

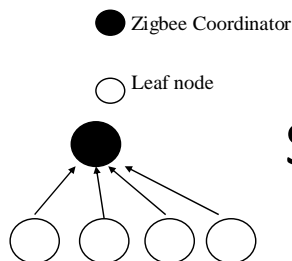
Enabling IEEE 802.15.4 Cluster-Tree Topologies in OMNeT++

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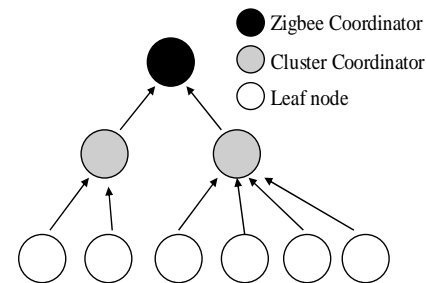
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- IEEE 802.15.4/Zigbee standards → protocol stack for communications of low cost, low rate, and energy efficient wireless embedded devices
- 802.15.4 enables star topologies (a coordinator and a set of leaf nodes)
- Coordinator emits a periodical ‘beacon’ to keep leaf nodes synchronized. After every beacon, nodes can transmit for a certain time (superframe duration) with CSMA/CA. The rest of the time nodes can be in a low consumption state.
- Star topologies can be interconnected to form mesh or cluster-tree networks: a coordinator (or router) can be coordinated
- Problem: Beacon emissions and superframe durations of the coordinators must be properly planned and scheduled.
- Goal: Modify existing 802.15.4 model in OMNeT++ to implement several algorithms that organize the activity periods of the coordinators in an IEEE 802.15.4 Cluster-Tree network.

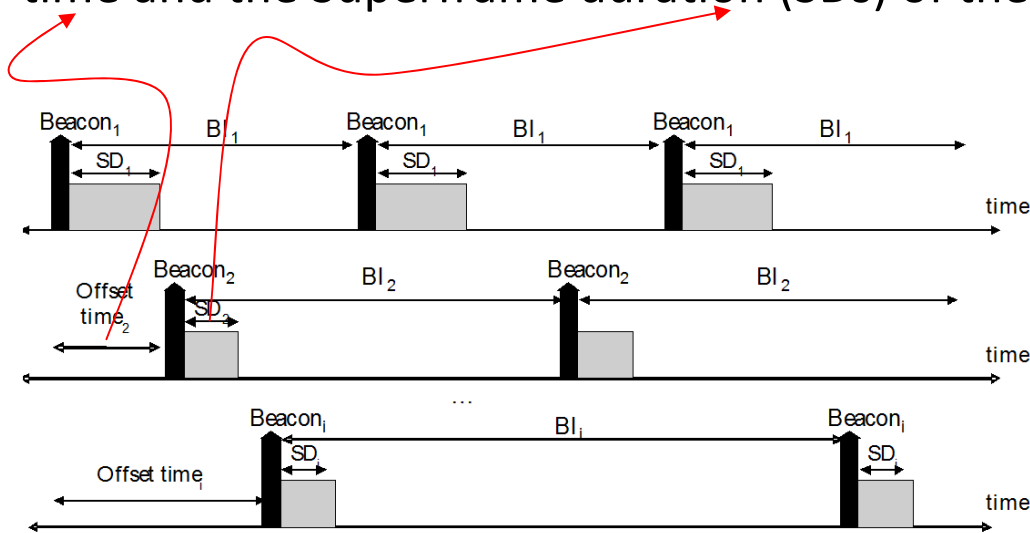


Star Topology



Cluster Tree

- Extended of the existing IEEE 802.15.4 model in OMNeT++ (Univ. of Erlangen) based on a NS-2 model.
- Original model implements the IEEE 802.15.4 protocol stack and includes a Routing Module to configure star topologies.
- To support Cluster-Tree topologies, the role of the ZigBee Coordinator (ZC) is defined. ZC regulates the Beaconsing of the ZigBee Routers (ZRs), mainly the offset time and the Superframe duration (SDs) of the routers.



- Configuration of these MAC parameters in file omnetpp.ini.
- 4 different proposed scheduling policies are implemented

- Complex networking with IEEE 802.15.4/ZigBee requires algorithms to optimize the activity period of the coordinators in cluster trees.
- Implementation on OMNeT++ of several policies aiming at coordinating the beacon emission of the coordinators in 802.15.4 Cluster-Trees
- Policies programmed as an extension of the capabilities of an existing 802.15.4 model for OMNeT++.
- Evaluated through different scenarios and typical use cases
- Further research: dynamic adaptation of the algorithms to network changes

