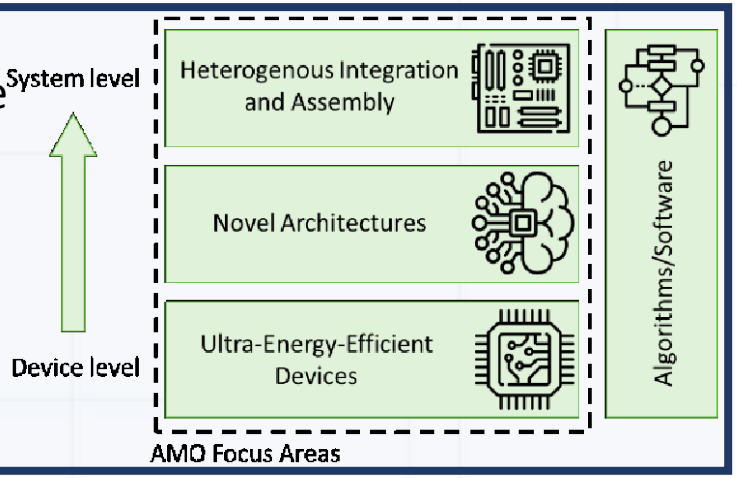
Quantitative Benchmarks for Energy Efficiency in Microelectronics

Goal:
Define comprehensive metrics to quantify energy efficiency for devices, novel architectures, and assemblies



Approach:
- Develop measurement techniques to v**erify** energy consumption at the device level
- Enable **validation** of multi-scale, multi-physics models needed for design and evaluation of advanced energy-efficient technologies
- Deploy *in-operando* measurements to identify dissipation/failure mechanisms

Challenges:
- Definition and quantification of metrics that consider other critical performance metrics can be challenging
  - Operations/Joule (computing)
  - Bits/Joule (communications)
  - Reliability and manufacturing metrics
- Methods to fairly compare different architectures
- Difficult to measure ultra-low-loss devices

Impacts:
- Document demonstrated improvements in energy efficiency over time and enable quantitative comparisons among different approaches
- Deliver measurements, data, standards, and models to enable quantitative benchmarking
- Provide routes to add new validated energy-efficient approaches into semiconductor design cycles

NIST COMMUNICATIONS TECHNOLOGY LABORATORY

James C. Booth, NIST RF Technology Division
(james.booth@nist.gov)