# RISC-V's growing influence in AI and high-performance computing



The evolution of the RISC-V instruction set architecture (ISA), introduced in 2014, is gaining significant traction in the realm of artificial intelligence (AI) and high-performance computing (HPC). Initially limited to microcontrollers and low-performance applications, RISC-V has rapidly diversified into various segments including complex embedded systems and high-performance data centre solutions. Its open-source nature not only fosters customisation but has also attracted a wide range of companies, expediting advancements and contributions across the architecture.

Industry observers note that RISC-V technology is uniquely well-suited for applications demanding cost-efficiency and flexibility, particularly in AI and HPC areas currently undergoing rapid development. Unlike the proprietary architectures of established competitors like Arm and x86, which are predominantly controlled by a few corporations, RISC-V allows for faster enhancements and community-driven innovation. As stated by Thomas Hackenberg, principal analyst at Yole Development, “There was initially some discouraging commentary about RISC-V’s inability to perform graphics or AI acceleration... This was alleviated with the RISC-V Vector Extension Version 1.0 ratified by RISC-V International in 2021.”

Key industry players now recognise RISC-V's potential. By the end of the 2010s, technology giants such as Nvidia, Qualcomm, and Samsung began utilising RISC-V cores in various applications ranging from microcontrollers to SSD controllers. This growing adoption has led to a flurry of announcements about upcoming RISC-V-based innovations aimed at performance-intensive applications.

Ian Ferguson, senior director at SiFive, commented on the trend stating, “There is absolutely a growing demand for RISC-V in AI and HPC applications since the open RISC-V standard offers unmatched flexibility, extensibility and scalability.” This sentiment is echoed across the industry, with executives from SemiDynamics and Ventana Micro underscoring the increasing interest among diverse companies, from major hyperscalers to enterprising startups.

Despite the burgeoning interest, analysts caution that RISC-V's current commercial adoption remains in an emergent phase. While significant progress has been made, Hackenberg asserts, “there is little mass-market commercial adoption yet, but that is likely to change based on... the huge demand for more power- and cost-efficient ways of handling AI processing.”

Customisation is a cornerstone of RISC-V's appeal. Companies utilising the ISA can develop highly specialised processors tailored for AI workloads while still benefiting from standardised profiles ensuring software compatibility. As David Harold, head of business development at Red Semiconductor, pointed out, “RISC-V’s open nature allows us to create highly specialized and optimized processors for AI applications.” This capability enables organisations to devise bespoke solutions that meet their performance specifications, ranging from CPU to GPU architectures.

Additionally, the process of adding new features to RISC-V is generally more efficient than with its competitors. The ability to introduce new data formats and instructions in a matter of weeks, as opposed to the two-year timeframe typical for Arm, positions RISC-V advantageously against quickly changing market demands. SiFive's Ferguson elaborated, “One of the important differences is that enhancements to the instruction set are not determined by one company.”

However, it is crucial to maintain the integrity of the RISC-V ISA amidst the rapid pace of customisation. To ensure consistency and prevent fragmentation, RISC-V International has set up working groups that oversee the advancements in the instruction set. This structured approach emphasises ongoing coordination within the community to ensure compatibility across various implementations.

While challenges remain, particularly in software support and business models that justify custom development, the potential for RISC-V in AI and HPC applications continues to gain momentum. With an increasing number of commercial entities evaluating RISC-V solutions, the landscape of computing architectures is poised for transformative changes as businesses aim to harness the advantages of custom hardware solutions tailored for their specific operational needs.

Source: [Noah Wire Services](https://www.noahwire.com)

## Bibliography

1. <https://www.wevolver.com/article/risc-v-instruction-set> - Explains the open standard nature of RISC-V, its support for variable-length instruction encoding, and its extensibility through instruction set extensions, which are key aspects of its evolution and suitability for AI and HPC.
2. <https://www.allaboutcircuits.com/news/companies-rally-risc-v-support-ai-hpc-applications/> - Discusses the growing support and adoption of RISC-V by companies for AI and HPC applications, highlighting its advantages over proprietary architectures like Arm.
3. <https://www.wevolver.com/article/risc-v-architecture> - Provides a comprehensive guide to RISC-V architecture, including its design principles, modularity, and extensibility, which are crucial for its adoption in various industries.
4. <https://www.wevolver.com/article/risc-v-enables-performant-and-flexible-ai-ml-compute> - Details how RISC-V's modular architecture and custom instructions enable performant and flexible AI/ML computing, including the integration of hardware accelerators like TPUs and NPUs.
5. <https://www.wevolver.com/article/risc-v-instruction-set> - Explains the ability to add custom instructions and extensions to the RISC-V ISA, which allows for tailored solutions for specific AI workloads while maintaining software compatibility.
6. <https://www.allaboutcircuits.com/news/companies-rally-risc-v-support-ai-hpc-applications/> - Mentions the involvement of major companies like Nvidia, Qualcomm, and Samsung in utilizing RISC-V cores, reflecting the growing industry recognition of RISC-V's potential.
7. <https://www.wevolver.com/article/risc-v-architecture> - Highlights the open-source nature of RISC-V, which fosters community-driven innovation and faster enhancements compared to proprietary architectures.
8. <https://www.wevolver.com/article/risc-v-enables-performant-and-flexible-ai-ml-compute> - Discusses the efficiency of adding new features to RISC-V, such as the RISC-V Vector Extension, which enhances its capabilities for AI and HPC applications.
9. <https://www.wevolver.com/article/risc-v-instruction-set> - Explains the structured approach by RISC-V International to ensure consistency and prevent fragmentation through working groups overseeing the advancements in the instruction set.
10. <https://www.allaboutcircuits.com/news/companies-rally-risc-v-support-ai-hpc-applications/> - Notes the current emergent phase of RISC-V's commercial adoption and the anticipation of significant growth driven by the demand for more power- and cost-efficient AI processing.
11. <https://www.wevolver.com/article/risc-v-architecture> - Describes how RISC-V's modularity and extensibility allow companies to develop highly specialized processors for AI applications while maintaining standardised profiles for software compatibility.
12. <https://www.eetimes.com/risc-v-in-ai-and-hpc-part-1-per-aspera-ad-astra/> - Please view link - unable to able to access data