



RISC-V Adoptions in ML/AI

Driving Innovations™

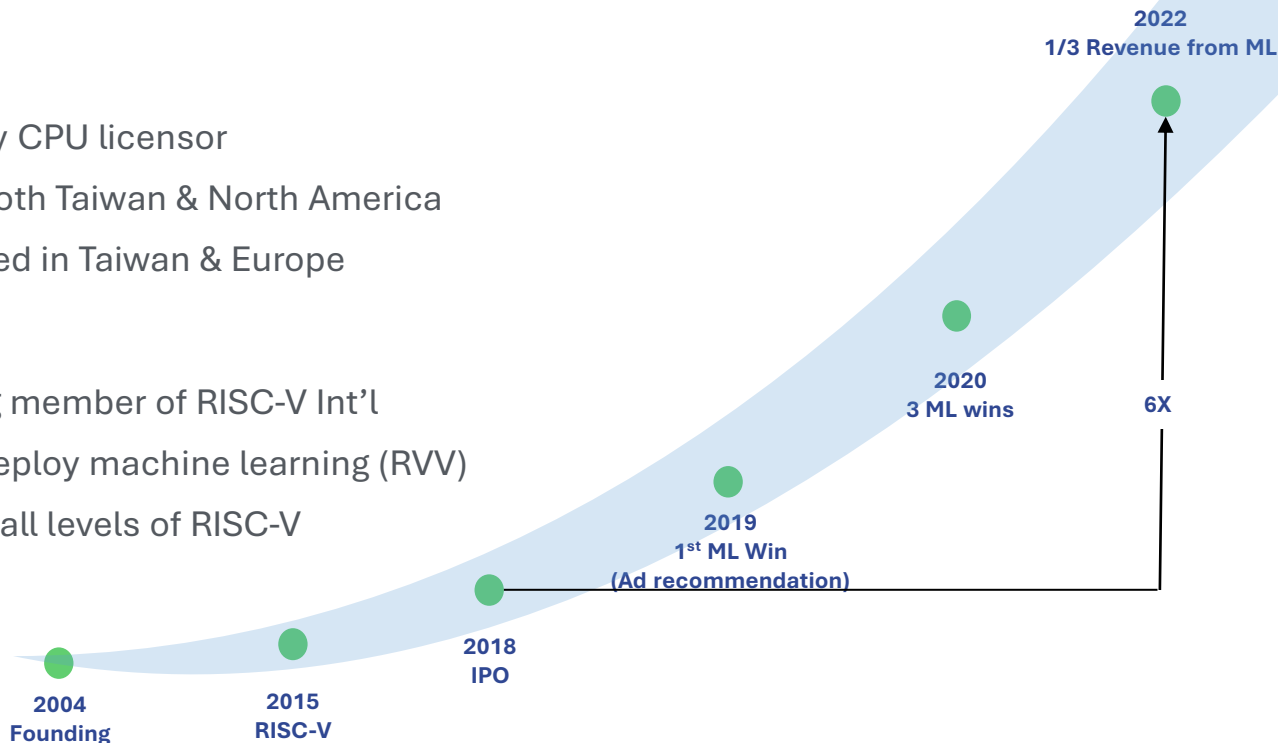
Andes Growth Started with RISC-V, Accelerated by ML

CPU

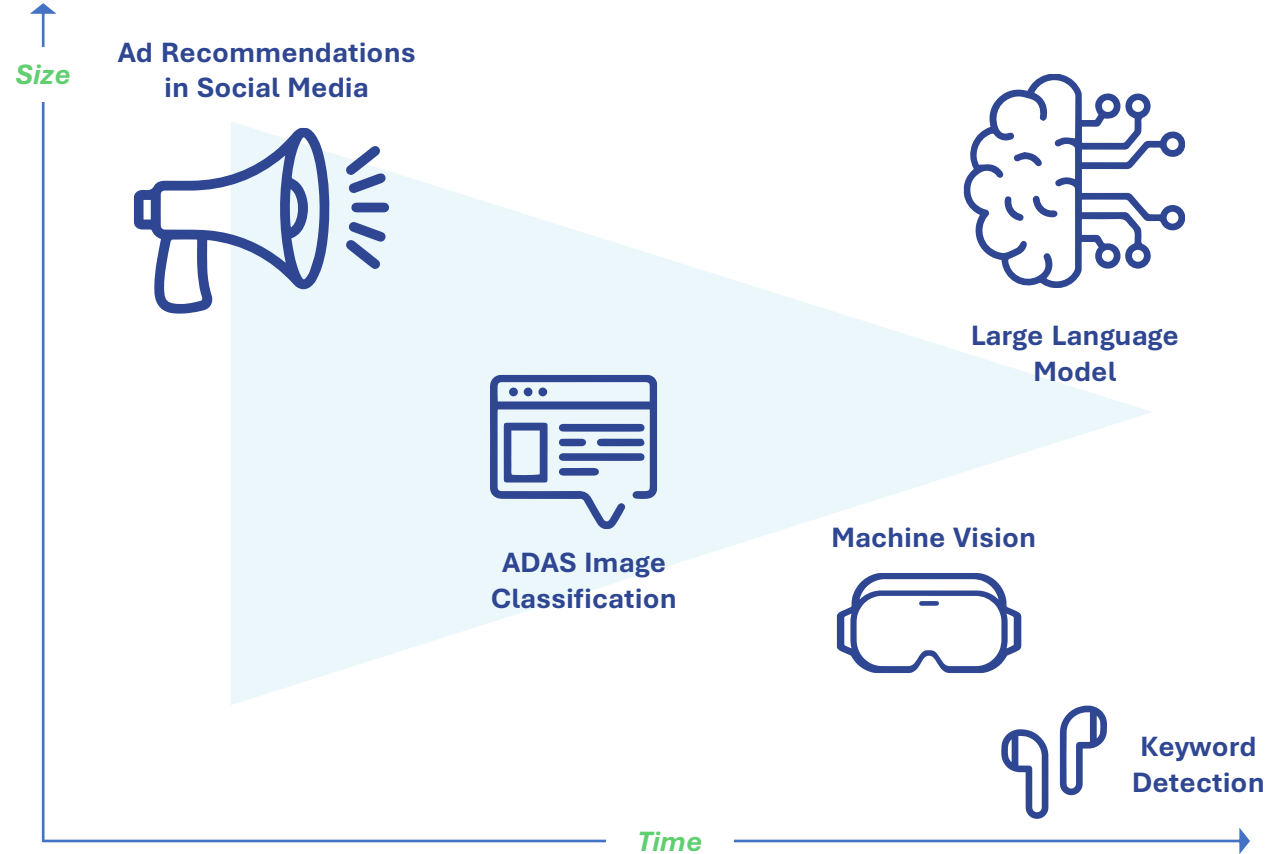
- ▶ Pure-play CPU licensor
- ▶ R&D in both Taiwan & North America
- ▶ Dual-listed in Taiwan & Europe



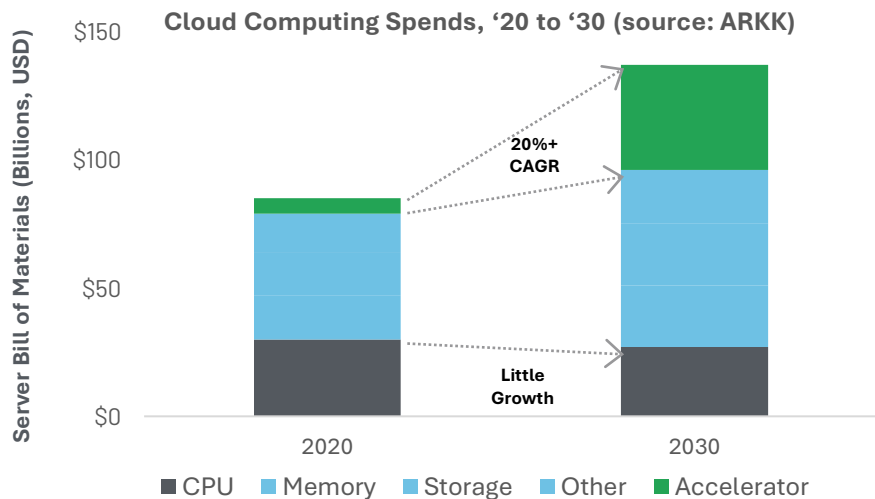
- ▶ Founding member of RISC-V Int'l
- ▶ First to deploy machine learning (RVV)
- ▶ Active at all levels of RISC-V



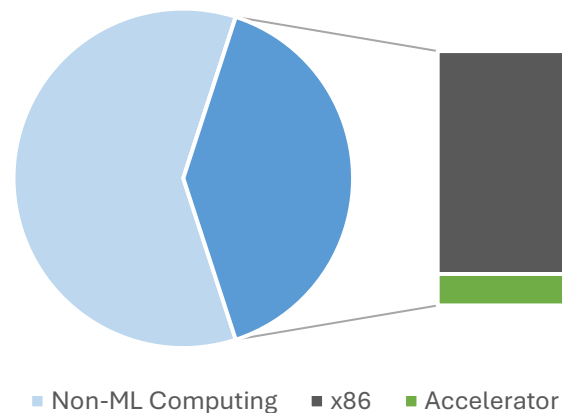
Taking RISC-V Acceleration from the Cloud & Into Small Devices



ML in the Cloud, Wildest Forecasts May Actually Come True

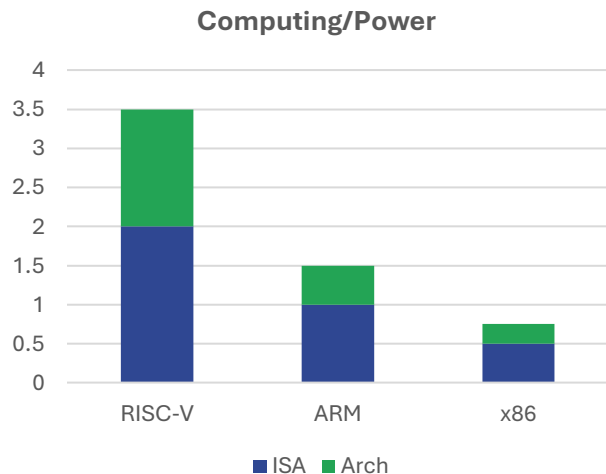
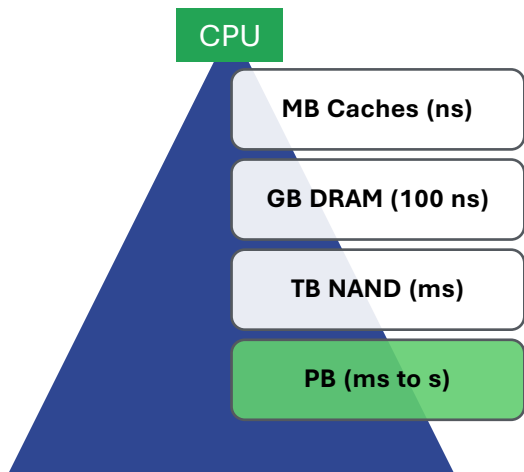


Today's Workload (source: SemiAnalysis)



- ▶ ML is now 40% of cloud computing workload
- ▶ Large Language Models (LLM) poised to fuel further growth
- ▶ Computing cost & power consumption motivate specialized hardware

Licensees Come for Efficiency, Stay for Openness



100% of Andes ML licensees add their instructions to the RISC-V baseline

Many ML Frameworks & Hardware Platforms

									
 PyTorch	?	?	?	?	?	?	?	?	?
 ONNX	?	?	?	?	?	?	?	?	?
 TensorFlow	?	?	?	?	?	?	?	?	?
 mxnet	?	?	?	?	?	?	?	?	?
 TensorFlow Lite	?	?	?	?	?	?	?	?	?
 Caffe2	?	?	?	?	?	?	?	?	?

Nice Solutions to Reduce the Maze

PyTorch

Caffe2

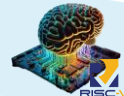
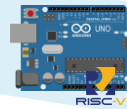
TensorFlow

mxnet

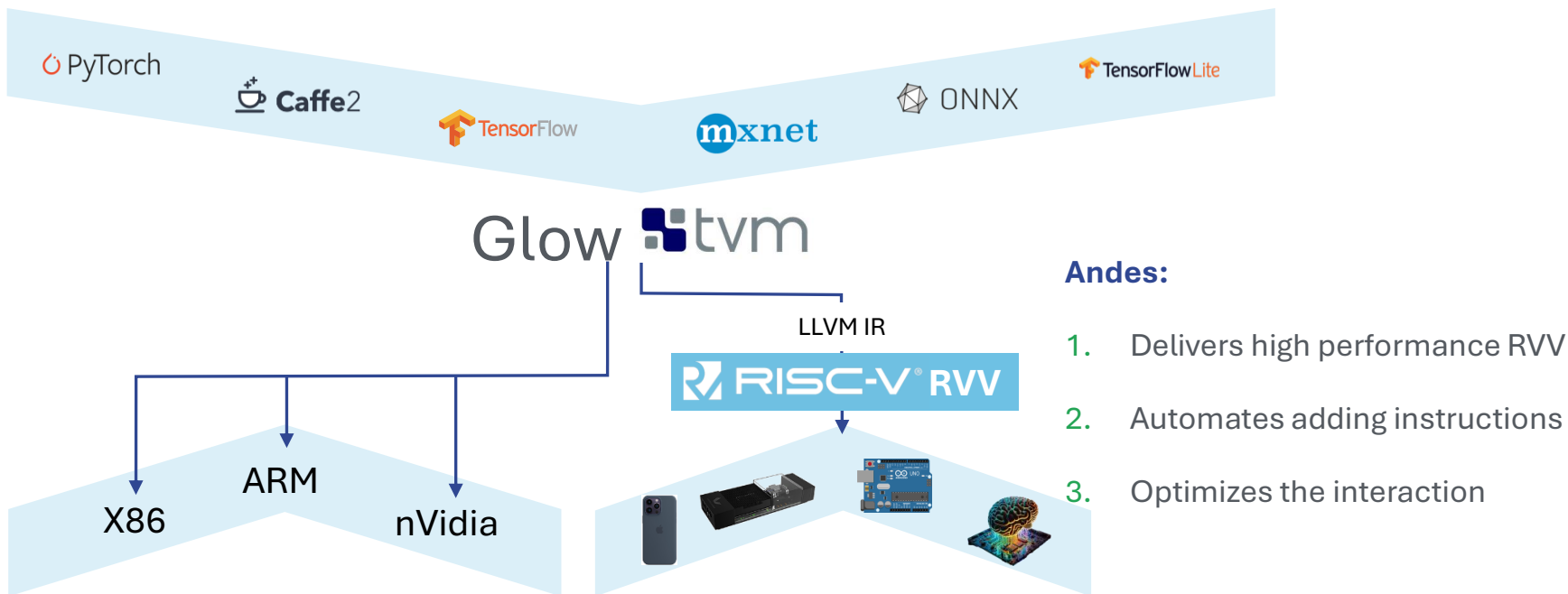
ONNX

TensorFlow Lite

Glow  tvml



Encapsulating the Accelerators into RISC-V Instructions ML Compilers Understand



Future is Bright with RISC-V & ML/AI

- ▶ Insatiable appetite for performance & power improvements
- ▶ Rapid evolutions in ML framework, compilers, tools
- ▶ RISC-V open ISA as a new computing platform