DSME-LoRa: A flexible MAC for LoRa

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Motivation: LoRaWAN and LoRa





Restricted downlink rate



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Unbounded end to end latency



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- Lack of peer to peer communication



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Mandatory infrastructure

backhaul

Peer to peer or Cluster-Tree topologies





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- Contention Access Period (CAP): CSMA-CA



- Contention Free Period (CFP): Guaranteed Time Slots (GTS)
- Highly configurable and flexible
 - □ Nº of Superframes, Superframe duration, Beacon interval



Can DSME overcome LoRaWAN limitations to enable direct communication between LoRa nodes?

DSME-LoRa: PHY mappings

- 16 channels in the EU868 band
 - □ SF7, CR4/5, BW125 (typical LoRaWAN settings)

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- □ 16 channels in the EU868 band
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- **CAP** uses only one channel
 - 10% duty cycle
 - **CSMA-CA** uses LoRa Channel Activity Detection (CAD)

Evaluation

- Omnet++ 6.0
 - □ with INET framework

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- OpenDSME

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- FLoRA
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- with INET framework
- OpenDSME
- **FLoRA**
 - Only the LoRa Radio model
- DSME-LoRa adaptation layer

Single hop peer to peer network with sensors (S) and actuators (A)



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- Single hop peer to peer network with sensors (S) and actuators (A)
- Each sensor transmits unconfirmed data to a subset of actuators
 - At an exponential rate
 - In a dedicated GTS time slot
- Size of the subset of actuators is defined as ApS (Actuators per Sensor)



- 4 Superframes per Multi-superframe
- ~32 seconds Multi-superframe duration

Slot schedule repeats every 28 slots



Average time to completion [s] for different simulation scenarios

#A=10, #S=30 #A=50, #S=110

	TX interval [s]					TX interval [s]				
	30	60	90	120	30	60	90	120		
	I	1	1	1		1	1	1		
◄ 4 -	22	18	17	17	22	18	17	17		
сд 3 -	24	19	18	17	24	19	18	17		
≝2 -	33	22	19	18	33	22	19	18		
<u> </u>	454	33	24	22	457	33	24	22		

- Time to completion
 - Only depends on TX interval and ApS, not on network size

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	•		•					
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	I	I	I.	I I	I	I	I.	L
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- Compliant with duty cycle regulations

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DSME-LoRa on real hardware (port OpenDSME to RIOT-OS)

Thank you!

DSME-LoRa implementation: github.com/inetrg/dsme_lora

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