Quelques travaux de MATTHIEU ROY

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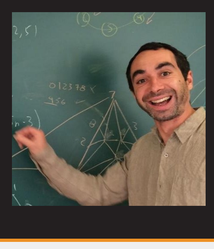

Travaux présentés par Matthieu aux journées FAC

- 2008: **Real-Time Failure Detectors**. Thomas Robert, Matthieu Roy, Jean-Charles Fabre
- 2013: **Distributed Monitoring of Temporal System Properties using Petri Nets**. Olivier Baldellon, Matthieu Roy, Jean-Charles Fabre
- 2014: **Specifying Safety Monitors for Autonomous Systems using Model-checking**. M. Machin, F. Dufossé, J.-P. Blanquart, J. Guiochet, D. Powell, M. Roy and H. Waeselynck
- 2014: **Run-time Control to Increase Task Parallelism in Mixed-Critical Systems**. A. Kritikakou, O. Baldellon, C. Pagetti, C. Rochange, M. Roy
- 2016: **Automatic Transformation of Synchrony into Concurrency**. M. Roy, P. Fraigniaud, E. Gafni, S. Rajsbaum
- 2019: **Convergence and covering on graphs for wait-free robots**. Armando Castañeda, Sergio Rajsbaum, Matthieu Roy

Architecting resilient computing systems: A component-based approach for adaptive fault tolerance

Miruna Stoicescu, Jean-Charles Fabre, Matthieu Roy – Journal of Systems Architecture 73, 2017

Resilient Computing

- **Resilience** ≡ persistence of service delivery that can justifiably be trusted, when facing changes
- **Idea** : build systems by separating the functional aspects from the fault tolerance aspects (dependability). Define Fault Tolerance Mechanisms (FTM) using concepts drawn from: reflexive programming languages, meta-object languages, component-based approaches, active object, . . .
- A forerunner to the current trends towards Over The Air updates (OTA) on software-intensive embedded systems. Accompanied by work on the validation of critical systems by fault injection in relation with standards such as ISO26262 in the automotive industry.
- This conceptual and prototyping work was followed by several development, in the automotive industry (col. with Technocentre Renault); numerous PhDs; a European NoE (ReSIST); ...

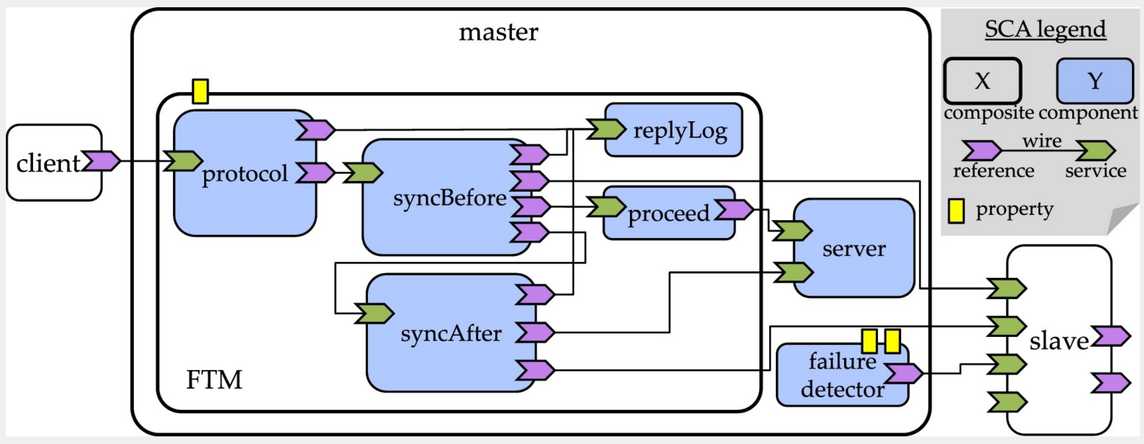

Figure 1: A component-based design pattern for *Primary-Backup Replication* (FBR)

Tasks in modular proofs of concurrent algorithms

Armando Castañeda, Aurélie Hurault, Philippe Quéinnec, Matthieu Roy – Information and Computation - 2023

Theory

- **Definition** A task is the distributed equivalent of a function in sequential computing, but may have no sequential specification.
- **Theorem** For every task there is a sequential object with two operations, set and get, with an equivalent behaviour.
- **Intuition** Decoupling the single operation of a task into two (atomic) operations allows us to model concurrent behaviors that a single (atomic) operation cannot specify.

Moir-Anderson renaming algorithm

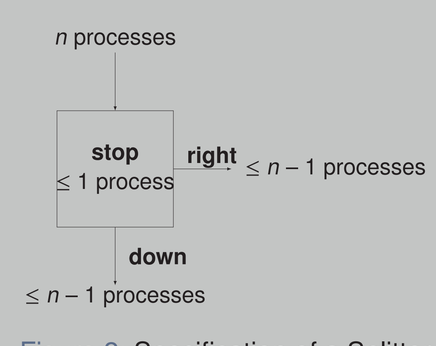

Figure 2: Specification of a Splitter

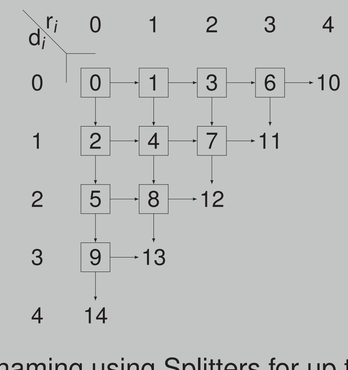

Figure 3: Renaming using Splitters for up to 5 Processes

Summary of the Approach

Concurrent splitter – *correctness* (*TLAPS*) – *completeness* (*TLC*)
Splitter with set/get – *correctness* (*TLAPS*) – *completeness* (*TLC*)
⇒ concurrent splitter ≈ set/get splitter

Renaming with set/get splitter – *correctness* (*TLAPS*) – *termination* (*paper*)
⇒ Renaming with concurrent splitters *correctness* *termination* (*paper*)

(TLAPS = proof assistant for TLA$^+$, TLC = model checker)

Collective responses of flocking sheep (Ovis aries) to a herding dog (border collie)

Vivek Jadhav, Roberto Pasqua, Christophe Zanon, Matthieu Roy, Gilles Tredan, *et al.* – Communications Biology 7, 2024

What is an interaction ?

- Behavior of a group (of sheeps) in the presence of a “predator” (herding dog) ⇒ **emergence** of a collective behaviour characterized by information flows between individuals.
- Spatiotemporal data collected using signals triangulation and a real-time location system based on high-resolution Ultra-Wide-Band tags (see SOUK project).
- Definition of an agent-based, predictive, discrete-time herding model.

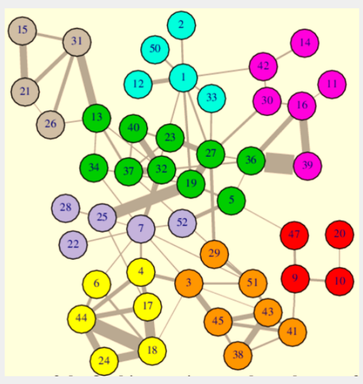

Figure 4: Layout of a human interaction graph—only most frequent links are represented.

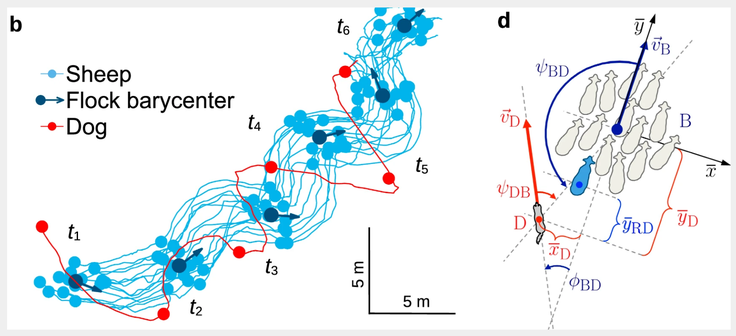

Figure 5: Quantitative analysis of the collective responses of a flock of sheep.

SOUK (Social Observation of hUman Kinetics)

- A framework to capture and analyze mobility data of crowds ≡ embedded system for ”micro-mobility”, 15cm precision, 1Hz.
- Study and provide models for mobility and interactions.
- See: M.-O. Killijian, M. Roy, G. Trédan and C. Zanon - *Souk: social observation of human kinetics*. ACM Int. Joint Conference on Pervasive and Ubiquitous Computing (2013).