A propos du centre ou de la direction fonctionnelle
Grenoble Rhône-Alpes Research Center groups together a few less than 650 people in 37 research teams and 8 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Contexte et atouts du poste
Cyber Physical Systems (CPS) are systems that create a link between physical and digital worlds and enable cooperation among systems. Applications are in domains like automotive, energy and industry automation, involving technologies like nanoelectronics, sensors, AI, cybersecurity and computing.

In CPS collaborative systems, individual CPSs require coordination because of the growing number of nodes and level of autonomy of systems, for which a mastery of modes of local and decentralized cooperation will be needed to exploit the potential of the CPS.

Autonomic, self-adaptive and reconfigurable computing systems are required in smart environments like CPS, because they have the ability to adapt to their environment in order to achieve a set of objectives (e.g., control, security, functionality boost or energy savings). This is done by changing their architecture configuration and behavior upon the occurrence of specific events. Building such systems requires to design and implement autonomic feedback loops that collect events and measurements, make decisions and execute the reconfiguration actions. The design and the implementation of such loops are made difficult by several factors: the complexity of systems with multiple objectives, the risk of conflicting decisions between multiple loops, the inconsistencies that can result from communication errors and hardware failures and the heterogeneity of the devices. Proposals have been made in previous work of the Ctrl-A team ([1,2,4]) to design frameworks for reliable and self-adaptive systems, where multiple autonomic loops can be composed into complex managers, with application to smart environments.

The research to be done takes place in the H2020 project CPS4EU, more particularly in Work Packages concerning CPS collaborative systems, and CPS for “Smart-Grid” use cases. It will be done in cooperation with our industrial partner RTE in Paris.

Mission confiée
The objective is to contribute to the self-adaptive control architecture, on top of the platform at RTE, in order to support the cooperation and coordination of multiple management and control loops, some concerning the physical systems, others the management of the middleware and the loop processes themselves. This work is complementary to other results obtained at the level of a larger area network ([3]). In particular we are interested in the self-reconfiguration of protection and automation functions in the IEC 61850 standard for power substations.

Principales activités
The work will involve:

- identify the requirements and build the specification of a self-adaptive framework for supporting dynamic adaptations by feedback loops, at application level (e.g. related to the physical process) or infrastructure level (monitoring HW/ SW architecture, load and performance, and acting by reconfiguration and redepolyment of resources and components), and taking into consideration the application domain of energy distribution and smart grids;

- considering coordination of multiple subsystems, instrumented with sensors and actuators, managed by their feedback loops, combining dynamic adaptations between subsystems, or between controllers of different types (logical, quantitative, probabilistic);
- instantiate the framework in an operational environment for experimental validation.
  study and experiment different architectures of cooperation of decentralized systems, safety and security issues, architecture and system analysis, orchestration and validation of systems definition of interaction, communication and collaboration mechanisms of a framework for Cyber Physical System of Systems.
- In particular for the IEC 61850 standard for power substations use case, we are interested in the study, that could be inspired by previous results [1], of a model and a discrete event controller synthesis for the reconfiguration and redistribution of protection and control function if case of the partial unavailability of computing resources.

[1] Discrete Control of Response for Cybersecurity in Industrial Control
Gwenaël Delaval, Ayman Hore, Stéphane Mocanu, Lucie Muller, Eric Rutten IFAC 2020 - IFAC World Congress 2020, Jul 2020, Berlin, Germany. pp.1-8


Mahyar T Moghaddam, Eric Rutten, Philippe Lalanda, Guillaume Giraud ECSA 2020 - 14th European Conference on Software Architecture, Sep 2020, L'Aquila, Italy. pp.1-16


Compétences
Expected technical competences are amongst the following:
- Self-adaptive systems,
- Autonomic computing,
- Industrial Control Systems Software architectures

Avantages
- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération
Gross salary: 2 653 euros (before income taxes)