Every SoC is Multi-ISA

Shankar Viswanathan
Typical Modern System-on-Chip

- CPU Cores
- GPU Cores
- Network-on-Chip
- I/O Controller(s)
- Multimedia Enc/Dec
- NN Engine
- Memory Controller
- Security, Power & Thermal Management
ISAs

- CPU: x86, ARM, RISC-V, etc.
- GPU: Vendor-specific SIMD ISAs
- Multimedia Engine: Various DSPs for audio processing and video encode/decode
- Neural Engine: Many ISAs
- System Management: Typically use microcontrollers ARM, Tensilica, AVR, PIC, etc.
- I/O Controllers: WiFi, Bluetooth controllers generally also have microcontrollers in the design
Where is the code?

- CPU: Bootcode, OS, Applications
- GPU: Driver, JIT compiler
- Multimedia, NN Engine: Code is loaded by the driver into the engine’s RAM, some code in ROM
- System Management: Code typically bundled with system boot code (BIOS)
- Other FW may exist in the BIOS or the OS/drivers
Complications

- Each “core” can have different expectations about memory ordering
- Some of the cores are hardware coherent with others, others may not
- LLC, NoC and memory controllers have to balance all these different requirements
Takeaways

● Heterogeneous ISA chips are the present and the future

● You may not realize that your apps are multi-ISA under the hood