the status of milestones achievement that were due in the reporting period.

Subproject	Milestone No.	Milestone Title	Lead Beneficiary	Planned due date	Achieved
EXTEND/DEVISE /VERIFY	H1	Start of the project	CTTC	01/12/2022	01/12/2022
EXTEND	H2	Consolidated description of use cases and vehicular services requirements	CELLNEX	31/08/2023	31/08/2023
DEVISE	H2	Consolidated description of use cases and vehicular services requirements	CELLNEX	31/08/2023	31/08/2023

VERIFY	H2	Consolidated description of use cases and vehicular services requirements	CELLNEX	31/08/2023	31/08/2023

Table 14: Milestone achievement - due in the reporting period

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