Competition:
Wireless-Transparent Sensing Platform

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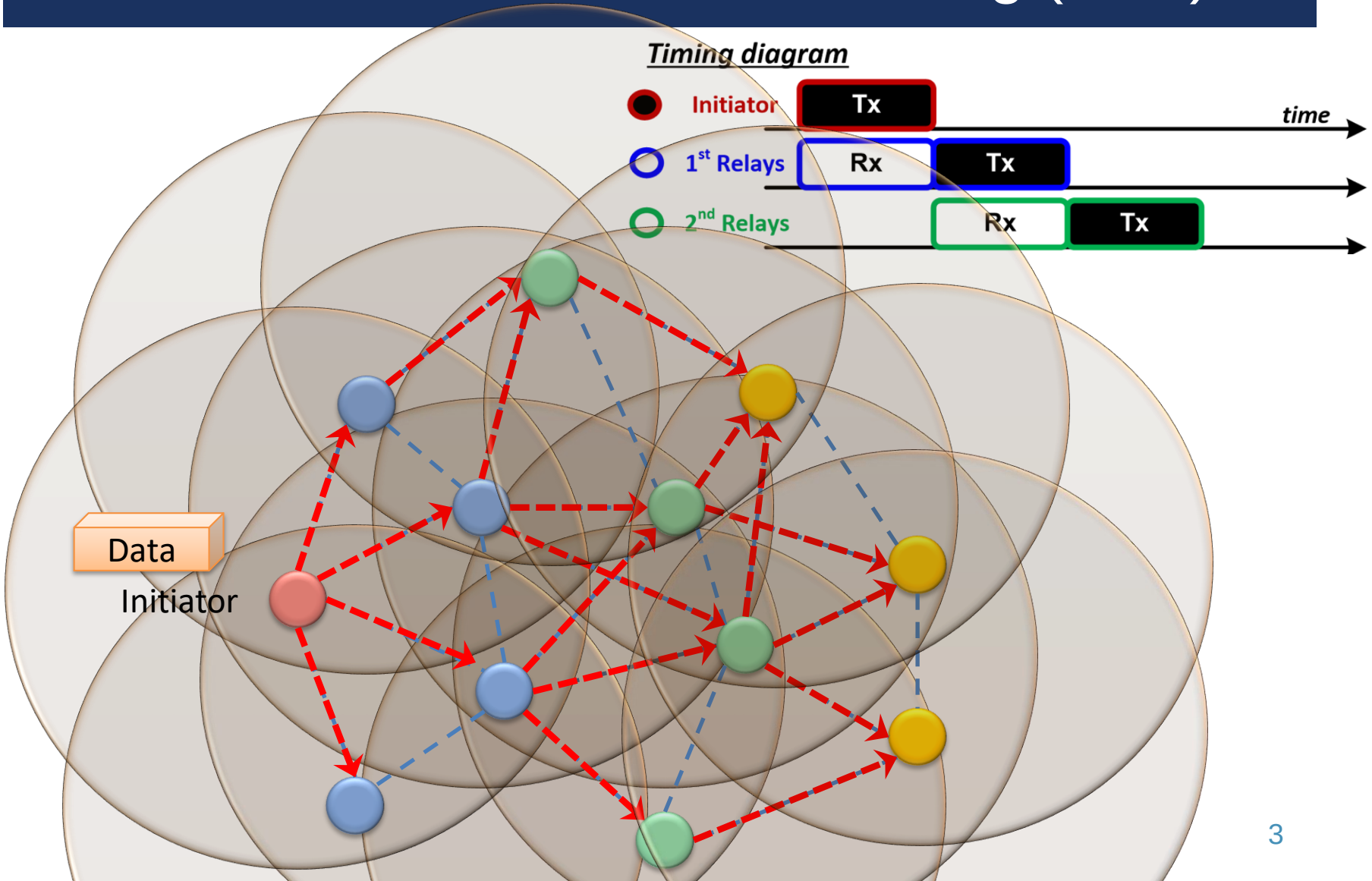
Wireless-Transparent Sensing Platform

- Full paper presented in EWSN 2017 [1]
- TDMA-based protocol adopting the concurrent transmission flooding (CTF)
  - The analysis in PHY layer [2] showed why IEEE 802.15.4 can survive synchronized packet collision.
- Flexible timeslot management
  - On-the-fly scheduling
  - Service-driven scheduling

[1] M. Suzuki, C.H. Liao, S. Ohara, K. Jinno, and H. Morikawa, “Wireless-transparent sensing,” in Proc. EWSN ’17.
[2] C.H. Liao, Y. Katsumata, M. Suzuki, and H. Morikawa, “Revisiting the so-called constructive interference in concurrent transmission,” in Proc. LCN ’16.

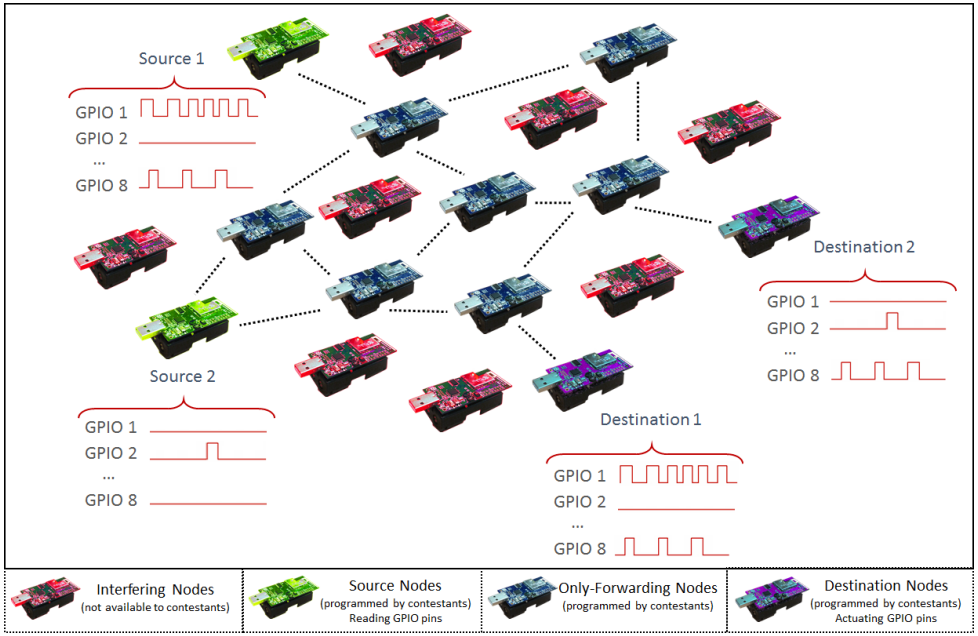
Concurrent Transmission Flooding (CTF)



Toward EWSN Competition 2018

Given multi-source multi-destination traffic pattern and harsh RF environments, several refinements have been made on WTSP including:

1) A dedicated service that realizes UDP-like one-way streaming dissemination
2) Progressive forwarding
3) Source redundancy



UDP-like One-way Streaming (1)

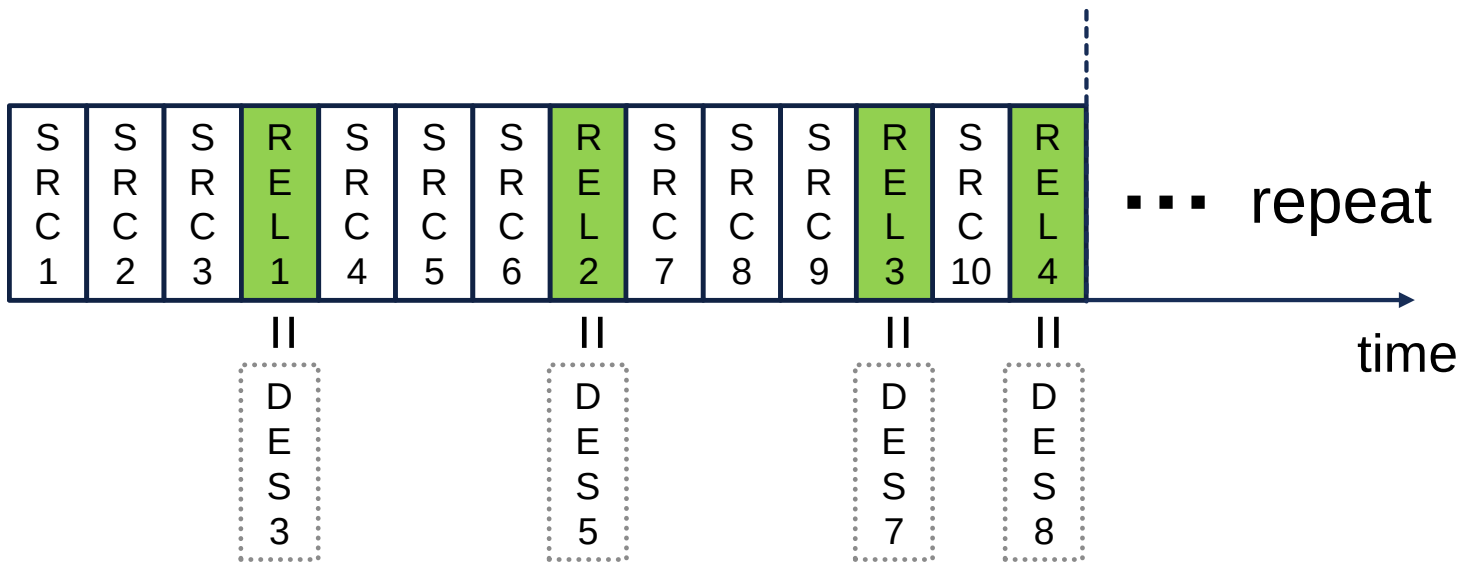
Challenge: Poor reliability even with end-to-end retransmission due to the harsh RF jamming

- Contention-based slot scheduling requires ACK to ensure end-to-end reliability.
- In dense traffic and harsh RF environments, this two-way communication may lead to severe network congestion.

One-way communication, Fixed scheduling

UDP-like One-way Streaming (2)

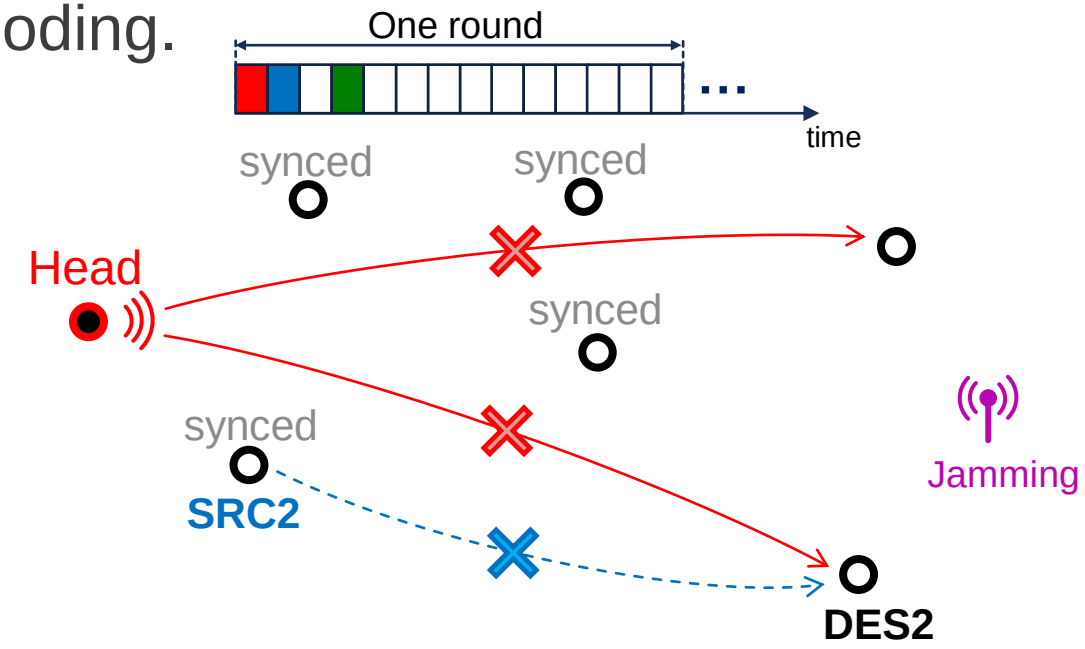
Improvement: Simple but efficient one-way dissemination without ACK



Progressive Forwarding (1)

Challenge: "**Volatile relaying**"

- A packet from an initiator hardly gets through the harsh RF jamming in one flooding.



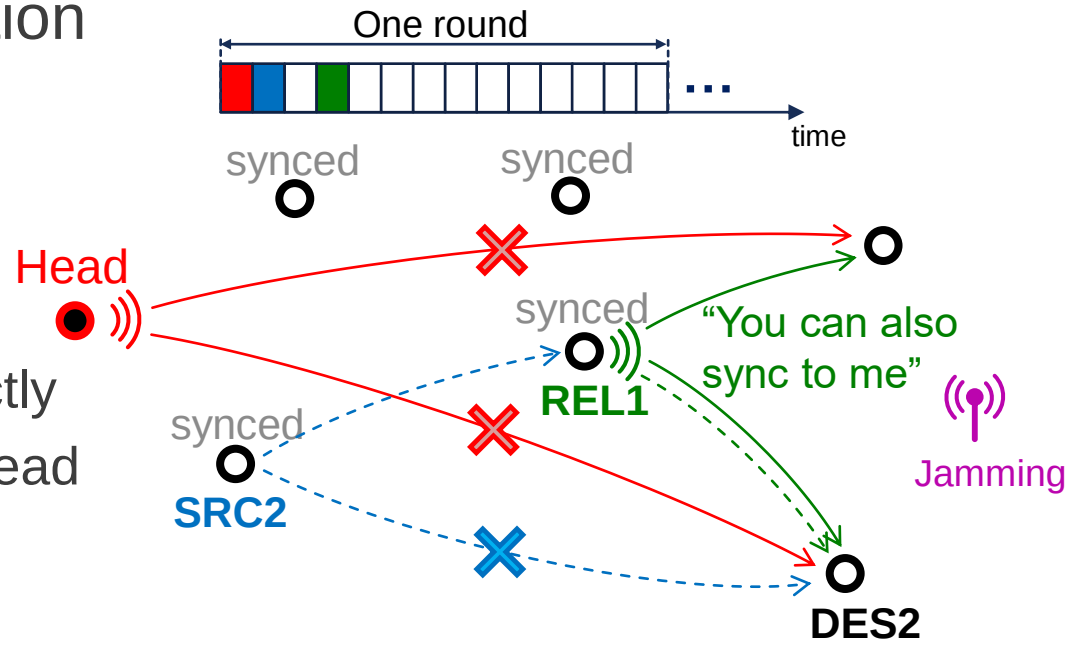
- Poor synchronization
- Poor end-to-end connectivity

Assisting nodes

Progressive Forwarding (2)

Improvement: Slot-owning nodes help synchronization and relaying information in progressive manner.

- Progressive synchronization
  1. "You can sync to me" flag set by a slot-owning node
     → *Quick sync.*
  2. Re-bootstrapping if not directly received from the network head for too long
     → *Unity of the network*



- Progressive forwarding nodes

Source Redundancy (1)

Challenge: Inefficiency of one-to-one packet format

- ***Large*** packet overhead, but ***tiny*** GPIO information

For example,

Field	Size
LEN	1 byte
Service header	1 byte
Slot No.	1 byte
Initiator node ID	1 byte
Relay count	1 byte
CRC	2 bytes

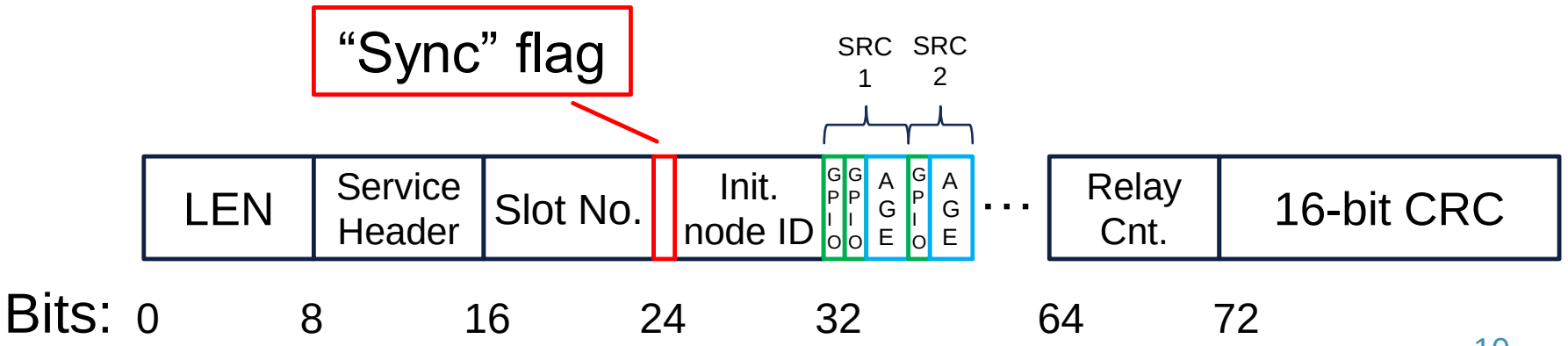
VS

1-bit GPIO

Source Redundancy (2)

Improvement: Transmitting information from multiple sources in a packet

- Highly-efficient packet format:
  1-bit for each GPIO and 2-bit age information for each source



Conclusion

- UDP-like one-way streaming as a dedicated service of WTSP
  - Pre-assigned slot scheduling
- Progressive forwarding
  - Quick synchronization, but still maintaining the unity
  - Arbitrary nodes can be assigned to be forwarding nodes.
- Source Redundancy
  - Efficient packet format
    1-bit for each GPIO, 2-bit age information for each source
- Others: channel hopping

Thank you.