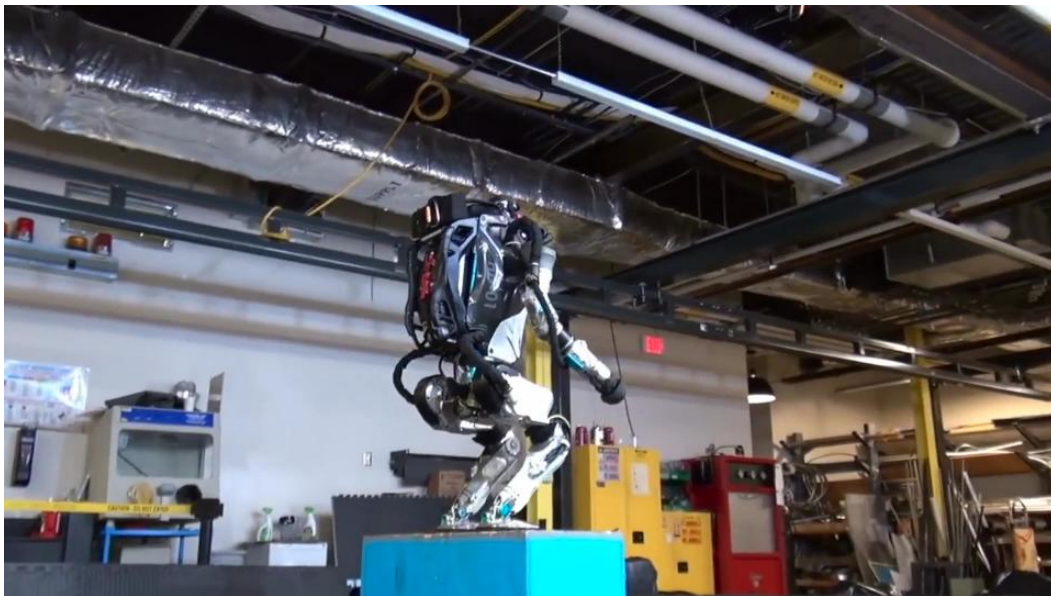




Collaborative autonomous vehicles as a new mode of transportation

Prof. dr. ir. B. Jayawardhana

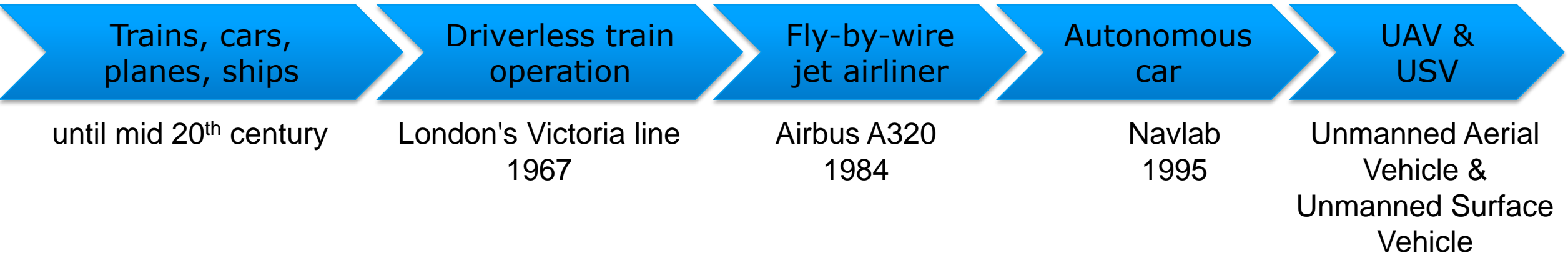




Contents

- › Autonomy in transportation systems
- › Short overview of ***distributed*** formation control
- › ***Cooperative*** autonomous vehicles as a new mode of transportation
- › Challenges and outlook

Autonomy in transportation systems



Coming soon:

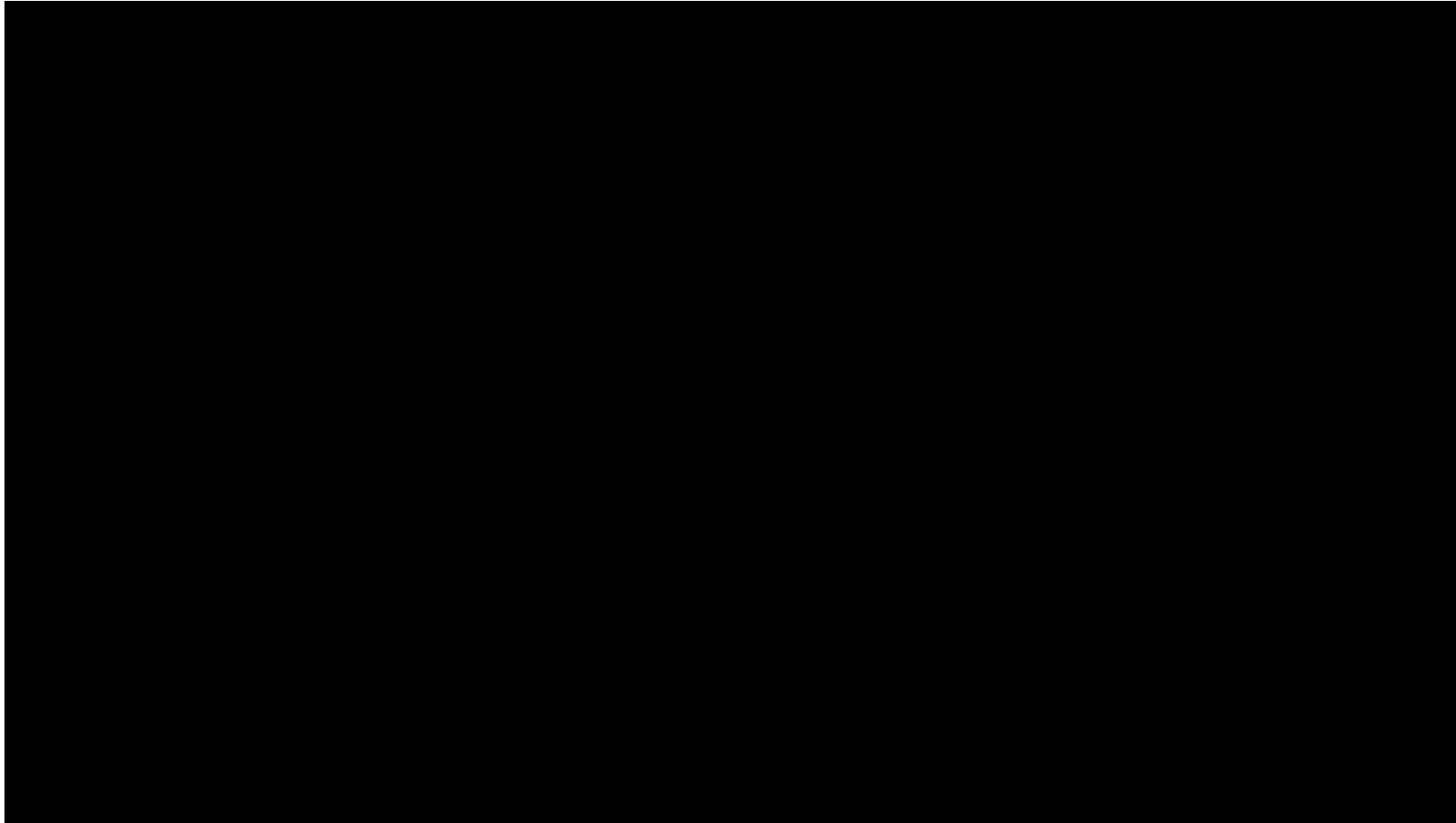
- > Autonomous ship (TRL high)
- > Autonomous jet airliner (TRL medium)
Proof-of-concept: Northrop Grumman X-47B
- > **Cooperative autonomous vehicles (TRL low-medium)**

Cooperative autonomous systems





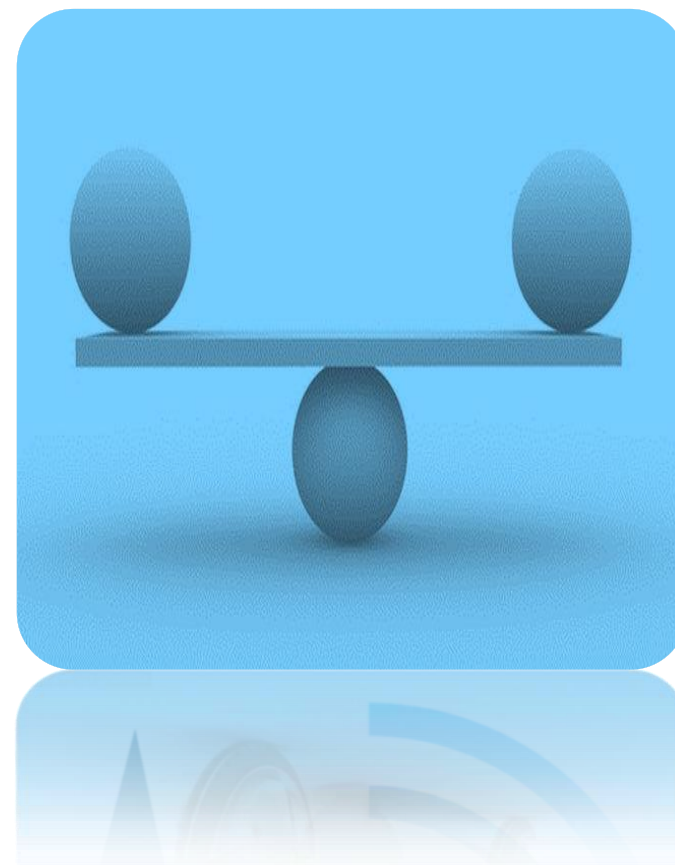
Cooperative autonomous systems



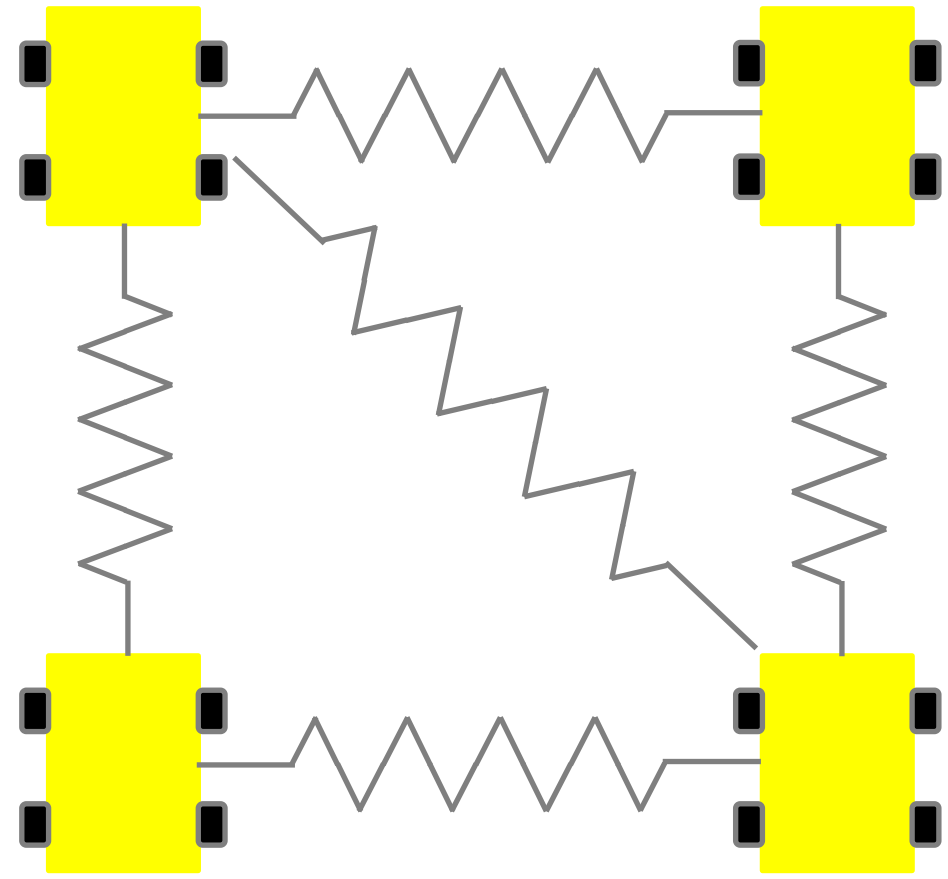
Credit: Rush Hour movie by Fernando Livschitz

Formation control (in short)

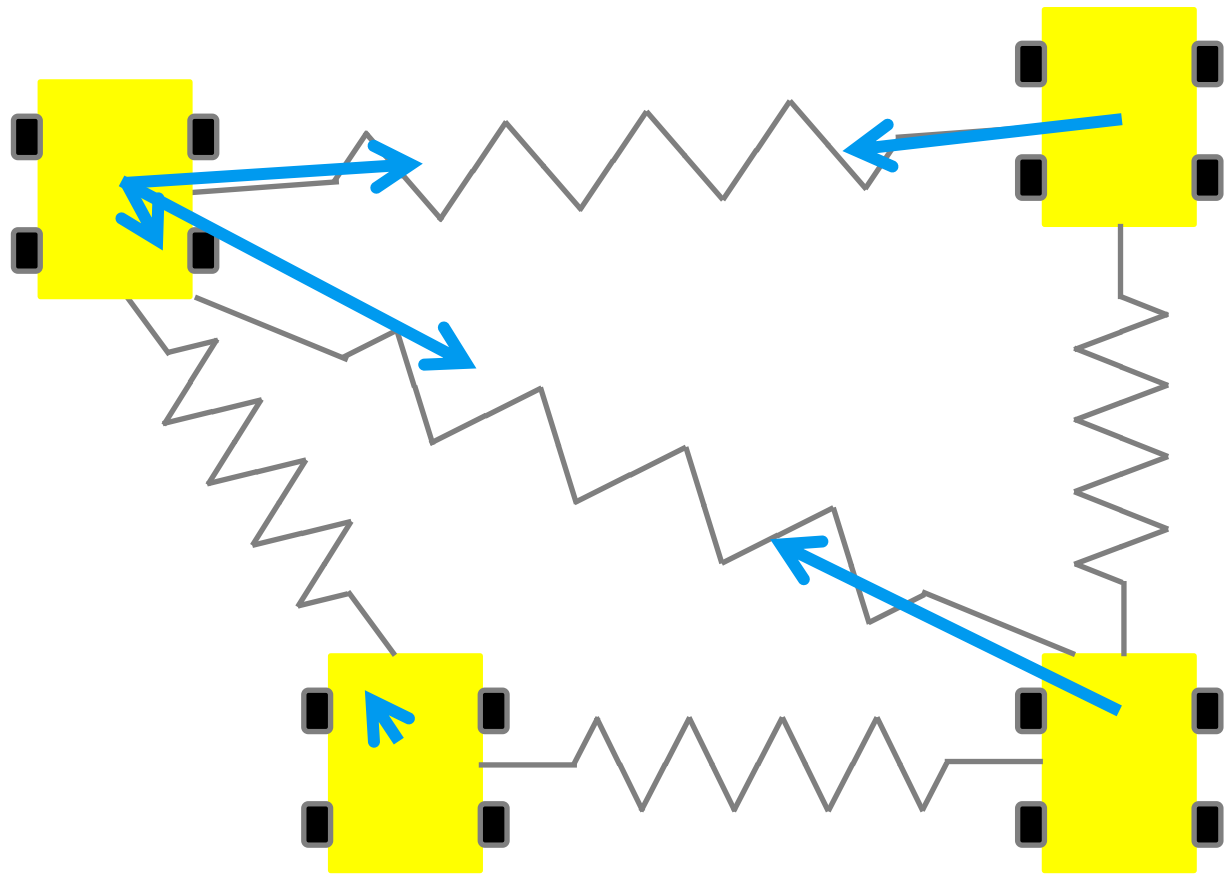
- > Coordination of multiple agents to accomplish an objective
- > Advantages
 - Reduce system costs
 - Scalability
 - Structure flexibility
 - Increase of robustness and efficiency
- > Typical characteristics
 - Onboard (**local**) sensing equipment
 - Onboard (**local**) computation ability
 - **No global information**
- > Important issue = stability



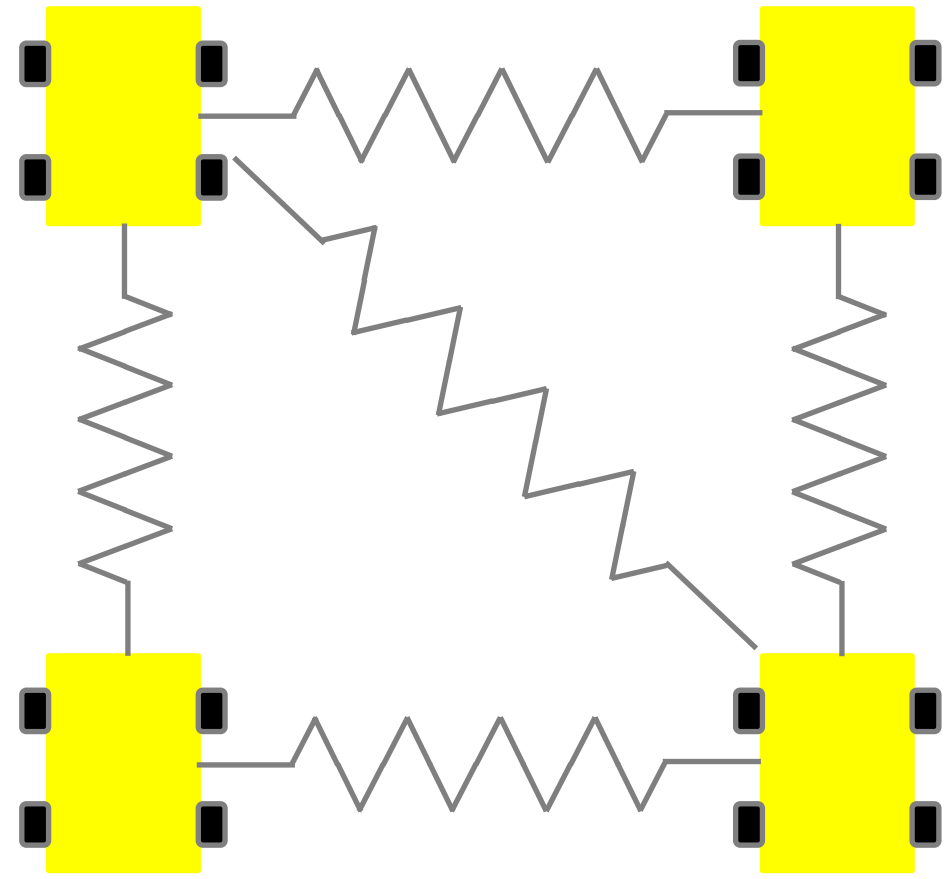
Formation control (in short)



Formation control (in short)

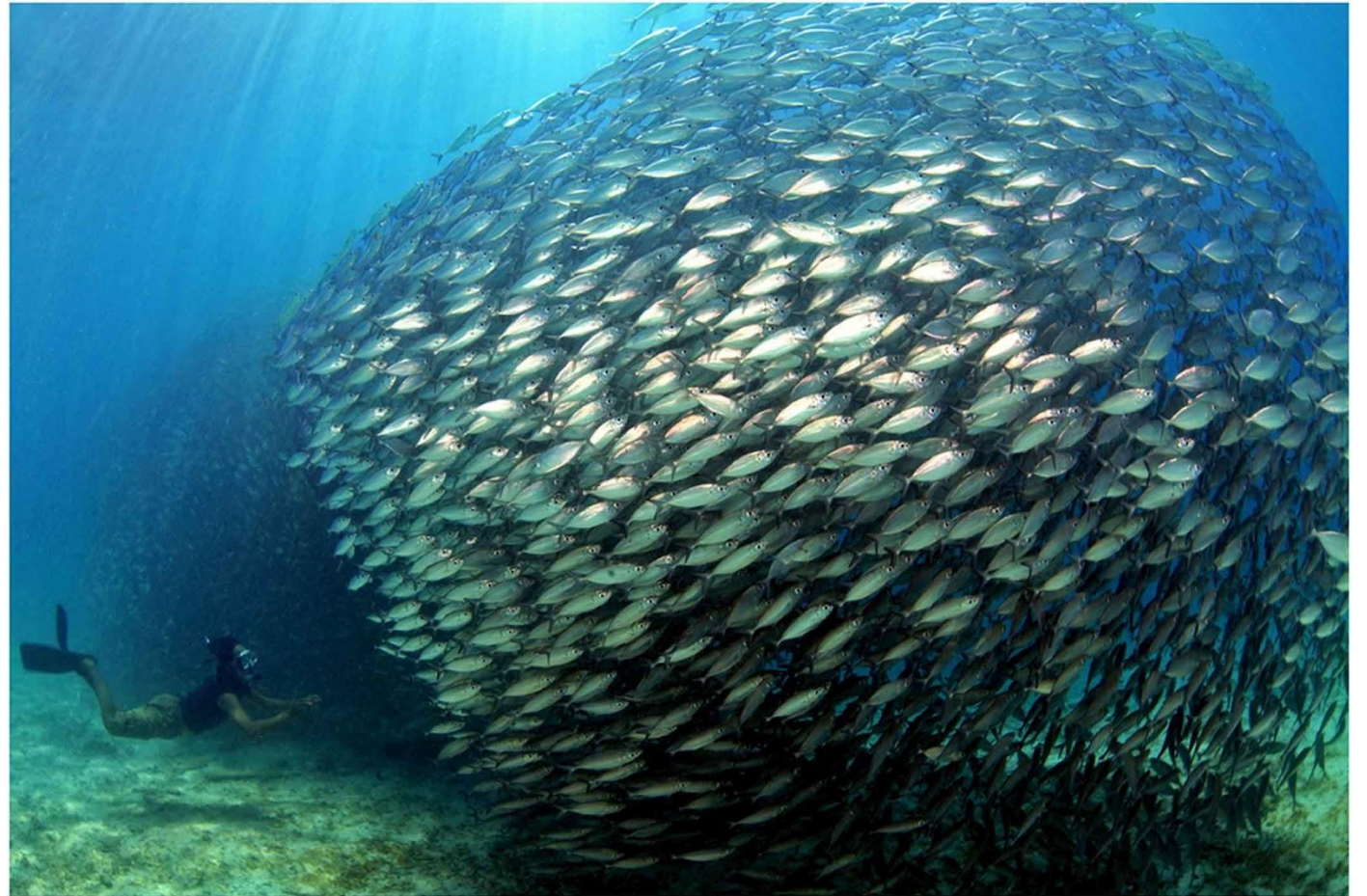


Formation control (in short)



Group motion

- › Leader-follower approach
 - has many drawbacks
- › Behaviour approach
 - requires continuous central coordination and global information
- › Virtual structure
 - suitable for cooperative autonomous vehicles





Formation control of mobile robots

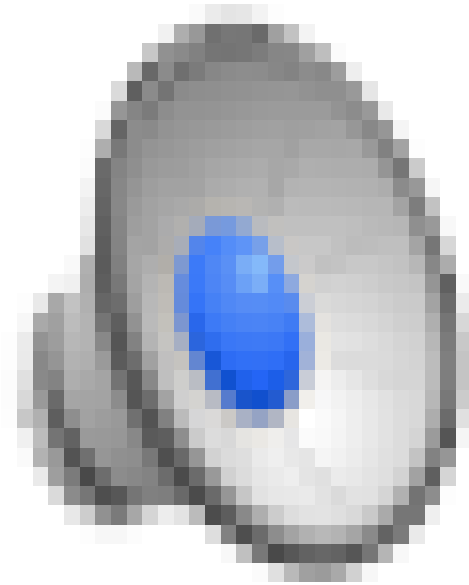
Formation control for industrial robots

Discrete Technology & Production Automation

University of Groningen



Formation control of drones



Challenges

- › Controlling group behavior via local action
- › Cooperative area mapping, localization and coverage
- › Guaranteeing safety and robustness of group behavior
- › Dynamic interaction with the environment
- › Cooperation among different autonomous vehicles
 - Including different drones and between aerial and ground vehicles

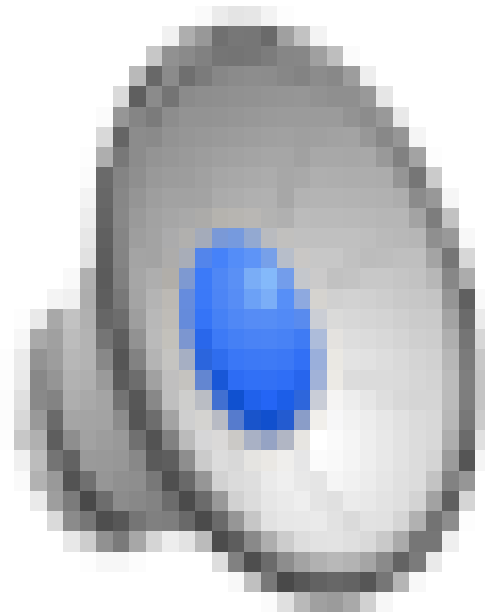


Outlook

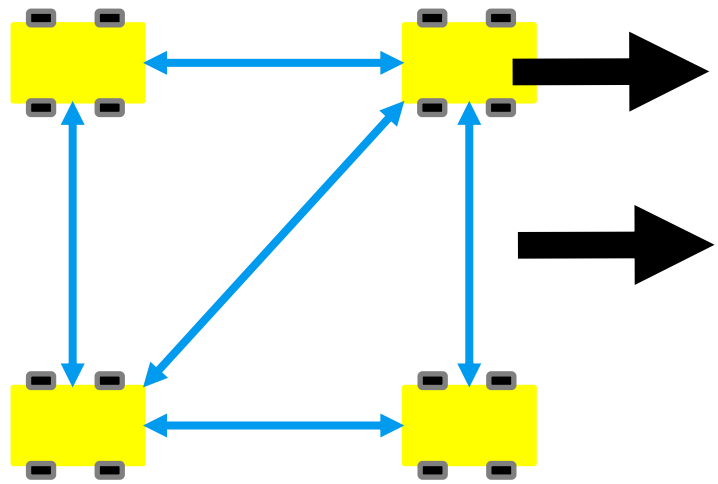
- › Autonomy has been present in modern transportation systems
- › Cooperative autonomous vehicles can be a new mode of transportation system



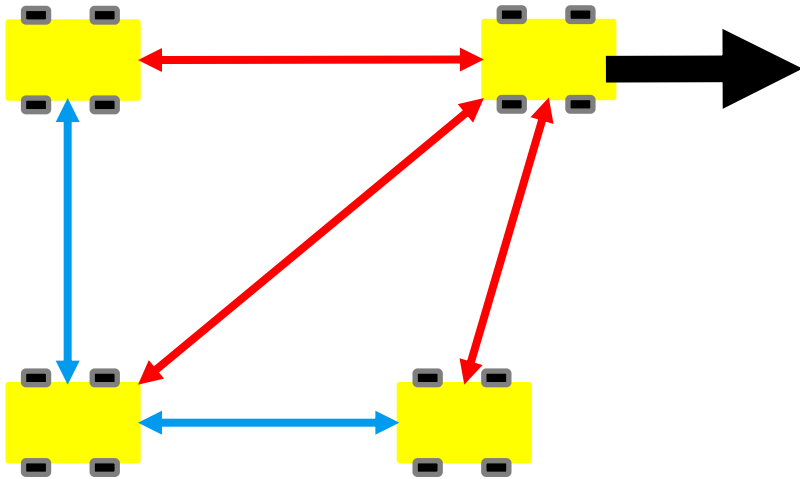
Thank you



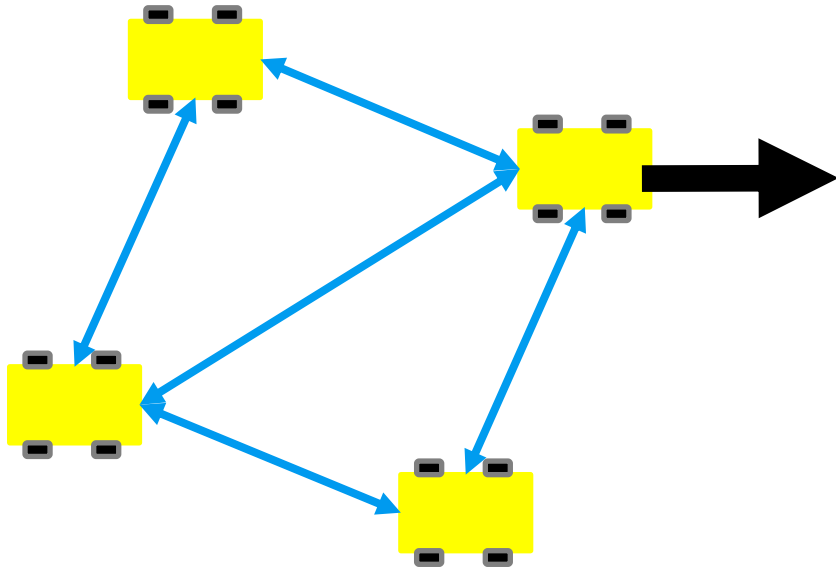
Group motion (leader-follower)



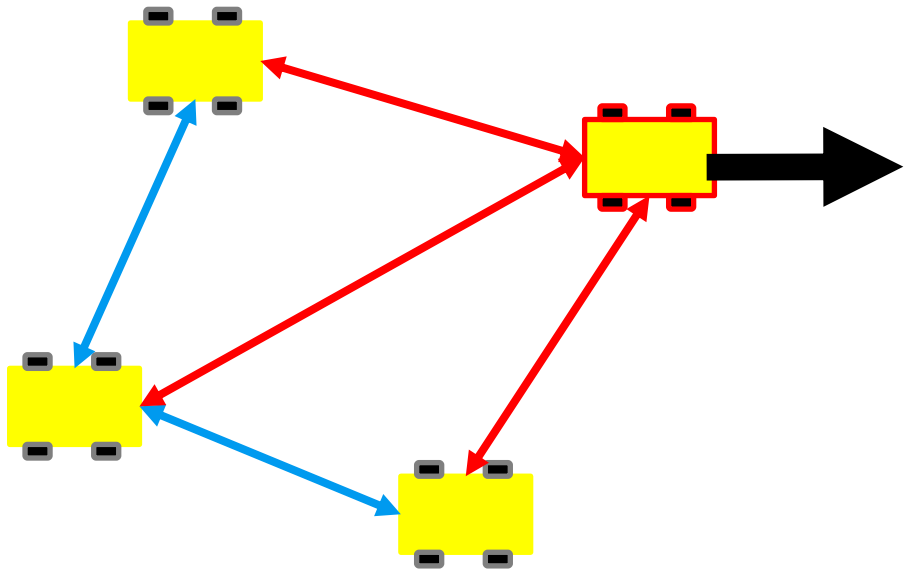
Group motion (leader-follower)



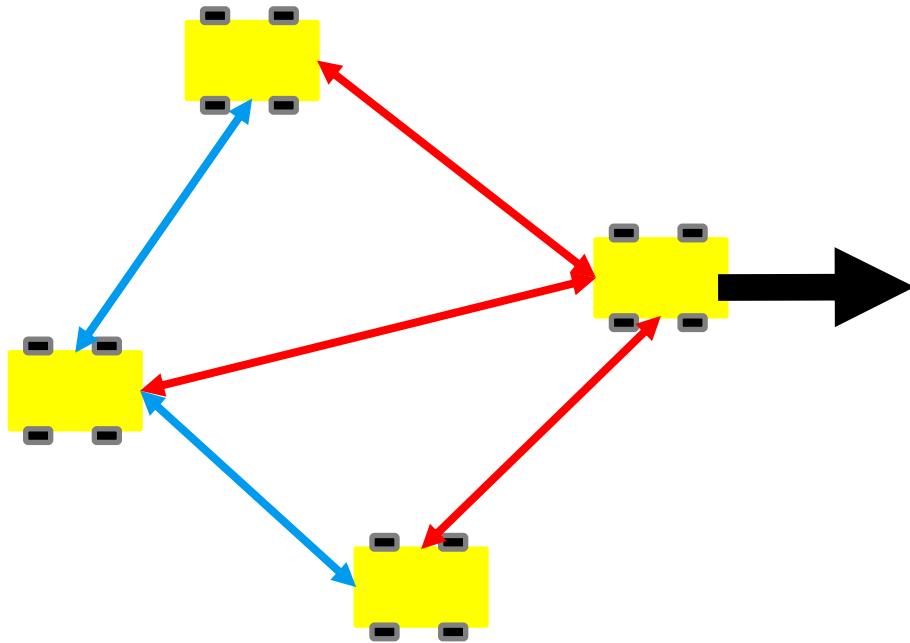
Group motion (leader-follower)



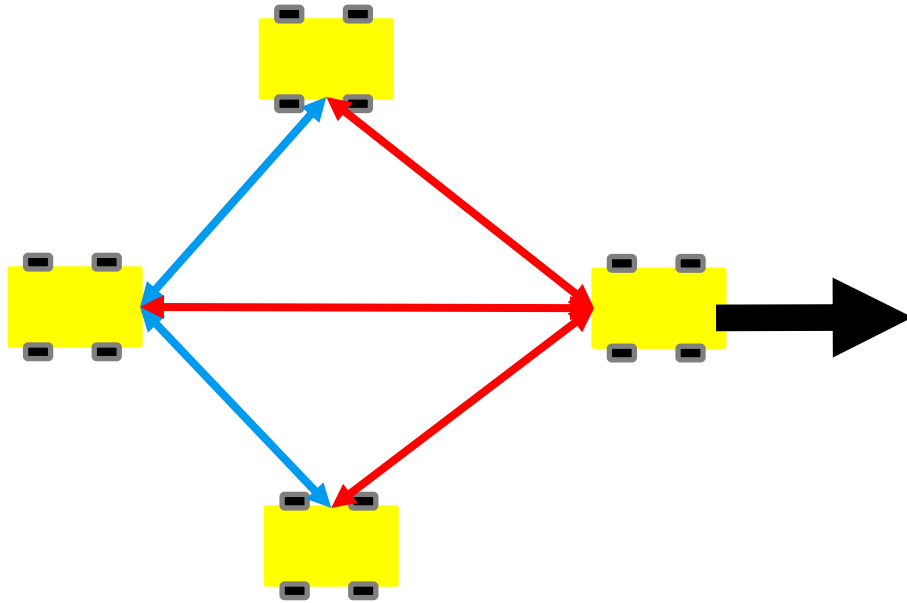
Group motion (leader-follower)



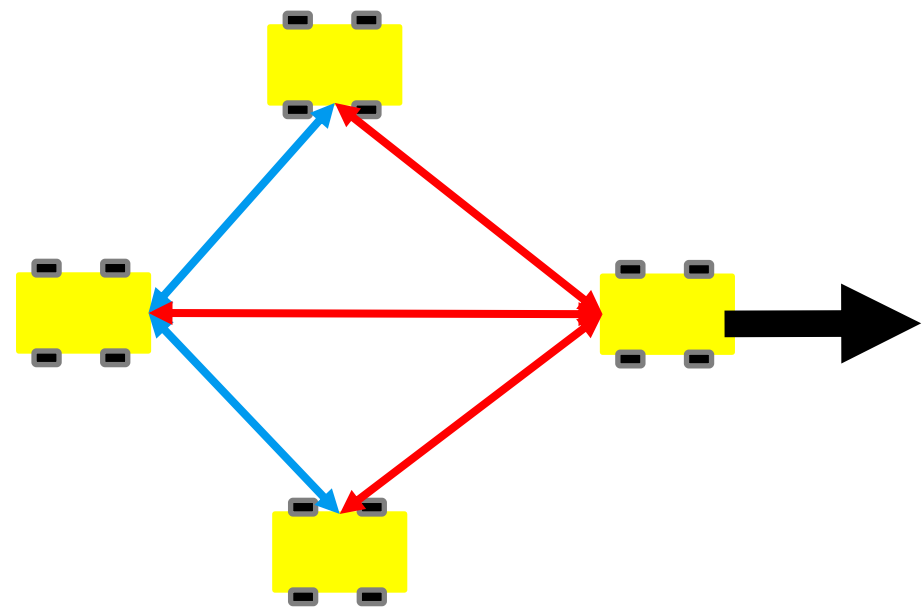
Group motion (leader-follower)



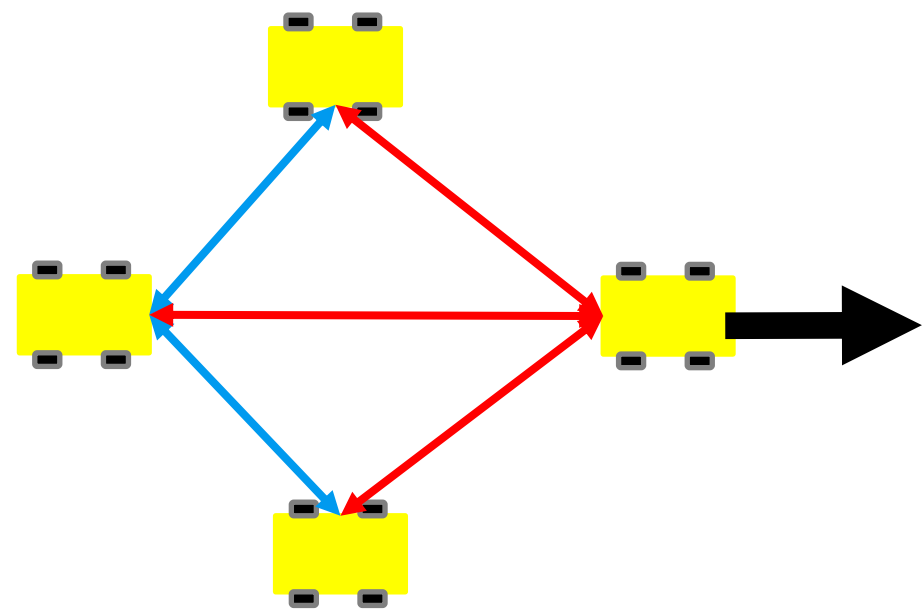
Group motion (leader-follower)



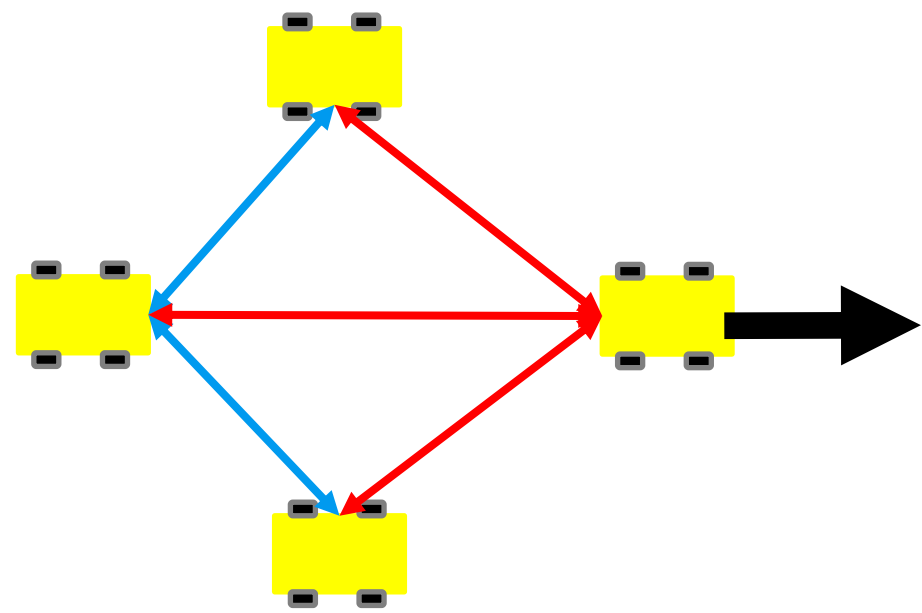
Group motion (leader-follower)



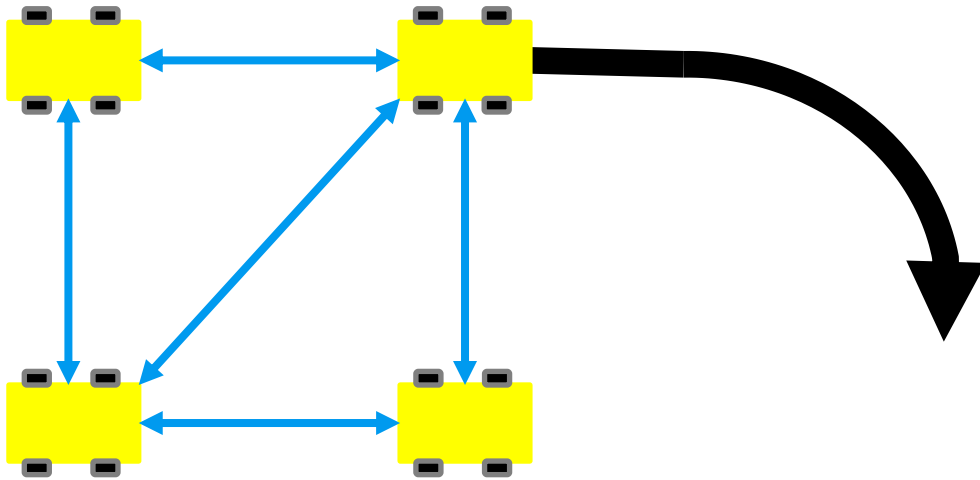
Group motion (leader-follower)



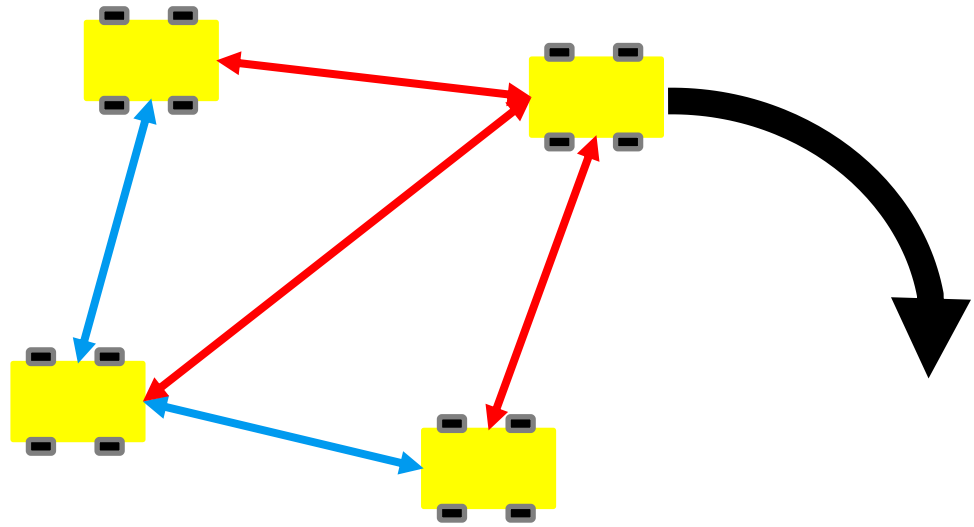
Group motion (leader-follower)



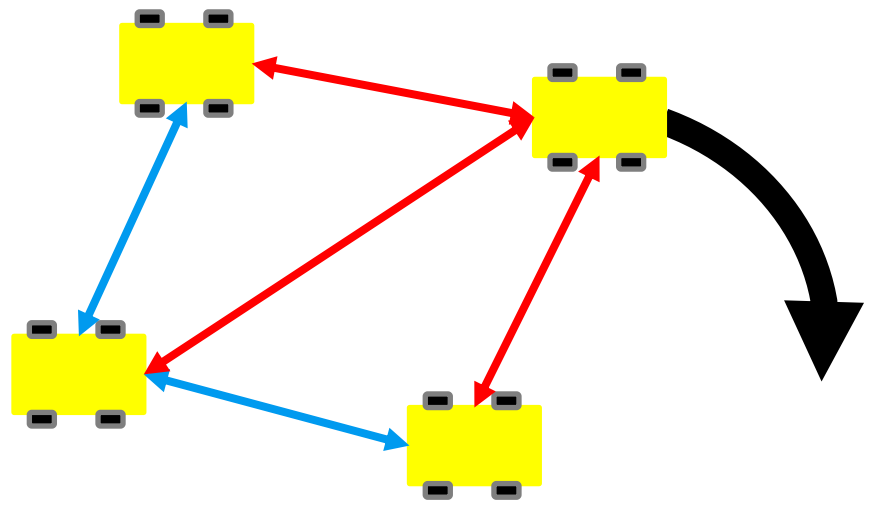
Group motion (leader-follower)



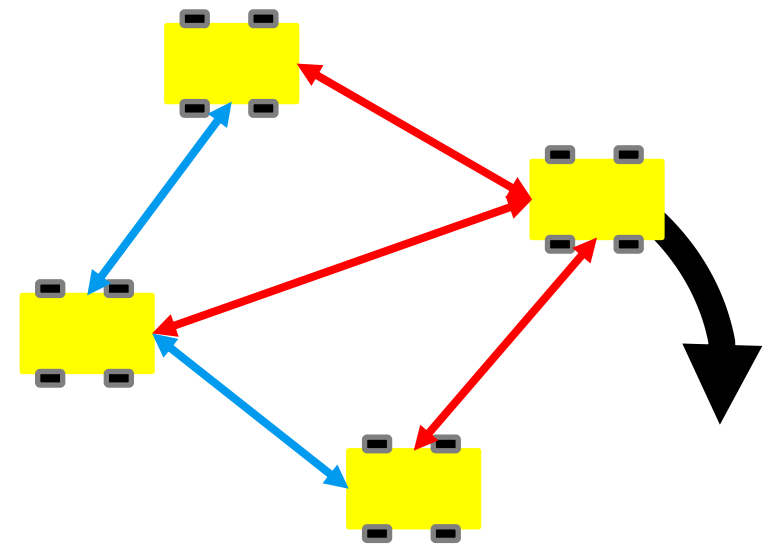
Group motion (leader-follower)



Group motion (leader-follower)



Group motion (leader-follower)



Group motion (leader-follower)

