

# AIMM

## **CELTIC-NEXT AIMM Project**

### **WP1: Project Management and Dissemination**

#### **Deliverable D1.5 – Final Activity Report**

**Authors: Hannah Taylor (BT), Arman Shojaeifard (InterDigital)**

Project Acronym: **AIMM**  
Project Full Title: **AI-enabled Massive MIMO**  
Project Coordinator: **Arman Shojaeifard (InterDigital)**  
Project Duration: **24 months (Oct. 2020 – Sep. 2022)**  
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#### **Abstract**

This report provides a summary of the activities from the work undertaken in CELTIC-NEXT AIMM project Work-Package 1 (WP1) on “Project Management & Dissemination”.

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## **Executive Summary**

This report describes the activities undertaken within the CELTIC-NEXT AIMM project Work-Package 1 (WP1) on “Project Management & Dissemination”.

The focus of this work-package is on the overall steering and co-ordination activities of the CELTIC-NEXT AIMM project.

For details on other work packages, please refer to the AIMM final public deliverables that are published at online.

This deliverable is supported by D1.6, which is the final report on the dissemination activities undertaken throughout the duration of the project.

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## Abbreviations

Abbreviation	Definition
<b>AI</b>	Artificial Intelligence
<b>AI/ML</b>	Artificial Intelligence/Machine Learning
<b>AIMM</b>	AI-enabled Massive MIMO
<b>BT</b>	British Telecommunications plc
<b>ETSI ISG</b>	ETSI Industry Specification Group
<b>IDE</b>	InterDigital Europe Ltd
<b>MIMO</b>	Multiple-input Multiple-output
<b>NBLS</b>	Nokia Bell Labs Stuttgart
<b>PCA</b>	Project Cooperation Agreement
<b>PCR</b>	Project Change Request
<b>RAN</b>	Radio Access Network
<b>RIS</b>	Reconfigurable Intelligent Surface
<b>UST</b>	University of Stuttgart
<b>WP</b>	Work Package

## 1. Summary of work carried out in WP1 (Project Management & Dissemination)

WP1 (Project Management & Dissemination) has taken care of the administrative tasks and the technical management of the project including the coordination of dissemination activities across the project. The timely kick-off of project activities and their overall coordination, ensuring participation from all project partners, contractual matters and the provision of collaborative tools are examples of the activity undertaken.

The timely preparation of Deliverables has been monitored throughout the duration of the project and quality checks have been conducted by the Project Coordinator. All project Deliverables and Milestones due in the project have been achieved as planned.

The major project management updates for the 2-year project in time order are:

- InterDigital Europe (IDE) were added as a self-funded partner - this was reflected in CELTIC-NEXT PCR#5, approved on 5<sup>th</sup> November 2020.
- CEMWorks from Canada were added as a new partner – this was reflected in CELTIC-NEXT PCR#6 which was approved on 15<sup>th</sup> February 2021. In addition, CELTIC-NEXT PCR#6 specified that the AIMM French cluster were inactive due to funding issues and the plans were modified accordingly.
- AIMM Project Consortium Agreement was executed with signatures from all ten active project partners across the three clusters.
- The French partners withdrew from the project due to a negative funding decision. This has been reflected in CELTIC-NEXT PCR#7 and the plan has been adjusted accordingly, specifically WP 4, Task 4.3 that was mostly covered by the French partners has been removed.
- Various project management processes were established to ensure the smooth running of the project such as key meetings, document templates, e-facilities and mailing lists. Further details on these can be found in subsequent sections of this document.
- Various dissemination was undertaken during the project including Intellectual Property creation, standards contributions, paper publications, press releases, newsletters etc. Further details can be found in D1.6 – Final Dissemination Report.

## 2. AIMM Project Overview and Work Package Structure

The AIMM project targeted radical performance improvements and efficiency dividends for 5G and beyond Radio Access Network (RAN) through advanced antenna array (Massive MIMO) and Reconfigurable Intelligent Surface (RIS) technologies powered through and managed by the latest advancements in AI.

- The AIMM project was divided into six tightly coupled work-packages (WPs) as illustrated in Fig. 1 below: WP1 provided the overall project management and dissemination activities. Led by Arman Shojaeifard (IDE) and supported by Hannah Taylor (BT).
- WP2 provided use case definitions including key-performance-indicators which drove comparisons between new and existing architectural approaches. Led by Adrian Sharples (BT).
- WP3 focused on the benefits and practical realisation of extremely large antenna arrays and intelligent radio surfaces. Led by Arman Shojaeifard (IDE).
- WP4 considered the design and implementation of AI/ML-based radio interface technologies. Led by Stephan ten Brink (UST).

- WP5 considered enabling frameworks and algorithms for AI-based RAN intelligence and automation.  
Led by Rui Inacio (Vilicom).
- WP6 focused on the building of standards-compliant testbeds for assessing and demonstration of the technical solutions.  
Led by Milan Zivkovic (NBLs).

This structure of the work packages was designed to maximise interaction between different work areas while maintaining each package with a clearly defined goal and output.

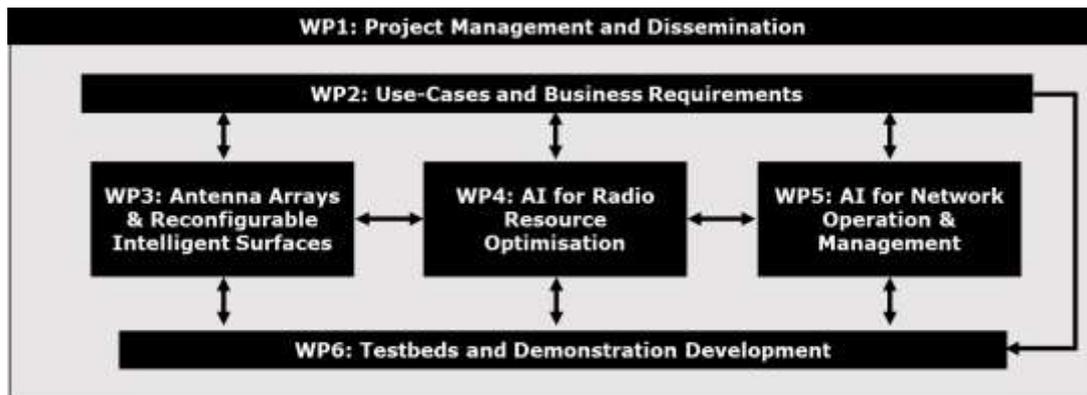


Fig. 1: AIMM project work-package structure.

The areas of interaction between the AIMM technical work packages are presented in Figure 2 as shown below:

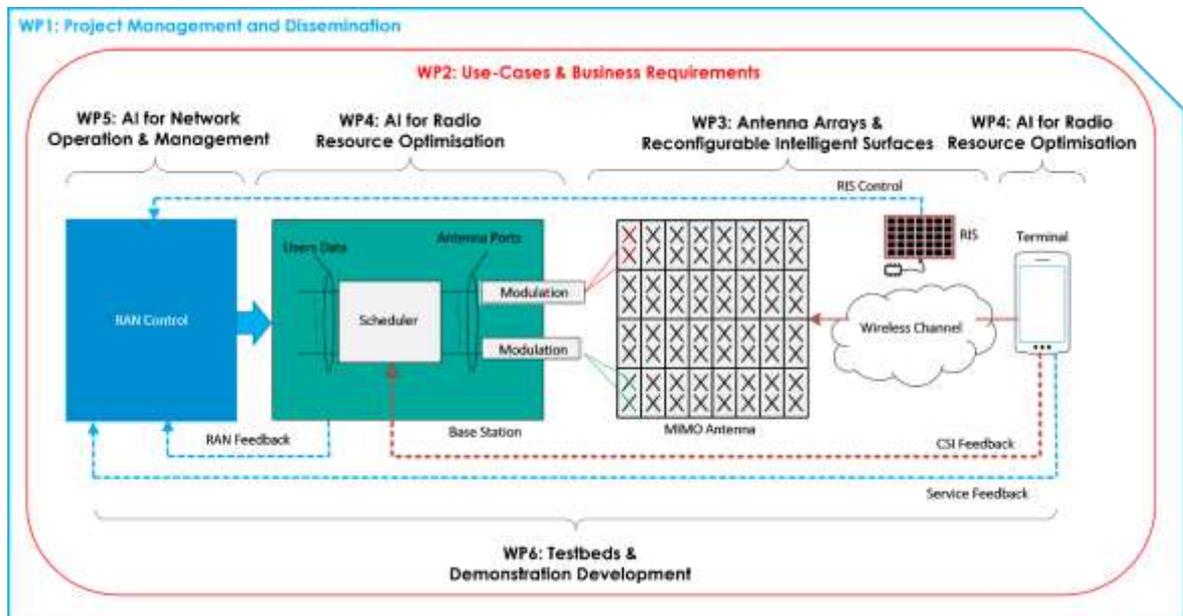


Fig. 2: AIMM work-package structure relationships.

### 3. AIMM Project Management Roles & Responsibilities

The AIMM Management Team comprised of the “Project Coordinator” and the “Work Package Leads”. In addition, there were “Local Country Partner Leads” who were responsible for interactions and meeting reporting requirements/reviews determined by the individual local funding bodies.

#### **Project Coordinator Responsibilities:**

- Supervised the overall technical progress of the project
- Organised and chaired monthly WP leadership meetings, plenaries, and quarterly reviews
- Maintained project workspace (on OnlyOffice), AIMM website, dissemination, and database for IPR control
- Reviewed project deliverables and acted as the main contact to CELTIC Office including raising any PCR's
- Quality sign-off on all work package deliverables

#### **Work Package Lead Responsibilities:**

- Created and maintained a WP execution plan and risk register
  - Tracked and update tasks, milestones, and deliverables
  - Responsible for the directing of the WP participants
- Coordination
  - Organised regular calls with the participants (biweekly or monthly as appropriate)
  - Overall co-ordination of deliverables
  - Track WP progress and update Execution plan and risk register as appropriate
- Reporting
  - Produced a short monthly report for the WP Leadership meetings

#### **Country Partner Lead Responsibilities**

- Led on fulfilling the reporting/review requirements determined by the local country funding bodies
- Raising any PCR's if required with the local funding bodies

### 4. AIMM Meetings & Reviews

There were several meetings and reviews during the project duration as per description below:

- **Leadership Meetings**
  - Monthly coordination calls between Project Coordinator and WP Leads
  - Quarterly review calls with all Partner Leads (as required)
- **Work Package Coordination Meetings**
  - Each WP had their own regular co-ordination calls, chaired by the WP Leads to discuss the technical activities and monitored progress of technical work and corresponding milestones and deliverables.
- **Consortium-wide Meetings**
  - Quarterly Plenaries – these are held with all project participants. These covered a high-level project update, technical updates from each partner and specific technical sessions on relevant subjects.

In addition, consortium wide briefings were issued as and when appropriate to report major project achievements, changes etc to all participants in the project

The following key project meetings/communications have occurred throughout the duration of the project

Event	Date/Venue	Purpose	Participants
Project kick-off meeting	29/10/2020 - Teams	Start of the project	All project participants
AIMM Plenary #1	25/01/2021 - Teams	Full plenary	All project participants
AIMM Plenary #2	27/04/2021 - Teams	Full plenary	All project participants
AIMM Plenary #3	21/07/2021 - Teams	Full plenary	All project participants
AIMM Plenary # 4 / CELTIC Next Mid Term Review	29/11/2021 - Teams	Full plenary	All project participants [CELTIC NEXT Reviewers / funding bodies (Optional)]
AIMM Plenary # 5	23/02/2022 - Teams	Full plenary	All project participants
AIMM Plenary # 6	21/06/2022 - Teams	Full plenary	All project participants
AIMM CELTIC NEXT Final Review / Final Plenary	29/11/2022 – Teams	Final Review	All project participants [CELTIC NEXT Reviewers / funding bodies (Optional)]

## 5. AIMM Management Tools

Several project management tools were deployed to support project work. These includes:

- Several **mailing lists** (all partners, one per WP, consortium-wide etc.) were set-up to manage communications across the consortium
- A **workspace (OnlyOffice)** was created for the project for Document Storing
- A **dissemination tracker (KPI) tool** was created to track all dissemination activities across the project
- A project **Logo** was developed to use across all dissemination activities
- **Templates** for project documents were created including templates for deliverables and presentations.

## 6. AIMM Milestones & Deliverables (all work packages)

The following tables outlines the key deliverables and milestones across all work packages in the CELTIC-NEXT AIMM project. All final deliverables are publicly available online.

WP	WP ID:	Deliverables Title and short description	Month	Planned Month	Status
<b>WP1</b>		<b>Project management and dissemination</b>			
	IR1.1	Project description		1	
	IR1.2	PCA - Project Cooperation Agreement		5	Final CA signed off on 29/04
	D1.1	Project presentation (public project description)		4	Issued
	D1.2	Public project website		5	
	D1.3	Interim activity report		12	Issued
	D1.4	Interim dissemination report		12	Issued
	D1.5	Final activity report		24	Issued
	D1.6	Final dissemination report		24	Issued
<b>WP2</b>		<b>Use-cases and business requirements</b>			
	M2.1	Interim material for D2.1		6	Issued
	D2.1	Business requirements, techno-economics, and security covers T2.1, T2.2		9	Issued
	M2.2	Interim material for D2.2		13	Issued
	D2.2	Background to AI-enabled 5G networks covers T2.3, T2.4		15	Issued
	M2.3	Interim material for D2.3		18	Issued
	D2.3	Final reviewed document with additional section covering technology dissemination recommendations and advising on the use of the developed technology to tackle real world practical problems.		24	Issued

<b>WP3</b>		<b>Antenna arrays and reconfigurable intelligent surfaces</b>		
3	M3.1	Interim material for D3.1.	6	Issued
	D3.1	Antenna array geometries, reconfigurable intelligent surfaces, and power amplifier enhancements (preliminary results). Covers all WP3 tasks; interim internal report.	12	Issued
	M3.2	Interim material for D3.2.	18	Issued
	D3.2	Antenna array geometries, reconfigurable intelligent surfaces, and power amplifier enhancements. Covers all WP3 tasks; final public deliverable.	24	Issued
<b>WP4</b>		<b>AI for radio resource optimisation</b>		
4	M4.1	Interim material for D4.1	6	Issued
	D4.1	AI for Radio Resource Optimisation – Initial Results. Covers all WP4 tasks; interim internal report.	13	Issued
	M4.2	Interim material for D4.2	18	Issued
	D4.2	AI for Radio Resource Optimisation. Covers all WP4 tasks; final public deliverable.	24	Issued
<b>WP5</b>		<b>AI for network operation and management</b>		
5	M5.1	Interim material for D5.1.	6	Issued
	D5.1	AI for network operation and management – Initial Results. Covers all WP5 tasks; interim internal report.	13	Issued
	M5.2	Interim material for D5.2.	18	Issued
	D5.2	AI for network operation and management – Final Results. Covers all WP5 tasks; final public deliverable.	24	Issued
<b>WP6</b>		<b>Testbed and Demonstration Development</b>		
6	M6.1	Successful design of a flexible network architecture.	7	Issued
	M6.2	Successful development of the centralized testbed.	13	Issued
	D6.1	Report on development of centralized testbed and baseband modules design for cell-less testbed. Covers WP6 Tasks 1-2; interim internal report.	14	Issued
	M6.3	Successful development of the cell-less testbed.	17	Issued
	D6.2	Successful evaluation and demonstration of the AIMM testbeds and capturing real-data set information. Final public report.	24	Issued

### 6.1 Deliverable Sign-off Process

A sign-off process for all milestones/deliverables was established. The production of the milestones/deliverables was the responsibility of the WP Lead who completed a final review of the deliverable 2 weeks in advance of the deliverable due date. The milestone/deliverable was then submitted, reviewed, and signed off by the project co-ordinator. All submitted milestones/deliverables are stored on the project document storage system (OnlyOffice).

## 7. AIMM Project Risks

The AIMM project identified risks at the start of the project and maintained a risk register. The risks were reviewed in monthly leadership meetings.

The key risks were, and associated mitigation plans as per detailed below

### 7.1 Commercial, managerial, and ethical risks

The following summarises the key risks on the project.

**1. Partner withdrawal:** this will be handled by a specified process in the Consortium Agreement, with the involvement when required of company lawyers.

**2. Lack of funding:** if partners fail to join at all or only in part through self-funding because of funding failure, different reduced project scope based on all possibilities have already been identified and will be executed accordingly.

This risk was realised with the removal of the French cluster

**3.Partner under-performance:** this will be handled initially by the appropriate WP leader, with the involvement of the Technical Manager when required. A formal escalation process will be specified in the Consortium Agreement.

4. There may be **ethical issues** regarding the use of confidential data as inputs to AI algorithms; this is foreseen as a very low risk as the AIMM testbeds will not collect or use personal data. Most AIMM AI algorithms will use purely technological data. Ethics issues, should they arise, will be handled in accordance with the partners' ethics policies.

## **7.2 Technical risks**

**1.Inability to develop required theoretical models:** this will be mitigated by a continuous monitoring process, a responsibility of WP leaders. In the worst case, a change of direction of the theoretical methods will be allowed under the project plan.

**2. Testbed failure** due to over-ambitious targets, or equipment incompatibilities: these risks will be required to be tracked by the partner hardware specialists, with a table of potential solutions identified at an early stage of the planning process.

**3.Failure of critical resources** (such as expertise or data sets): in such cases the project manager and technical manager, in consultation with WP leaders, will decide a minimal alteration of the project targets.

## **8. Overview of deviations / delays of project activities and remedial actions**

There were no significant delays or deviations in the project activities.

## **8. Resources & Spending**

Given this is a CELTIC-NEXT project, resourcing and spending was managed at the local country level and was the responsibility of the lead partner to liaise with the relevant funding body should any resourcing/spending variations arise. Funding bodies determined the financial reporting requirements and associated claims/audit procedures.

This aspect is not managed by the Project Coordinator.

## **9. AIMM Dissemination**

An AIMM dissemination tracker (KPI's) was maintained by the Project Coordinator. The tracker was reviewed in the leadership team meetings and updated as an when dissemination activities took place.

A project website was created and served as a key tool for public dissemination- <https://www.celticnext.eu/project-aimm/>. The website was managed by WP1 with contributions being provided across the AIMM project community.

The project has been very active in disseminating the results of the 24-month project in a variety of ways, including patent applications, paper publications, publication of over-the-air channel datasets, simulation codes, standards participation and contributions, newsletters, press releases, workshops, and industry talks/panels.

All relevant externally approved dissemination documents are published on the [AIMM project website](#).

Please refer to D1.6 - Final Dissemination Report.

## **10. Conclusion**

The work in WP1 has progressed in accordance with the AIMM Project Plan.

