Review 6th Fed4FIRE+ Open Call MOTIVE

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Dilution

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Outline

1. Experiment Description

MOTIVE

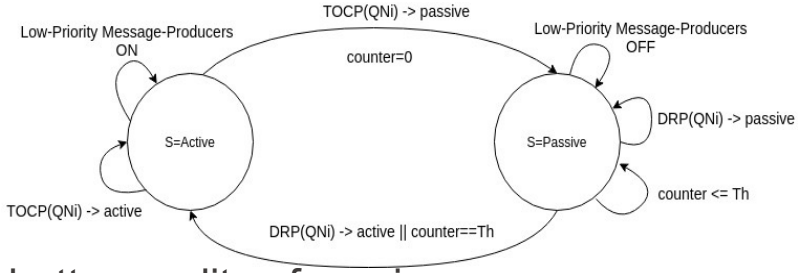
TIME - OPTIMIZED CONTEXTUAL INFORMATION FLOW ON UNMANNED VEHICLES

1. Experiment Description

1.1 CONCEPT & OBJECTIVES

MOTIVE:

- is a framework that uses a stochastic optimization model based on Optimal Stopping Theory **(OST)**,
- monitors quality network indicators **(QNI)** such as Packer Error Rate (PER) and Latency,
- enables two states: **Active** and **Passive**,
- enables to select **high** and **low** priority messages



Objectives

i) critical information delivery with low latency **ii)** better quality of service

iii) resource conservation **iv)** reduced RTL (Return To Launch mode) probability

1. Experiment Description

1.2 BACKGROUND AND MOTIVATION

- Internet of Things (IoT) → sensors, actuators and unmanned vehicles
  - Are UxVs sensors?
- UxV application is constanly rising → mobile IoT
- Network conditions are not always ideal
  - Mission failure
  - Device safety

MOTIVE addresses:

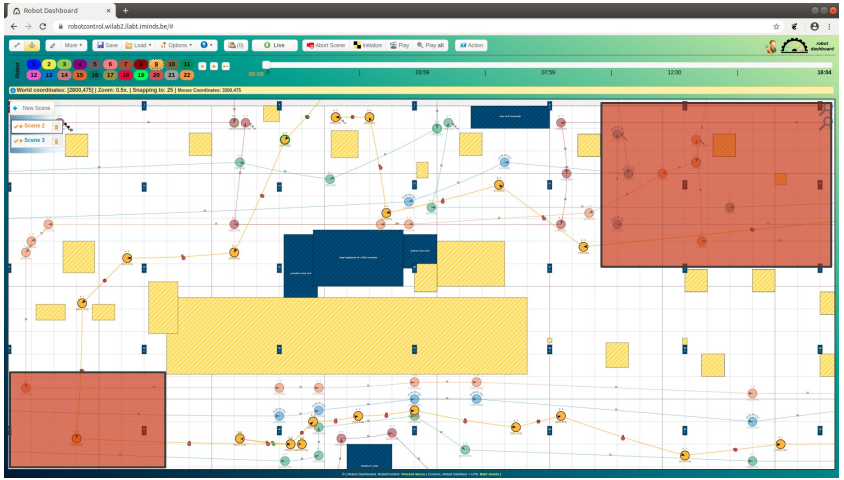
1. Continuous Operation of Drones
2. Operations Beyond the Visual Line Of Sight (BVLOS)
3. Good perfomance with no prior knowledge of the area / network
4. Any kind of vehicle (aerial, ground, sea) but also static nodes

1. Experiment Description

1.2 EXPERIMENT SET-UP

MOTIVE experiment requirements:

1. Mobile nodes with a planed path
2. Saturated network conditions in specific areas
3. Local and cloud servers running instances of Apache Kafka

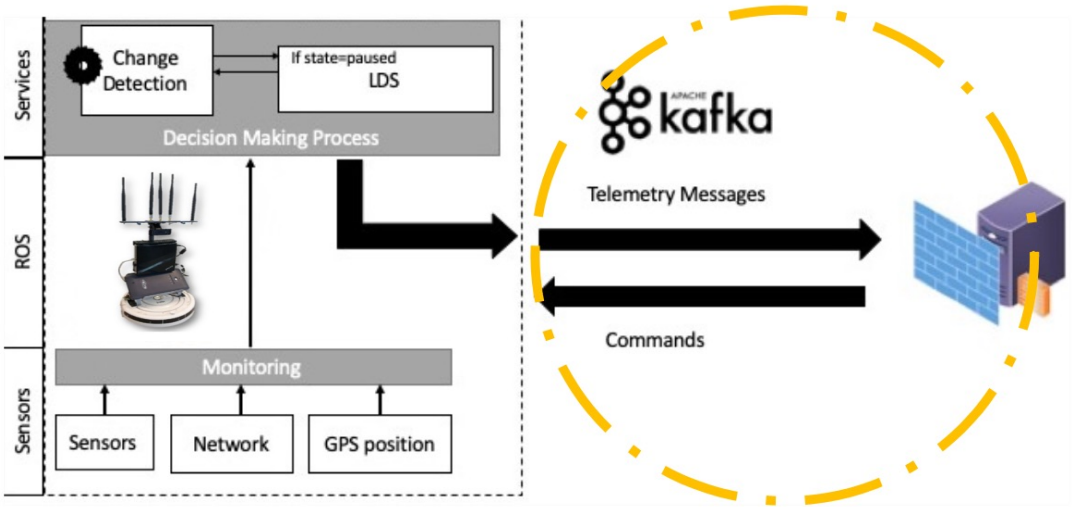


1. Experiment Description

1.2 EXPERIMENT SET-UP

Experiment Profile:

- 3 different scenarios with 1 - 5 mobile nodes
- 12 zotac & 2 NUCs
- 5 policies



2. Project Results

MOTIVE

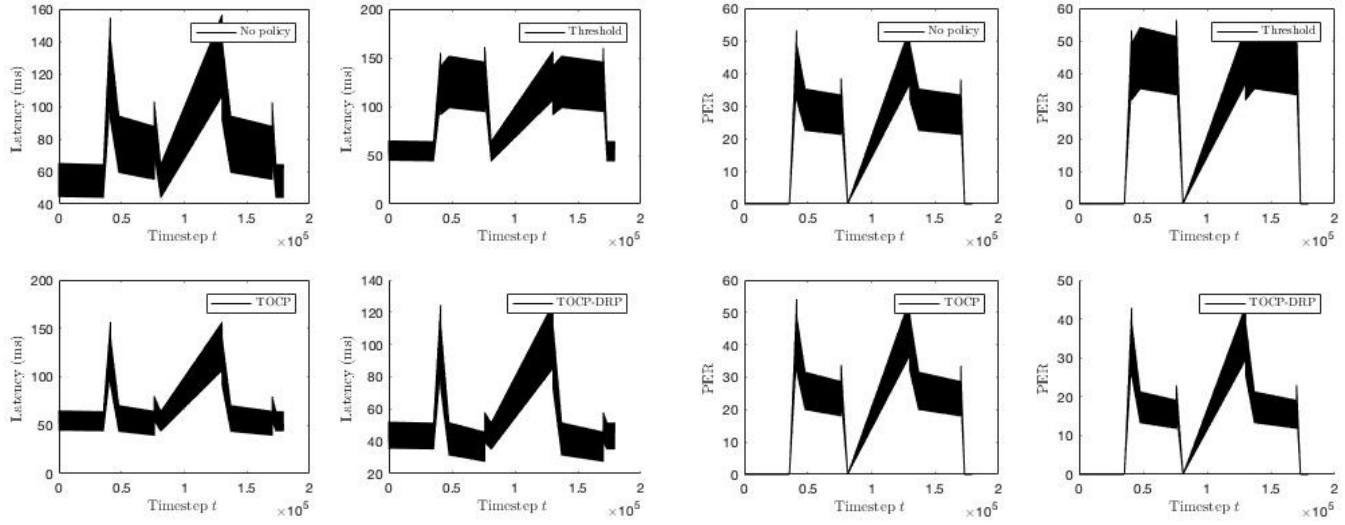
TIME - OPTIMIZED CONTEXTUAL INFORMATION FLOW ON UNMANNED VEHICLES

2. Project Results

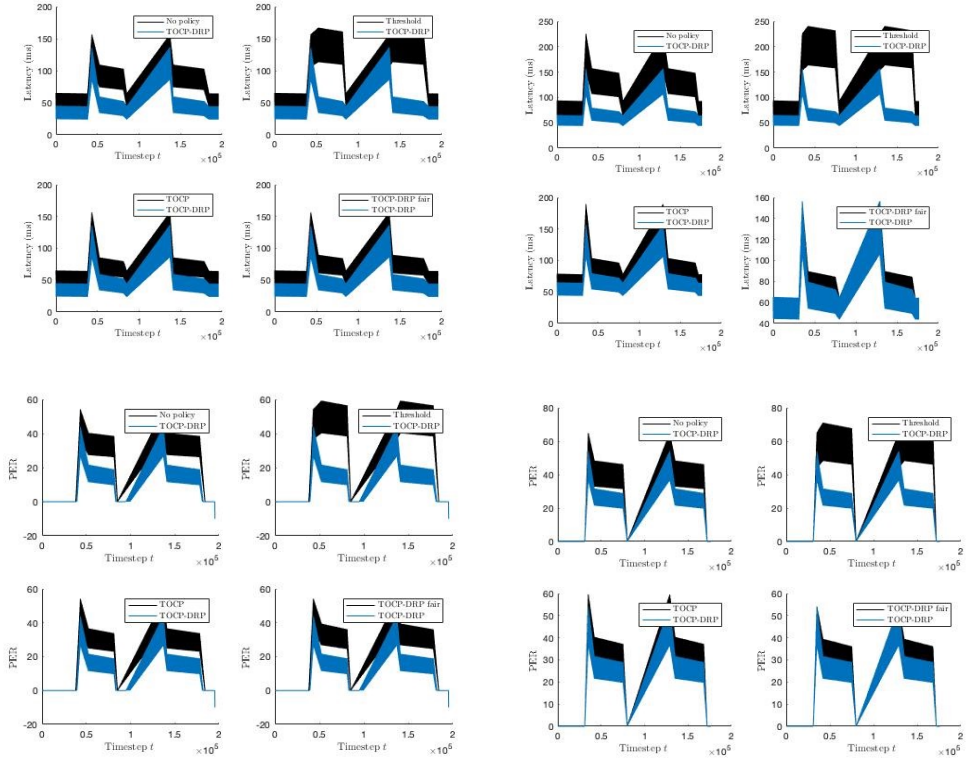
2.1 MEASUREMENTS

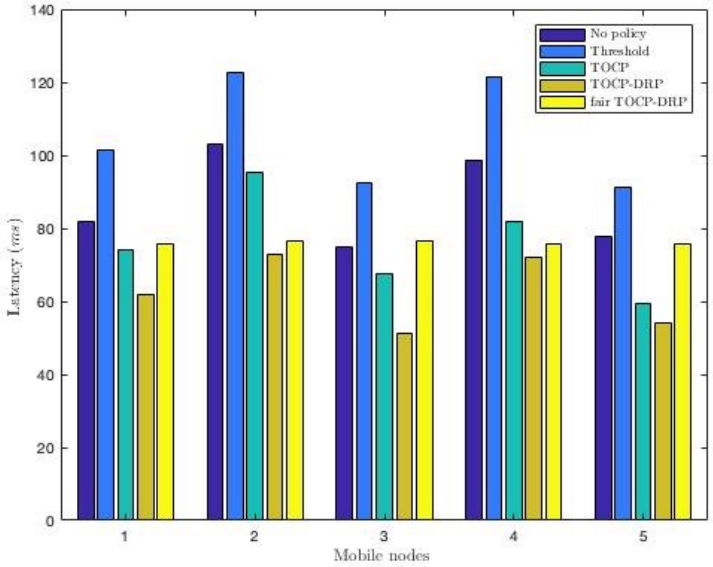
5 policies:

1. no-policy
2. heuristic
3. TOCP
4. TOCP-DRP
5. fair TOCP-DRP



2. Project Results





2. Project Results

2.2 LESSONS LEARNED

Mobile IoT environment of vehicles-driven distributed computing is facing with the following research and technical challenges

- Real-time surveillance and monitoring applications
- Connectivity among UxVs and GCS

MOTIVE presented a new solution that:

1. Optimizes latency and PER for poor network conditions in a automated decision making model
2. Develops a transparent prioritization layer in Pub/Sub architecture of Kafka message bus based on existing network infrastructures

Through MOTIVE, we were able to validate the solution in realistic conditions involving mobile vehicles operating in “dangerous zones” of communication loss. The promising results of the MOTIVE experiment have already led to activities focusing on new ideas involving drones operating in emergent areas Beyond LOS.

3. Business Impact

MOTIVE

TIME - OPTIMIZED CONTEXTUAL INFORMATION FLOW ON UNMANNED VEHICLES

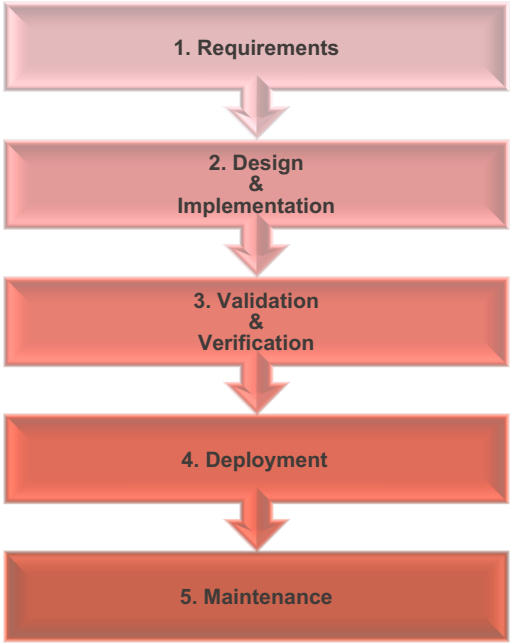
3. Business Impact

3.1 DIRECT IMPACT

Impact related to our product:

Through the successful experimentation on the Fed4FIRE+ facilities MOTIVE:

- successfully passed the Validation & Verification step of our software/product process
- showed promising results → our product can be considered a viable solution
- was validated in almost real – life conditions
- had new deployment process investigated to automate and optimize our software delivery



3. Business Impact

3.1 DIRECT IMPACT

Impact related to our SME:

Through the successful experimentation on the Fed4FIRE+ facilities we able to:

- Focus on making our idea a new product or line of products

  → **A potential new market**

- Gain knowledge on how to generally support UV distributed message communication solutions, edge decision support mechanisms

  → **a new IoT area has opened up**

- Test our initial hypothesis

  → **gained confidence**

3. Business Impact

3.2 VALUE PERCEIVED

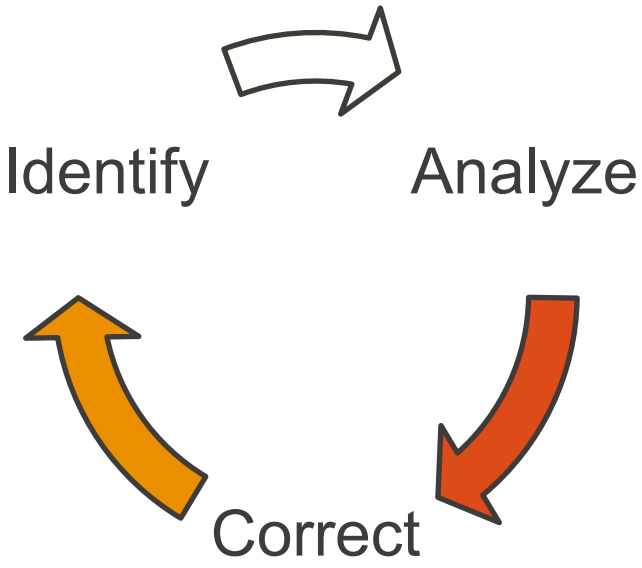
Fed4FIRE+ offered us:

- Tools that allowed real-world experimentation
- A platform that introduced us to UVs, gaining new knowledge and skills
- A way to experiment, test and validate our solution by minimizing our risk
    - ✓ No need to invest on expensive hardware for testing our solution
- A chance to work with highly accredited academic – industrial partners
- Increased visibility, credibility and enhanced business portfolio

3. Business Impact

3.3 FUTURE PLANS

- Further improvement on our solution with follow up projects
    - Enhance device safety through our framework
    - Extend our solution to static nodes
    - Experiment in the open/urban areas with more UVs
    - Provide a complete solution for edge devices that dynamically adapt in adverse network conditions
- Investing in the IoT sector by acquiring some aerial UVs and piloting licenses
- Identify the market potential, interested parties and refine the user requirements
- Further strengthen our relation with the research and academics world by participating in new projects (national, European)



4. Feedback

MOTIVE

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4. Feedback

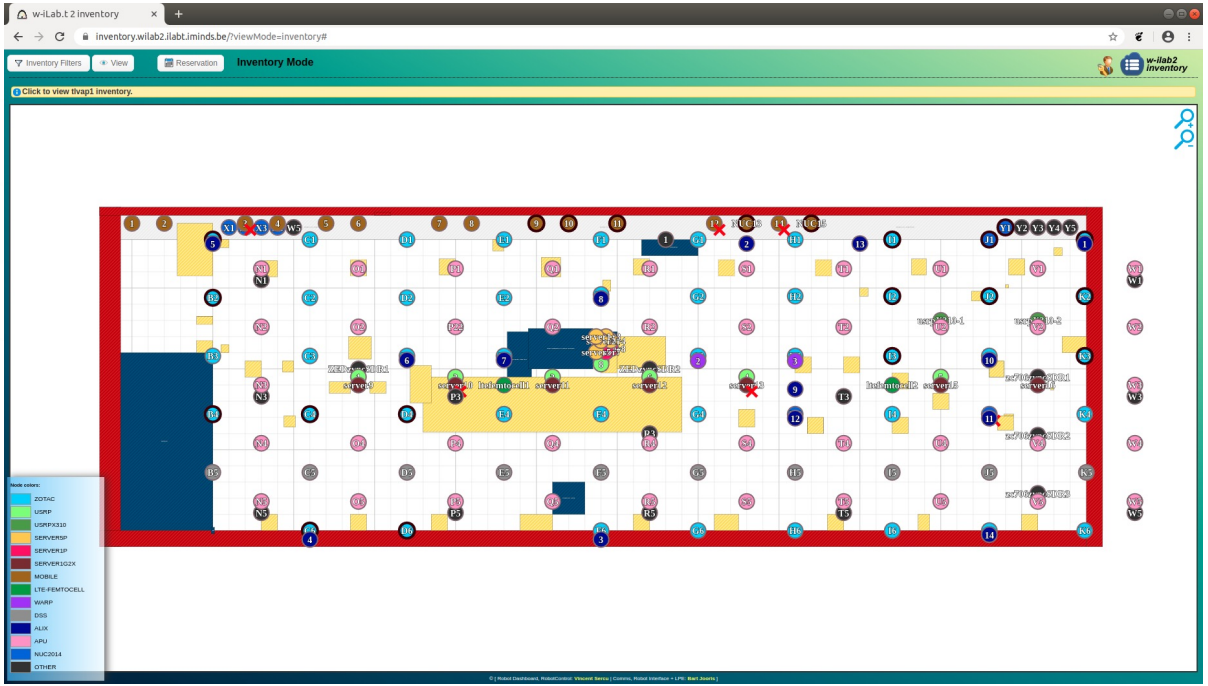
4.1 USED RESOURCES AND TOOLS

Resources:

- 5 mobile nodes
- 12 zotac
- 2 NUCs

Tools:

- JFed
- Robot Dashboard
- Rest interface of mobile nodes



4. Feedback

4.1 USED RESOURCES AND TOOLS

Experimentation Environment:

+ Control
+ Trustworthy (data protection, privacy)
+ Rich in terms of services and resources
+ Network conditions almost too good
+ Enough time to run our proposed experiments

- Learning curve, but gradually gets better
- Set up time vs Experimentation time
- Repeating the experiment

4. Feedback

4.1 USED RESOURCES AND TOOLS

Documentation:

+ Easy to understand
+ Essentially our go-to guide
- OMF & OML no longer maintained
- Configuration of AP needed some extra steps

Support:

+ Attentive to our needs
+ Quick to respond
+ Able to solve problems
+ Proficient and qualified

During the lifetime of the experiment:

- Participated in the workshop in Athens
- Arranged a telco afterwards to discuss the experiment set-up

4. Feedback

4.2 ADDED VALUE OF FED4FIRE+

Fed4FIRE+ is all it claims to be:

- Rich in services and resources → heterogeneous
- Connects and enables interoperability between testbeds → federation
- Employs state of the art technologies and unique equipment
- Enables experimentally driven research in new areas
- Excellent support & documentation

Highly valuable components:

1. Federated Testbeds
2. Support & Documentation
3. Tools offered
4. Diversity of resources

What is missing?

- Ways to speed up the experiment set-up
- Collision avoidance for the Robot control dashboard
- Would you consider supporting experimentation in the open?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THANK YOU FOR YOUR ATTENTION!

WWW.FED4FIRE.EU