<table>
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<tr>
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<td><a href="https://movere.di.unito.it/">https://movere.di.unito.it/</a></td>
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## Context of the research activity

Advances in miniaturization, power efficiency, and telecommunication capabilities are shaping a world permeated by interconnected heterogeneous computational entities. Novel scenarios emerge, such as the Internet of Things (IoT) and Cyber-physical systems (CPSs), featuring computation and communication capabilities in wearable and hand-held devices, in everyday objects, as well as in drones and other robots whose activities intertwine with human ones towards a common goal. The growing complexity of these systems calls for a well-engineered, top-down development approach. In particular, as the availability of computing devices continues to increase, it becomes increasingly useful to manage an entire network of (physical or logical) devices as a single computing machine distributed in space and time --- thus dramatically simplifying the design, creation, and maintenance of these systems. The research activity will carried on in collaboration with REPLY (https://www.reply.com/it/), which is building a corporate laboratory on these technologies, including a laboratory for autonomous motion and delivery.

## Objectives

Aggregate Computing \([1,2,3]\) is an innovative paradigm for developing complex systems in terms of a single computing machine distributed in space and time. The goal of this research project is to re-think the approach at the methodological and engineering level, advancing the state of the art by achieving the following objectives:

i) designing and implementing a unified middleware to map heterogeneous Aggregate Computing languages on heterogeneous devices;

ii) designing and implementing a monitoring control platform for aggregate systems;

iii) investigating and developing a methodology and related tools for hybrid real-virtual systems, allowing a smooth transition between the simulated and the real-world development through mixed virtual-real stages;

iv) applying and validating such results on a case study involving heterogeneous drone swarms.

## References
Skills and competencies for the development of the activity

The ideal candidate should have a strong background in some of the following topics:

* C++, Scala, or Kotlin.
* Distributed systems.
* Embedded systems.
* Formal methods.
* Concurrent programming.
* Functional programming.
* Mobile programming.

The ideal candidate should have the ability to work in team and the willingness to improve her/his knowledge in the aforementioned disciplines.

The activities of this research project, to some extent, can be adapted to the profile of the winning candidate, resulting in a more foundational-focused or application-focused project.

