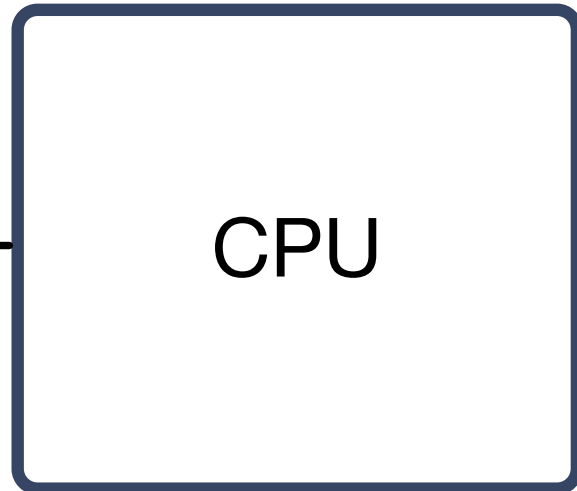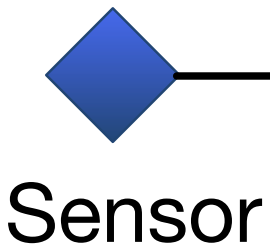# Approximate Computing for Energy-Harvesting Sensor Nodes
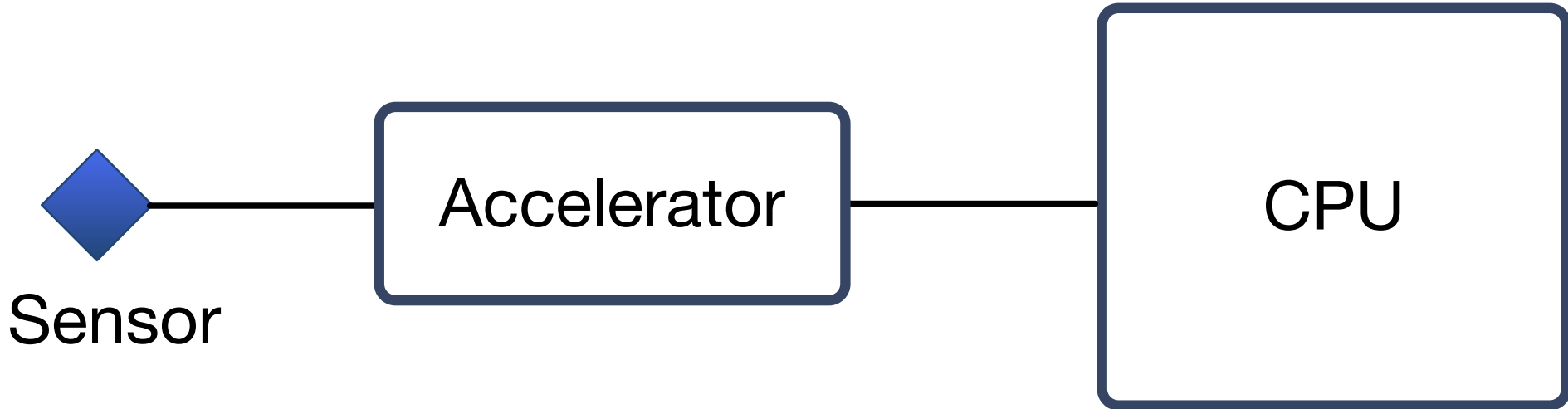
Armin Alaghi

Research Associate
Computer Science and Engineering Department
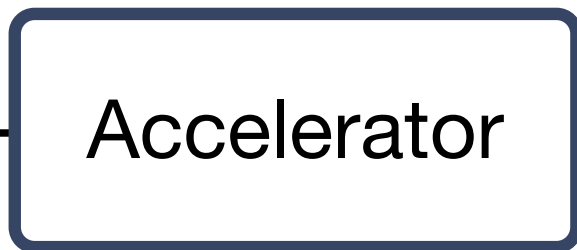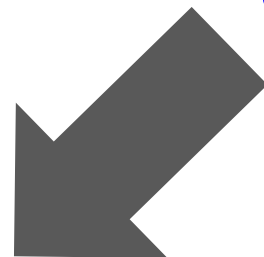University of Washington

April 3, 2016

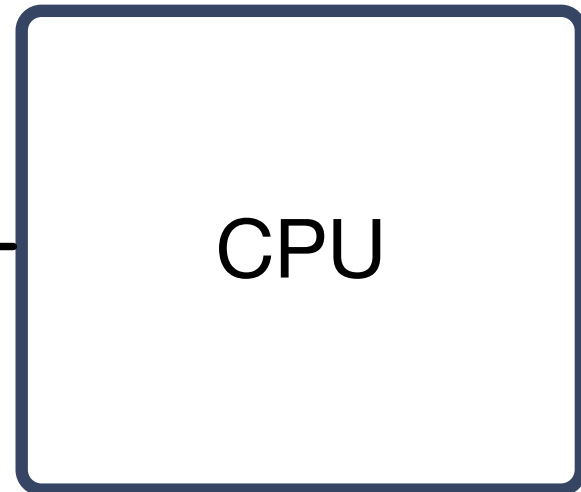Sensor

CPU

Hardware Acceleration

Sensor

Accelerator
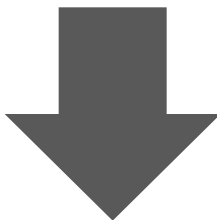
CPU

Hardware Acceleration **+** **Approximate Computing**
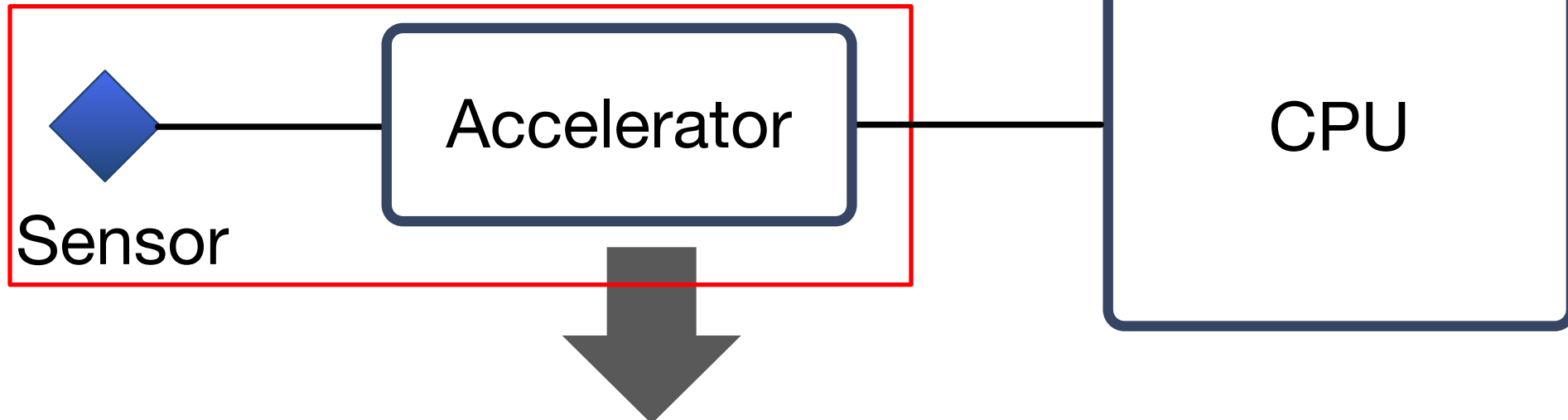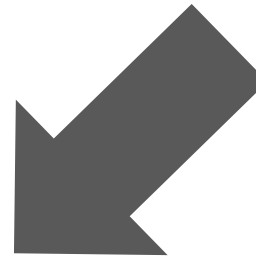
Sensor

Accelerator

CPU

Energy efficiency

Hardware Acceleration **+** **Approximate Computing**

Sensor — Accelerator — CPU
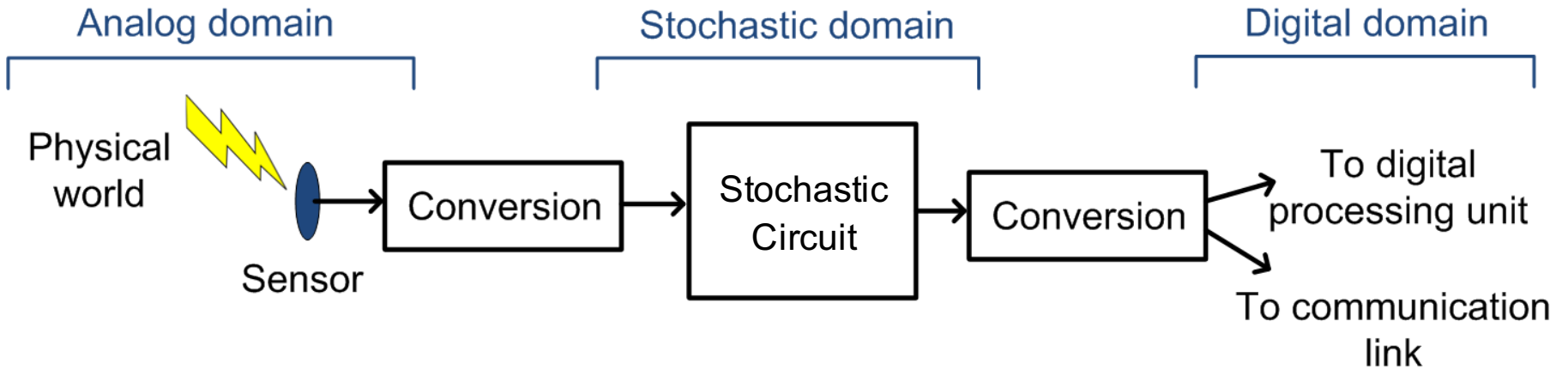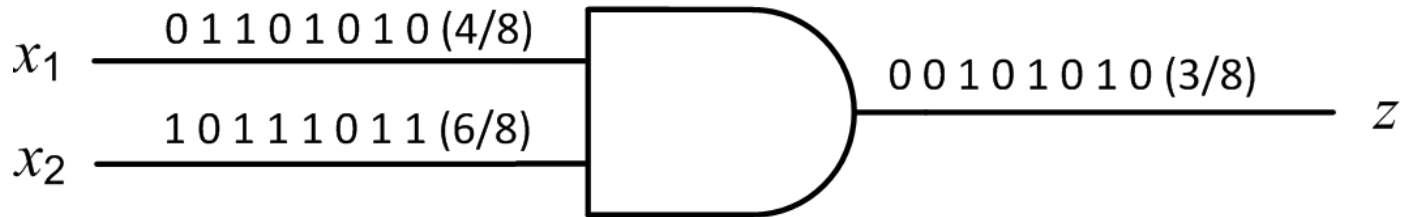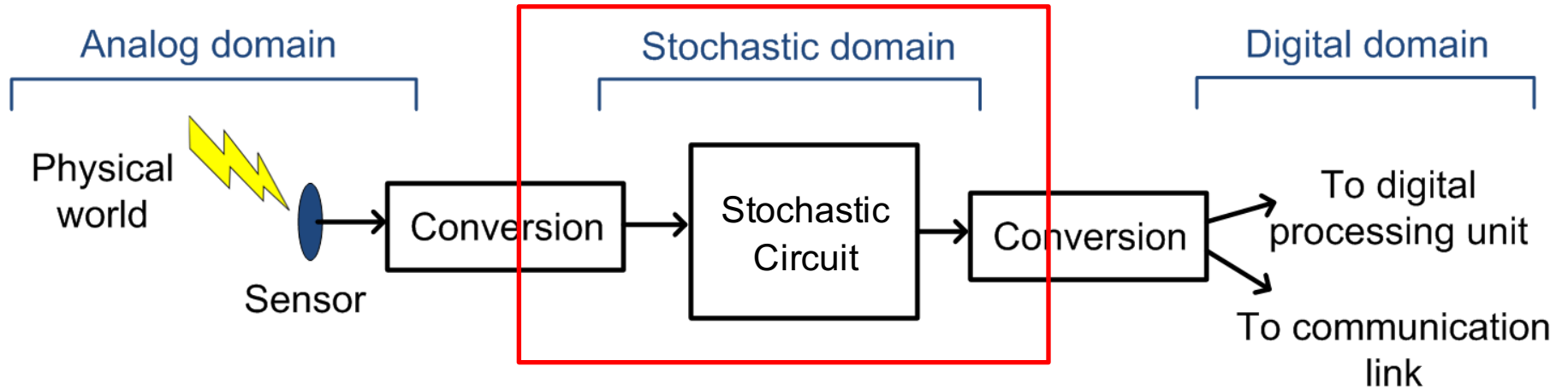
Energy efficiency

- Signals/inputs are already approximate
- Applications are amenable to approximation
- Closer to the circuit level

Digital-Analog Hybrid: Stochastic Computing

Digital-Analog Hybrid: Stochastic Computing

Analog domain — Stochastic domain — Digital domain

Physical world → Sensor → Conversion → Stochastic Circuit → Conversion → To digital processing unit / To communication link

x_1 0 1 1 0 1 0 1 0 (4/8)

x_2 1 0 1 1 1 0 1 1 (6/8)

0 0 1 0 1 0 1 0 (3/8) z

Digital-Analog Hybrid: Stochastic Computing

Analog domain

Physical world

Sensor

Conversion

Stochastic domain

Stochastic Circuit

Conversion

Digital domain

To digital processing unit

To communication link

x_1 — 0 1 1 0 1 0 1 0 (4/8)

x_2 — 1 0 1 1 1 0 1 1 (6/8)

0 0 1 0 1 0 1 0 (3/8) — z

Sensing

Stimulation

Stochastic Circuit

Example: Medical implants