

## Internship Subjects

**Title:** Assessment and Conformance testing mechanisms for control loops in autonomic networks.

**Location:** Alcatel-Lucent Bell Labs France, route de Villejust, 91620 Nozay - FRANCE.

**Home Department:** "Advanced Internet Research", part of "Networking Technology Research Domain".

**Contacts:** [Laurent.Ciavaglia@alcatel-lucent.com](mailto:Laurent.Ciavaglia@alcatel-lucent.com), [Samir.Ghamri-Doudane@alcatel-lucent.com](mailto:Samir.Ghamri-Doudane@alcatel-lucent.com)

**Targeted training:** Master

**Duration:** 5-6 months.

### Context:

The concept of "Self-Management" in the field of networks is the set of solutions that aim to introduce autonomy in their operation and management. These solutions thus allow realizing complex functions in a more efficient and less manual-intensive operations, compared with traditional implementation. The main objective is to master the growing complexity of today's networks and reduce operational costs. The research project UniverSelf [1] fits into this context.

Control and management will thus be implemented using a combination of automated processes (control loops) deployed in the network and each pursuing a predetermined goal. Design flaws and unanticipated operational situations (especially in complex environments) may cause malfunctions of these control mechanisms. These potential shortfalls, and the negative impact they can have on network performance, are an obstacle to the deployment and activation of these control loops by operators. Validation tools and mechanisms for "runtime" verification are needed to address the risks associated with their deployment. The design, development and validation of conformance testing protocols for control loops are also a key elements and a prerequisites for the adoption of these solutions in a "carrier-grade" context.

### Objectives:

In this context, and based on examples of specific control mechanisms (from the project UniverSelf [1]), the proposed internship is aimed to study:

- Modelling techniques (behavioural) control loops;
- Metrics and mechanisms to detect and characterize failure of these control loops;
- Mechanisms to help identify the exact causes of these failures;
- Models and languages for checking the development of protocols for conformance testing;
- The best current practices and the standardization of the certification process.

The role the trainee will consist in realizing a literature review to make sure you understand the context of the study and then design and evaluate solutions (models and algorithms) to meet the objectives mentioned above. The end of the intership will be devoted to the preparation of the report summarizing the results and a research paper to be submitted for

publication. The work and results of the course will also participate in the standardization strategy of Alcatel-Lucent notably in ETSI and IETF.

Objectives are likely to be tailored to the needs and ideas brought by the trainee.

[1] The project UniverSelf - website: <http://www.univerself-project.eu/>

**Expected competencies:**

- Good knowledge of algorithms and modelling.
- Good knowledge in networking / telecom and graph theory would be a plus, they would help to quickly grasp the context and content of design features.
- Autonomy in programming and computing lab experimentation.