



# Jennic

TECHNOLOGY FOR A CHANGING WORLD

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# Agenda

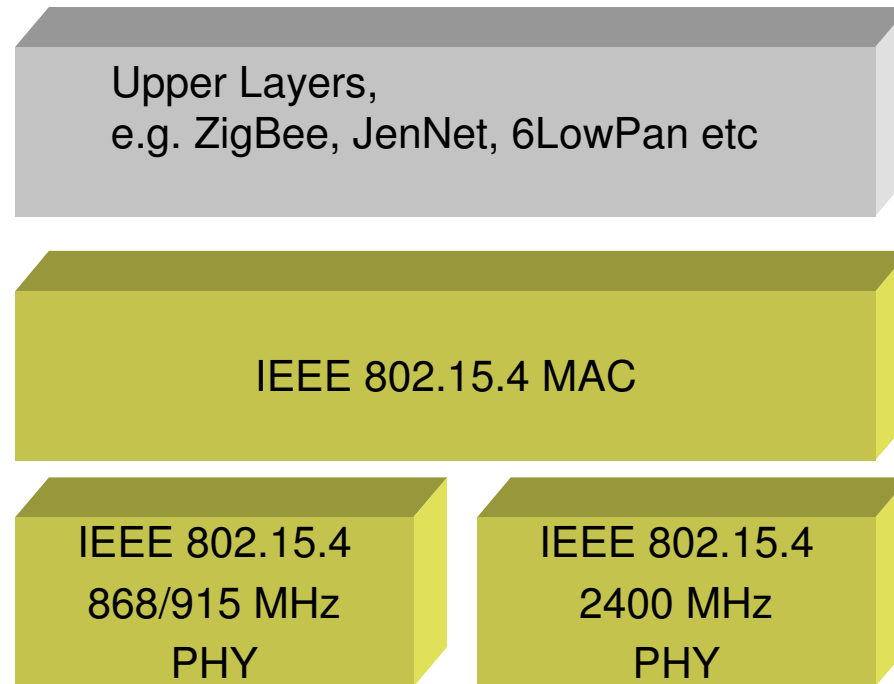
- Introduction to 802.15.4
- Standards vs Proprietary
- Proprietary Network overview - JenNet
- IEEE802.15.4 - the standard for proprietary systems

## 802.15.4 Key Features

- Low data rate WPAN
- Support for large networks
- Short range
- Secure transmissions using 128bit AES Encryption
- Low power consumption
- Low cost

# Protocol stack

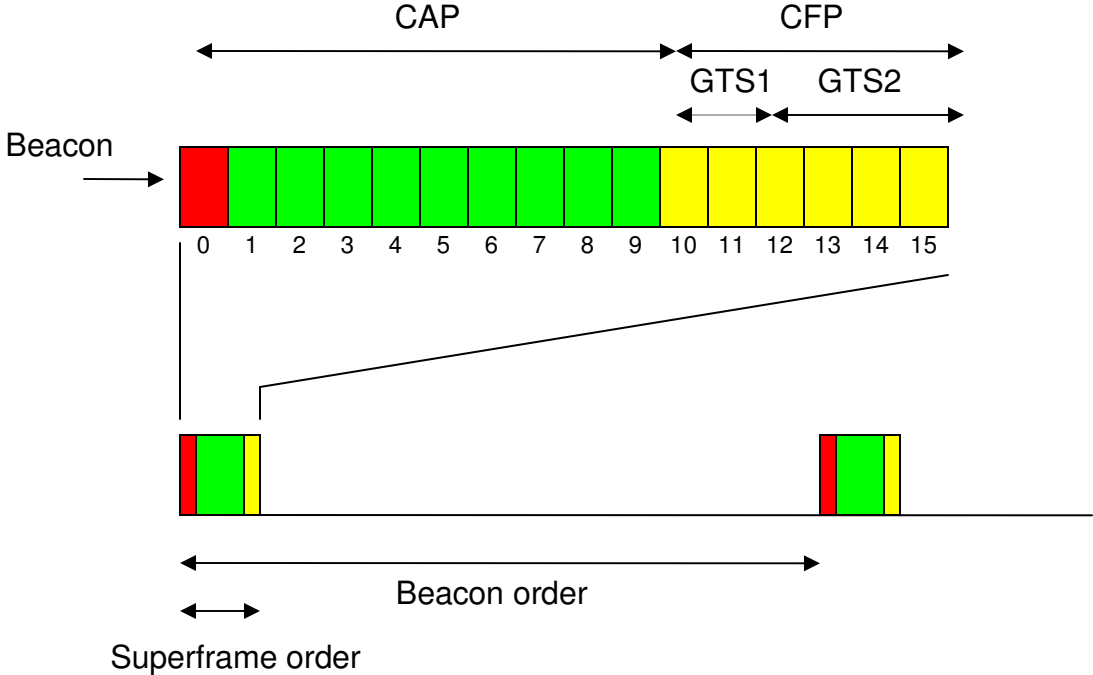
- The IEEE 802.15.4 standard describes two layers:
- MAC – Medium Access Control
- PHY – Physical



# MAC Layer - Overview

- MAC layer provide the following data transmission and management services:
  - Beacon Management
  - GTS Management
  - Channel Access
  - Frame Delivery (including validation and acknowledgement)
  - Association and Disassociation

# MAC Layer – Beacon Management (1)

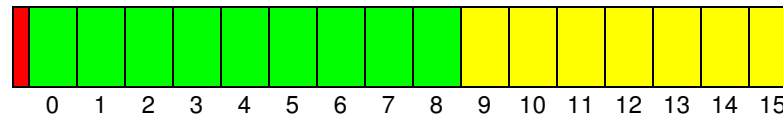


## MAC Layer – Beacon Management (2)

- It is possible to operate without the use of regular beacons.
  - Beacons are only used for device discovery
- No superframe structure at all
- Communication is done using *unslotted CSMA/CA*
- Higher layer is responsible for data scheduling

# MAC Layer – Channel Access

- Access to the radio channel is obtained using either slotted or unslotted CSMA/CA
- Slotted CSMA/CA



- Unslotted CSMA/CA



# Benefits of Proprietary Systems

- Can address specific issues
  - Long thin networks
  - Sleeping routers
  - Large ratio of Sleeping End Devices to Routers
- No need to join Alliances
- More Secure
  - Custom options can be included to help improve RF security
  - Custom features can be included to prevent easy copying

# JenNet Overview

Jennic designed network stack

For Jennic's wireless microcontroller family

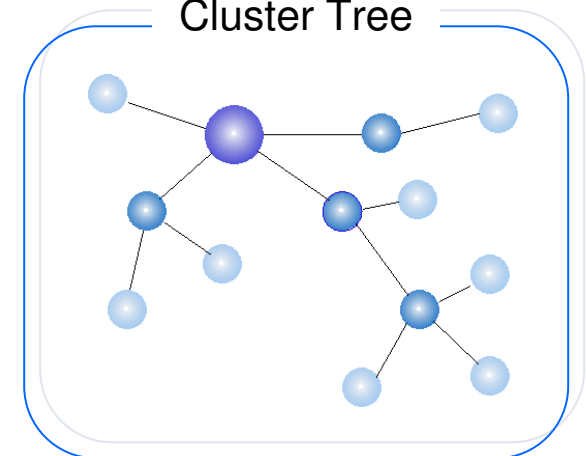
- Proprietary network - supports star, tree and linear topologies
- Supports up to 1000 node networks
- Small memory footprint
- Fast response times between two adjacent nodes - less than 2ms typ.
- Reliable and robust communication, end-to-end acknowledgements for sent messages available
- Low power operation for battery powered End Devices
- 128-bit AES encryption of data
- Broadcast Messages

**JenNet**

**IEEE802.15.4 MAC**

**IEEE802.15.4 PHY**

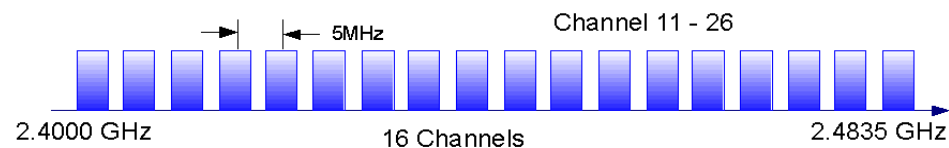
Cluster Tree



# JenNet Network Management

A JenNet network is initialised by setting the following three values, which can be set by the user or automatically:

- A PAN ID (16-bit)
- One or many channels out of 16 in the worldwide unlicensed ISM 2.4GHz band



- A JenNet specific network ID (32-bit)

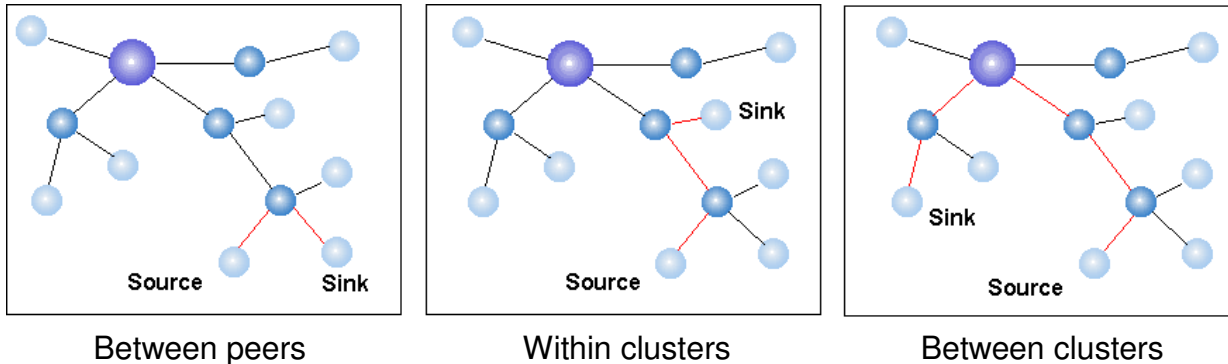
After successful setup of the Coordinator, additional devices can join either as Routers or End Devices

- If there is more than one router in the same space the joining device gathers additional information and tries to join the 'best' node using a combination of depth in the network, current number of children and signal strength.
- The number of nodes allowed to join can be limited or even completely disabled dynamically
- Nodes can choose to leave the network

For network management functions/visualisation routing tables can be read from routers

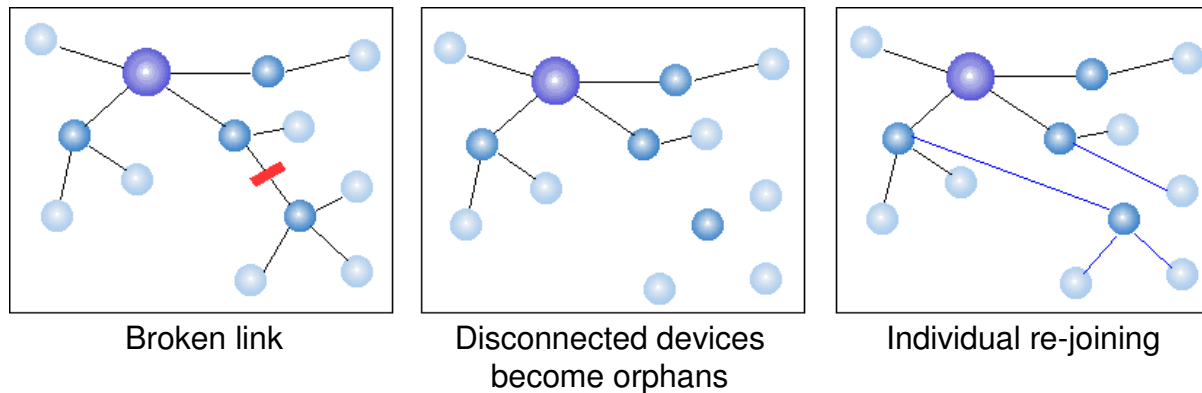
# JenNet Routing

Routing information is stored on Routers and the Coordinator. Messages are routed through the network as follows:



Routing tables and application data can be stored via Save/Restore context. This feature provides a quick reformation of the network after brown out/power cycling

If a network link is broken, JenNet nodes perform an automatic route repair function:



# Benefits of Standards based Network Layers

- Developed by groups of industry experts
  - More man years spent on design than any one company could afford
  - More markets considered and catered for
- Interoperability
- Cost effective to develop chips and software
  - Economies of scale for a manufacturer
  - Multiple vendors

# The best of both worlds

- IEEE802.15.4 provides a high performance platform for low power wireless sensor networks
- Jennic offers chips and modules that conform to 802.15.4 that include a powerful 32bit micro to allow them to run any of the current standards based stacks as well as Jennic's own stack, JenNet

# Summary

- Standards allow economies of scale and interoperability
  - many suppliers of IEEE802.15.4 and ZigBee chips
  - many application areas for IEEE802.15.4 based networks
- Proprietary systems can address specific problems and can be designed to offer better overall security
- For Low Power Wireless Sensor Networks, the best of both worlds can be realised
  - Use IEEE802.15.4 for PHY and MAC layers
  - Build a proprietary networking layer above this - eg JenNet



# Jennic

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## Any Questions?