Ultra low-power communication protocol for Structural Health Monitoring

- Alternates short active phases and long sleep ones
- **Active phase** (100% duty cycle):
  - guard time, resynchronization (sink-to-nodes) and data collection (nodes-to-sink)
- **Sleep phase** (0.1% duty-cycle):
  - new nodes, out of synchronization management
- **Adaptive Engine**: collects statistics -> adapts the schedule -> minimizes the duty cycle
- **Implicit Backward Channel**: nodes-to-sink communication -> resynchronization, changes sampling periods, shares schedule
- **Collection Tree Protocol**: sink-to-nodes communication (Gnawali et al.) -> reliably collects data

Results:

- Ultra-low duty-cycle (<1% for 5min. Sampling period)
- High delivery rate (>99.5%)

Improved interface with sensors

- 6 mechanical sensor input lines
- Wide power supply voltage range (CP approach) (1.5 – 24V)
- Improved analog sensor architecture (PLL based detection fundamental mode)
- Improved analog sensor implementation
- PAM amplitude
- Sleep mode available

**Processor**

- **MSP430F6638**

**CPU**

- RISC - 16 bit

**Program Flash Memory**

- 256KB

**RAM**

- 16KB+2KB

**Supply Voltage Range**

- 1.8 V to 3.6 V

**USCI**

- 2

**Real-time clock module**

- 1

**DMA**

- 1

**RF Transceiver**

- **CC2520**

**Transmit data rate**

- 250 kbps

**Frequency**

- 2.4 GHz

**Receiver sensitivity**

- -98 dBm

**RF power (max)**

- 5 dBm

**Serial Memory Flash Memory**

- 32 MB

**Speed**

- 75 MHz

**Digital Humidity Sensor**

- SHT75

**Energy Consumption**

- 80uW

**RH operating range**

- 0-100% RH

**T operating range**

- -40 - +125 °C