Second PEPR-NF FITNESS workshop

Industrial IoT: from theory to industrial applications

Monday, 17th March 2025

Online via Teams (no registration required): click here

contact : nicolas.cassiau@cea.fr

Agenda (CEST)

13:30 – 13:35 : introduction (Nicolas Cassiau, CEA)
13:35 – 14:55 : presentations #1 to #4 (15' + 5' Q&A, each)
14:55 – 15:10 : pause
15:10 – 16:30 : presentations #5 to #8 (15' + 5' Q&A, each)
16:30 – 17:00 : Questions, answers and discussion with presenters

This workshop brings together researchers and industry professionals to explore the latest advancements and challenges in the field of Industrial Internet of Things (IIoT).

The integration of the IoT into industrial settings promises unprecedented levels of efficiency, innovation, and connectivity. Over the course of this event – collaboration between academic researchers and industrial practitioners – participants will delve into a diverse range of topics, from the **academic underpinnings** of IoT technologies (presentations #1 and #2) to their **real-world applications** in industrial environments (presentations #7 and #8) through **architectural evolutions** (presentations #3 and #4) and **experimental testing** (presentation #5). **Use cases** is a critical step in the development and deployment of IoT systems, as it enables stakeholders to understand the specific requirements, constraints, and expected outcomes of IoT applications; this will be addressed in presentation #6.

This workshop is an opportunity for attendees to gain a comprehensive understanding of the current landscape of Industrial IoT, network technology requirements, and the strategic planning necessary for successful implementation. Whether you are a researcher seeking to expand your knowledge, an industry professional looking to apply new technologies, or simply an enthusiast eager to learn about the future of industrial innovation, this workshop promises to provide valuable insights and foster meaningful connections.

Presentation #1

Presenter: Hiba Dakdouk

Affiliation: CEA-Leti

Title: Queue-Aware Multi-Armed Bandits for Wireless Remote Control in Industrial IoT

Summary: In industrial IoT (IIoT), the primary goal is to reduce human involvement within industrial processes. This requires a tight integration of automatic control systems and communication technologies in order to support various application areas, such as intelligent traffic control systems and automatic warehouse management systems. Multi-armed bandit (MAB) algorithms have proven their effectiveness as a robust framework for solving control problems. In this workshop, we present the use of MAB algorithms to control remote devices, which faces considerable challenges primarily represented by latency and reliability. We analyze the effectiveness of MABs operating in environments where the action feedback from controlled devices is transmitted over an unreliable communication channel and stored in a Geo/Geo/1 queue. As an extension, we discuss the effects of physical layer configuration on wireless remote control.

Presentation #2

Presenter: Filip Maksimovic

Affiliation: Inria-Paris, AIO team

Title: Low-power networks for the future of industrial IoT

Summary: In this talk, I will present recent innovation in the "smart dust" vision of millimeter-scale wireless sensors, which is primarily an academic endeavor, and the barriers stopping this vision from being compatible with the industrial IoT, including a discussion of standards compatibility, robustness, and security.

Presentation #3

Presenter: Siwar BEN HADJ SAID

Affiliation: CEA LIST

Title: 5G-TSN Integration for Deterministic Industrial Communication

Summary: The deployment of private 5G networks in factory should be able to guarantee deterministic performance for industrial automation systems with strict requirements . This presentation explores the convergence of 5G cellular networks and Time-sensitive networking (TSN) to address critical challenges in industrial communication. The proposed approach explores the use of TSN standards to achieve stable and precise end-to-end time synchronization as well as bounded latency. The study examines key integration mechanisms, including time synchronization protocols, quality of service mapping, and radio adaptation strategies, to support these emerging industrial applications.

Presentation #4

Presenter: Alexander PELOV, Amina MOKDAD

Affiliation: IMT Atlantique, IRISA

Title: Introduction to SCHC and its integration in 5G.

Summary: This presentation introduces Static Context Header Compression (SCHC) and its application areas, with a focus on its use in 5G. An architecture for integrating SCHC into 5G will be detailed, followed by a use case in IIoT.

Presentation #5

Presenter: Fatma LTAIEF

Affiliation: IMT Nord Europe

Title: Simulation environment for experimenting with 5G signal mapping strategies using autonomous robot.

Summary: Experimenting with new robotic solutions is costly because developments must be placed in real situations to validate the effectiveness of robotic system behaviors. While simulation does not completely eliminate the need to experiment with real robots, it does reduce this need, thereby significantly accelerating development phases. Here, we are interested in a system's ability to map telecommunication capabilities in an indoor environment, particularly using a 5G technology base with one or more private antennas located outside the building. To achieve this, we need to couple robotic simulation with 5G simulation. The goal is to characterize the gap that may exist between the same experiment conducted in a simulated environment and a real environment.

Presentation #6

Presenter: Mihia KASSI

Affiliation: Mines Saint-Etienne

Title: Industry 4.0 Use Cases: Network Technology Requirements and Decision-Support Grid

Summary: The digitalization of industry faces several challenges with respect to the use of network technologies and IIoT. Based on Industry 4.0 use cases, we analyze their network requirements (e.g., packet size, throughput, latency). Building on this study and the technical capabilities of existing network standards, we propose a decision-support grid to help industrial stakeholders make informed choices regarding the most suitable network technologies for each use case.

Presentation #7

Presenter: Yoann Corre

Affiliation: SIRADEL

Title: Optimizing IIoT Radio Layer Performance with Ray-Tracing Technology: Insights from Industrial Applications

Summary: The performance of the radio layer can be effectively evaluated or optimized through virtual tests implementing realistic IIoT scenarios. At the heart of SIRADEL's testing solutions, ray-tracing technology, once properly calibrated, allows for the simulation of radio channel behaviors across a wide range of scenarios, whether for communication links or sensing. The synthetic data generated can be used for learning, evaluation, sizing, or deployment. Several examples will be provided, which have been carried out in an industrial environment.

Presentation #8

Presenter: Cédric Thiénot

Affiliation: Firecell

Title: 5G Geolocalisation for IoT

Summary: Presentation of the use of 5G Geolocation functionality for IoT devices.