Time synchronization for programmable matter based modular robots

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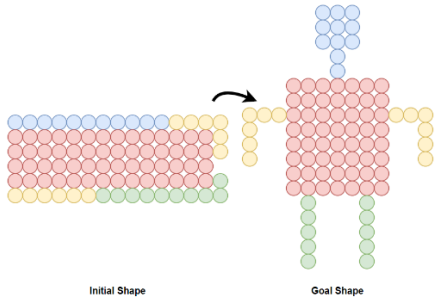
Location : Montbéliard, one meeting per week

Modular robots (MR), or modular self-reconfiguring robotic systems, are autonomous systems with variable morphology. These systems are composed of independent connected elements called modules or particles, whose connections to one another form the overall shape of the system. Beyond sensing, processing and communication capabilities, a modular robot includes actuation and motion capabilities that allow it to reconfigure its shape by rearranging connections between modules.



The accurate and efficient operation of many applications and protocols in MR require synchronized notion of time. Unfortunately, built-in hardware clocks of modules are not sufficient alone to fulfill this requirement due to the large number of modules and connections. By means of time synchronization, each module establishes a logical clock whose value at any time represents the network-wide global time. However, this establishment is not straightforward and requires coping with several aspects such as environmental dynamics, various error sources arising from communication, topological changes and power, memory and computation constraints of the modules. These aspects make time synchronization challenging.

The main objective of this project is to propose and implement a new synchronization protocol for modular robots. The idea is to propose an algorithm based on flooding and a local technique that uses Bayesian estimation for reducing the uncertainty error associated with delay and clock inaccuracy.

Keyword (4-5) : programmable matter, modular robots, synchronization, Bayesian approach, distributed algorithms

Prerequisites : Programming skills