SyLA - **Systèmes Logiciels Adaptables**

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Reconfiguring large distributed

A complex task

- **Interdependencies:** interconnected components, modifying one part may have consequences on others;
- **Scalability:** numerous nodes or modules, increasing complexity;
- **Configuration Management:** maintain consistency;
- **Security:** Changes might introduce vulnerabilities;
- **Performance Optimization:** must be as fast as possible
- ...

Auto-adaptation with MAPE-K loops

Autonomic management

Analyze → Plan

Knowledge

Monitor → Execute

Sensors → Effectors
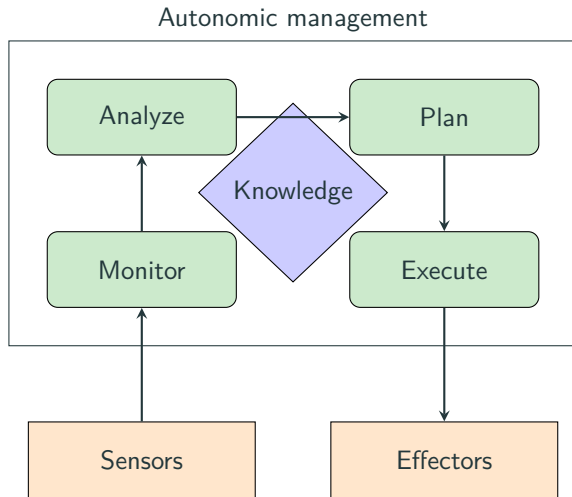
- Set of properties to maintain
- Decision-taking on defined criteria
- Autonomous loops

Endogenous events and exogenous events

Endogenous events

Originate within the system itself - Mostly predictable leading anticipated management

- Timeout
- Process failure
- Consistency update
- ...

Exogenous events

Originate from outside the system - Less predictable, very large possibilities

- Query from users
- Cloud provider actions
- Real-world disaster
- ...

Research Areas - Analysis and control of internal dynamics (endogenous)

- **Information Retrieval and Aggregation:** How to efficiently collect coarse-grained data about the system's overall state?
- **High-Level Control:** Optimize interactions between the system and its components while maintaining an appropriate control granularity (i.e., high-level).
- **Optimization of Analysis and Planning Phases:** Use collected data to solve resource placement, task scheduling, and load balancing problems.

Research ares - Environmental interactions (exgoeneous)

- **Modeling of Exogenous Events:** Define a structured space of possibilities, classify, and quantify external events.
- **Consideration of Uncertainty:** Integrate a probabilistic approach to anticipate and react to external events.

Research Areas - Uncertainty Management

- **Modeling:** How to represent the uncertainties associated with internal events or observations?
- **Uncertainty Propagation:** Study the impact of uncertainties on the decisions made by the MAPE-K loop.
- **Learning and Control Approaches:** Leverage machine learning or approximation techniques to dynamically adjust the system's behavior in the face of partial information.

Extra-Functional Properties

Examples of studied properties in this context

- **Safety:** Ensure that critical properties are respected.
- **Level of Uncertainty:** Quantify uncertainty to guide decision-making.
- **Reliability:** Assess the confidence in the collected information.

Community

People with interest

- **Spirals, Lille:** Simon Bliudze
- **Vesontio, Besançon:** Olga Kouchnarenko
- **Stack, Nantes:** Hélène Coullon
- **DiverSE, Rennes:** Jolan Philippe, Noel Plouzeau
- **LMV, Orléans:** Frédéric Loulergue
- **Kairos, Nice:** Julien De Antoni
- **Verimag, Grenoble:** Marius Bozga, Radu Iosif
- **Ctrl-A, Grenoble:** Sophie Cerf, Eric Rutten
- **OLAS, Sophia-Antipolis**
- **LTCI:** Rabéa Ameur

Related to ongoing projects

- Taranis (PEPR Cloud)
- SeMaFoR (ANR)
- Smartcloud (ANR)
- ADAPT (ANR)