Wireless Sensor Networks (WSNs) are emerging as enabling infrastructures for various types of large-scale distributed embedded applications. Some of those applications do not pose stringent timing requirements on data delivery. There are however a number of other applications in which timeliness is of great importance (industrial automation, process control, etc.). In addition to an increased robustness and fault tolerance, each node is expected to perform computations in real-time and to send large amounts of data with guaranteed Quality-of-Service (QoS).

The IEEE 802.15.4 protocol specifies the Medium Access Control (MAC) layer and the Physical Layer for Low-Rate Wireless Personal Area Networks (LR-WPANs). In IEEE 802.15.4 the star and the peer-to-peer topologies are supported as shown in the figure.

Two different device types can participate in an IEEE 802.15.4 network:
- full-function device (FFD)
- reduced-function device (RFD)

Data transfer mode:
- Beacon enabled (use of Superframe)
- Non-beacon enabled (unslotted CSMA/CA)

Throughput and Packet Delivery Ratio

![Graph showing Throughput and Packet Delivery Ratio](attachment:graph.png)

The implementation of the IEEE 802.15.4 (Open-ZB) protocols in ERIKA is organized in a layered architecture. In this design we implemented the MAC and PHY services making use of Operating System primitives, generic libraries and hardware-dependent features. The software architecture is depicted in the following figure.

ERIKA runs on several platforms (e.g. Microchip dsPic, Atmel Atmega128, Altera NIOS II). FLEX is the ERIKA Enterprise development board for Microchip dsPic.

The Open-ZB toolset is available as open-source and aims at implementing, testing and evaluating the functionalities defined in the IEEE 802.15.4 standard as well as new add-ons.

The IEEE 802.15.4 implementation in ERIKA supports the beacon-enabled mode, therefore it includes functionalities such as the slotted version of the CSMA/CA algorithm, and the GTS mechanism.

Open-ZB is ported to TinyOS, Contiki, and ERIKA microkernels.