



Improving Air Traffic Management through machine learning collaboration on private data sets

Presentation of Poster of Project # 894162 in the SESAR 2020 Exploratory Research
Topic SESAR-ER4-2019 - Digital Information Management (DIM)
Full project title: *A platform for privacy-preserving Federated Machine Learning
using Blockchain to enable Operational Improvements in ATM*

Project site:
www.aichain-h2020.eu

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*This project has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 894162.
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SESAR JU members other than the Union.*



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GOALS AND CONCEPT PROPOSED



MOTIVATION:

Air traffic management (ATM) can greatly benefit from **cyber-secured exploitation of large private data sets** belonging to different stakeholders.

The EU-funded **AICHAIN project** is proposing an **innovative digital information management (DIM) concept** that will help exploit those valuable private datasets through machine learning collaboration on private data sets with no exchange of sensitive data. The project aims to address technical and motivational barriers.

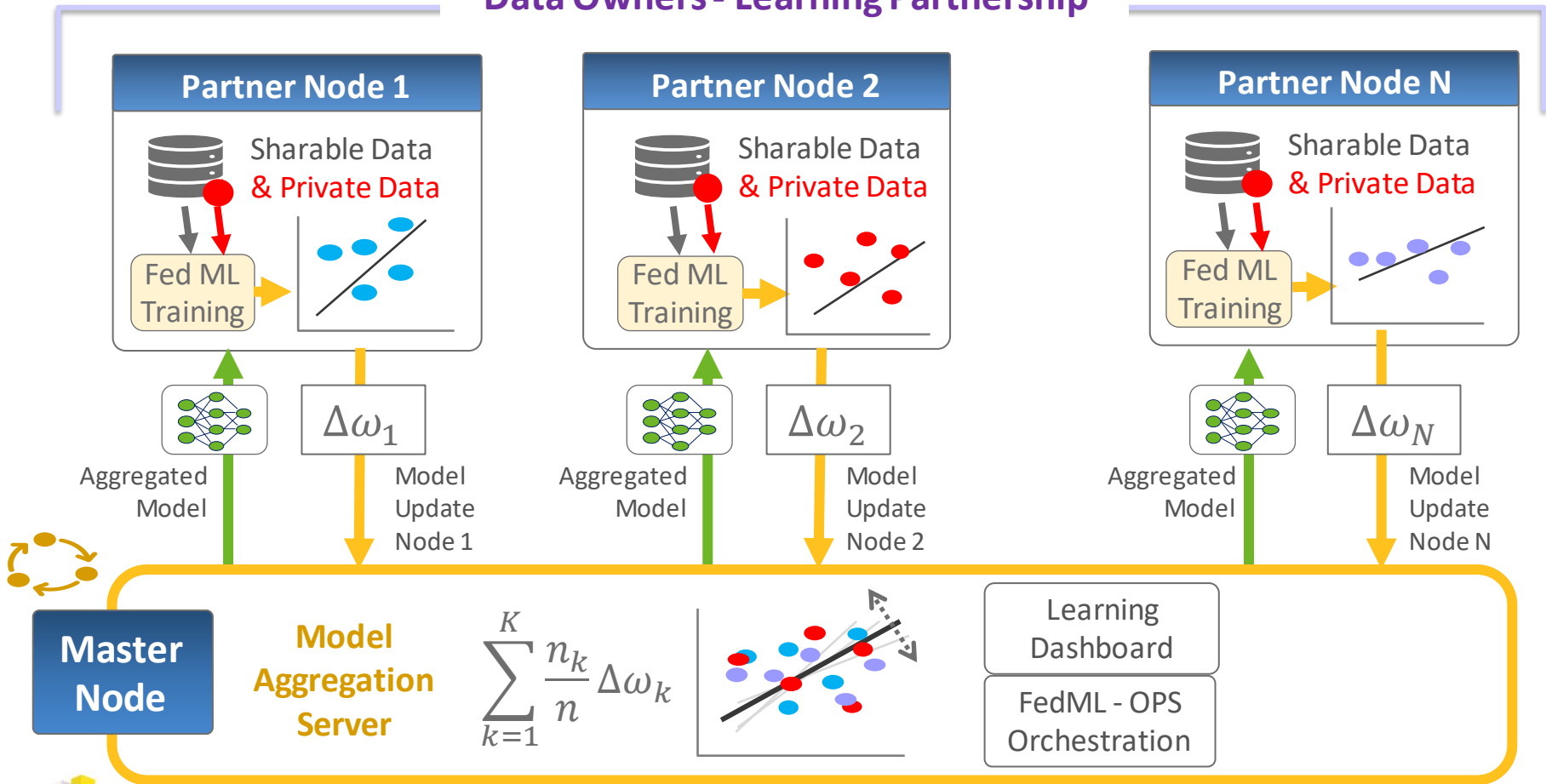
CONCEPT PROPOSED:



THE FEDERATED LEARNING CONCEPT

FedML consist in sharing the ML models instead of the data, and training them in a federated way (i.e., distributed and collaborative). Only the ML parameters locally trained are shared and then aggregated in the master node.

Data Owners - Learning Partnership



Technical Solution in ATM context

Digital Information Management (IT systems) viewpoint



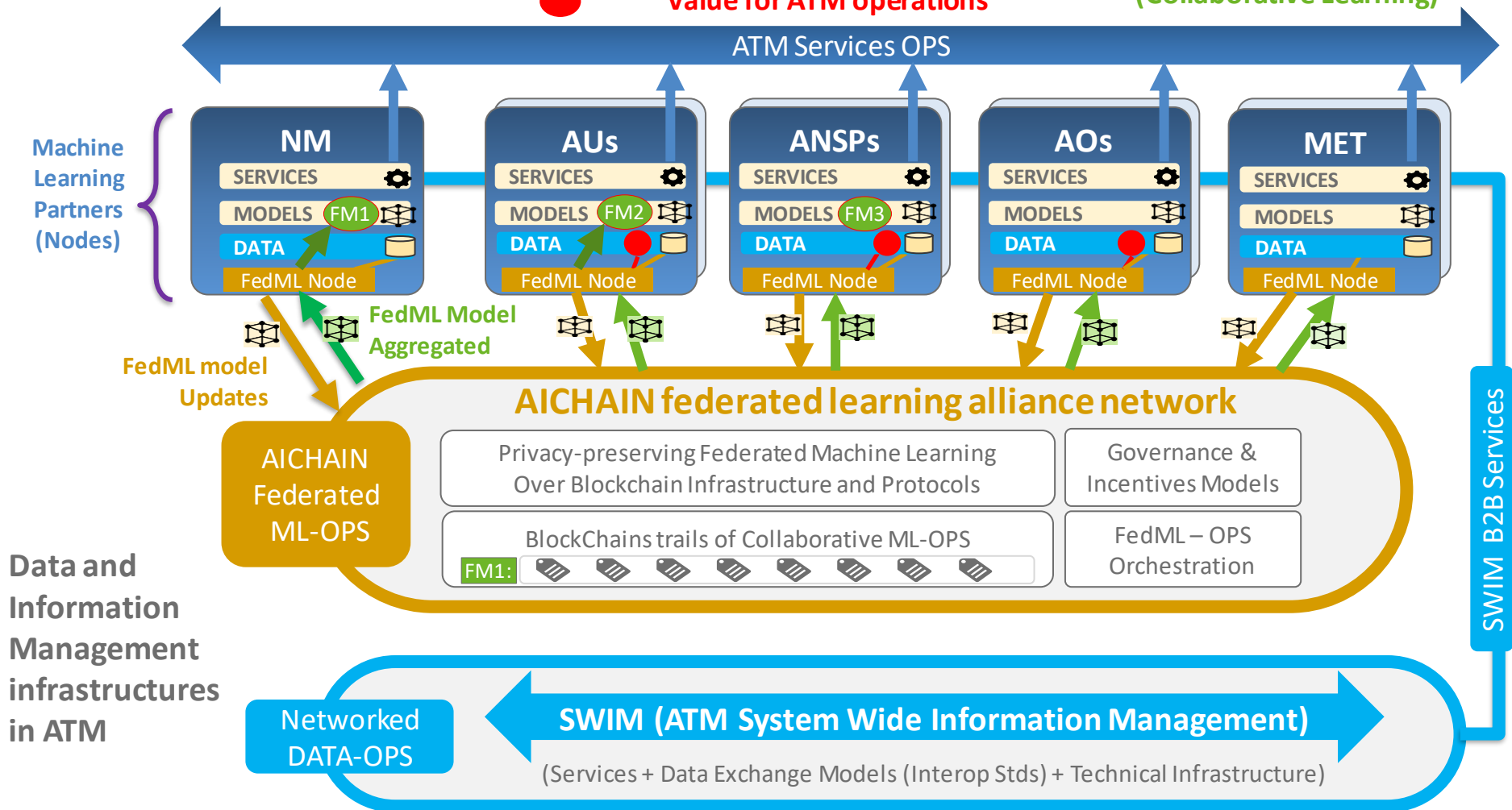
ATM USERS & STAKEHOLDERS



Siloed Private data with value for ATM operations



Federated Models (Collaborative Learning)



Data and Information Management infrastructures in ATM



Research Areas and Methodology



Research Question



Topics researched



Research Answers

Tech Area



AICHAIN Technology Solution Architecture and Experimental Prototype

- 1** **Is the AICHAIN enabler feasible?**
 (i.e., is it possible to exploit information in a federated way while preserving trust, cyber-security and scalability?)

Target Architecture

Experimental Prototype

Experimental Evidence Of Cyber Security, Trust, Privacy protection



ATM Ops Area



Operational Value experiments and analysis with an ATM Use Case

- 2** **Does the solution bring operational value to ATM?**

(i.e. can AICHAIN help to improve the ATM performance e.g. capacity, cost-efficiency, predictability, etc.?)

Use cases selected within Demand Capacity Balancing (DCB) Operational Focus Area.

Data Sets for FedML Experiments

ATM Operations Predictability

ETOT Prediction

Impact of DCB

AUs reaction to DCB measures

Experimental Evidence Of Operational Improvements (in a DCB use case)



Gov. Area



Governance and incentives Models

- 3** **Will data owners be motivated to share data value?**

(i.e., which potential incentive mechanism could be implemented in future research?)

Rules for participants

Participant benefits

Incentive instruments

Equity & Access

Regulation compliance

Expert Panel Qualitative Validation Workshops



Expected Outcomes of the Project



1. **AICHAIN Architecture proposal** (as a potential new SESAR Technological Enabler for multiple Operational Improvements and ATM use cases with federated machine learning)
2. **A functional prototype** (to proof the feasibility of federated machine learning while ensuring data privacy protection and trust and enable ATM use cases experimentation)
3. **Proof of potential operational benefits with an ATM use case** (quantitative & qualitative evidence of private data value)
4. **Governance & incentive scheme and mechanisms** (definition and validation with expert panel workshops, towards the smooth integration and use of the AICHAIN enabler in operations)





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Thank you very much fo your attention!

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