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X-Sense RTD 2010

FNSNF

Low-Power Wireless Bus

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SWEDISH ICT SICS

Motivation

Emerging low-power wireless applications feature

Multiple communication patterns
(*e.g.*, closed-loop control [Ceriotti et al., IPSN`11])

Mobile and static devices
(*e.g.*, clinical monitoring [Chipara et al., SenSys`10])

Current Solutions

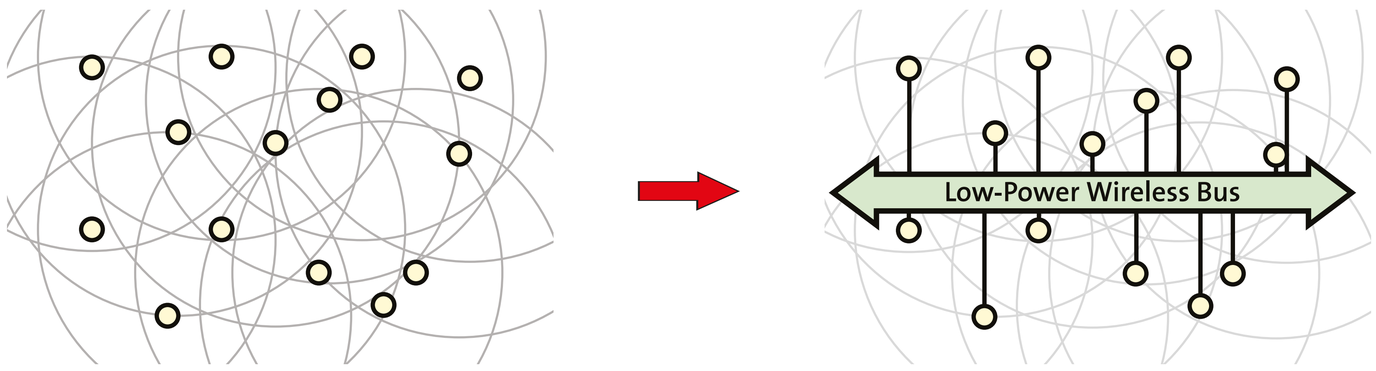
Ensembles of multiple protocols

- Interactions among protocols increase overall system complexity
- Each is tailored to specific traffic patterns and application scenarios
- Each maintains topology-dependent state (*e.g.*, routing)
- Significant control overhead against topology changes

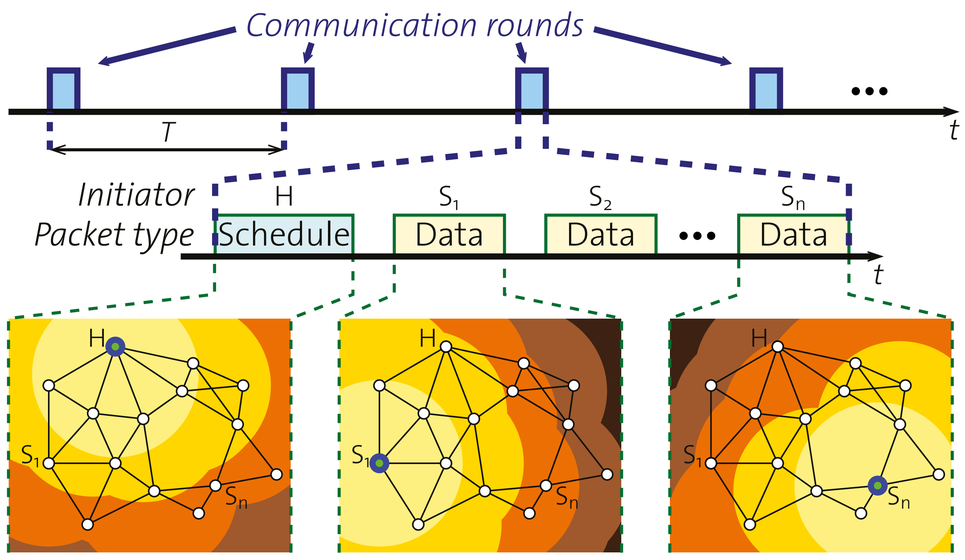
Low-Power Wireless Bus (LWB)

Unified communication support that maps all traffic demands onto Glossy network-wide floods

LWB turns a multi-hop wireless network into a shared bus where all nodes are potential receivers of all packets



- **Support for multiple traffic patterns**
- **No topology-dependent state**
- **Resilience against topology changes**
- **Support for mobile nodes**



Time-triggered communication

(A) **Communication rounds** repeat with period *T*
(radio off between two rounds)

(B) Rounds consist of non-overlapping **communication slots**
- First, a host node H transmits the schedule for the round
- Then, each source node S_i is granted access to the bus

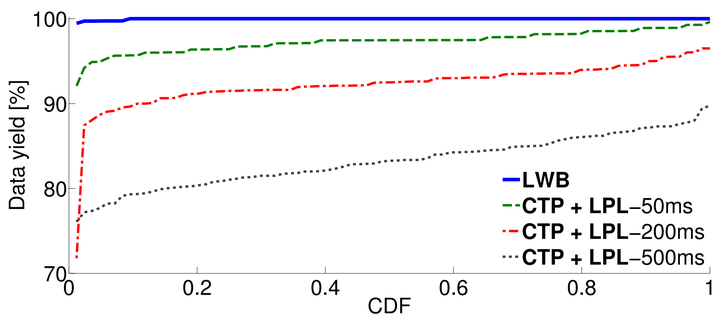
(C) Slots correspond to **distinct Glossy floods**
(Glossy provides also accurate global time synchronization)

Results

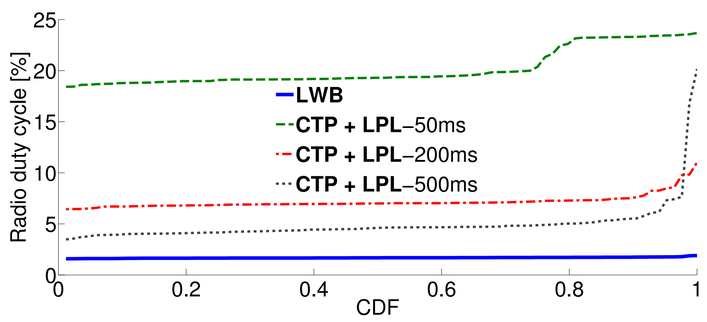
Experiments on the **Twist** testbed *(90 TelosB nodes, transmit power -7 dBm, one packet per minute,* ***same LWB prototype*** *with T = 1 min)*

Many-to-one data collection

Comparison with **CTP + LPL**
1 sink, 89 sources, *per-node* performance



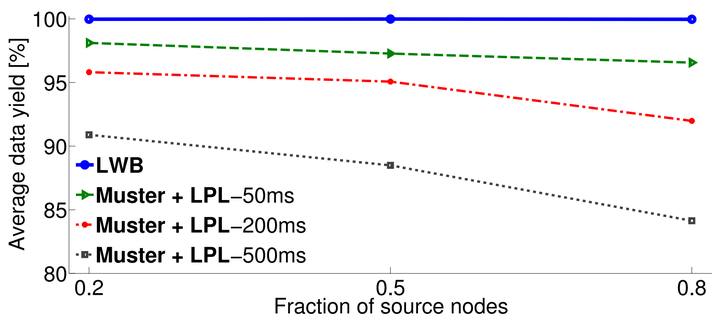
LWB data yield
minimum: 99.45 %
average: 99.97 %



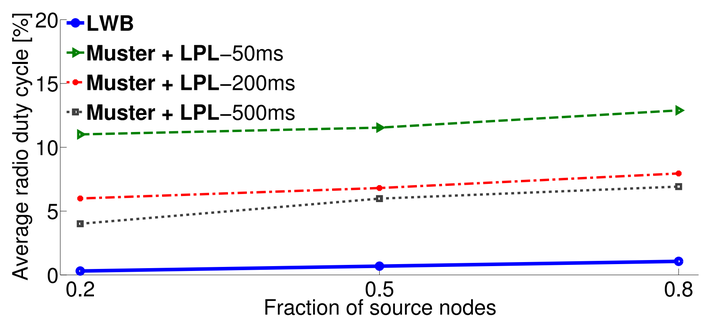
LWB radio duty cycle
maximum: 1.90 %
average: 1.69 %

Many-to-many data collection

Comparison with **Muster + LPL**
8 sinks, varying fraction of sources, *average* performance



LWB data yield
steadily at 99.97 %



LWB radio duty cycle
at most 1.07 %

The same LWB prototype efficiently supports many-to-one and many-to-many communication