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# A Heterogeneous System Architecture for Event-triggered Wireless Sensing

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## > Motivation

***Wireless Acoustic Sensing with High Spatial Resolution***

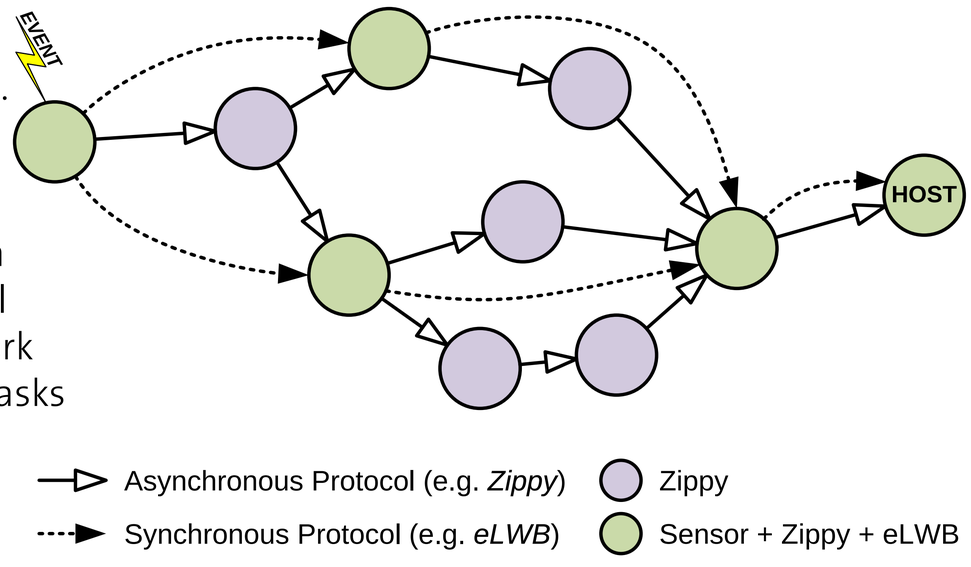
- Detection and characterization of an acoustic event with high spatial resolution.
- Examples: intruder detection, structural monitoring, sniper localization, etc.

***Challenges:***

- Acoustic Sensor Interface → support low-power event detection and acquisition
- Rapid Network Wake-up → energy-efficient network wake-up upon event arrival
- Adaptive Data Dissemination → dynamic data-rate adaption throughout network
- Resource Interference → conflict between resource-intensive and time-critical tasks

***Our Solution:***

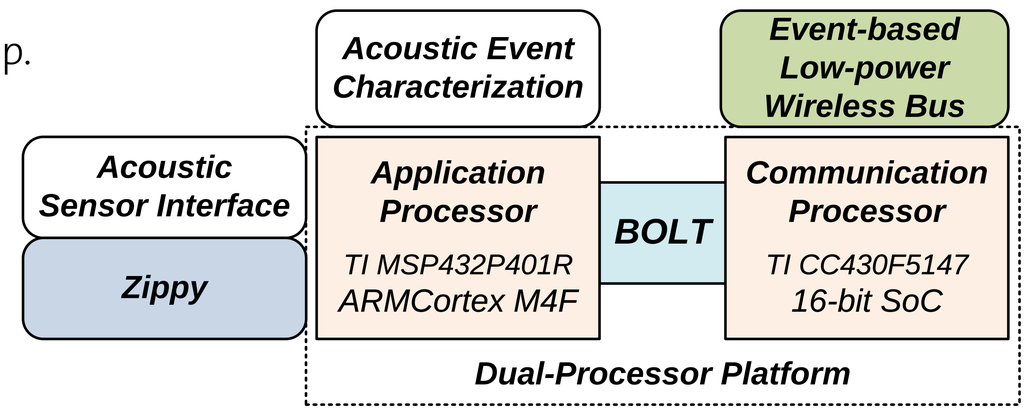
- System architecture consisting of a *heterogeneous protocol and platform.*

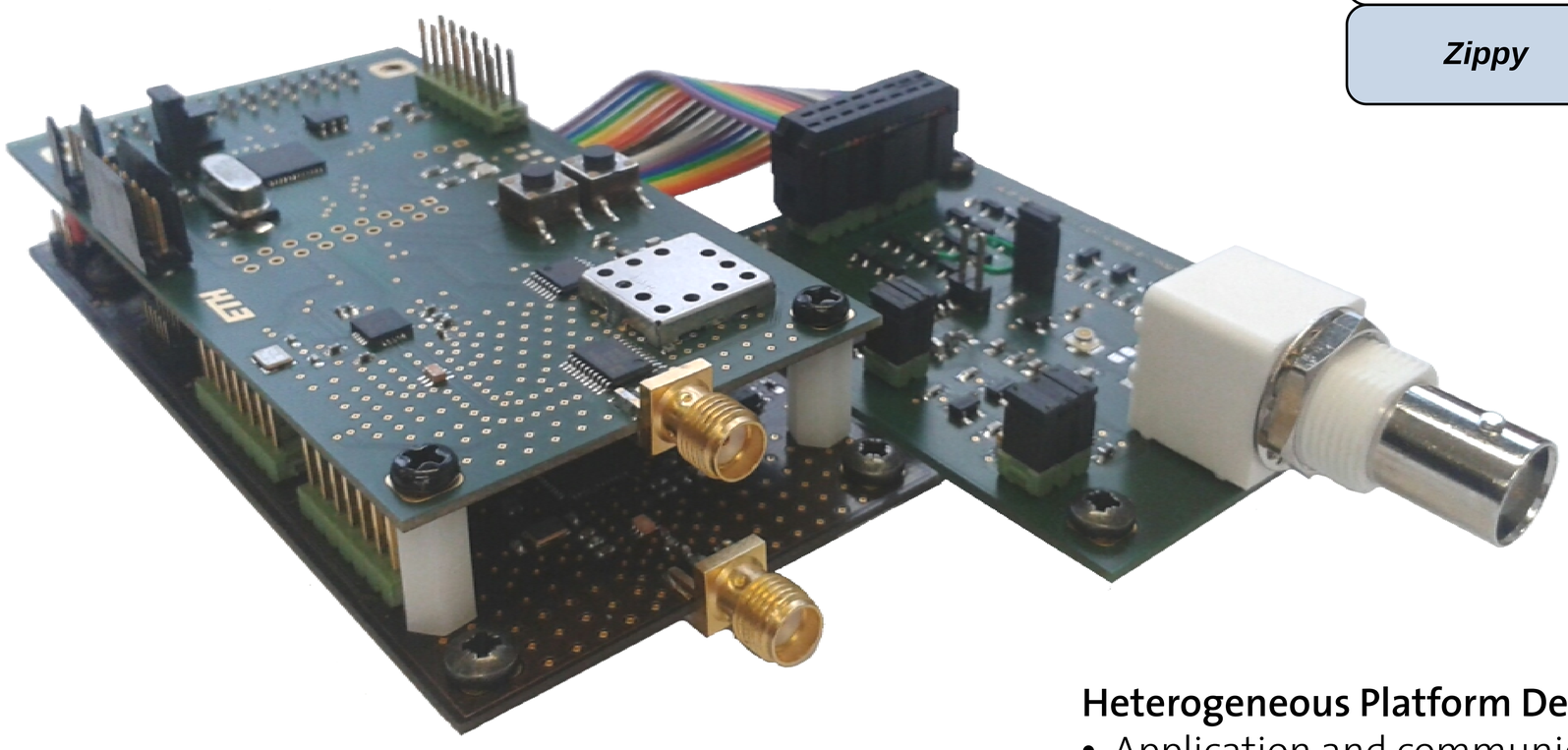



## > Heterogeneous Protocol and Platform Design

**Heterogeneous Protocol Design:**

- Asynchronous protocol (***Zippy***) for rapid and on-demand network wake-up.
  → "*Zippy as a Sensor*" to enable rapid acoustic event characterization.
- Synchronous protocol (***eLWB***) for robust multi-hop dissemination.
  → Low-power Wireless Bus tailored for rapid event-based dissemination.



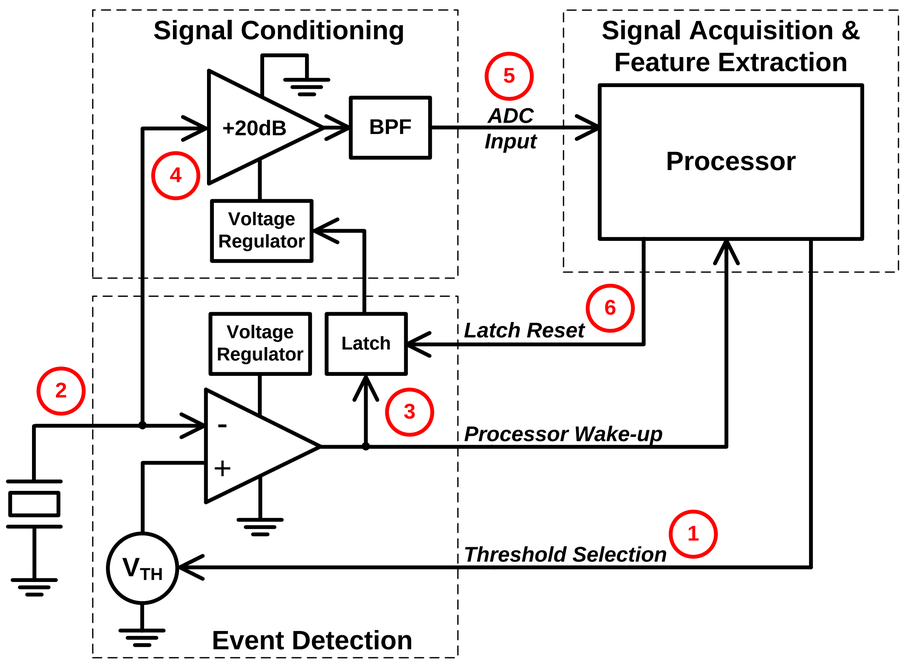



**Preliminary Power Dissipation:**

| Component | During Periods of Inactivity |
|---|---|
| Acoustic Sensor Interface | 6.3 µW |
| Zippy as a Sensor | 9.6 µW |
| Acoustic Event Characterization | 2.5 µW |
| BOLT Processor Interconnect | 1.3 µW |
| Event-based Low-power Wireless Bus | 5.5 µW |
| Total | 25.2 µW |

**Acoustic Sensor Interface:**

- Ultra-low power analog circuit to facilitate sensor-initiated wake-up using a piezoelectric transducer.
- Wake-up application processor and start event characterization when acoustic signal greater than $V_{TH}$.




**Heterogeneous Platform Design:**

- Application and communication tasks onto dedicated processors.
- Mitigate resource interference using the BOLT processor interconnect.