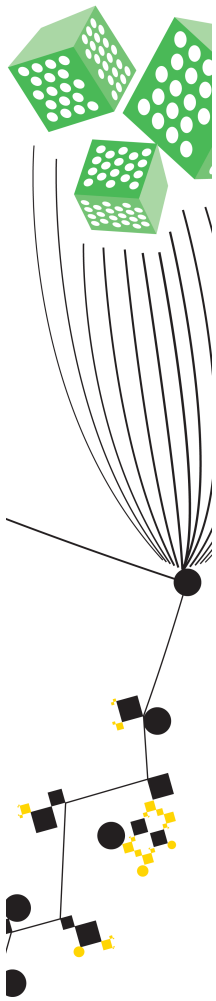
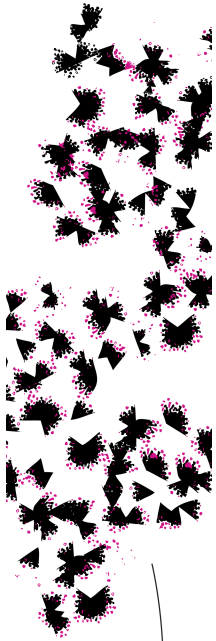


A New Energy Efficient MAC protocol with Noise Based Transmitted Reference Modulation for Wireless Sensor Networks

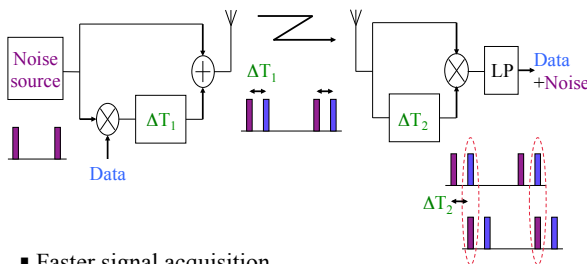
Sarwar Morshed, Geert Heijenk, Arjan Meijerink,
Dawei Ye, Ronan van der Zee, Mark Bentum

University of Twente, The Netherlands.
Email: s.morshed@utwente.nl



1. Transmitted Reference (TR) modulation

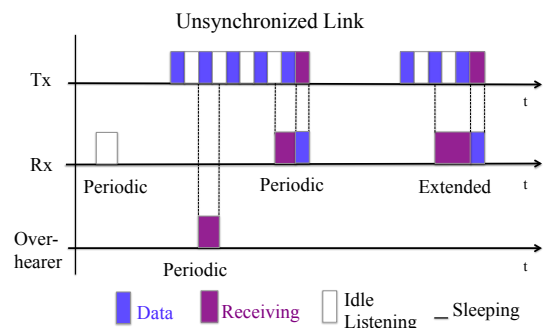
- Both modulated and unmodulated signals are sent
- Identified at receiver by time or frequency offset
- Demodulation by self-correlation
- Multiple access by using different offsets



- Faster signal acquisition
- Channel state information is not required
- Stable oscillator is not needed
- Good for short-range low duty cycle WSNs

4. Timing diagram: Unsynchronized Link

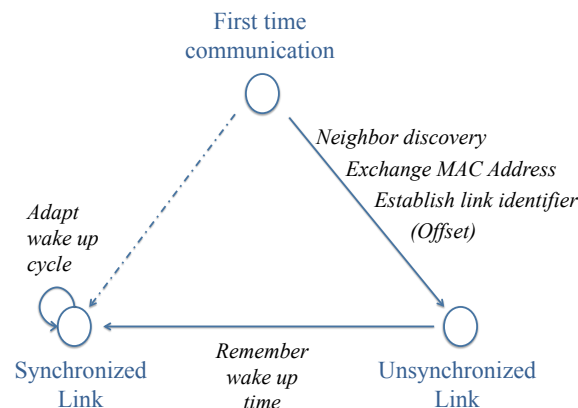
- Data can be sent right away since TR modulation does not need long preamble
- Link identifier can be derived from link offset
- Transmitter sends data-listen bursts
- Receiver acknowledges after receiving a data burst
- Overhearer goes back to sleep



2. Why a new energy efficient MAC protocol?

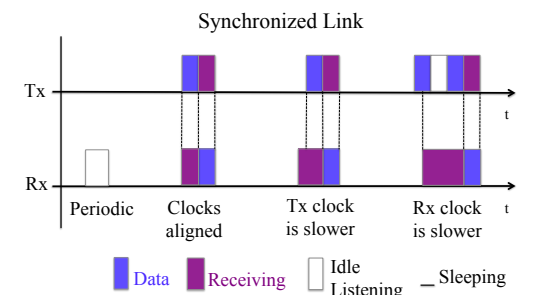
- TR modulation uses more transmission power for individual bits
- Early data transmission without long preamble
- Using energy harvesting gives new requirement

3. New MAC protocol: Three states



5. Timing diagram: Synchronized Link

- Both transmitter and receiver can store each other's next wake up time
- Transmission can be either transmitter-driven or receiver-driven based on available energy
- Duty cycle can be adapted based on requirement



• Vision:

Design an energy efficient MAC protocol for robust noise-based radio link using low-power ICs



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<http://www.utwente.nl/ctit/research/projects/national/stw/walnut.doc>



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