Research Proposal

Monitoring Network Systems Subject to External Attacks

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Context: This work will be carried out in the NeCS team (Networked Control Systems), a joint CNRS/INRIA team at GIPSA-Lab laboratory in Grenoble, France. The team's innovative research concerns control and estimation of networked systems, with a broad spectrum of applications.

Topic description: Network systems stand for dynamical systems interconnected through a network. Nowadays most of systems can be viewed as network systems. Even though the network interconnection allows the design of modular systems, it also introduces vulnerabilities due to external malicious entities. In this project, we adopt a system theoretic point of view to analyze such systems. Specifically, we consider a network of agents monitoring a network system that can be subject to external attacks. The aim of the monitoring agents is to estimate the state of the network and to reconstruct the possible external attacks, in real time. Each monitoring agent only has access to a subset of nodes of the network system of interest. The following scenarios will be considered:
i) A single agent is monitoring the system;
ii) Several agents are monitoring the system and each agent is tracking the state of the whole network system;
iii) Several agents are monitoring the system, but each agent only tracks some part of the whole network state, corresponding to a subset of nodes; the subsets monitored by different agents are supposed to be overlapping.
The aim of this project is to **develop joint input-and-state observers** for each scenario, in a setup where the location of the attacked nodes is unknown. Some additional assumption on sparsity in time of the attack might be exploited.

Candidate profile: This work requires strong skills in systems theory (estimation, observers synthesis), and some notions of graph theory.

Bibliography

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