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QOS-ADEQUATE COMUNICATION

PAUL DETTERER

THE OUTLINE

- Emerging applications in the Internet-of-Things
- Quality-of-Service-Adequate Wireless Receiver Design[1]
- Between wireless and neural networks
- Event based neural works and their implementations

[1] Detterer 2023

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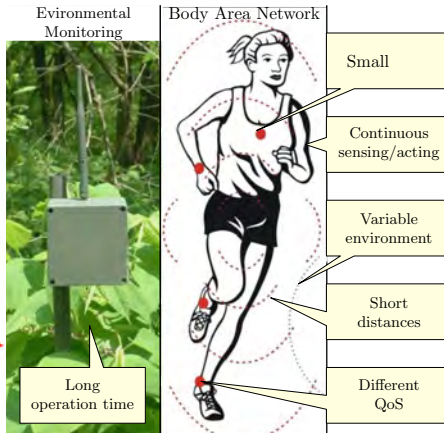

[2]Navarro, Li, and Liang 2014; Jovanov et al. 2005

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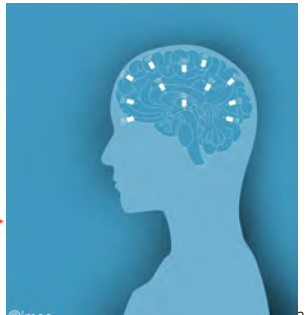
Intranet-of-Neurons



[2]

[2]He et al. 2022

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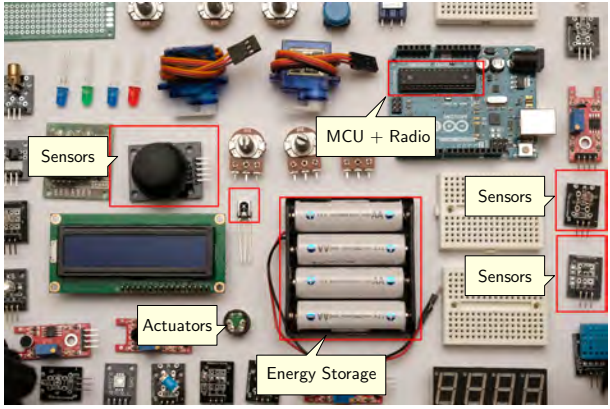
COMPONENTS OF IOT NODE



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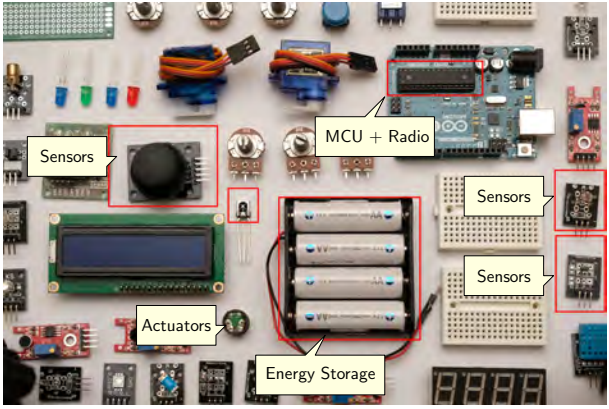

Observation

Energy efficiency is the enabler of emerging IoT applications

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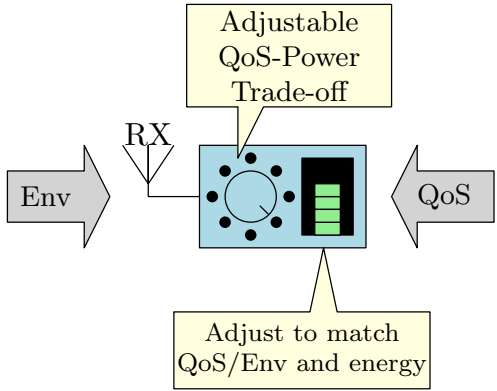
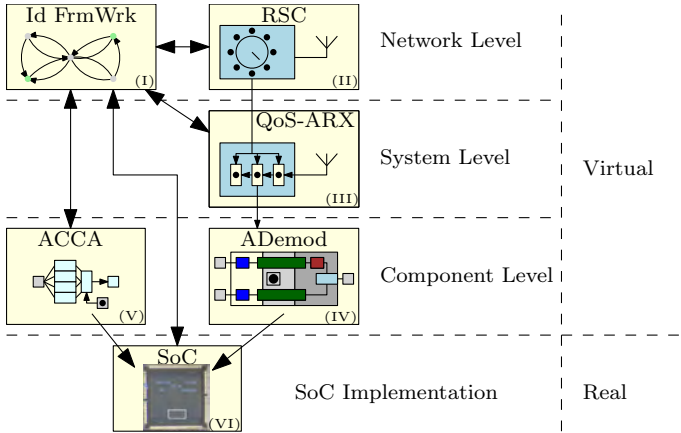
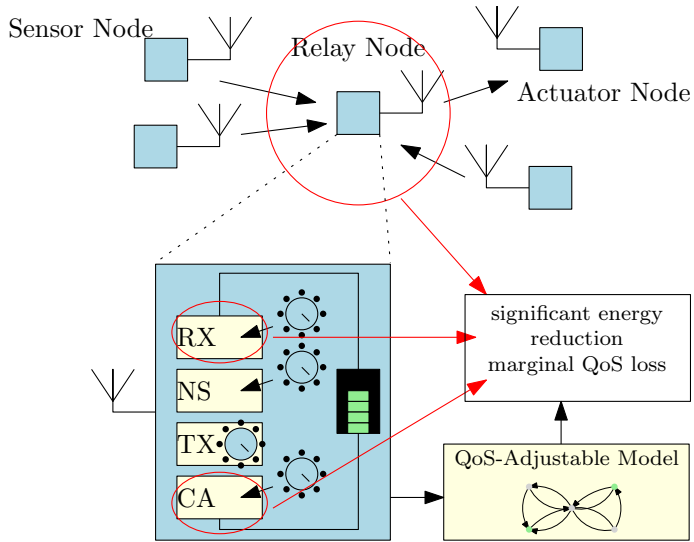
QUALITY-OF-SERVICE-ADEQUATE RECEIVER (QOS-ARX)



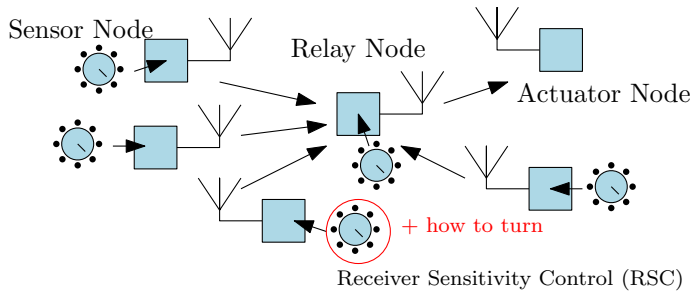
THINKING ACROSS MULTIPLE ABSTRACTIONS



(I) NETWORK LEVEL OPPORTUNITY IDENTIFICATION FRAMEWORK



(II) RECEIVER SENSITIVITY CONTROL



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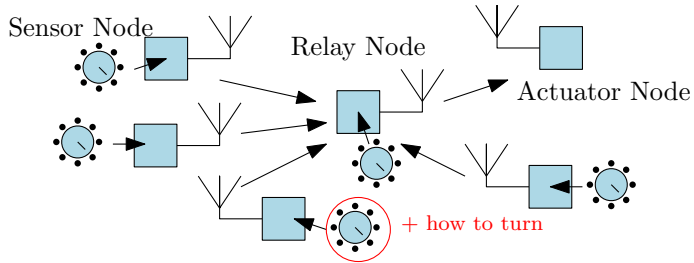
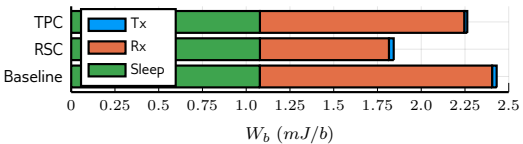
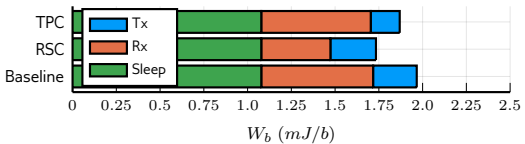
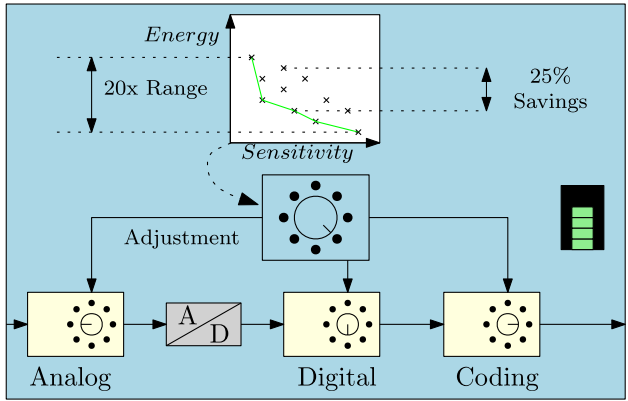






(III) SYSTEM LEVEL QOS-ARX DESIGN



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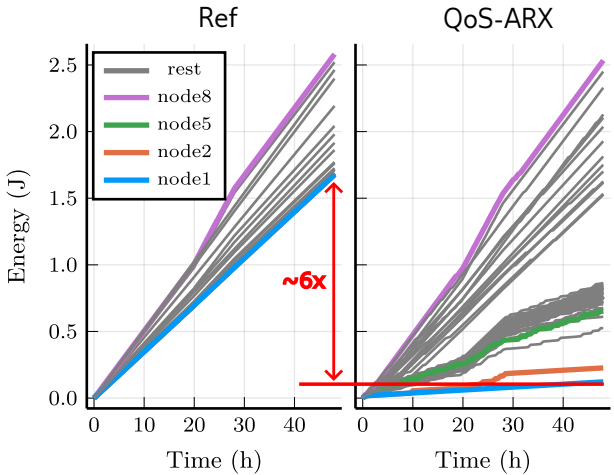
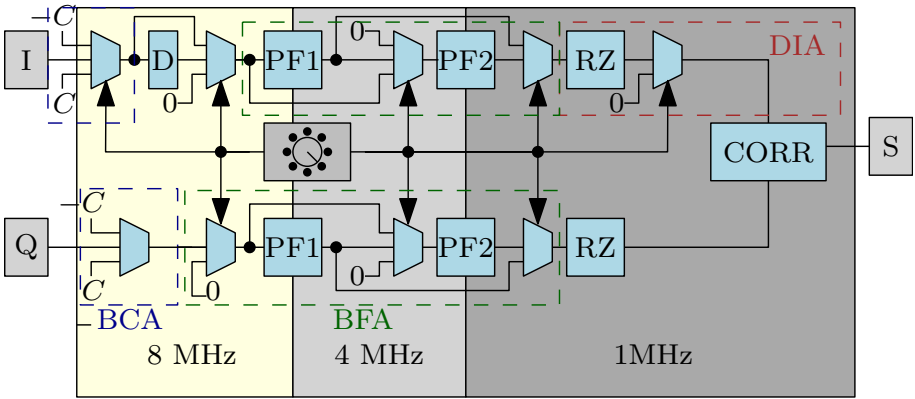


(IV) ADJUSTABLE DEMODULATOR



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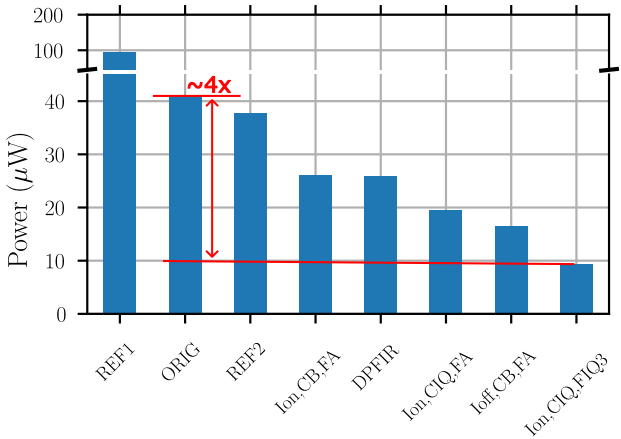

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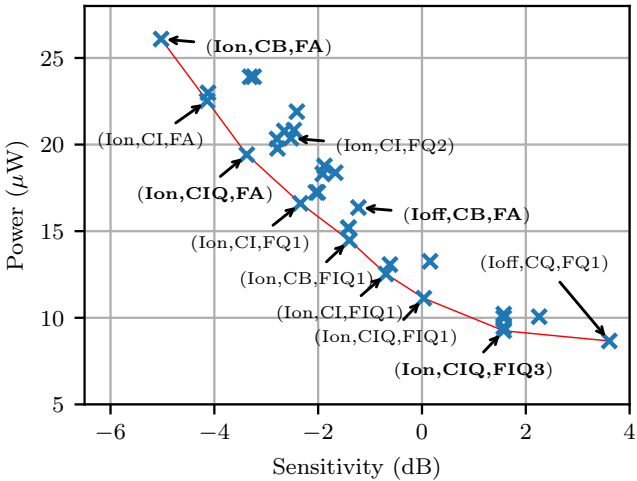
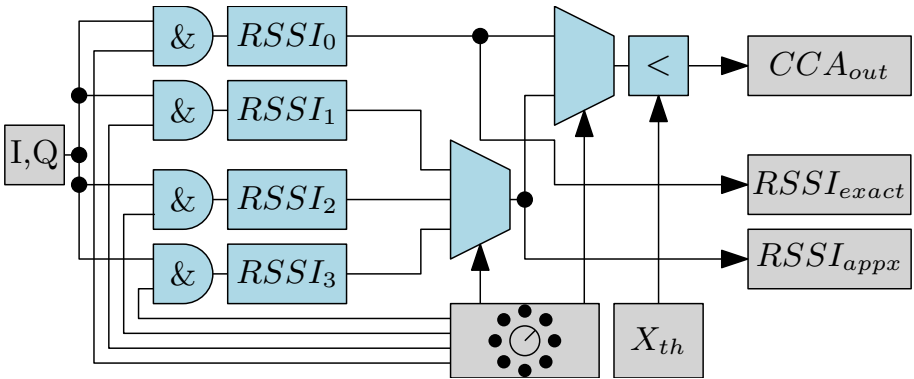


(V) ADJUSTABLE CLEAR CHANNEL ASSESSMENT (CCA)



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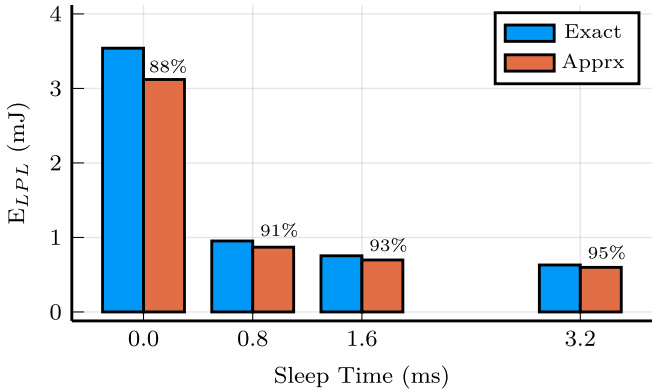
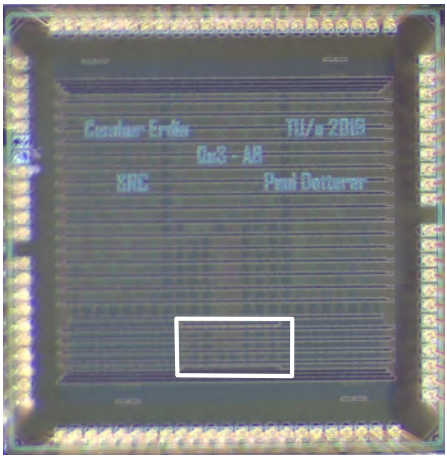
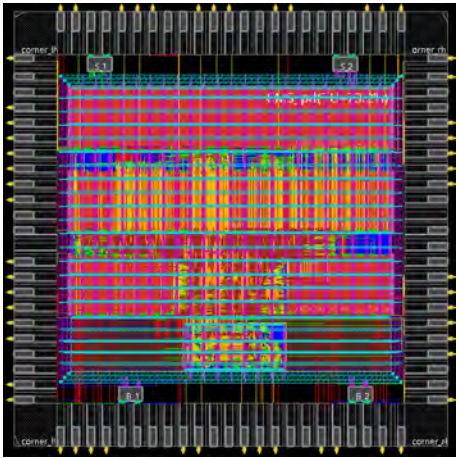


(VI) DESIGN AND IMPLEMENTATION OF QOSARX SOC





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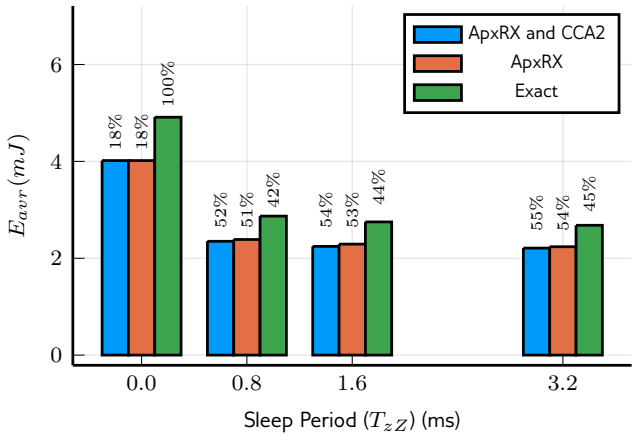
(VI) DESIGN AND IMPLEMENTATION OF QOSARX SOC



PARADIGM SHIFTS

Trends Before	Trends Now
Flexibility ↗ → Energy ↗	

PARADIGM SHIFTS

Trends Before	Trends Now
Flexibility ↗ → Energy ↗	Flexibility ↗ → Energy ↘

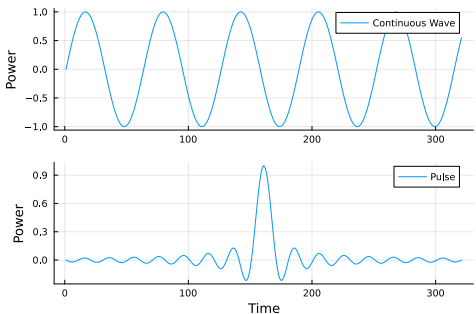
PARADIGM SHIFTS

Trends Before	Trends Now
Flexibility $\nearrow \rightarrow$ Energy $\nearrow$	Flexibility $\nearrow \rightarrow$ Energy $\searrow$
Broad Band $\nearrow \rightarrow$ Energy $\nearrow$	

PARADIGM SHIFTS

Trends Before	Trends Now
Flexibility $\nearrow \rightarrow$ Energy $\nearrow$	Flexibility $\nearrow \rightarrow$ Energy $\searrow$
Broad Band $\nearrow \rightarrow$ Energy $\nearrow$	Broad Band $\nearrow \rightarrow$ Energy $\searrow$

PULSE BASED UWB COMMUNICATION



- Lower Power Consumption:
  - Lower Energy Consumption
- Measurable Time-of-Flight
  - Sensor
  - Secure Communication

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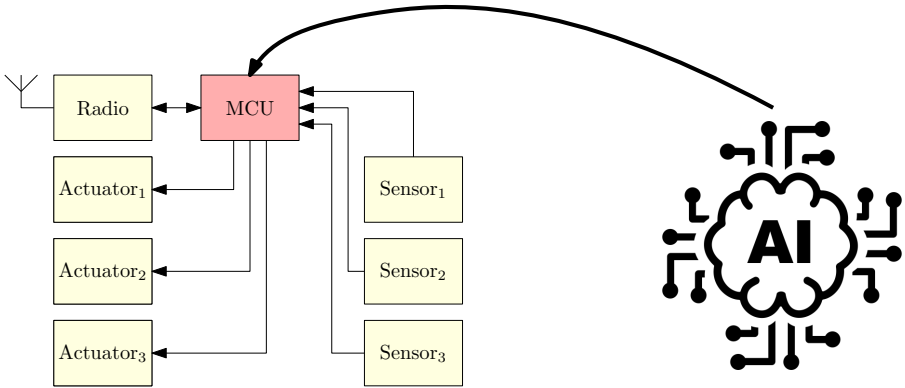
LOW POWER PULSE BASED UWB TRANSMITTER

- P ≈ 5 mW
- Data rate ≈ 27 Mb/s
- Signal Strength ≈ -3 dBm

See more in Allebes et al. 2021.

THE EDGE-COMPUTING



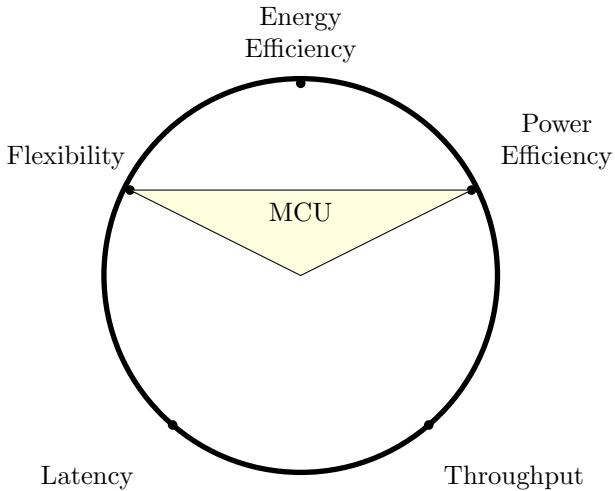
CHALLENGES OF THE EDGE-COMPUTING

- Strict energy constraints
- Strict resource constraints

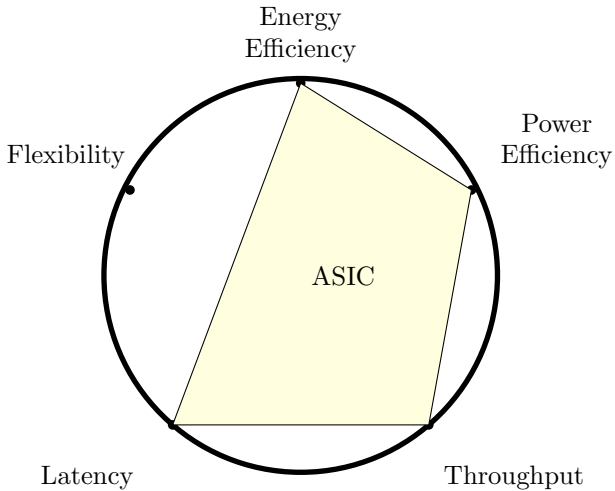
CHALLENGES OF THE EDGE-COMPUTING

- Strict energy constraints
- Strict resource constraints
- Massively parallel algorithms

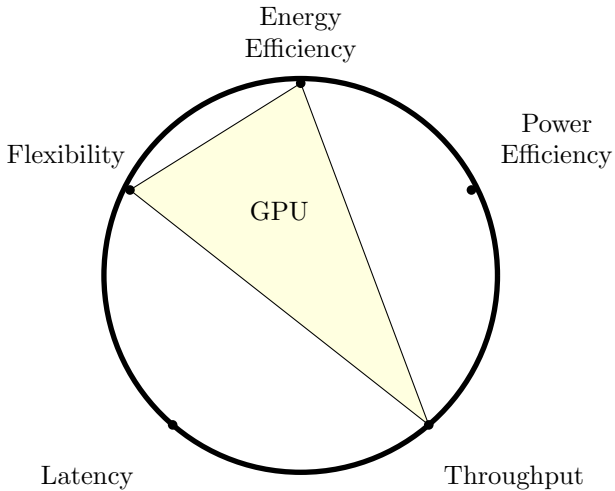
MCU FEATURES



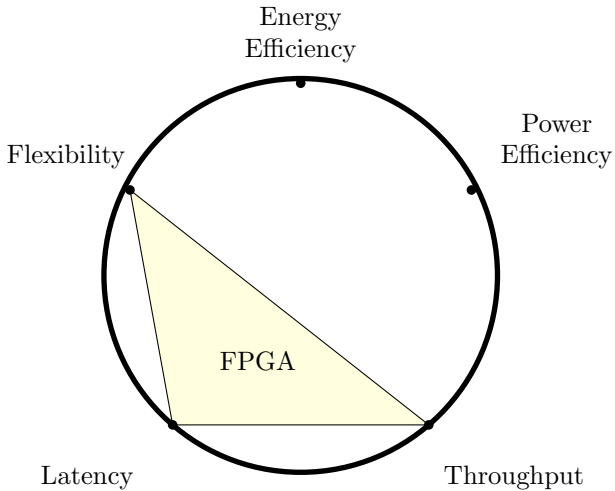
ASIC FEATURES



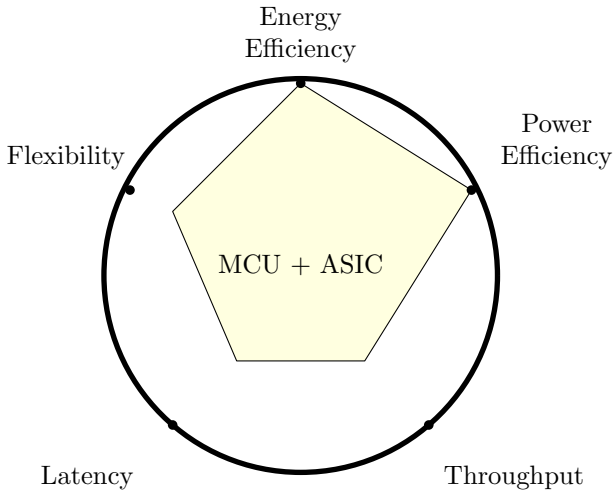
GPU FEATURES



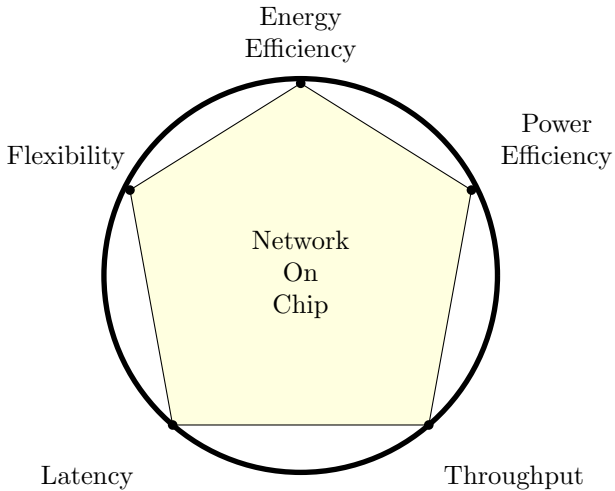
FPGA FEATURES



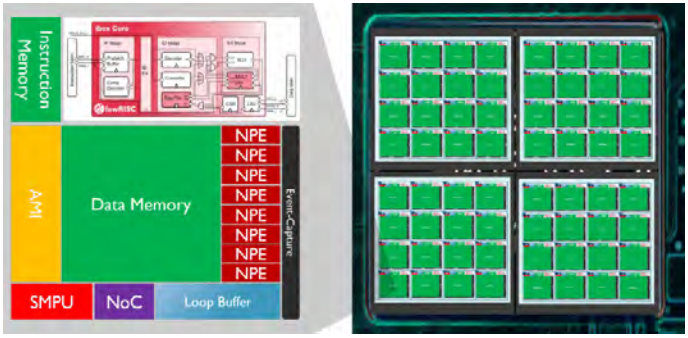
MCU WITH ASIC



NOC METRICS BACK TO NETWORK DESIGN



SENECA[3]



Computation vs Communication

[3]Yousefzadeh et al. 2022

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