

# Selforganization in Synchronization

Johannes Klinglmayr,  
Research Days  
07/15/09



# Outline

- Definition
- Benefit
- Model
- Firefly Algorithm
- Adaptation to real world
- Outlook/ Future steps

# What do we mean by Synchronization

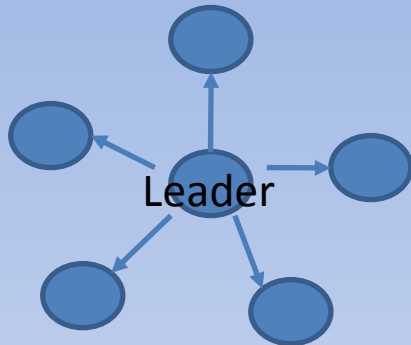
- Ask Wikipedia:  
Synchronization is timekeeping which requires the coordination of events to operate a system in unison.

Here:

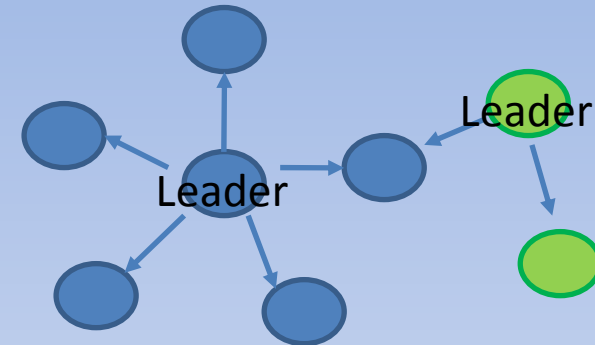
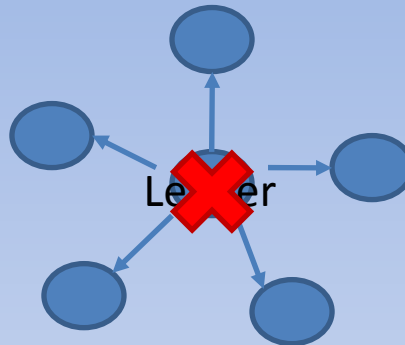
A set of wireless nodes should have the same notion of time.

# What can Selforganization do for Synchronization

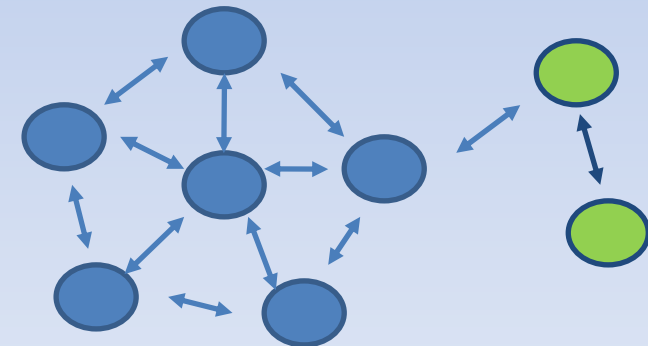
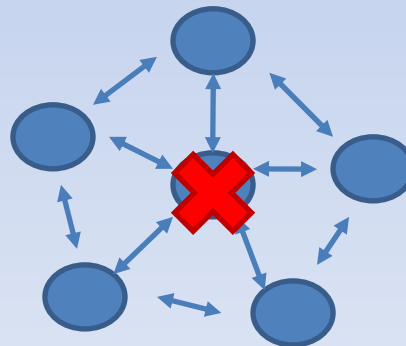
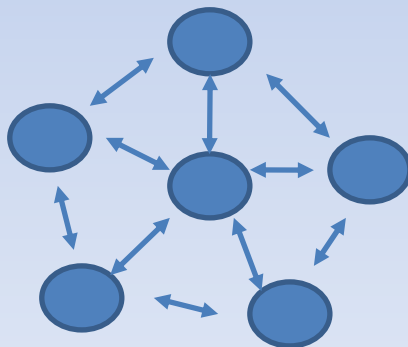
Centralized Sync.



Possible Situations:



Decentralized Sync.



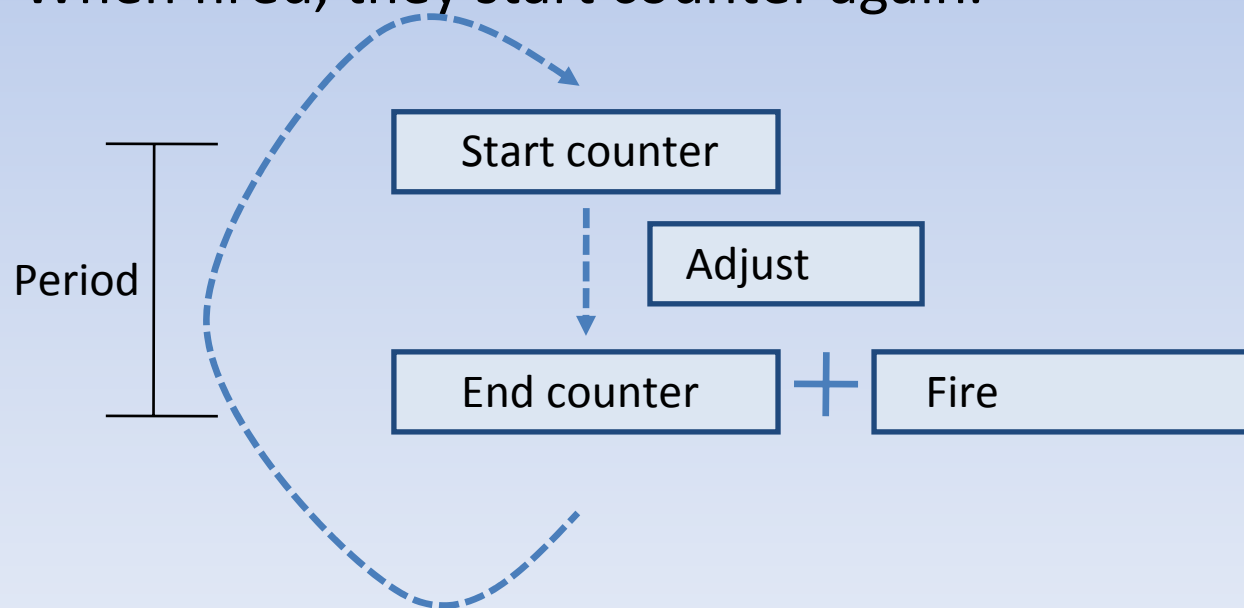
# How do we approach Synchronization – What is the setting?

- We take a look at nature:  
Fireflies in South-East Asia developed their own self-organized way of blinking in unison.
- We use the derived synchronization algorithm and apply it to wireless sensor nodes.

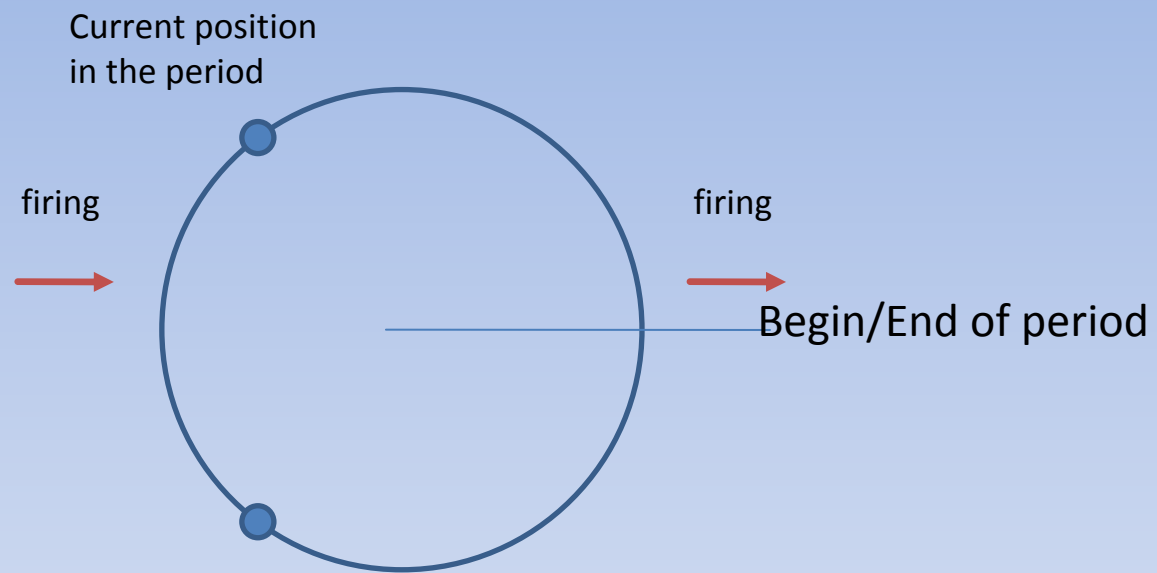
# Fireflies in Nature

# Modelling

- Fireflies have intrinsic oscillator. After their counter finished they emit a light signal called firing.
- Whenever they see a firing, they adapt.  
They adapt by moving their own counter closer to period end.
- When fired, they start counter again.



# Firefly Algorithm





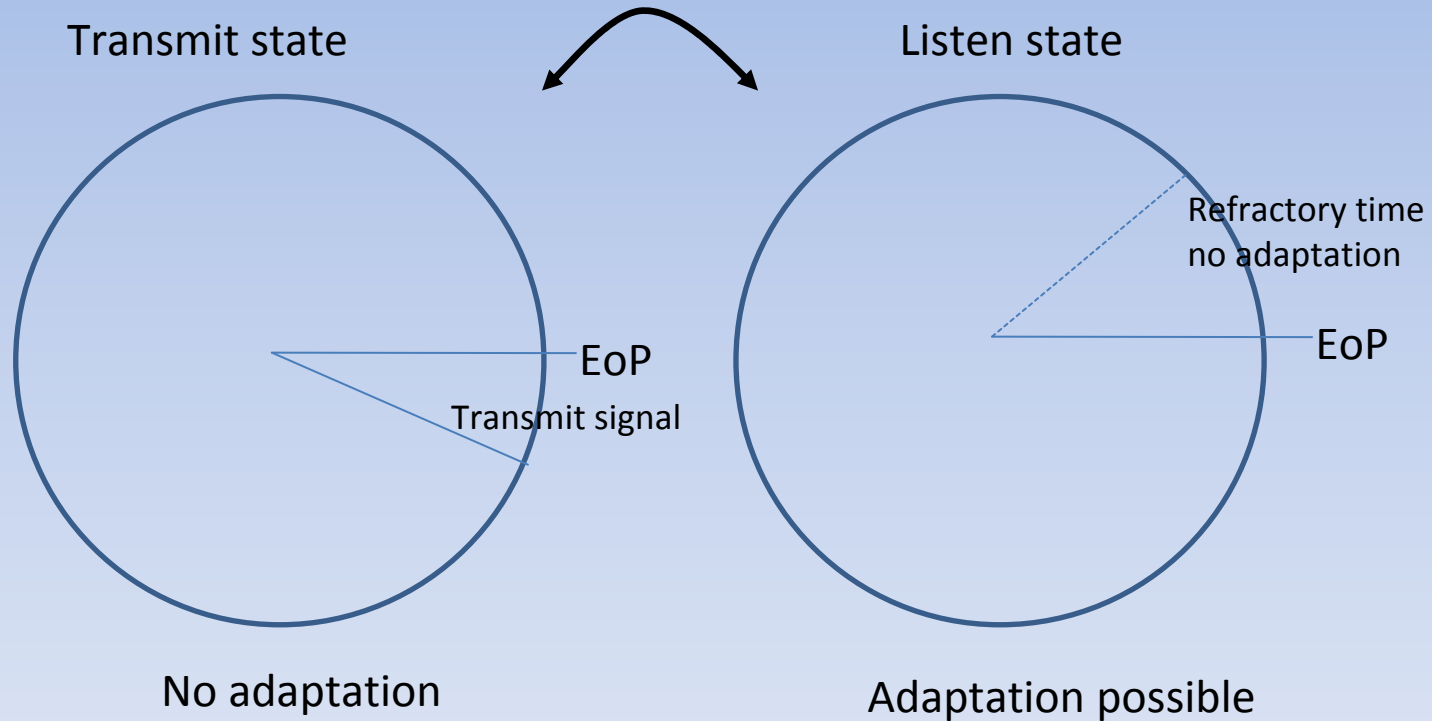
# Adaptation to wireless environment

- In wireless environment we cannot transmit instantaneously
- Experience harsh surroundings
- Frequency drift of oscillators
- Propagation delay

# Adapted Firefly Algorithm [1]

[1]

Node can change state at beginning of period, due to random process



EoP ... end of period

[1] A. Tyrrell, C. Bettstetter

# Demonstration

# MATLAB presentation

# Outlook, what comes next?

- Robustness of Firefly Algorithm
- Error analysis:
  - What happens to the synchronization if, a node gets “blind”, and cannot adjust itself anymore.
  - Topology changes
- What happens if faulty nodes are present:
  - Assuming faulty node cannot adjust but send permanently.
  - Assuming its period notion deviates by 20 %.
  - What is the influence of the topology.
  - Is there a way to get around faulty nodes.

# Robustness of Firefly Algorithm

- Error analysis:
- What happens to the synchronization if, a node gets “blind”, and cannot adjust itself anymore.
- Topology changes

# What happens if faulty nodes are present:

- Assuming faulty node cannot adjust but send permanently.
- Assuming its period notion deviates by 20 %.
- What is the influence of the topology.
- Is there a way to get around faulty nodes.

# Thanks

Thank you for your attention, and please  
feel free to share comments.