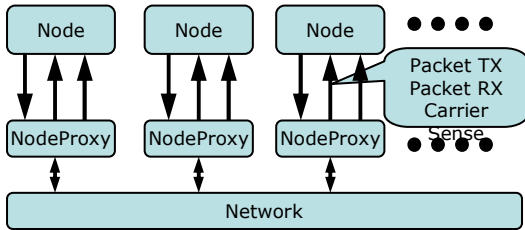


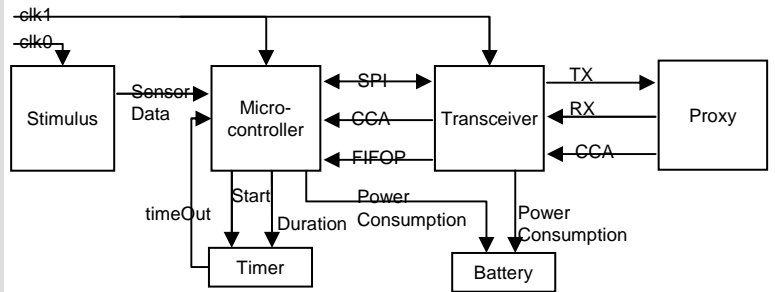
Object

- Support the entire IEEE 802.15.4 protocol stack
- Support different hardware platforms.



A Model of Wireless Sensor Network

1. Node and NodeProxy in SystemC
2. Network in C++



A Model of Nodes

1. Support ATMEL ATmega-128 and Texas Instruments CC2420 (CC1000 is under development)
2. Processing time and energy aware

IEEE 802.15.4 Operation modes supported

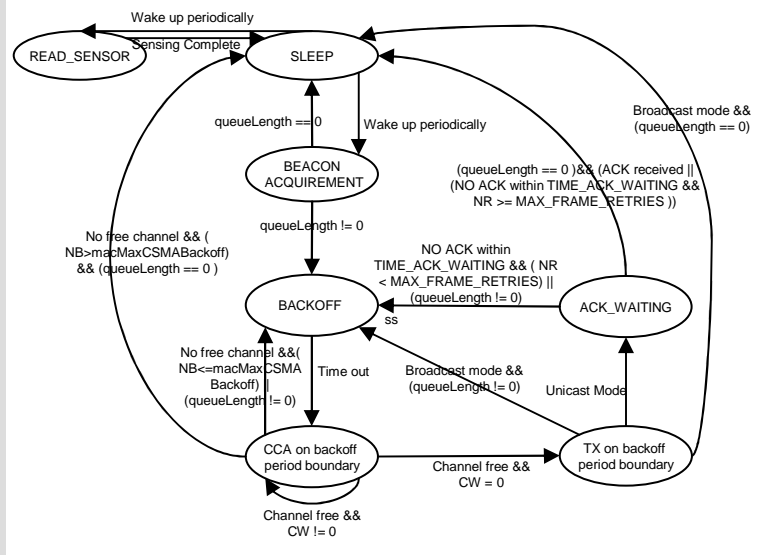
Mode	Non-beacon	Beacon
Method	CSMA-CA	Slotted CSMA-CA Predictive GTS Non-Predictive GTS

Current Consumption and Execution Time of Tasks in Microcontroller

	ADC	SPI
Current consumption	9mA (µC) 320µA (ADC)	9mA
Execution time (µs)	218.6	$0.68+8*x/7.3728$ $+(2.584+8*x/7.3728)*$ frameLength

Current Consumption and Duration of Transceivers according to its states

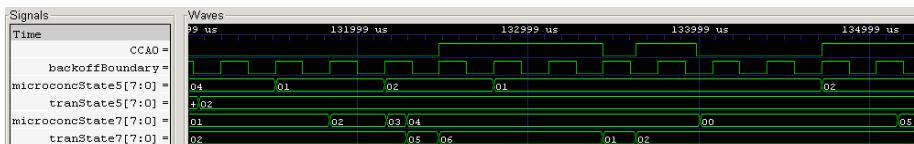
	ID-LE	Calibrate RX	RX	Calibrate TX	TX
Current consumption	426 µA	18.8 mA	18.8 mA	Depend on output power	9mA
Execution time (µs)	--	192 µs	LenPacket* 8/dataRate	192 µs	LenPacket* 8/dataRate



Microcontroller with Beacon Slotted CSMA-CA

- Reading Sensor operation may occur at any time
- Reading Sensor operation has the first priority

A communication process example of a network consisting of 1 coordinator and 8 nodes in beacon CSMA-CA mode



- Nodes' states: SLEEP=0, BACKOFF=1, CCA=2, TX=3, A_W=4
- Transceivers' states: CALIBRATE_RX=1, RX_FRAME=2, CALIBRATE_TX=5, TX_FRAME=6

A design space exploration example of a network consisting of 1 coordinator and 8 nodes

Payload (bytes)	1	5	10
Sample Rate (Hz)	65	326	651
Packet Delivery Rate (%)	54.9	50.3	41.5
Average Latency (µs)	201633	253599	295140
Average Power Consumption (µW)	26895.9	26921.6	27113.6

Beacon Slotted CSMA-CA

Payload (bytes)	1	5	10
Sample Rate (Hz)	65	326	651
Packet Delivery Rate (%)	97	97	97
Average Latency (µs)	7973.9	8109.8	8367.2
Average Power Consumption (µW)	17951.9	19984.9	20188.1

Beacon Predictive GTS