This project has received funding from the European's Union Horizon 2020 research innovation programme under Grant Agreement No. 957258

Architecture for Scalable, Self-human-centric, Intelligent, Secure, and Tactile next generation IoT

assist-iot

D2.6 – Risk Management v2

Deliverable No.	D2.6	**Due Date**	30-APR-2022
Type	Report	**Dissemination Level**	Public (PU)
Version	1.0	**WP**	WP2
Description	The deliverable includes the risk policy, forecasted and detected risks and their mitigation measures, along with ethical and legal risks.		

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History

Date	Version	Change
17-Dec-2021	0.1	Table of Contents shared with the Consortium
20-Feb-2022	0.2	Content added at several sections
15-Mar-2022	0.3	Risks from various WPs are inserted by WP leaders
19-Apr-2022	0.4	Version complete, ready for IR by the PIC/PCC
30-Apr-2022	1.0	Version corrected after IR, ready to be uploaded to the EC portal

Key Data

Keywords	Risk Management, risk identification template, mitigation measures
Lead Editor	Carlos E. Palau (UPV)
Internal Reviewer(s)	PCC

Executive Summary

This Risk Management Plan is written within the context of WP2 – Project Coordination and Management of **ASSIST-IoT** project, under Grant Agreement No. 957258. The document is a reference to the work being carried out as a part of task *T2.2 - Technical coordination, quality assurance and risk management*. In particular, it is related to the management and assessment of risks of the ASSIST-IoT project. This document contains the second full report of the risk management related activities that have been performed in ASSIST-IoT. In particular, it summarises the current status of the risk assessment, as it has been performed during the M18 of the action (April 2022).

The Risk Management Plan is based on a well-known 4-steps procedure composed of identification, estimation, mitigation and monitoring. All sub-steps have been considered in this document, while the most relevant part is presented in four tables, with information associated to specific risks that have been identified (separated in "areas" – management, technical, pilots and impact creation).

By M18 of the project (April 2022), 31 risks have been identified (classified in 8 administrative/managerial, 13 technical, 7 related to pilots and 3 about impact creation). They are detailed in four summarising tables, that include the description of the risk itself, its materialisation likelihood, its "advance" from the last iterations and the mitigation and corrective measures defined for each of them.

Risks included in this document cover those usual in RIA projects, as well as some identified along the way related to potential issues that may occur during the next phase of ASSIST-IoT project (pilot experimentation) as well as some risks that have materialised and were unforeseen.

Currently, no high warning risk(s) have been identified, and all detected risks are "under control", although there are some that are being continuously and carefully observed. However, continuous tracking of the status of identified risks, and identification of new ones is being undertaken. Specifically, this document will be updated/modified as it (already) is a living document (in continuous update) and will be used as a guide to the day-to-day work in terms of risk management.

Table of contents

List of tables

List of figures

List of acronyms

Acronym	Explanation
AB	Advisory Board
AI	Artificial Intelligence
ASSIST-IoT	Architecture for Scalable, Self-*, human-centric, Intelligent, Secure, and Tactile next generation IoT
CA	Consortium Agreement
COVID / COVID19	Disease caused by SarsCOV2 virus – refers to the outbreak of 2020 and 2021
CSA	Coordination and Support Action
DevSecOps	Development-Security-Operations, methodology for Secure Continuous Integration and Continuous Delivery.
DX.Y	Deliverable No Y of Work Package No X
GA	Grant Agreement
IEEE	Institute of Electrical and Electronics Engineers
KPI	Key Performance Indicator
ML	Machine Learning
M*X*	Month No *X* of ASSIST-IoT project execution
N/A	Not Applicable
PC	Project Coordinator
PCC	Project Coordination Committee
PIC	Project Implementation Committee
PO	Project Officer
R*X.Y*	Risk No Y of WP No X
SotA	State-of-the-Art
TC	Technical Coordinator
TL	Task Leader
WP	Work Package
WPL	Work Package Leader

1. About this document

The main objective of this document is to provide update of all aspects of risk management. As stated in the action proposal, the aim of ASSIST-IoT management is to systematically monitor risks, and to establish ways of counteracting them before they have adverse effect on the action's results.

1.1. Deliverable context

Table 1. Deliverable context

Keywords	**Lead Editor**
Objectives	The objective of this document is not related to the technical development of the project. This deliverable establishes and reports over the Risk Management Plan and the main procedures proposed to correctly manage the likelihood of risk materialisation in a continuous and timely manner.
Exploitable results	N/A
Work plan	This document is developed within the WP2 "Project Coordination and Management", being useful for every task of the project and a daily reference of overall project planning and coordination. This document corresponds to the works carried out under the scope of task *T2.2 - Technical coordination, quality assurance and risk management.*
Milestones	N/A
Deliverables	This document is a live asset (living document), subject to be updated. Current version can be seen as an update performed on risk assessment provided in the action proposal. Moreover, it is fed directly from the Project Management Handbook (D2.1). Furthermore, this document is semi-independent from D2.3 and D2.4, which cover all aspects of ethical risks. Hence, ethical risks are not considered here. It will be iterated (enhanced, updated) by deliverable D2.7 (M27).
Risks	**Planning problems** – This deliverable establishes mechanisms to ensure the quality of the documentation and the processes, facilitating the correct interpretation by the partners so that they know the timing and responsibilities.
	Collaboration issues – This deliverable describes coordination mechanisms, communication tools, and procedures that allow correct decision-making and conflict resolution in the face of any situation that may arise throughout the project.

1.2. The rationale behind the structure

The content of the deliverable is organized in six main sections:

- **Section 2**. Update of risk management strategy.
- **Section 3**. This section reports the current status of risks assessment in the project, separated per risk area (a sub-section each).
- **Section 4** concludes with some reflections and next actions about how the risk management is effectively performed in ASSIST-IoT.

2. Update of Risk Management in ASSIST-IoT

Following the high-quality procedures settled in D2.5 (the guiding document for risks management, tracking and reporting in ASSIST-IoT), the activity of months M9-M18 has redounded in a slight update of the risks tracking procedure.

We are living in ever-changing times (pandemic outbreaks, war in Europe, inflation, shortage of material, etc.), needing agile responses in research projects both with regards to execution of the activities and also to risk identification, tracking and mitigation.

In that regard, D2.5 established a risk assessment table that informs of the advances in regards to the risks identified since the proposal stage together with newly arisen risks that were being tracked by M9 of the project. For this round of iterations, some additional elements have been introduced in order to improve the process:

- Formal "division" of the identified risks in clearly defined areas. In D2.5, a tentative drilldown for the risks was proposed, that is in D2.6 explained and consolidated (see next sub-section).
- Inclusion of the likelihood and impact levels of each risk.
- Addition of the "potential consequences" field per risk, in order to have a clear rationale behind the assignment of likelihood and impact levels.
- An improved conclusive section with statistics and reflections to move ahead.
- Inclusion of a "tracking" space in the table for each risk in which the status of the risk from previous iterations is highlighted, including notes/remarks for further documents. This way, the added information in each iteration is clearly visible and thus the risk management activity will be eased. The iterations are as follows:

Figure 1. Risk management reporting iterations

2.1. Risk classification

As mentioned, risks in ASSIST-IoT are now being classified in various "areas". Depending on which type of action they fall under, risks might be considered as being:

- **Management risks**: Those related with managerial aspects like partners collaboration, delays in reporting, documentation issues, misalignments in communication, Advisory Board, Open Call participants (in terms of funding, participation, impact, etc.). They fall under WP2 but might actually affect the execution of other WPs.
- **Technical risks**: Those related to technical actions, both in software development and in hardware design and availability. These risks also entail any aspects around integration, testing and interaction between enablers and any part of the modular architecture. The WPs are WP3, WP4, WP5 and WP6.
- **Pilot risks**: Those related to the deployment of ASSIST-IoT technology in the actual pilots of the project, including the availability of pilot equipment (scanner, cranes, TOS, car, connectivity, etc.) and the software/hardware of the project to be used. It also covers the actual completion of the objectives of the pilot as well as their validation and measurement through KPIs. Associated to WP7 and WP8.
- **Impact risks**: Those related to the outreach of the project, dissemination capacity, external professionals' engagement, standardisation, exploitation, etc. Associated with WP9 activities..

3. Current risk assessment tables

The following tables contain the current information of the risk assessment tracking file (live document) managed in ASSIST-IoT. Those risks marked in light purple correspond to the risks identified since the proposal stage, while those in green come from the enhancement reported in D2.5 and the ones that have been identified during this last 9-months period (M9-M18) for D2.6 are highlighted in blue.

3.1. Management risks

Table 2. Management related risks in ASSIST-IoT

Risk description, comments and potential consequences	Mitigation measures, corrective actions and status/comments per iteration
Name Partners related risks (identified since Proposal stage) ***Description:*** Underperforming, leaving the project, key-personnel temporally not available, reorganization distracting day-to-day activities. ***Potential consequences:*** • As per D2.5 (M9): Delays, extra efforts to be justified. • As per D2.6 (M18): Not reaching on time documentation and software (enablers) delivery, jeopardising further activities. ***Likelihood + Severity:*** • At D2.5 (M9): *Low + Medium* • At D2.6 (M18): *Low + Medium* ***Notes in D2.5 (M9):*** COVID-19 increases possibility of materialization of these risks. Moreover, partners may be overburdened by the success/failure related to the COVID pandemics (too many/too few activities). Related also to the next risk. ***Notes after the latest execution period: M9-M18:*** By the middle of the project, execution is overall smooth and the partners are in a good position to face the pilot deployment and to welcome Open Call winners.	***Mitigation measures:*** Flexible project management structure and project CA allow quick shift of resources to alternate partners, and quick inclusion of new partners in the Consortium, if necessary. All Consortium partners are involved in related areas with more than one staff member, ensuring an immediate substitution. ***Additions in D2.5 (M9):*** COVID-related aspects of these risks, and possible mitigation approaches (including importance of the need of efficient communication) have been discussed during the Kick-off meeting, and have been acknowledged by the partners. So far, no need to elaborate this risk further occurred. ***Additions after the latest execution period: M9-M18:*** Managerial measures proposed were discussed again in the February 2022 meeting with partners, with no red flag or issue raised. Status: • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected.*

Name: Planning problems (identified since Proposal stage) ***Description:*** Resources underestimated, project timing not appropriate, deliverables/milestones delayed ***Potential consequences:*** • As per D2.5 (M9): Delays, extra efforts to be justified. • As per D2.6 (M18): Not reaching on time documentation and software (enablers) delivery, jeopardising further activities ***Likelihood + Severity:*** • At D2.5 (M9): *Low + Med* • At D2.6 (M18): *Low + Med* ***Notes after the latest execution period: M9-M18:*** COVID-19 outbreaks have prevented the project to host physical meetings, which has had certain influence in the planning of tasks, etc. This is about to change as the 4th Plenary Meeting of the project is expected to take place in Valencia during M19.	***Mitigation measures:*** Potential solutions: involvement of other partners with available resources, rearrangement of resources among partners, change of project plan, as a result of self-assessment activities (in direct communication with the EC / Project Officer), and ensuring timely implementation of corrective actions ***Additions in D2.5 (M9):*** COVID-related aspects of these risks, and possible mitigation approaches (including importance of the need of efficient communication) have been discussed during the Kick-off meeting, and have been acknowledged by the partners. So far, no need to elaborate this risk further occurred. ***Status:*** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *Some symptoms detected and under control*
Name: Collaboration issues (identified since Proposal stage) ***Description:*** Consortium cannot agree, WP interaction not satisfactory, coordination not efficient. ***Potential consequences:*** • As per D2.5 (M9): Delays, extra efforts to be justified. • As per D2.6 (M18): Not reaching on time documentation and software (enablers) delivery, jeopardising further activities ***Likelihood + Severity:*** • At D2.5 (M9): *Medium + High* • At D2.6 (M18): *Low + Medium* ***Notes in D2.5 (M9):*** Issues considered in this risk are on "higher level" than the ones discussed in the previous risk. While symptoms of the communication risk have been observed and mitigated, no symptoms covered by this risk have been spotted.	***Mitigation measures:*** The project management (as described in Project Handbook; D2.1) provides appropriate decision-making and conflict resolution procedures, which will be applied. As the last instance, management of the affected organisations, including the coordinating organisation, will be involved in problem resolution. ***Additions in D2.5 (M9):*** COVID-related aspects of these risks, and possible mitigation approaches (including importance of the need of efficient communication) have been discussed during the Kick-off meeting, and have been acknowledged by the partners. So far, no need to elaborate this risk further occurred. ***Additions after the latest execution period: M9-M18:*** Additional communication/collaboration channels have been put in place like GitLab comments, GitHub account and Slack.

Notes after the latest execution period: M9-M18: COVID-19 outbreaks have prevented the project to host physical meetings, which has had certain influence in the planning of tasks, etc. This is about to change as the 4th Plenary Meeting of the project is expected to take place in Valencia during M19. Severity is also considered a bit lower as partners are more gotten to each other at this stage of the project and communication is more fluid.	***Status:*** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected.*
Name: External risks (identified since Proposal stage) ***Description:*** Change of project requirements due to evolution of relevant technology and market landscape ***Potential consequences:*** • As per D2.5 (M9): Enablers developed become obsolete before even getting out to the "market". • As per D2.6 (M18): Architecture designed in ASSIST-IoT struggles to become a real reference for NGIoT deployments and the orchestrating/deploying approach is no longer sound. ***Likelihood + Severity:*** • At D2.5 (M9): *Low + High* • At D2.6 (M18): *Low + Medium* ***Notes in D2.5 (M9):*** Particularly relevant due to research related to cutting-edge areas. Meeting of ASSIST-IoT with its AB took place in M9 and no indication of risk from this category was raised by its members. ***Notes after the latest execution period: M9-M18:*** Severity has been shifted to "Medium" as it has been observed that the underlying technologies upon which ASSIST-IoT approach is based (k8s, Helm charts) are becoming de-facto standards in the edge-cloud deployment commercial and research projects.	***Mitigation measures:*** The PC/TC/PIC/PCC will immediately analyse concrete impact on the project and propose corrective actions in the work plan. Role of Advisory Board is foreseen. Proposed actions, if necessary, will be consulted with the Project Officer. ***Additions in D2.5 (M9):*** COVID-related aspects of these risks, and possible mitigation approaches (including importance of the need of efficient communication) have been discussed during the Kick-off meeting, and have been acknowledged by the partners. So far, no need to elaborate this risk further occurred. ***Additions after the latest execution period: M9-M18:*** No further specific measures have been elaborated during this period. ***Status:*** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected.*

Name: AB support issues (identified since Proposal stage) ***Description:*** Advisory Board members are not able to conduct satisfactorily the required assessment and/or advisory roles ***Potential consequences:*** • As per D2.6 (M18):Decisions taken based on AB's feedback may guide the project to non-advantage positions. ***Likelihood + Severity:*** • At D2.5 (M9): *Low + Low* • At D2.6 (M18): *Low + Low* ***Notes in D2.5 (M9):*** In M9, during the initial meeting of the AB, all its members were present and were very excited about the project and actively (one could even say, enthusiastically) provided advice and offered further help. The AB took place in M9 and no indication of risk from this category was raised by its members. ***Notes after the latest execution period: M9-M18:*** Further meetings and interactions have taken place with the AB members and the feedback has been immensely satisfactory.	***Mitigation measures:*** The Consortium will monitor AB activities assuring that they are aligned with the project, implementing the adequate procedures. AB membership can be adjusted in case some AB member underperforms. ***Additions in D2.5 (M9):*** COVID-related aspects of these risks, and possible mitigation approaches (including importance of the need of efficient communication) have been discussed during the Kick-off meeting, and have been acknowledged by the partners. So far, no need to elaborate this risk further occurred. ***Additions after the latest execution period: M9-M18:*** The second meeting with the AB was co-located with the February 2022 meeting of ASSIST-IoT, and inputs retrieved from the first contact were endorsed as well as new information was provided. Willingness from all AB members to keep proactiveness going, eager to know more about project advances, was experienced. ***Status:*** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected.*
Name: Communication issues (identified during the 1st iteration) ***Description:*** Lack of direct (personal) contact (due to COVID pandemics travel restrictions) leads to problems in in-depth understanding between partners. Particularly "dangerous" when partners are involved in "joint activities". ***Potential consequences:*** • As per D2.5 (M9): Delays, extra efforts to be justified. • As per D2.6 (M18): Not reaching on time documentation and software (enablers) delivery, jeopardising further activities ***Likelihood + Severity:*** • At D2.5 (M9): *High + Medium* • At D2.6 (M18): *Medium + Medium*	***Mitigation measures introduced in D2.5 (M9):*** Flexible project management structure and project CA allow quick shift of resources to alternate partners, and quick inclusion of new partners in the Consortium, if necessary. All Consortium partners are involved in related areas with more than one staff member, ensuring an immediate substitution. The PC and the TC pay particular attention to the way partners are communicating, and the common understanding is achieved. As a counter-measure, extra teleconferences (involving "handpicked" groups of partners) have been introduced to mitigate effects of materialization of this risk. Positive effects of these teleconferences have been observed. For instance, there are no delays in project schedule, while the quality of deliverables is adequate. However, the very fact that the risk has started to materialise requires extra attention.

Notes in D2.5 (M9): COVID-19 increases possibility of materialization of these risks. Moreover, partners may be overburdened by the success/failure related to the COVID pandemics (too many/too few activities). Related also to the next risk. Potential problems related to/originating from lack of personal communication have been discussed during the Kick-off meeting, and acknowledged by all partners. ***Notes after the latest execution period: M9-M18:*** The situation has substantially improved, mobility restrictions are increasingly being removed and physical meetings are again an option (next one to be taking place in Valencia – May 2022). Likelihood shifted to "Medium".	This risk will be monitored with high level of involvement by the PC/TC and the PCC/PIC, in upcoming months. ***Additions after the latest execution period: M9-M18:*** 4th Plenary Meeting (that will be physical) will be hosted in Valencia on 17th, 18th and 19th May 2022 and will count with hybrid option. ***Status:*** • At D2.5 (M9): *Some symptoms detected. Initial problems in reaching appropriate level of common understanding between WP/Task leaders, and partners involved in these WPs/Tasks, have been observed* • At D2.6 (M18): *Situation has improved with regards to this risk.*
Name: Technical management correlation (identified during the 1st iteration) ***Description:*** Complexity of interrelations between WP4, WP5 and WP6 leads to managerial problems and negatively influences realization of action outcomes. ***Potential consequences:*** • As per D2.5 (M9): Delays, extra efforts to be justified. • As per D2.6 (M18): Not reaching on time documentation and software (enablers) delivery, jeopardising further activities ***Likelihood + Severity:*** • At D2.5 (M9): *High + Medium* • At D2.6 (M18): *Medium + Medium* ***Notes in D2.5 (M9):*** COVID-19 increases possibility of materialization of these risks. Moreover, partners may be overburdened by the success/failure related to the COVID pandemics (too many/too few activities). Related also to the next risk. ***Notes after the latest execution period: M9-M18:*** This risk has not impacted the project and considering that partners are more used to each other now, likelihood is shifted to Medium.	***Mitigation measures introduced in D2.5 (M9):*** TC and PC are aware of the potential problems and will pay extra attention to the progress in interrelated tasks. Potential problems related to the need of on time delivery of results to avoid bottlenecks have been discussed during the Kick-off meeting and acknowledged by all partners. Extra teleconferences (with presence of TC and, possibly, PC) are planned to mitigate effects of materialization of this risk. ***Additions after the latest execution period: M9-M18:*** Periodic teleconferences between WP4, WP5, WP6 and WP7 leaders are now taking place. In addition, WP8 has just started and the technical leaders are also keeping constant communication with responsible partners so that WP3 requirements, WP4-5-6 technical deliveries, WP7 testing (in pilot) actions and WP8 measurements via KPIs will be aligned. ***Status:*** • At D2.5 (M9): *Some symptoms detected.* • At D2.6 (M18): Less symptoms detected.

Name: Open Call winners reliability (identified during the 2nd iteration) ***Description:*** The Open Call winners end up not being reliable as: (i) to complete their committed works, (ii) to carry out the expenditures of the budget, (iii) to justify their work, (iv) to achieve proper successful communication with ASSIST-IoT Coordination or with partners. ***Potential consequences:*** • As per D2.6 (M18): Other (better) participants have been excluded, time from partners would have been lost and further efforts to find other candidates should be put in place. ***Likelihood + Severity:*** • At D2.6 (M18): *Low + High*	***Mitigation measures introduced in D2.6 (M18):*** During the evaluation phase, a pre-screening has been performed analysing (among other) the trajectory of the potential winners of the OC as participants of H2020 or similar projects. In addition, a Collaboration Agreement will be drawn (based on DESCA model) and signed (by both parts) between each winner and the Project Coordinator, in which enough articles to ensure responsiveness and reliability will be included. As a corrective action, budget of the OC winners in the 1st call that fall under the prior conditions (if this risk materialises) will be devoted to other participants of the Open Call in the 2nd round. ***Status:*** At D2.6 (M18): *This risk is not applicable yet.*

3.2. Technical risks

Table 3. Technical related risks in ASSIST-IoT

Risk description, comments and potential consequences	Mitigation measures, corrective actions and status/comments per iteration
Name: Dynamic market environment (identified since Proposal stage) ***Description:*** The market environment or the user views change making the results obsolete ***Potential consequences:*** • As per D2.5 (M9): Enablers developed become obsolete before even getting out to the "market". • As per D2.6 (M18): Architecture designed in ASSIST-IoT struggles to become a real reference for NGIoT deployments and the orchestrating/deploying approach is no longer sound ***Likelihood + Severity:*** • At D2.5 (M9): *Low + High*	***Mitigation measures:*** Robust effort on market analysis in WP2 and development of an appropriate exploitation plan in WP8, including a business analysis, will assure that users' needs and wishes, as well as market trends, are constantly taken into account. ***Additions in D2.5 (M9):*** Assessment based on monitoring performed continuously by the IM. ***Additions after the latest execution period: M9-M18:*** A spin-in customer taskforce has been put in place during this period of the project with the goal of defining personae and potential customers. This exercise has helped to realise whether or not the initial requirements are still sound.

• At D2.6 (M18): *Low + Med* ***Notes after the latest execution period: M9-M18:*** As mentioned before, this severity has been reduced as it has been witnessed that k8s and Helm charts are widely used nowadays and are also expected so in the foreseeable future.	***Status:*** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected.*
Name: Insufficient testing (identified since Proposal stage) ***Description:*** Not enough testing of technical components, either from a single, isolated perspective and also as parts of a wider system. ***Potential consequences:*** • As per D2.5 (M9): leading to failures, lack of functionality or dissatisfaction by users ***Likelihood + Severity:*** • At D2.5 (M9): *Low + High* • At D2.6 (M18): *Low + High* ***Notes after the latest execution period: M9-M18:*** Some deliverables have been elaborated establishing clearly: • Unit and integration tests per enabler (D6.2) • Joint integration tests with different enablers (D6.2) • Enough documentation per-enabler basis (D6.5)	***Mitigation measures:*** Design of adequate testing plan (WP6) taking into account information gathered during design (WP3) and monitoring of technical tasks (WP4 and WP5) should result in avoiding this risk. ***Status:*** • At D2.5 (M9)*: This risk is not yet applicable as component development, and their testing (according to project schedule) are still to be initiated.* • At D2.6 (M18): *Tests have been just initiated for PoCs of enablers, it is still early to assess the status of this risk in a proper scale.*
Name: Self-* and AI mechanisms match (identified since Proposal stage) ***Description:*** Problems with including/using results of machine learning / artificial intelligence in self-* mechanisms ***Potential consequences:*** • As per D2.5 (M9): • As per D2.6 (M18): ***Likelihood + Severity:*** • At D2.5 (M9): *Low + Medium* • At D2.6 (M18): *Low + Medium*	***Mitigation measures:*** For one side, there will be thorough analysis of mechanisms to be implemented in the architecture and, for the other, within the ASSIST-IoT, three complex pilots with several scenarios will be implemented and thoroughly analysed to prepare a reproducible catalogue of self-* capabilities. ***Additions after the latest execution period: M9-M18:*** Bi-weekly telcos are being held between the responsible partners involved in the FL task and the self-* mechanisms in order to align both deliveries (SRIPAS, PRO, CERTH). Stakeholders also partake under request so that their needs are considered in the technical design of the enablers.

Notes after the latest execution period: M9-M18: Tasks T5.1 and T5.2 are now much more advance, having developed PoCs of diverse enablers.	***Status:*** • At D2.5 (M9): This risk is not yet applicable as use of ML/AI/self-* mechanisms (according to project schedule) is still to be initiated. • At D2.6 (M18): No symptoms detected.
Name: Selected approaches for enablers (identified since Proposal stage) ***Description:*** The different technologies selected for the development of enablers might not be the better ones. ***Potential consequences:*** • As per D2.5 (M9): Incompatibilities could exist if this exercise is n not well supervised. • As per D2.6 (M18): Too many encapsulation exceptions could appear. ***Likelihood + Severity:*** • At D2.5 (M9): *Low + High* • At D2.6 (M18): *Low + Med* ***Notes after the latest execution period: M9-M18:*** All tasks in WP4 and WP5 are now much more advanced, having developed PoCs of diverse enablers and this risk has not materialised.	***Mitigation measures:*** Special care must be placed on evaluation of requirements and existing solutions for each plane/enabler. A proof of concept, based on a technology, can be created if its capacity is not fully understood. ***Additions after the latest execution period: M9-M18:*** In order to mitigate this potential risk, the technical partners adopted two additional measures: • Design of a "template" per enabler in which the technologies, libraries and API methods selected for that enabler (and its inner components) were to be described. • Explain in several meetings (bi-weekly WP4 and WP5 teleconferences) to the rest of technical partners and also to the whole Consortium (in Plenary meetings) the chosen technologies. That way, if anyone detected any incompatibility (or would like to suggest a better choice), this could be identified in advance. ***Status:*** • At D2.5 (M9): *This risk is not yet applicable as realization of enablers within pilots (according to project schedule) are still to be initiated* • At D2.6 (M18): *No symptoms detected*.
Name: Data standardization and interoperability (identified since Proposal stage) ***Description:*** The project has committed to be active in regards to standardization. In addition, the achievement of data interoperability in the to-be reference architecture for NGIoT is one of the most ambitious challenges. ***Potential consequences:***	***Mitigation measures:*** A specific task devoted to data interoperability has been envisioned to avoid this risk, and to create the most adequate data standardization, in order to homogenize the information provided by each pilot ***Additions in D2.5 (M9):*** A number of activities, involving data interoperability, have been envisioned within the project.

• As per D2.6 (M18): Misalignment with current standardization trends and technology, redounding in future (potentially uncomfortable) needed changes to the technical provisions. ***Likelihood + Severity:*** • At D2.5 (M9): *Low + Low* • At D2.6 (M18): *Low + Low* ***Notes in D2.5 (M9):*** . Project actively participates in CSA activities related to standardization. Moreover, one of members of the AB leads IEEE SAB and promised active help in standardization efforts. ***Notes after the latest execution period: M9-M18:*** Deliverable D9.3 reports about the standardization-related activity by the partners.	Moreover, a number of activities related to various aspects of standardization have been already undertaken. Hence, due to the direct involvement in these and, hence, awareness of existing standards, potential problems related to interoperability and data standardization can be avoided. ***Status:*** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected.*
Name: Security, privacy inline with the market (identified since Proposal stage) ***Description:*** Security, privacy, and trust design decisions are not aligned with the IoT market and standard trends, potentially causing the need of future improvement of the enablers. ***Likelihood + Severity:*** • At D2.5 (M9): *Low + Medium* • At D2.6 (M18): *Low + Medium* ***Notes in D2.5 (M9):*** Based on analysis performed by pertinent partners (CERTH and 21SEC) and Innovation Manager ***Notes in D2.6 (M18)*** DevSecOps methodology, as well as definition of security and privacy enablers have advanced in the period M9-M18.	***Mitigation measures:*** DevSecOps has been selected as the development methodology, in order to guarantee that security, privacy and trust are considered and in line with the market. Additionally, link with security agents will be kept as part of the impact. ***Additions after the latest execution period: M9-M18:*** DevSecOps methodology has been defined. Status: • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected.*
Name: Transversal enablers concept (identified during the 2nd iteration) ***Description:*** Lack of understanding of the concept of transversal enablers by stakeholders. The role of transversality (crossing planes) and functionalities that should be provided may be confusing to the potential end user.	***Mitigation measures introduced in D2.6 (M18):*** Providing a comprehensive documentation and usage examples e.g., in the context of pilot applications. A complete Wiki page per each enabler (Readthedocs of the project) has been created that is continuously updated.

Potential consequences: • As per D2.6 (M18): Lack of application and/or problems in applying transversal enablers by users of ASSIST-IoT solution, as well as identifying which transversal enablers are needed for each pilot. ***Likelihood + Severity:*** • At D2.6 (M18): *Low + Moderate* ***Notes in D2.6 (M18):*** Whereas the concept of horizonal enablers is quite intuitive, the idea and justification of transversal (or, better, vertical, as used in ASSIST-IoT) enablers is harder to understand.	Conducting integration between enablers and application of transversal enablers in pilots to verify and justified functionalities provided by them. ***Status:*** At D2.6 (M18): *Some symptoms detected but mitigation measures as well as communication with all stakeholders seem to be working.*
Name: Delays in enabler (software) development (identified during the 2nd iteration) ***Description:*** Delay in releasing PoCs and next versions of enablers may negatively impact integration activities and pilots implementation. ***Potential consequences:*** • As per D2.6 (M18): Delays in project execution, jeopardising the integration activities and unit and joint tests. ***Likelihood + Severity:*** • At D2.6 (M18): *Moderate + High* ***Notes in D2.6 (M18):*** This risk has appeared in the 2nd iteration as the enablers are advancing at different speeds and this period has been intensive in the development tasks. MVPs are being defined.	***Mitigation measures introduced in D2.6 (M18):*** Monitoring on task and WP level. Reporting on any problems and risks as soon as they are identified. Keeping Enablers status spreadsheet up-to-date. Organizing periodic telco on tasks and WP level. Having tasks registry with current statuses. Defining a series of "essential" enablers, first ballot artifacts that are considered top priority and that will be present in any ASSIST-IoT deployment. These enablers are prioritised whenever delays or blockages are a threat. Also, a global prioritisation structure has been created. This way, the most prioritised enablers will be given preference and their integration-deployment will be more protected. ***Status:*** At D2.6 (M18): *Some symptoms detected but mitigation measures proposed above promise to work. A relevant milestone will need to be carefully observed: Pilot deployment with integrated ASSIST-IoT enablers.*
Name: Integration issues (identified during the 2nd iteration) ***Description:*** Inconsistencies or incompatibilities while integrating enablers (incompatible technologies, versions, dependencies…) ***Potential consequences:*** • As per D2.6 (M18): Delays in project execution and/or reduced performance	***Mitigation measures introduced in D2.6 (M18):*** Monitoring on WP level. Regular technical meetings to report progress and discuss issues Dedicated testing and integration infrastructure to allow testing in real environment. This has already been put in place, although not completely exploited. ***Status:***

Likelihood + Severity: • At D2.6 (M18): *Moderate + High* ***Notes in D2.6 (M18):*** Although not explicitly mentioned above, it is also possible that "developing and/or testing environments" affect also to this risk.	At D2.6 (M18): *No symptoms detected. The actual "integration" has not started yet. At this moment, only PoCs of communicating enablers are in places, whereas most enablers have delivered at least a working version. It is expected that this riks might materialise to a larger scale during the next period (M18-M27).*
Name: UC-enablers compatibility (identified during the 2nd iteration) ***Description:*** Use cases may not be developed as already described due to the enablers are not totally developed yet ***Potential consequences:*** • As per D2.6 (M18): Leads to issues in the limited evaluation of the ASSIST-IoT architecture or delays on the pilot deployment. ***Likelihood + Severity:*** • At D2.6 (M18): *Moderate + Moderate*	***Mitigation measures introduced in D2.6 (M18):*** Formalisation and fine-tuning of the use case in accordance with requirements traceability matrix. Multi-round testing and integrations based on RTM ***Status:*** At D2.6 (M18): *No symptoms detected.*
Name: Isolated enablers (identified during the 2nd iteration) ***Description:*** All the enablers may not be interlinked and worked together under the ASSIST-IoT architecture. ***Potential consequences:*** • As per D2.6 (M18): This may introduce computing delays and dependencies that may negatively affect in ASSIST-IoT architecture ***Likelihood + Severity:*** • At D2.6 (M18): *Moderate + Moderate* ***Notes in D2.6 (M18):*** Compatibility issues may occur during the integration phase of the enablers.	***Mitigation measures introduced in D2.6 (M18):*** Developing enablers based on the needs of the ASSIST-IoT architecture and interaction with the collaborative enablers Multi-round testing in the phase of enablers integration and mapping of the required enabler per use case ***Status:*** At D2.6 (M18): *No symptoms detected.*
Name: Encapsulation exceptions (identified during the 2nd iteration) ***Description:*** Some enablers (due to the underlying technologies/libraries that they use) cannot follow the encapsulation rules set out for ASSIST-IoT enablers (k8s, Helm charts...).	***Mitigation measures introduced in D2.6 (M18):*** As long as they will be reachable from the network and interactable via APIs (this is the real important matter for those enablers), they will be able to be integrated.

Potential consequences: • As per D2.6 (M18): They are not able to be deployed via the smart orchestrator nor can be controlled the same way as the others from the manageability interface. ***Likelihood + Severity:*** • At D2.6 (M18): *High + Low* ***Notes in D2.6 (M18):*** Examples: MR enabler (HoloLens), and the actual manageability interface (the PUI9-based software is installed as-is in the host that will act as k8s master in the deployment).	The first mitigation strategy is to select as much as possible open technologies that had already been tested / used in similar deployment environments as those of ASSIST-IoT (K8s, Helm charts, DevSecOps, etc.). If this is not possible, as a second mitigation strategy, an external service (automated) interacting with such enabler (e.g., MR device) and exposing an API to be reached, is planned. ***Status:*** At D2.6 (M18): *Some enablers have already been detected as "encapsulation exceptions". See D3.6. No actual issue has derived from this risk yet.*
Name: Open Call integration (identified during the 2nd iteration) ***Description:*** Open Call winners integration require too much adaptation effort, having to re-design some enablers or to deliver ad-hoc technology, APIs... ***Potential consequences:*** • As per D2.6 (M18): Inner tasks of the project, including development of enablers might be delayed and/or even jeopardised. ***Likelihood + Severity:*** • At D2.6 (M18): *Medium + Medium*	***Mitigation measures introduced in D2.6 (M18):*** In the Open Call evaluation process, two steps within the whole flow consider the "intervention" of ASSIST-IoT technical partners to ensure that the proposed projects fit the plan and technological approach of ASSIST-IoT. In addition, a specific task in WP7 (T7.4) has been established to work together with Open Call participants. Specially at the beginning of their actions, it will be paramount to align their technical scope (communication protocols, technologies to be using, databases, integration approach, etc.) to minimise the materialisation likelihood of this risk. ***Status:*** At D2.6 (M18): *This risk is not applicable yet.*

3.3. Pilot risks

Table 4.Pilot related risks in ASSIST-IoT

Risk description, comments and potential consequences	Mitigation measures, corrective actions and status/comments per iteration
Name: KPI computation (identified since Proposal stage) ***Description:*** Unable to measure or compute the KPIs as planned ***Potential consequences:*** • As per D2.5 (M9): Ability to extract information and measures for pilots can be altered	***Mitigation measures:*** Due to unexpected factors, ability to extract information and measures for pilots and the project in general, in order to compute the KPIs, can be altered, thus leading to change and adapting the planning of KPIs calculation. ***Additions after the latest execution period: M9-M18:***

• As per D2.6 (M18): In case the defined KPIs for the pilots cannot be measured, the validation will be incomplete, and the project will not be able to verify the benefits of their developments ***Likelihood + Severity:*** • At D2.5 (M9): *Low + High* • At D2.6 (M18): *Low + Medium* ***Notes after the latest execution period: M9-M18:*** It is considered Medium (the severity) as D8.1 has served the good purpose of fine-tuning the KPIs and address the measurement strategies.	D8.1 has included a specific exercise of defining the specific measurement procedure that will be carried out for each KPI (surveys, benchmarking, analysis of results, acceptance methodologies, etc.). Drawing from this, D8.2 should be ready to start reporting about those KPIs, while the partners still expect some minor changes in other to accommodate for this risk to not materialising. ***Status:*** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *Some symptoms detected. Actions put in place through D8.1 are expected to overcome the potential materialisation of this risk.*
Name: Pilot description detail level (identified during the 1st iteration) ***Description:*** Detailed specification of pilots (performed in WP3) leads to realization that some goals / KPI's may be very difficult to reach. ***Potential consequences:*** • As per D2.5 (M9): Potential issues to complete the pilot goals (either too ambitious or too vague to work upon). • As per D2.6 (M18): Insufficent quality for finalising key tasks in the project – T3.2 and T3.3. ***Likelihood + Severity:*** • At D2.5 (M9): *High + Medium* • At D2.6 (M18): *Medium + High* ***Notes in D2.5 (M9):*** Based on self-assessment performed in M8, jointly by the PC and the TC.	***Mitigation measures introduced in D2.5 (M9):*** Analysis reaching beyond SotA (T3.1), seeking alternative solutions to be able to reach goals / KPI's. Establishing hierarchy of goals to be able to focus on realizing the most important ones (engineering 80:20 rule). Engaging Advisory Board and/or Project Officer and/or Project Reviewers to adjust the goals and KPIs in a way that will be satisfactory to all parties. ***Additions after the latest execution period: M9-M18:*** D3.2 has enriched the information that was contained in D3.2, making it more actionable and directly engaging current actions of the pilot owners to finalise the use-cases definition. ***Status:*** • At D2.5 (M9): *Some symptoms detected.* • At D2.6 (M18): *Less symptoms detected.*
Name: Global chip shortage (identified during the 2nd iteration) ***Description:*** The Global Chip Shortage will probably affect the delivery of procured equipment needed to: (i) produce the GWEN, (ii) carry out on-premise pilots. ***Potential consequences:***	***Mitigation measures introduced in D2.6 (M18):*** Flexible pilot procurement strategy, aiming at considering more than a single solution for carrying out pilots' trials At least two alternatives will be considered in order to have the HW on place on time. Status:

• As per D2.6 (M18): Delays and in the worst case failures on pilots deployment validation ***Likelihood + Severity:*** • At D2.6 (M18): *Medium + Serious* ***Notes in D2.6 (M18):*** Project partners are finalising the list of procured equipment that will be used in the pilots' trials.	• At D2.6 (M18): *Some symptoms detected.*
Name: Pilot's KPIs realization (identified during the 2nd iteration) ***Description:*** Detailed specification of pilots KPIs and requirements in WP3 may be very difficult to reach in real deployments in pilots ***Potential consequences:*** • As per D2.6 (M18): Leads to problems in pilot assessment and validation, risking the fulfilment of the expectations of the pilots. ***Likelihood + Severity:*** • At D2.6 (M18): *Low + Moderate* ***Notes in D2.6 (M18):*** Project partners are finalising the list of procured equipment that will be used in the pilots' trials.	***Mitigation measures introduced in D2.6 (M18):*** Engaging Advisory Board and/or Project Officer and/or Project Reviewers to adjust the goals and KPIs in a way that will be satisfactory to all parties. Reviewing all KPIs in D8.1, proposing the shift of some of them that seem unfeasible towards other (equally relevant) valid alternatives. The scope of the pilots is not being changed, but rather enhanced with the selection of more fine-tuned validation metrics to check/report. Establishing hierarchy of goals to be able to focus on realizing the most important ones (engineering 80:20 rule) ***Status:*** • At D2.6 (M18): *Some symptoms detected.*
Name: Port cartography (identified during the 2nd iteration) ***Description:*** BS-P1-1 requires the use of port terminal detailed cartography, which was initially assumed it was available but it has been realised that it is not. ***Potential consequences:*** • As per D2.6 (M18): The demonstration of BS-P1-1 would not be as accurate as possible due to not having an accurate provisioning of terminal layout ***Likelihood + Severity:*** • At D2.6 (M18): *Low + Moderate* ***Notes in D2.6 (M18):*** Project partners are finalising the list of procured equipment that will be used in the pilots' trials.	***Mitigation measures introduced in D2.6 (M18):*** Make use of open-source libraries available online. In case the pilot 1 partners are not able to obtain a very detailed terminal layout GIS map, they will make use of open source ortophotos provider such as OpenStreetMap or Mapbox ***Status:*** • At D2.6 (M18): *The risk that was not identified was realised due to its actual materialisation. With the proposed measures, the impact should be mitigated.*

Name: Port database access (identified during the 2nd iteration) ***Description:*** The port HW infrastructure is currently facing severe overloaded resource conditions ***Potential consequences:*** • As per D2.6 (M18): Until these very demanding conditions are relaxed, ASSIST-IoT development will not be able to be deployed in Pilot 1, or at least at the expected pace. ***Likelihood + Severity:*** • At D2.6 (M18): *Low + High* ***Notes in D2.6 (M18):*** Project partners are finalising the list of procured equipment that will be used in the pilots' trials.	***Mitigation measures introduced in D2.6 (M18):*** Act and plan with flexibility on Terminal Infrastructure, designing use cases PoCs and tests with relaxed needs of usage of the actual terminal equipment. Instead of accessing to the Production environment of the port terminal, Pilot 1 partners will set up a pre-production, controlled environment specific for the trials of the project. ***Status:*** • At D2.6 (M18): *Some symptoms detected.*
Name: Open Call deployment and pilots (identified during the 2nd iteration) ***Description:*** The proposals from Open Call winners differ too much from the goal of pilots' use-cases, preventing actual added value to be provided. ***Potential consequences:*** • As per D2.6 (M18): (i) Too many roundabouts must be taken, or (ii) ad-hoc infrastructure equipment must be provided for them, or (iii) too much effort is needed to be devoted from ASSIST-IoT stakeholders, deviating their focus from successing in the pilot. ***Likelihood + Severity:*** • At D2.6 (M18): *Low + Medium*	***Mitigation measures introduced in D2.6 (M18):*** In the Open Call evaluation process, one step within the whole flow considers the "intervention" of ASSIST-IoT stakeholders partners to ensure that the proposed projects fit the pilots' approach. In addition, the expert evaluators of the Open Call proposals have been specifically instructed to consider the "stickiness to pilot spirit and goals" as a paramount evaluation criterion. ***Status:*** At D2.6 (M18): *This risk is not applicable yet.*

3.4. Impact risks

Table 5.Pilot related risks in ASSIST-IoT

Risk description, comments and potential consequences	Mitigation measures, corrective actions and status/comments per iteration
Name: Lack of interest (identified since Proposal stage)	***Mitigation measures:***

Description: Lack of interest in the project results by external stakeholders. ***Potential consequences:*** • As per D2.5 (M9): Lead to problems in applying successfully the impact plans and meeting the set KPIs ***Likelihood + Severity:*** • At D2.5 (M9): *Low + Low* • At D2.6 (M18): *Low + Low* ***Notes in D2.5 (M9):*** Based on responses to the result dissemination as performed within the scope of WP9. ***Notes after the latest execution period: M9-M18:*** All events organised by the project (Webinars, surveys with stakeholders, Open Call landing acceptance, etc.) have been reasonably followed by the community and all KPIs are under control.	Targeted dissemination and communication plans focused mainly on industry and academia will be provided, elaborating further the core ASSIST-IoT impact plans (D9.2), for raising external stakeholders' awareness and increasing interest in results ***Additions in D2.5 (M9):*** They will be systematically evaluated and adapted (through upcoming WP9 deliverables), to assure successful results sharing and impact. ***Additions after the latest execution period: M9-M18:*** Closely following, executing and adapting the impact plans described in D9.2. New, updated content is being continuously generated and communicated through all ASSIST-IoT channels on a daily basis. Quarterly issued ASSIST-IoT Newsletter is communicated through website and ASSIST-IoT social media channels addressing 1000+ website visitors and social media followers. Interaction with other projects is continuous through events, associations and impact task forces. **Status:** • At D2.5 (M9): *No symptoms detected.* • At D2.6 (M18): *No symptoms detected. KPIs are meeting expectations in global lines.*
Name: Underperformance in scientific dissemination (identified during the 1st iteration) ***Description:*** There is the risk that the project will fall short in achieving KPIs of scientific dissemination (e.g., 38 total publications by M36). ***Potential consequences:*** • As per D2.6 (M18): Less dissemination capacity, reduced impact outreach, weaker scientific baseline for further research. ***Likelihood + Severity:*** • At D2.5 (M9): *High + Low* • At D2.6 (M18): *High + Low* ***Notes in D2.5 (M9):*** Based on self-assessment performed in M8, jointly by the PC and the TC.	***Mitigation measures introduced in D2.5 (M9):*** Due to the COVID-19 a number of potential target conferences did not materialise (e.g. they were postponed or did not happen). Moreover, participation in online conferences has considerably lover impact in comparison with on-site conferences. Moreover, due to the, above mentioned, communication issues, resources have been devoted to delivery of core results, rather than dissemination-related activities. This problem has been spotted during M6 project review. In M9, the situation in this area is much better and it is still possible to "catch-up" with scientific dissemination; e.g. because travel resources have been preserved due to COVID-imposed travel restrictions. ***Additions after the latest execution period: M9-M18:*** The creation of "Technical Reports" has been enhanced, uploading to project's website any scientific article created even though it has not yet been accepted or

Notes after the latest execution period: M9-M18: This risk is the second one that has started to materialise. It has been spotted and is being monitored by the PC/TC and T9.2 leader.	published (pre-print). Attending conferences/workshops and making ASSIST-IoT presentations remain a top activity even in virtual format. In M18, the situation in this area is much better and from now on it is expected that scientific dissemination events will be resumed, where ASSIST-IoT presence is foreseen (e.g., IoTWeek2022, EU-IoT Hackathon, TRA2022). ***Status:*** • At D2.5 (M9): *Some symptoms have been spotted in M5-M8 and counter-measures applied.* • At D2.6 (M18): Situation is much better and more events and special issues are being tackled.
Name: COVID-19 impact for dissemination (identified during the 2nd iteration) ***Description:*** COVID-19 restrictions related to travelling and organisation of physical events ***Potential consequences:*** • As per D2.6 (M10-M11): COVID-19 may continue to restrict travelling and organisation of physical events, affecting in this way the impact activities of the projects (mainly the ones related to scientific dissemination and f2f communication through physical attendance of scientific events, workshops, exhibitions etc.). ***Likelihood + Severity:*** • At D2.6 (M10-M11): *Moderate + Moderate* • At D2.6 (M18): *Low + Moderate*	***Mitigation measures introduced in D2.6 (around M10-M11):*** Alternative types of communication and dissemination activities will continue to apply (as already done during the first period of the project) i.e participation in virtual events, use of digital content for enhancing communication. Impact activities will continue through participation in activities and events organised virtually. Most type of events offered a virtual type of organisation during the last two years. If physical events are not resumed, all partners will continue creating impact through digital channels and means ***Status:*** • At D2.6 (M10-M11): *Not possible to perform on-site dissemination. The risk is materialising.* • ***At D2.6 (M18):*** *By the time of closing this deliverable (D2.6 – M18), the situation with travelling and physical events is little by little resuming the pre-pandemic scenario, therefore the likelihood of this risk has been reduced to Low*

4. Conclusions

Every procedure settled in this document has been guided by highest quality considerations, from technical and management point of view, according to all ASSIST-IoT members.

Discussions that took place during the 1st Technical Meeting in September 2021 and the 3rd Plenary Meeting in February 2022 were considered valuable inputs increasing the number of risks as well as tracking re-evaluating and reporting on the already identified ones.

Some relevant reflections about the findings within this deliverable are:

- Total number of risks has moved from 19 in M9 (D2.5) to 31 in D2.6, which seems logical and by far not worrying considering the natural evolution of the project, where more technical (development, evaluation, research, etc.) activities are advancing.
- COVID-19 related risks (impact, dissemination and communication issues, physical events attendance) are diminished due to the removal of restrictions across Europe.

Reflecting on the day-to-day activities of the project (for the Risk Management Team, performing its activities under the task T2.2), this document intends to be a useful guide and ready to be updated as many times as necessary.

The main conclusion emanating from this deliverable is the current well "controlled" status of the identified risks, both administrative, technical, pilot-wise and related to impact creation. The risk management team is continuously monitoring the potential risks to be taking place in the project and suggesting actions in advance, for minimising their materialisation and negative impact likelihood.