RISC-V: Enabling a New Era of Open Data-Centric Computing Architectures

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The Evolving Role of Data
Creating the data-driven economy

Data as a record
Data as communication
Data as efficiency
Data as currency

Value

Richness

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#LetDataThrive
Diverse and Connected Data Types

Tight coupling between Big Data and Fast Data

Big Data
- Insight
- Prediction
- Prescription
- Scale

Fast Data
- Performance
- Mobility
- Real-time Results
- Smart Machines

Data Aggregation
Batch Analytics
Modeling
Artificial Intelligence
Machine Learning
Streaming Analytics
Algorithm
From General Purpose to Purpose Built

Architectures designed for Big Data, Fast Data applications

Big Data

Expanding applications and workloads

Fast Data

General purpose compute-centric architecture

- Solutions
- Systems
- Platforms
- Devices
General Purpose Architectures No Longer Sufficient

Big Data and Fast Data workloads exceed capability of uniform resource ratios

- Predetermined ratios of:
  - OS/App Processor
  - Specialty Processor
  - Memory
  - Storage
  - Interconnect

- Overhead of “PC” logic

- CPU-centric
General Purpose Architectures No Longer Sufficient

Big Data and Fast Data workloads exceed capability of uniform resource ratios

General Purpose Compute Architecture

General Purpose Transportation

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General Purpose Architectures No Longer Sufficient

Big Data and Fast Data workloads exceed capability of uniform resource ratios
General Purpose Architectures No Longer Sufficient

*Big Data and Fast Data workloads exceed capability of uniform resource ratios*
Workload Diversity Demands Diverse Technologies and Architectures

Big Data

Storage-centric architecture

HDD

SSD

Storage

Memory-centric architecture

NVM

DRAM

SRAM

Memory

Interconnect

Storage Semantic Data Flow

Memory Semantic Data Flow

Compute

Storage SOC

General Purpose CPU

GPU

FPGA

ASIC

Purpose-built data-centric architectures

Capacity-centric scale

Performance-centric scale

Fast Data

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Data-Centric Environments

Big Data and Fast Data workloads need independent scaling of resources

**Big Data**
- Massive Storage
- Moderate Processing
- Machine Learning

**Fast Data**
- Large Memory
- Specialty Processing
- High-bandwidth interconnect
- Large Memory and Specialty Processing
- Large Specialty Processing

**Analytics**
- Security Detection
- Event Correlation
- Blockchain
Independent Scaling Demands Openness

Rapid adoption of new open source technologies and standards
Data-Centric Applications at the Edge

Environments require modular technologies and dense integration to optimize space, weight and power consumption.
RISC-V Meets the Needs of Big Data and Fast Data

Provides a foundation for purpose-built, data-centric compute environments

**Big Data**

- **Move Compute to Data**
  - CPU for device, platform, system
  - Minimize data movement
  - Offload workload to “smart” storage
  - Localized machine learning

**Fast Data**

- **Memory Centric Compute**
  - Highly scalable main memory
  - Minimize data movement
  - Heterogeneous processor support
  - Scalable accelerators/offload engines

**RISC-V**

- Open and free
- Enables modular chip designs
- From 16 to 128-bit

- Scales from embedded to enterprise
- Direct integration with specialty accelerators
- Extensible ISA (for special purpose functions)
RISC-V Enables Purpose-Built Environments for Big Data and Fast Data Applications

Purpose-built data-centric architectures

Storage-centric architecture

Big Data > Purpose-built data-centric architectures > Fast Data

Storage:
- HDD
- SSD

Memory:
- NVM
- DRAM
- SRAM

Interconnect:
- Storage Semantic Data Flow
- Memory Semantic Data Flow

Compute:
- Storage SOC
- General Purpose CPU
- GPU
- FPGA
- ASIC

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RISC-V Meets the Needs of Big Data and Fast Data

Big Data
- Genomics
- Predictive Analytics

Fast Data
- Autonomous Machines
- Safety & Security
- Private Exchange
- Machine Learning

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#LetDataThrive
Driving Momentum

Western Digital ships in excess of 1 Billion cores per year... and we expect to double that.
Accelerating the RISC-V Ecosystem

Western Digital to contribute one billion cores annually to fuel RISC-V

1. Support development of open source IP building blocks for the community

2. Actively partner and invest in the ecosystem

3. Accelerate development of purpose-built processors for a broad range of Big Data and Fast Data environments

4. Multi-year transition of Western Digital devices, platforms and systems to RISC-V purpose-built architectures
Innovating for a Data-Centric World

Big Data and Fast Data need purpose-built environments

Openness and ecosystem enable best-in-class innovation

Western Digital brings the momentum of >1B cores per year

Western Digital®
Western Digital
We create environments for data to thrive