

Challenges and Opportunities for the Open-Standard RISC-V

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Unending Computational Demands: A Human Quest

The Exponential Growth of AI Infrastructure and Compute

AI Infrastructure Demand

\$6.7T

MCKINSEY

Global data center CapEx needed, 2025-2030

\$7.6T+

Goldman Sachs

Cumulative AI infrastructure CapEx, 2026-2031

156 GW

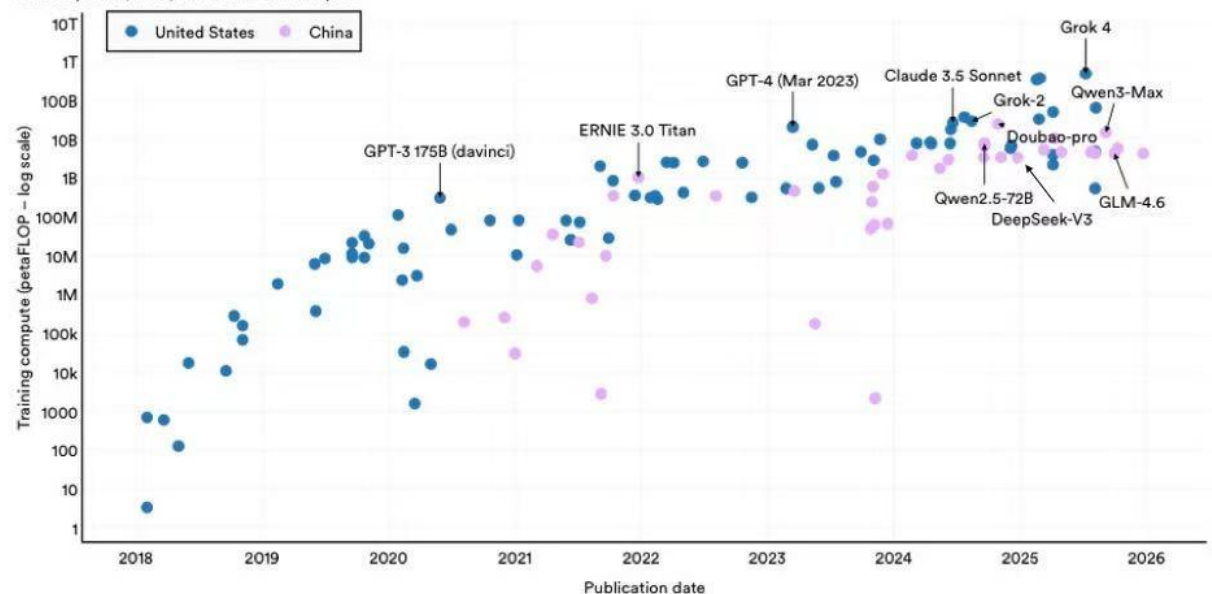
MCKINSEY

AI-related data center capacity demand, 2025-2030

Training Compute of Notable AI Models

Training compute of select notable AI models in the United States and China, 2018-25

Source: Epoch AI, 2026 | Chart: 2026 AI Index report



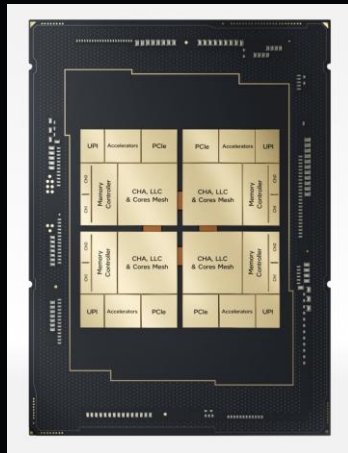
AI Training Compute Has Been Doubling Roughly Every Six Months.

AI is Driving an Unprecedented Demand for Compute.

Convergence of Computing Architectures

From General-Purpose Flexibility to Heterogeneous AI Compute

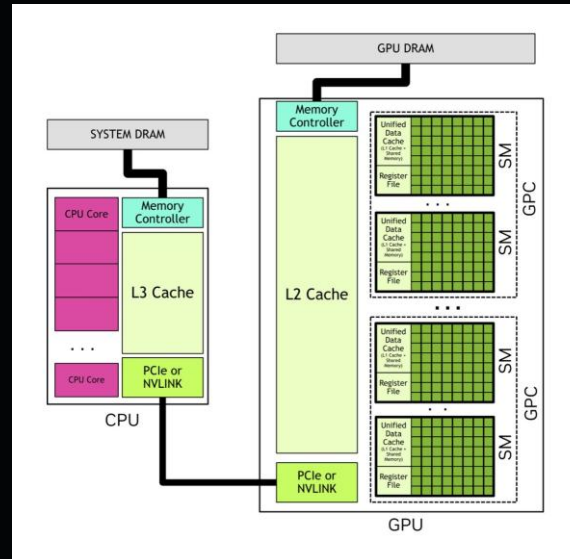
General-Purpose Computing



Intel Sapphire Rapids SoC

- General-Purpose
- Sequential Execution
- Compiler-Driven Flexibility

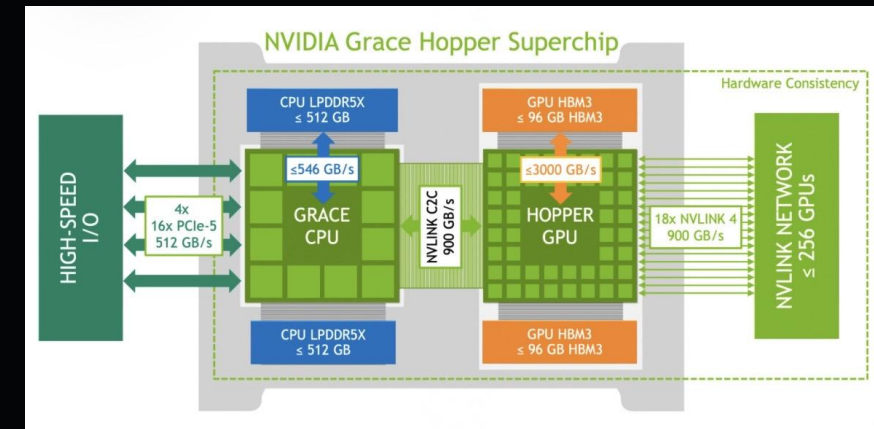
Massively Parallel Computing



*NVIDIA CUDA Programming Guide
GPCs, SMs, GPU Memory*

- Massive Parallelism
- Throughput-Oriented Execution
- CUDA/SIMT

Heterogeneous Computing



NVIDIA Grace Hopper Superchip

- Unified System *CPU + GPU + Memory in one system*
- Specialized Compute *General-purpose + AI acceleration*
- Shared Data *Unified/coherent memory access*

Computing is Converging across Architecture.

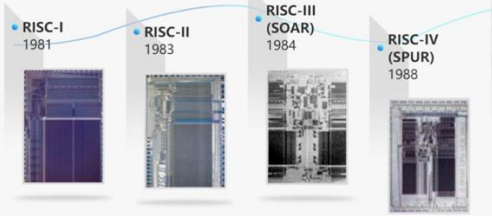
RISC-V: From Berkeley Research to a Global Standard

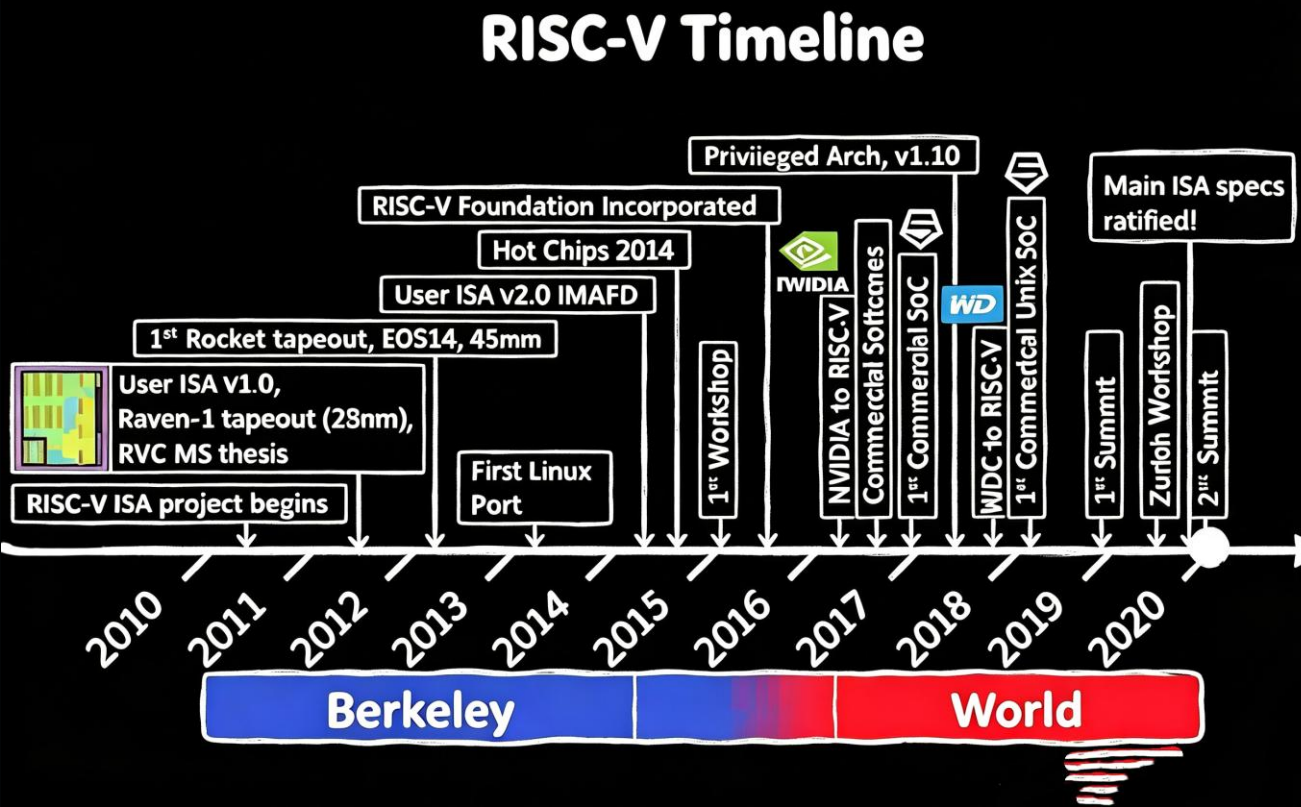
An Open ISA Designed for a New Era of Computing



John Hennessy (left) and David Patterson with their influential textbook, *Computer Architecture*, circa 1991. (Photo by Shane Harvey)

- RISC-I 1981
- RISC-II 1983
- RISC-III (SOAR) 1984
- RISC-IV (SPUR) 1988





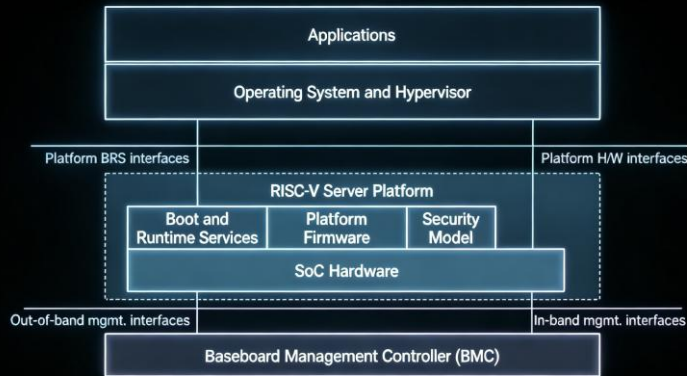
Where RISC-V Stands Today

From Open Research to a Global Standard

Why ISA Should Be Open Sourced

From Open Interfaces to Industry-Wide Innovation

Interoperability



Open the Software–Hardware Interface

One standard lets software and hardware evolve independently.

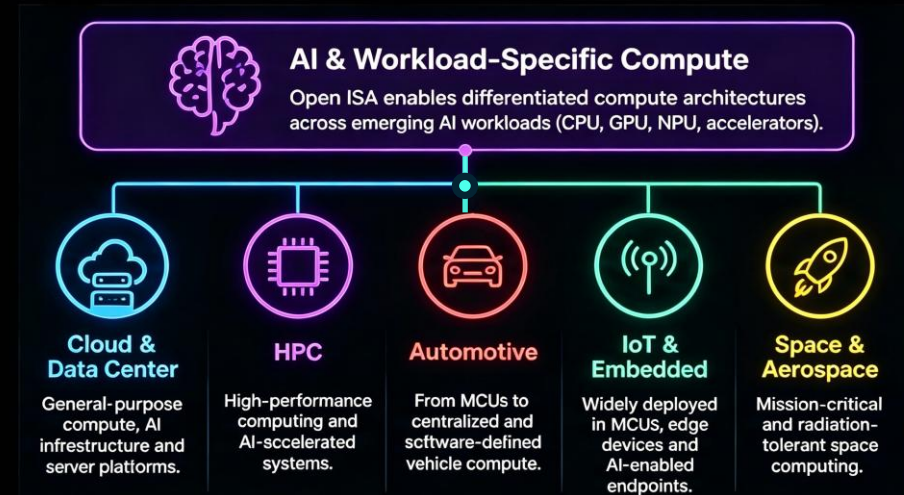
Collaboration



Open the Industry Ecosystem

One standard reduces collaboration costs across the industry.

Innovation



Open to Industry Needs

Open ecosystems absorb real-world needs and enable differentiated innovation.

Open ISA → Open Ecosystem → Open Innovation
Open standards lower the cost of building, integrating and innovating across the computing industry.

The Processor Architecture Landscape Is Changing

Four Models, Different Trade-offs

	Custom ISA	Licensed ISA	Licensed ISA + Arch. License	Open-Source ISA
Design Flexibility	High	Low	Moderate to High	High
License Fees	None	\$0 to millions	\$0 to millions	None
Royalty Fees	None	0 to a few %	0 to a few %	0 to a few %
Available Software	None to Little	Moderate to Extensive	Moderate to Extensive	Little to Moderate
Processor Cores	Custom	Standard	Standard to Custom	Custom or Standard
HW Engineering Cost	High	Low	Low to Moderate	High
SW Engineering Cost	High	Low to Moderate	Low to Moderate	Moderate to High
Development Time	Long	Short	Short to Moderate	Long
Manufacturability Risk	High	Low	Low to Moderate	Moderate to High
Time-to-Market	Long	Short	Short to Moderate	Moderate to High

Openness

Removing proprietary barriers to innovation and collaboration

Technology

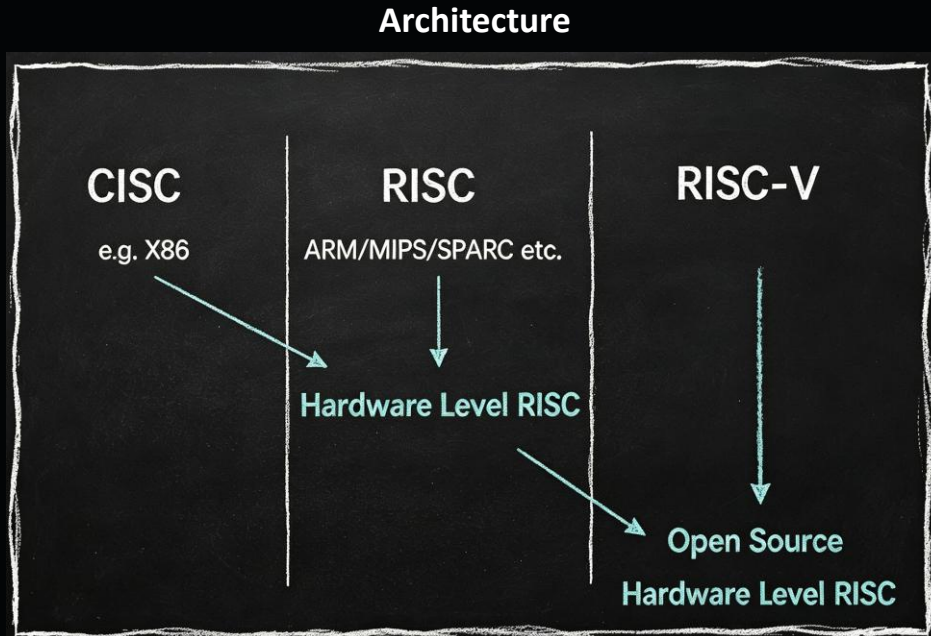
Modular and extensible architectures for specialized compute

Adoption & Maturity

A growing ecosystem of cores, toolchains and commercial products

RISC-V is Changing the Economics of Processor Innovation.

Why RISC-V, Why Now?



**Simplification is the Natural Evolution
of Processor Architecture**

Architecture
RISC Simplifies the Processor

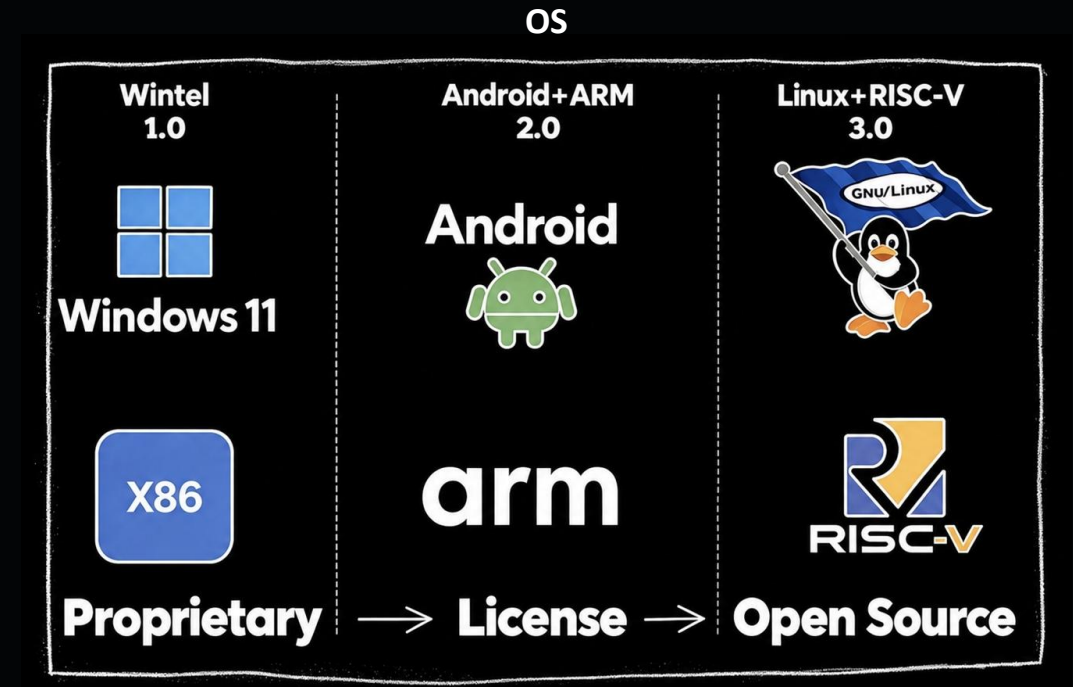
Simpler instruction sets enable higher efficiency, frequency, and implementation flexibility. Even CISC processors increasingly translate instructions into internal RISC-like micro-operations.

Open Source
Open Source Has Already Transformed Software

Linux and Android demonstrate how open ecosystems can scale across platforms and industries. Hardware is now moving from proprietary licensing toward open architectures.

Convergence
Open Software + Open Hardware

The convergence of open-source software and open processor architectures is reshaping the foundation of computing.



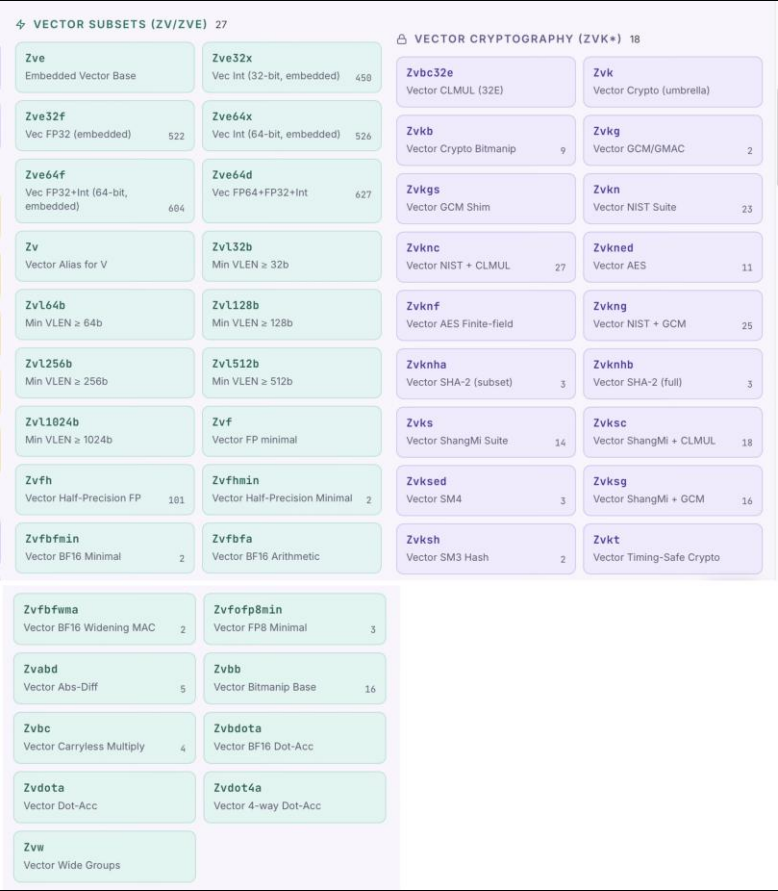
**Open Source is Reshaping
the Foundations of Software and Hardware**

What Makes RISC-V Different?

A Modular ISA Designed to Evolve with New Workloads

SIMPLIFIED	MODULAR	SCALABLE	EXTENSIBLE
47 Base Instructions	Standard + Custom Extensions	One ISA, Many Compute Domains	New Capabilities Without Replacing the Base ISA

RISC-V ISA EXTENSION LANDSCAPE

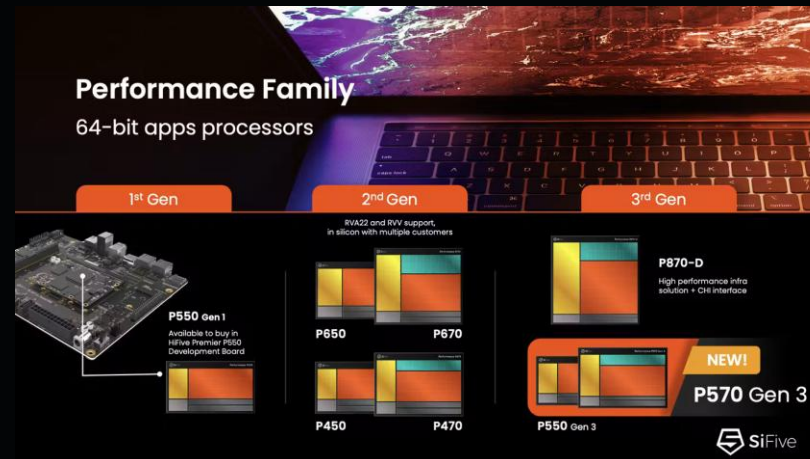


Source: RISC-V ISA Explorer v1.4.0; RISC-V International Ratified Specifications Library (RVA23), September 2026..

What Could RISC-V Do? — CPU

Scaling from Edge Compute to the Data Center

Edge/Consumer → RISC-V CPU Evolution → Data Center

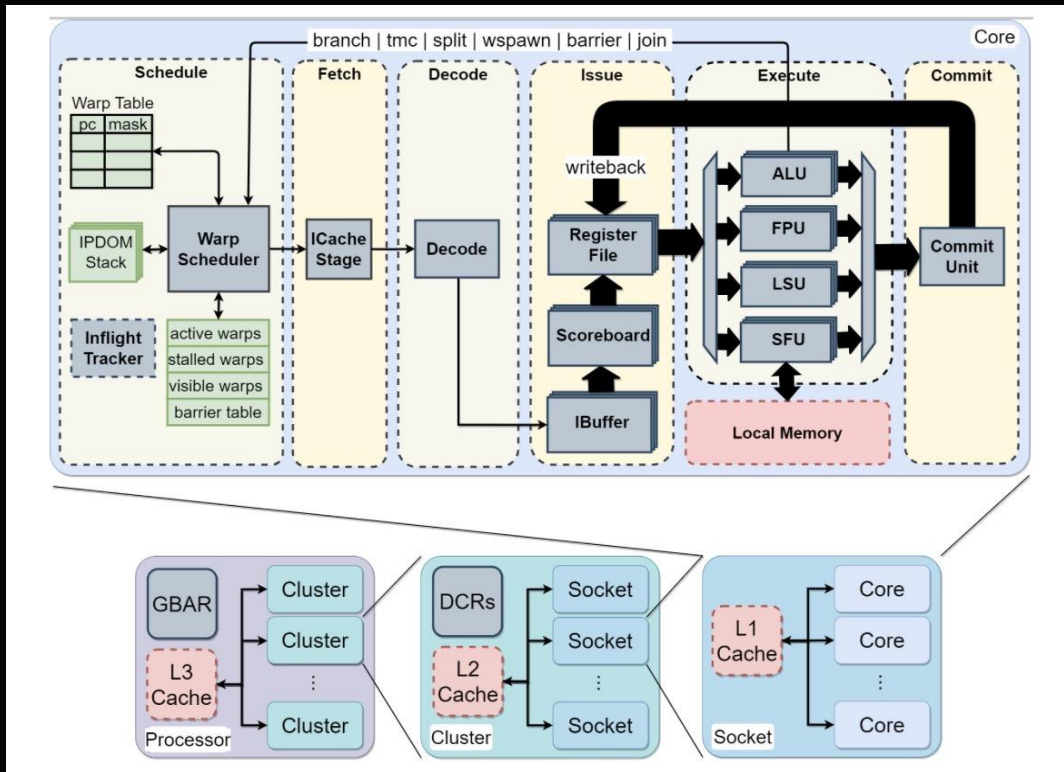


One Open ISA
Scaling across an Expanding Range of Compute Systems

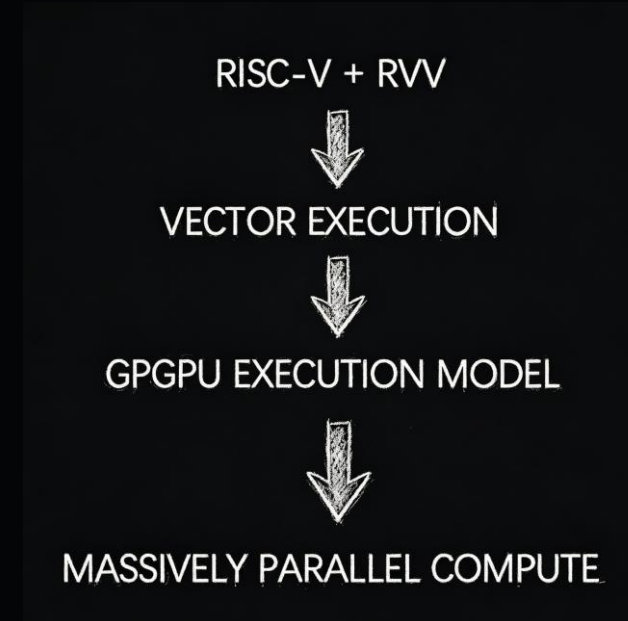
What Could RISC-V Do? — GPGPU

From RISC-V Vector ISA to Massively Parallel Compute

Open-Source RISC-V GPGPU



Vortex Microarchitecture
RISC-V V Extension · Open-Source Architecture



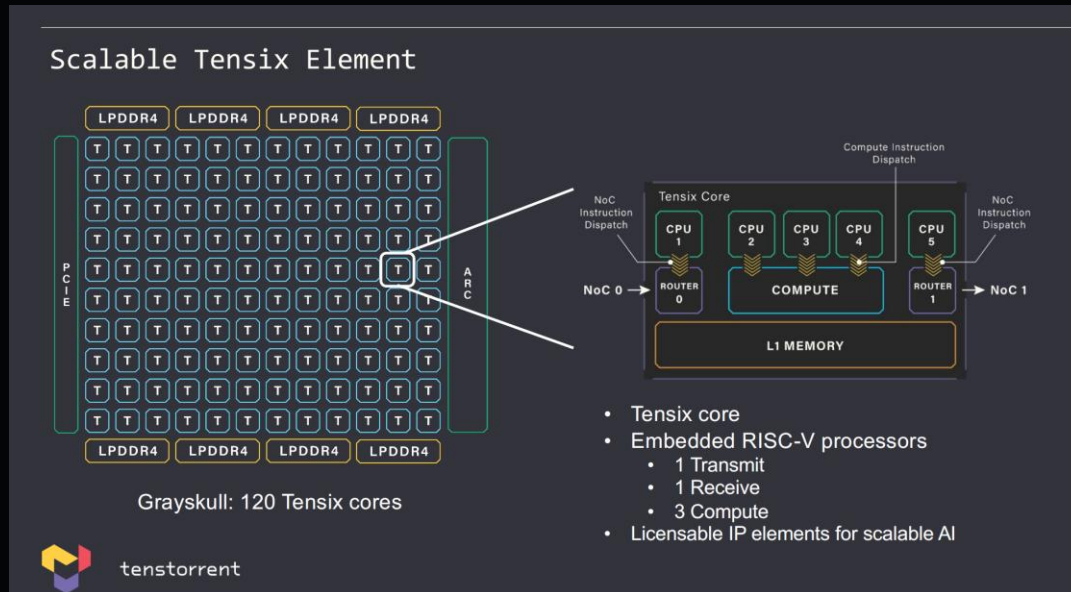
OPEN ISA | VECTOR | PARALLEL

RISC-V Extends beyond CPUs into Massively Parallel Architectures.

What Could RISC-V Do? — AI Compute

Beyond Traditional CPU and GPU Architectures

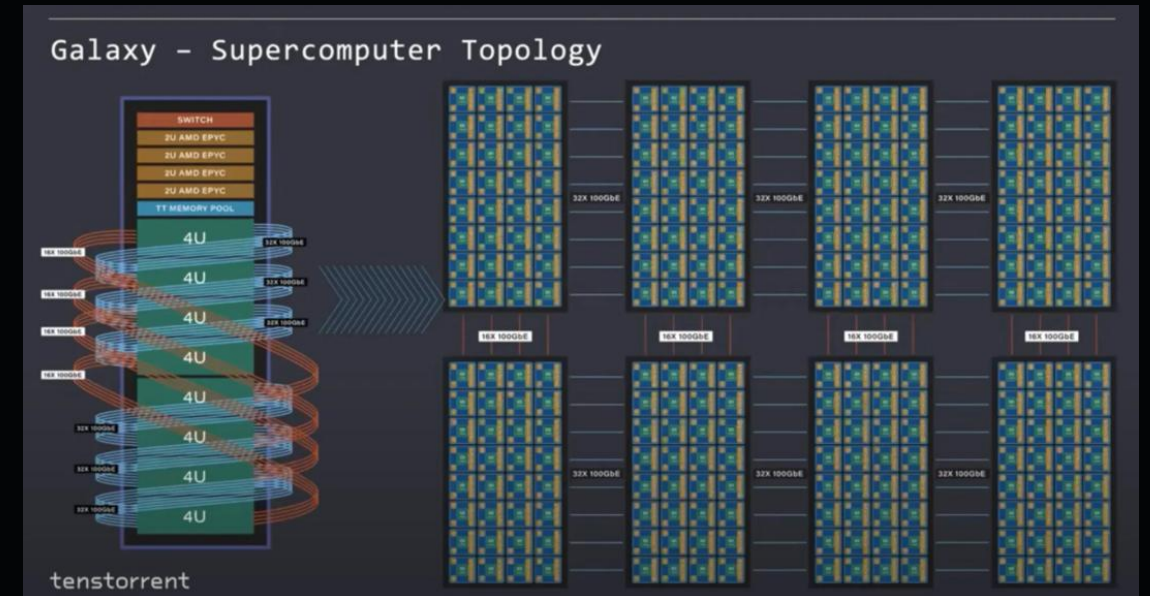
Compute Building Block



RISC-V + Compute + Memory + NoC

RISC-V cores control computation, data movement and the surrounding NoC.

System Scale



From One Compute Element to a Scale-out AI System

Core → Chip → System → Cluster

RISC-V is Becoming a Building Block for AI-Native Computing.

Most Recent Software Update

From ISA Compatibility to a Growing Software Ecosystem

Development Stack

Compilers · Debuggers ·
Simulators
GCC · LLVM · GDB · QEMU · Spike ·
Lauterbach

Libraries & Frameworks

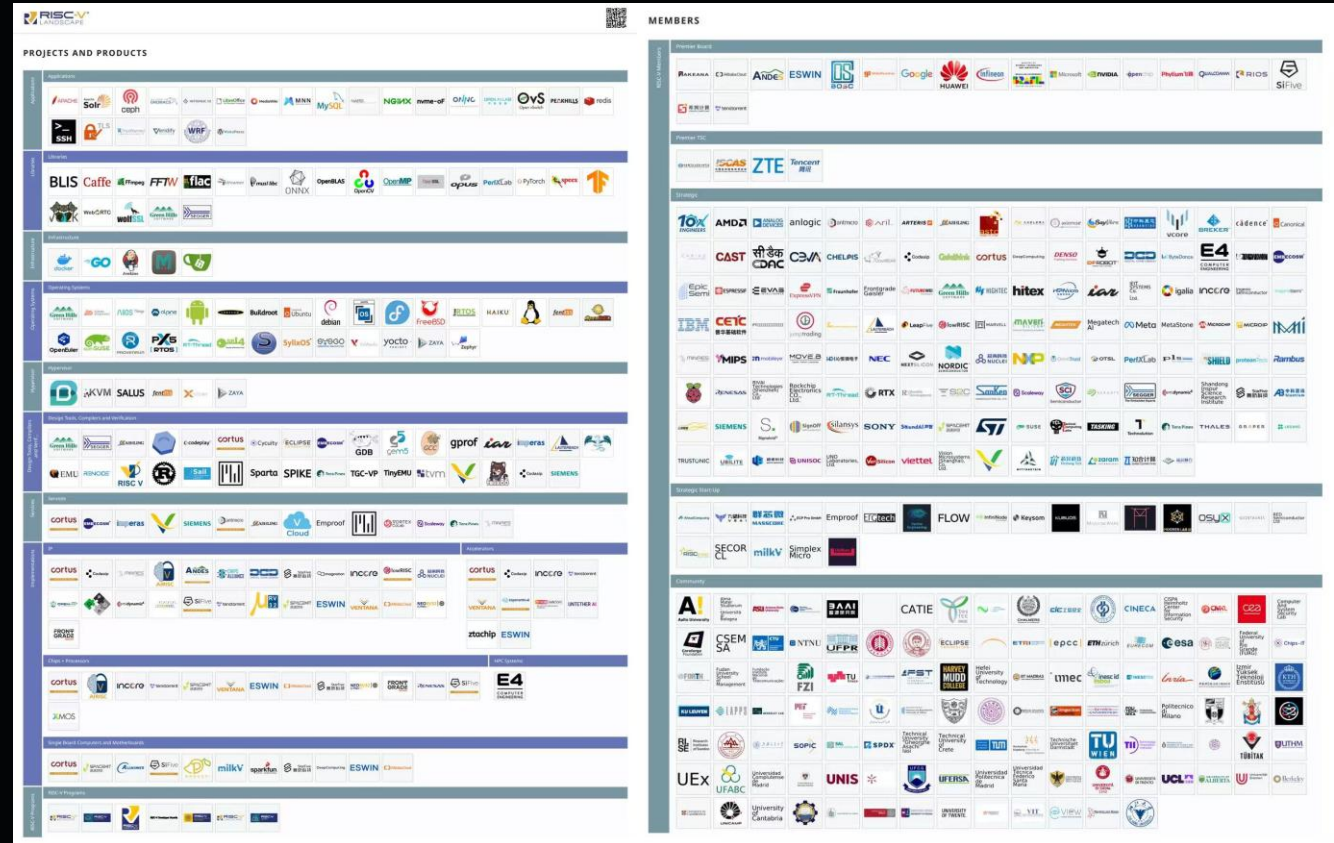
AI · Compute · Media ·
Security
OpenBLAS · OpenCV · ONNX ·
PyTorch · TensorFlow

Operating Systems

Linux · Android · RTOS
Ubuntu · Debian · FreeRTOS · Zephyr
· VxWorks

Applications

From Embedded to Cloud
Edge · Automotive · IoT · HPC · Data
Center

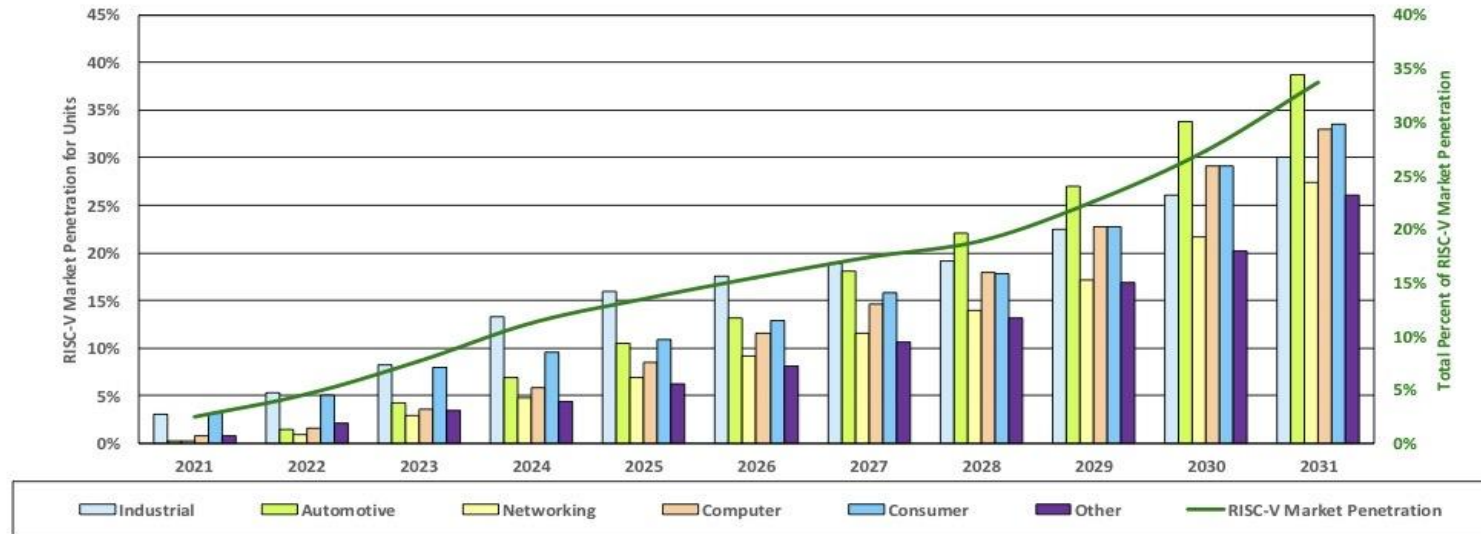


RISC-V is Moving from ISA Compatibility to Full-Stack Software Adoption.

Where Is RISC-V Going?

Expanding Across the Full Spectrum of Computing

RISC-V Market Penetration by Industry



Forecast Years: 2025 – 2031

Source: The SHD Group, October 2025

- Total market penetration for RISC-V reaches >33% by 2031
- Penetration is highest in Automotive and Consumer



One Open ISA
An Expanding Computing Ecosystem

THANK YOU