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# Reliable beacon transmission based MAC protocol for LR-WPANs over WLAN interferences

JZUS C (Comput & Electron)

**Key words:** Low rate wireless personal area network (LR-WPAN), Interference, Wireless local area network (WLAN), Beacon

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# Motivation

- IEEE 802.15.4 based wireless sensor networks and IEEE 802.11 based wireless local area networks use the same ISM frequency bands, and they interfere each other.
- Performance degradation depends upon the distance between LR-WPANs and WLANs, locations, the channels used by LR-WPANs, and the traffic loads of WLANs.
- Reliability of the beacon frame needs to be guaranteed because the loss of beacon frames causes huge performance degradation.
- After aMaxLostBeacons times, the re-association process is initiated, which requires a long process delay.

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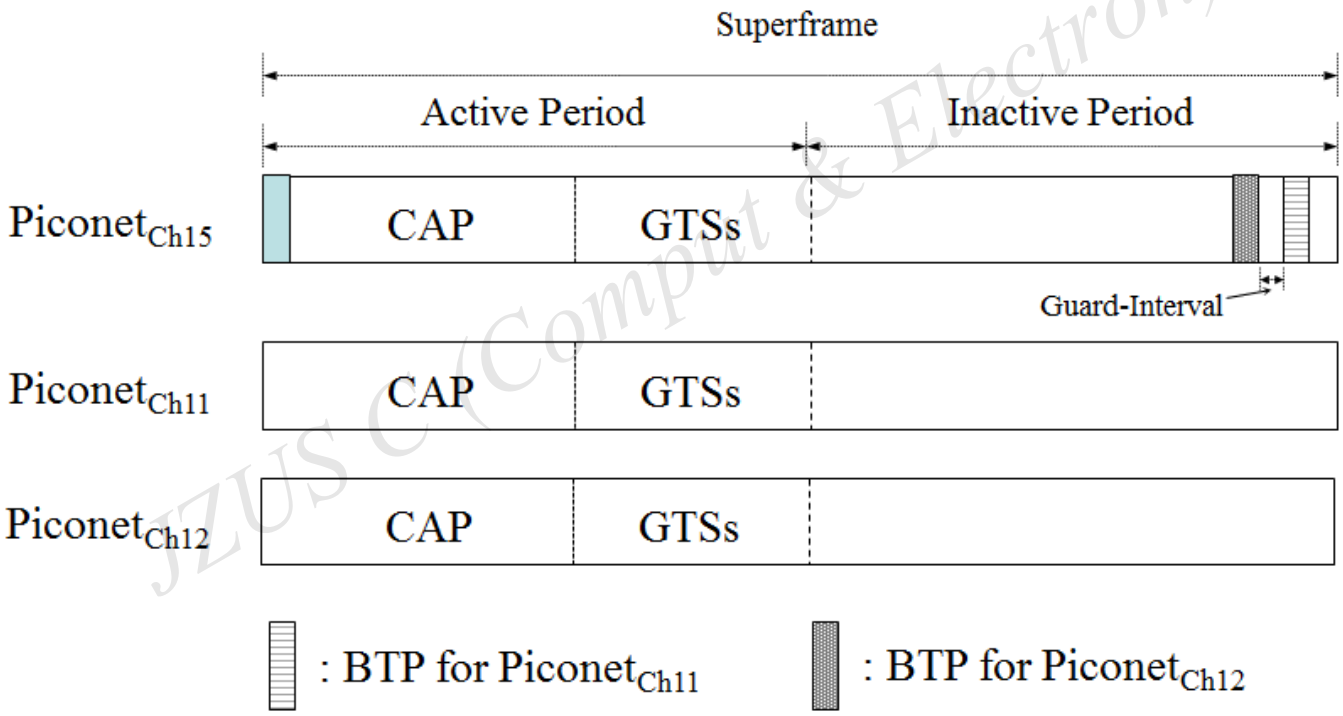
# Proposed protocol (1/5)

- We propose a MAC protocol to improve the performance of IEEE802.15.4 based WSNs
- Two types of piconets are considered:
  - Primary-piconet (P-piconet)
  - Secondary-piconet (S-piconet)
- P-piconet uses one of the interference-free channels and S-piconet has to use channels interfered with the WLANs channel
- The interfered channel is used for data transmission and the interference-free channel for beacon frame transmission
- Improve the overall channel utilization and minimize the performance degradation

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# Proposed protocol (2/5)

- Example of operations




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**An example of constructing superframes using the proposed method**

# Proposed protocol (3/5)

- New frame formats

(a)

| Octets: | 1 | 1 |
|---|---|---|
| MAC header | Command Frame Identifier | Beacon Length |

(b)

| Octets: | 1 | 1 | 2 | 1 |
|---|---|---|---|---|
| MAC header | Command Frame Identifier | Beacon ID | Beacon Tx Time | Max. BTP |

(c)

| Octets: | 1 | 1 |
|---|---|---|
| MAC header | Command Frame Identifier | Beacon ID |

(d)

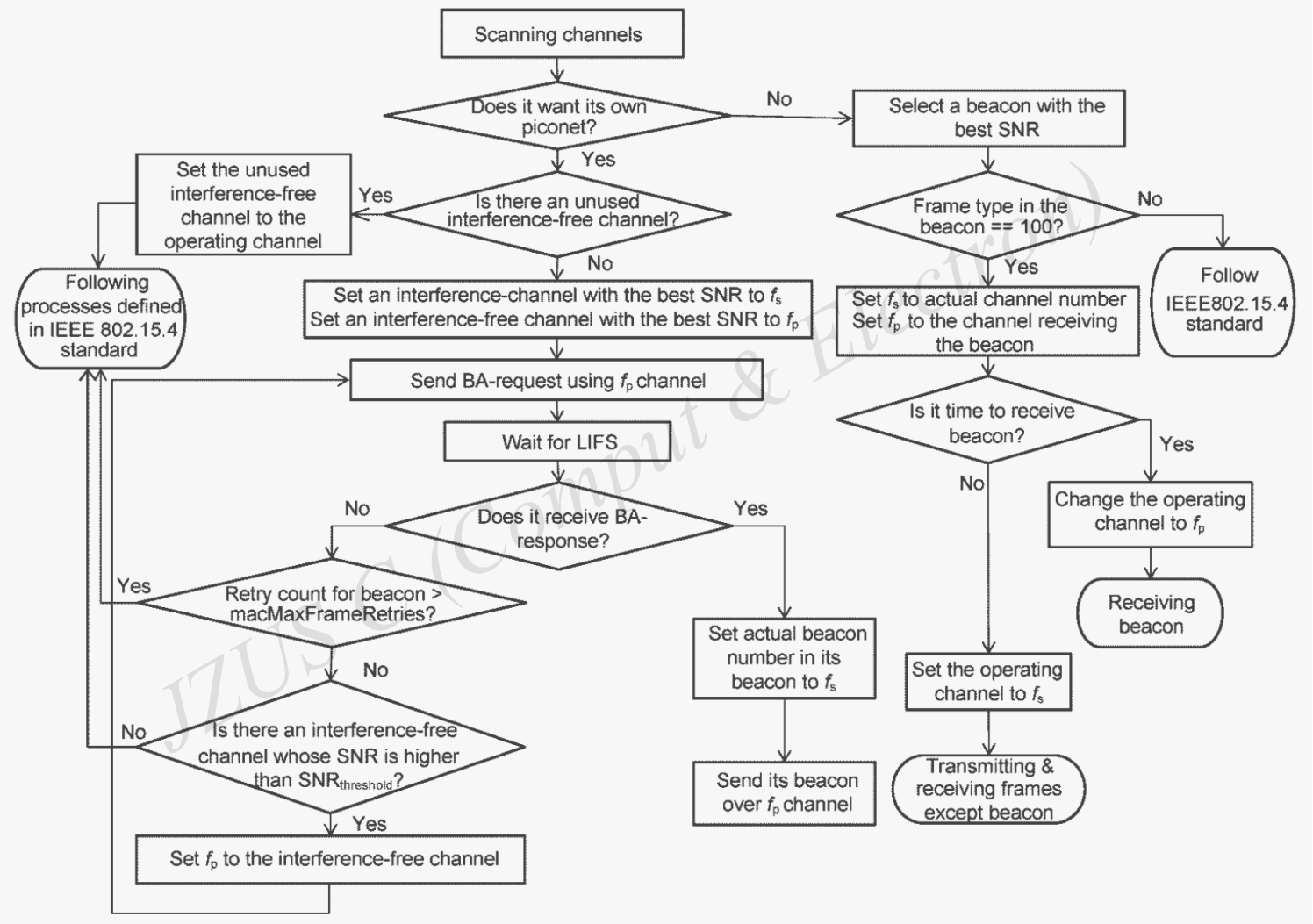
| Octets: 2 | 1 | 4/10 | 0/5/6/10/14 | 2 | variable | variable | variable | 2 |
|---|---|---|---|---|---|---|---|---|
| Frame Control | Sequence Number | Address Field | Auxiliary Security Header | Superframe Specification | GTS Field | Pending Address Fields | Beacon Payload | FCS |

| 1 | variable |
|---|---|
| Actual Channel Number | Payload |

**Frame formats of BA-request (a), BA-response (b), BD-request (c), and a beacon frame for RBT-MAC (d)**

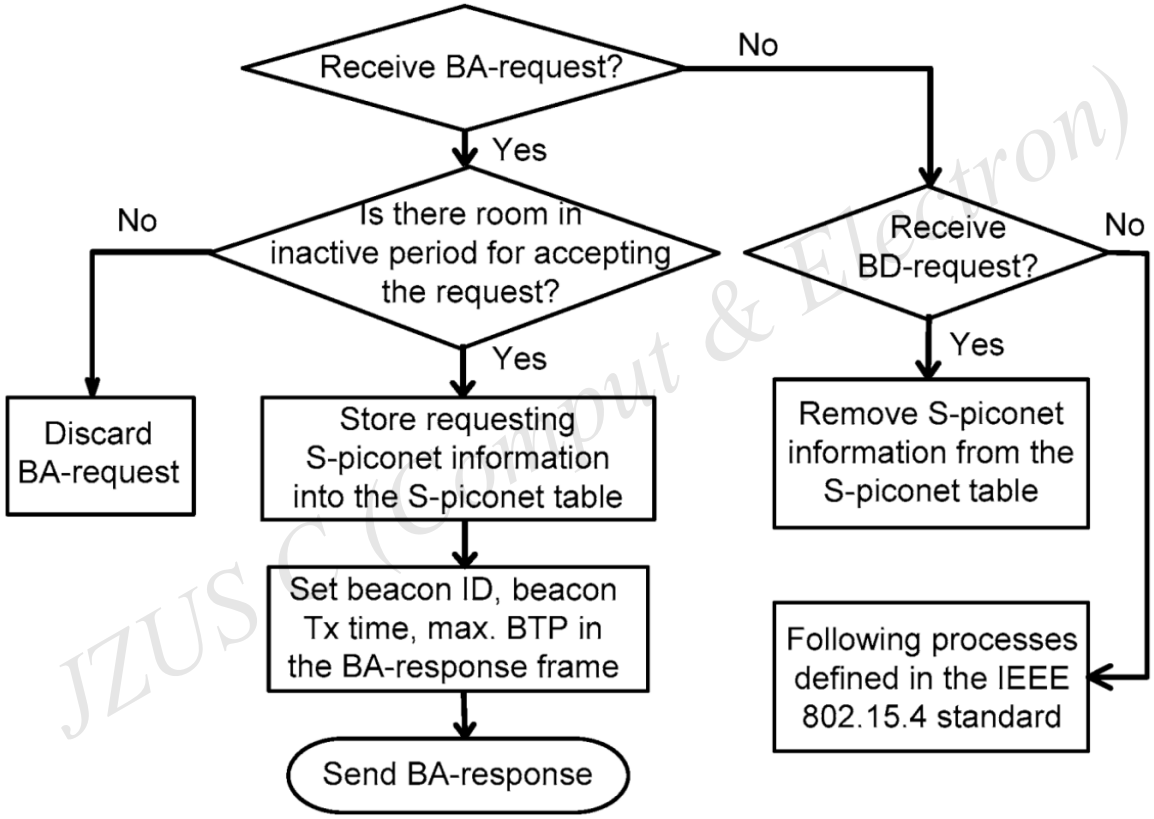
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# Proposed protocol (4/5)




**Flow chart of the process that a device configures and associates with the S-piconet using the RBT-MAC protocol**

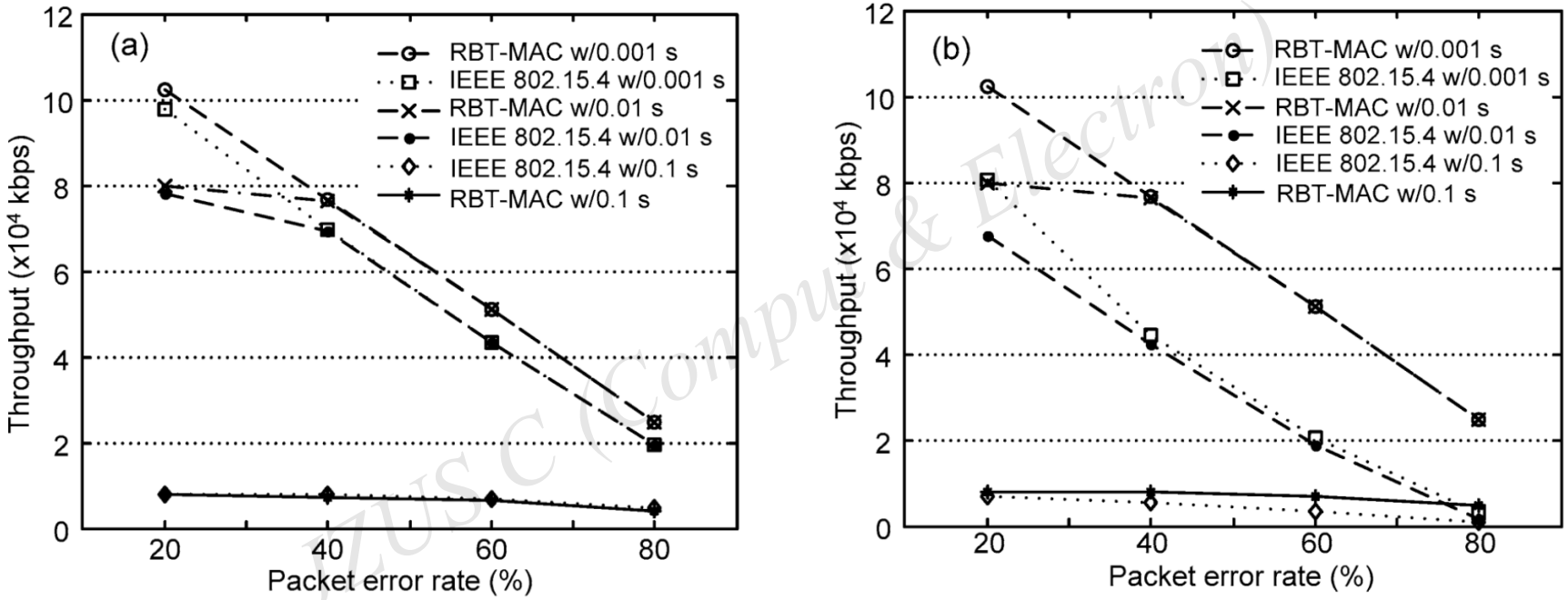
# Proposed protocol (5/5)




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**Flow chart of the process at a PNC of the P-piconet**

# Performance evaluations




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**Throughput as a function of the packet error rate and packet inter-arrival time with a beacon frame length of 14 bytes (a) or 100 bytes (b)**