

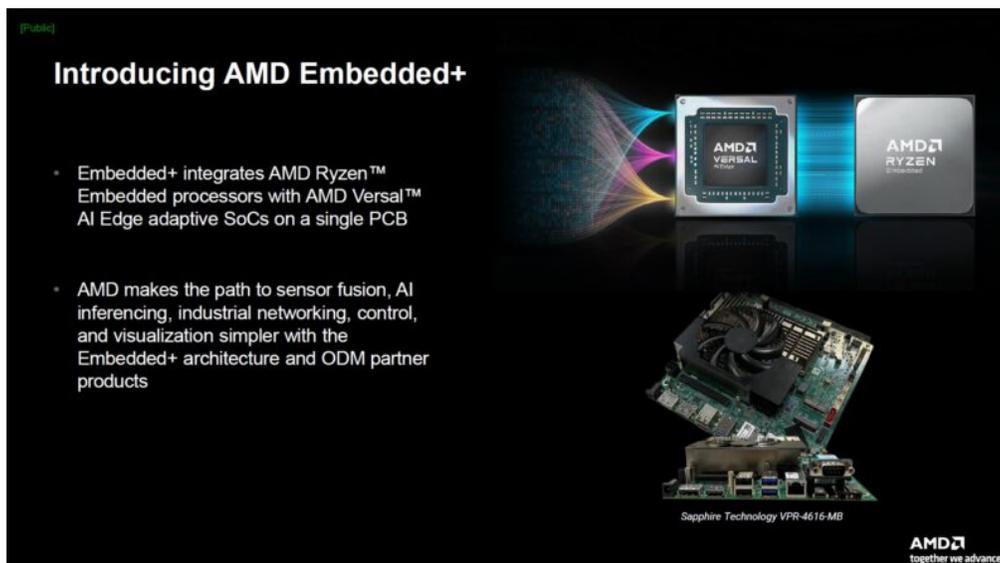
# AMD EMBEDDED+ FOR ADVANCED EDGE APPLICATIONS

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## CONTEXT

AMD announced the launch of AMD Embedded+, a novel architectural solution that integrates AMD's Ryzen Embedded processors with its Versal adaptive onto a single board.

The integrated compute platform offers scalable and power-efficient solutions to accelerate the time-to-market for original design manufacturer (ODM) partners for embedded applications.



Critical aspects of AMD Embedded+ include:

- **Efficiency and Speed:** AMD validates the Embedded+ platform to help ODM customers reduce qualification and build times, enabling faster product deployment without extra hardware and R&D resource investment.
- **Target Applications:** It is particularly suited for applications requiring low power, small form factors, and lengthy lifecycles, such as in the medical, industrial, and automotive sectors.

- **Innovative Architecture:** The Embedded+ architecture combines AMD x86 compute capabilities with integrated graphics and programmable hardware, ideal for critical AI inferencing and sensor fusion applications. It offers a blend of adaptive computing and AI Engines for high-performance-per-watt inferencing.
- **Graphics and Multimedia Capabilities:** With Ryzen Embedded processors that include “Zen” cores and Radeon graphics, the platform provides exceptional rendering and display options, supporting advanced 4K multimedia experiences and built-in video codecs for 4K H.264/H.265 encoding and decoding.
- **Flexible and High-Performance Solution:** The architecture facilitates high performance for critical tasks by integrating adaptive computing in real-time with flexible I/O, AI Engines for inferencing, and AMD Radeon graphics.
- **First ODM Solution by Sapphire Technology:** The first product based on this architecture is the Sapphire Edge+ VPR-4616-MB. This low-power Mini-ITX motherboard incorporates the Ryzen Embedded R2314 processor and Versal AI Edge VE2302 Adaptive SoC. It offers full capabilities at as low as 30W of power.
- **Customer and Market Benefits:** Embedded+ enhances product aspects other than compute architecture, reducing time-to-market and R&D costs.

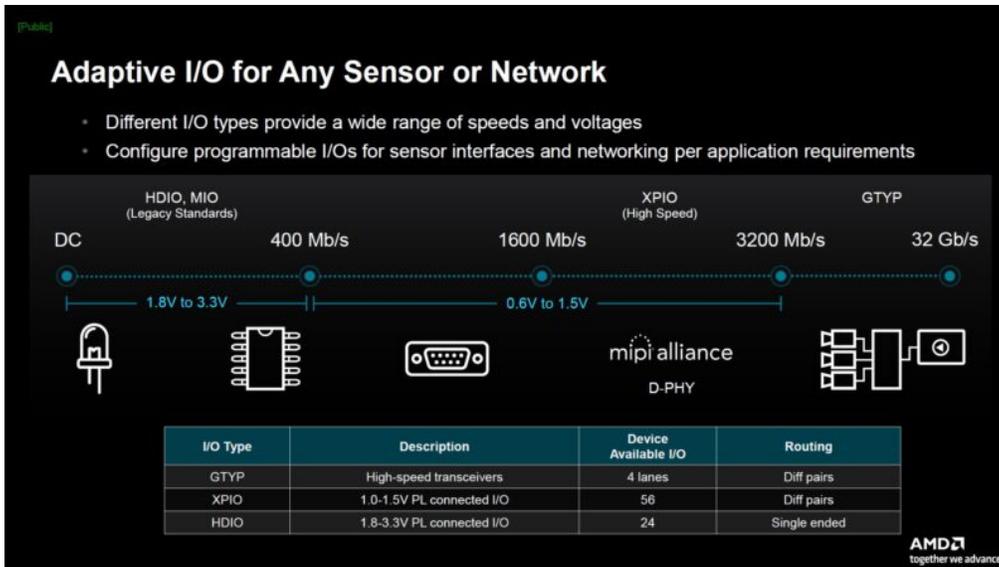
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## DETAILS: AMD EMBEDDED+

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AMD Embedded+ provides a highly integrated and efficient solution for various applications. At its core, AMD Embedded+ combines the capabilities of AMD Ryzen Embedded processors with Versal adaptive SoCs integrated onto a single PCB.

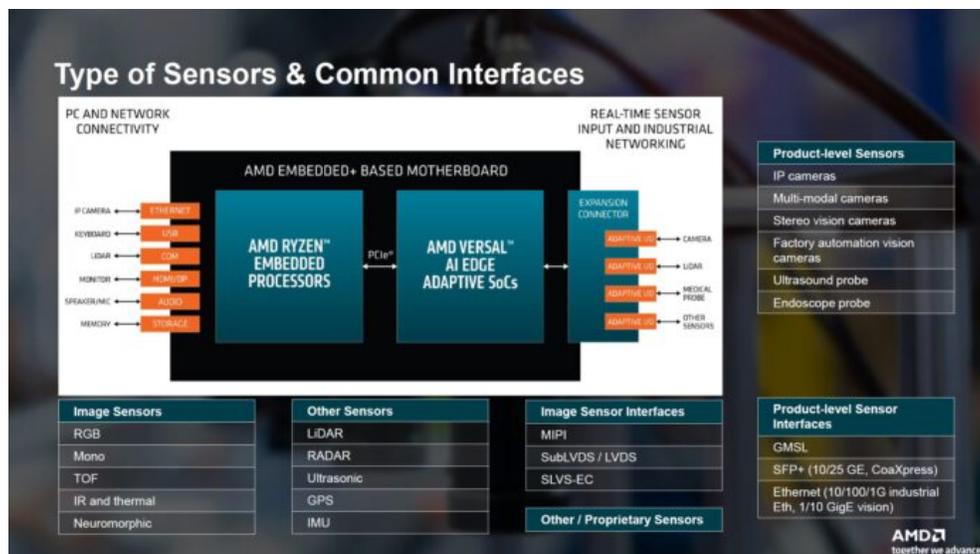
AMD’s approach combines the high-performance x86 computing power of the Ryzen processors, known for their advanced "Zen" cores and Radeon graphics, with the flexibility and programmability of Versal adaptive SoCs. The latter delivers customizable, low-latency processing ideal for AI inferencing and sensor fusion applications.



In the AMD Embedded+ platform, Ryzen and Versal components connect via PCIe for fast and efficient communication and data transfer between the CPU and FPGA.

This design enables the system to leverage the strengths of each component – utilizing the x86 cores for general-purpose processing and graphics while employing the FPGA for specialized, performance-intensive tasks such as signal processing or AI computations.

AMD Embedded+ also emphasizes adaptability in handling diverse I/O requirements, a critical factor in embedded systems, which often need to interface with various sensors and peripherals.



Additionally, the platform is designed with longevity in mind, with components like the Zen+-based AMD Ryzen Embedded R2314 SoC, which has a planned ten-year availability. This long lifecycle is crucial in embedded markets like industrial and medical applications, where systems often need to remain operational and supported for extended periods.

Furthermore, incorporating Radeon graphics and video codec capabilities enhances the platform's utility in applications requiring high-quality visual outputs and multimedia processing. On the other hand, the Versal AI Edge architecture handles I/O, DSP functions, and other platform-specific requirements, solidifying its role in AI edge computing.

AMD Embedded+ represents a natural integration of CPU and FPGA technologies tailored to meet the demanding requirements of embedded systems design. This integration offers a high degree of performance and efficiency and simplifies the development process for original design manufacturers, reducing time to market and R&D efforts.

## DETAILS: AMD RYZEN EMBEDDED R-SERIES



**AMD RYZEN™ EMBEDDED R-SERIES**  
**R2314 SoC**

Second-gen mid-range SoC featuring:  
High-performance “Zen+” x86 CPU  
AMD Radeon™ graphics  
High-speed I/Os and peripherals

<b>4C/4T</b> “Zen+” x86 CPU Cores	<b>6</b> Radeon Graphics Compute Units	<b>3</b> 4K Display Support	<b>16L</b> PCIe® Gen3 12L Available	<b>DDR4</b> 2,667 MT/s with ECC Support	<b>Ubuntu</b> 22.04 LTS Linux®	<b>10</b> Years Planned Availability
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**AMD**  
together we advance.

The AMD Ryzen Embedded R-Series processors are part of AMD's lineup of embedded processors, designed for use in various applications where performance, power efficiency, and graphical capabilities are crucial. These processors are well-suited for embedded systems in sectors like digital signage, gaming, industrial automation, and thin clients.

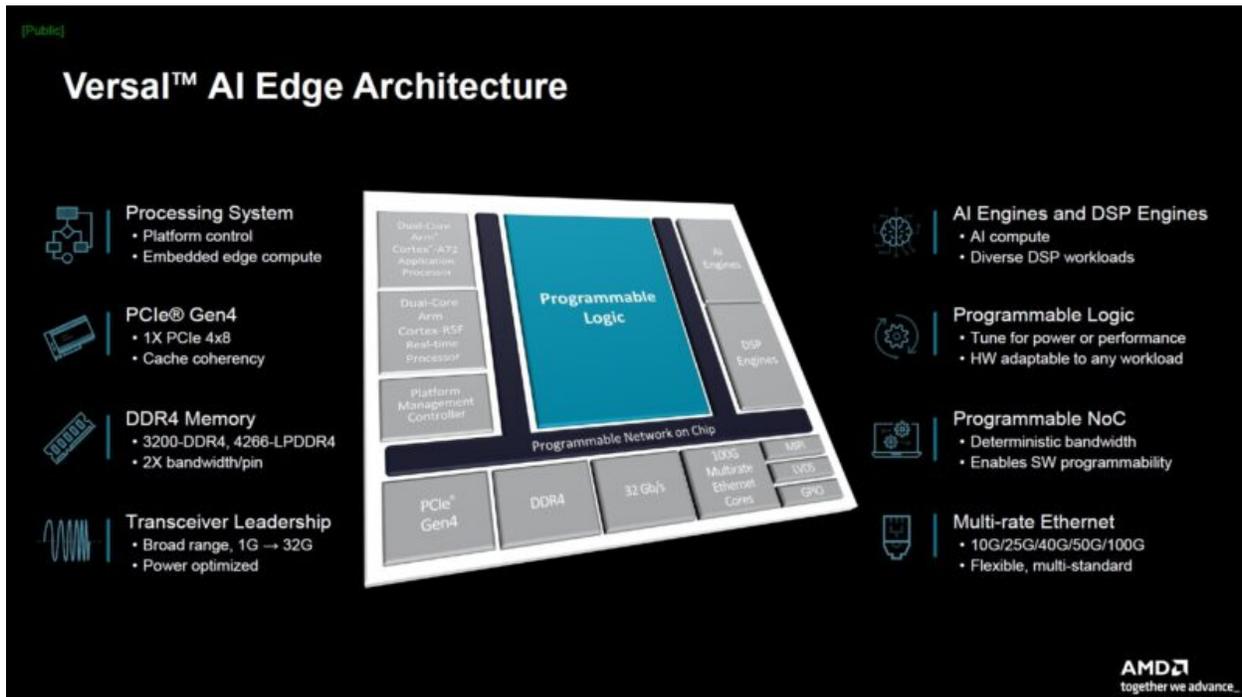
Here are some key characteristics of the AMD Ryzen Embedded R-Series:

- **High-Performance Computing:** The Ryzen Embedded R-Series processors are known for their high performance, leveraging AMD's advanced "Zen" microarchitecture. This gives them strong computing capabilities to handle complex and demanding applications in embedded systems.
- **Graphics Capabilities:** These processors typically include integrated Radeon Graphics, offering impressive GPU performance for embedded solutions. This makes them ideal for applications that require high-quality visual outputs, such as digital displays and gaming systems.
- **Efficient Power Consumption:** Despite their high performance, Ryzen Embedded R-Series processors are designed to be power efficient. This is crucial in embedded systems where power availability can be limited or low power consumption is a priority for cost, heat, or environmental impact.
- **Scalability and Versatility:** The Ryzen Embedded R-Series offers various models with different core counts and performance levels, providing scalability and flexibility for additional embedded system requirements. This versatility makes them suitable for various applications, from entry-level devices to more advanced systems.
- **Support for High-Speed Interfaces:** These processors support high-speed interfaces and I/O options, including PCIe lanes, USB ports, and more, facilitating fast data transfers and connectivity with a wide range of peripheral devices.
- **Longevity Support:** AMD provides extended availability for the Ryzen Embedded R-Series, a critical requirement in the embedded market where products often have long life cycles.
- **Security Features:** The Ryzen Embedded R-Series includes advanced security features to protect systems from various threats, an increasingly important aspect for connected and IoT devices.
- **Real-Time Performance:** Some models are well-suited for real-time applications, which is necessary in industrial automation and control systems.
- **Operating System Support:** These processors support various operating systems, including Windows and Linux, offering flexibility for different embedded system applications.
- **Embedded Controller Applications:** With their balance of power and performance, Ryzen Embedded R-Series processors are particularly well-suited for applications in embedded controller systems, where they can drive complex tasks while maintaining efficient operation.

The AMD Ryzen Embedded R-Series processors are a solid choice for a wide range of embedded applications, offering a balanced mix of performance, graphics capabilities, power efficiency, and security features. They cater well to industries requiring robust and reliable embedded systems.

## DETAILS: VERSAL AI EDGE

The Versal AI Edge architecture significantly advances adaptive compute acceleration platforms (ACAPs). Its architecture caterd to the increasing demands for edge computing, where data processing occurs close to the source of data generation rather than in distant data centers.



Key aspects of the Versal AI Edge architecture include:

- **Adaptive Computing:** At its core, the Versal AI Edge is built around the concept of adaptive computing, which combines the flexibility of software programmability with the high efficiency and performance of hardware acceleration. This makes it highly suitable for a wide range of applications, including those in AI and machine learning.
- **AI Optimization:** The architecture is specifically optimized for AI and machine learning workloads. It features AI Engine tiles dedicated to handling complex AI and DSP computations efficiently, offering high throughput and low-latency processing capabilities.
- **Scalable Performance:** Versal AI Edge delivers scalable performance, making it suitable for applications ranging from sensor fusion and robotics to automated driving and avionics. This scalability is crucial in edge computing, where requirements vary significantly based on the application.
- **Integrated Architecture:** The architecture integrates various components, including ARM-based processors, AI Engines, and programmable logic (FPGA fabric). This integration allows for a high degree of customization and flexibility in how the chip is used and for what purpose.

- **Energy Efficiency:** Versal AI Edge is designed with energy efficiency in mind, an essential factor for edge devices that often operate on limited power budgets. This efficiency does not compromise its performance, making it ideal for power-sensitive edge applications.
- **High-Speed Connectivity:** Versal AI Edge supports high-speed connectivity options to support the high data rates required in many edge applications. These options include protocols like PCIe, Ethernet, and others, facilitating fast data transfer and communication with other devices and systems.
- **Software Support and Tools:** AMD provides a comprehensive suite of software tools and development environments to support the Versal AI Edge architecture. This includes the Vitis unified software platform, which enables developers to take advantage of this architecture without needing deep hardware design expertise.
- **Real-Time Processing Capabilities:** The architecture is well-suited for real-time processing needs, a critical requirement in many edge computing scenarios, such as industrial automation and real-time analytics.
- **Security Features:** Recognizing the importance of security in edge computing, Versal AI Edge incorporates advanced security features to protect against threats and ensure the integrity and confidentiality of data.

The Versal AI Edge architecture represents a sophisticated convergence of adaptive computing, AI optimization, and energy-efficient design, making it highly suitable for various demanding edge computing applications.

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## ANALYSIS

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AMD's Embedded+ marks a strategic advancement in the company's approach to addressing the embedded market. Integrating AMD Ryzen Embedded processors with Versal adaptive SoCs onto a single board is an excellent approach that signals AMD's commitment to addressing the evolving demands of the embedded computing market.

### Strategic Implications for AMD:

- **Expanding Market Reach:** With Embedded+, AMD strategically diversifies its product portfolio beyond traditional CPUs and GPUs. This move indicates AMD's intent to capture a larger share of the embedded systems market, which is crucial for industries like automotive, medical, and industrial automation.
- **Enhanced Efficiency and Performance:** The Embedded+ platform's focus on combining scalability, power efficiency, and rapid time-to-market is precisely aligned with ODMs' current needs.
- **Targeted Application Sectors:** AMD's emphasis on low power, small form factors, and long lifecycles directly caters to specific industry needs, especially in medical, industrial, and automotive applications.

### Competitive Landscape:

- **Challenging Established Players:** This launch puts AMD in direct competition with other major players in the embedded systems market. It's a bold move to capture market share from companies traditionally dominating this space.
- **Collaboration with Sapphire Technology:** The partnership with Sapphire Technology for the inaugural ODM solution based on Embedded+ architecture is a strategic alliance. It validates the Embedded+ platform and leverages Sapphire's market presence for greater penetration.

### Technological Innovations:

- **AI and Sensor Fusion Applications:** The architectural combination of adaptive computing with AI inferencing capabilities positions AMD as a leader in innovative embedded solutions. This is particularly relevant for AI and sensor fusion applications, which are increasingly important in automated systems.
- **Enhanced Graphics and Multimedia:** AMD's inclusion of high-performance "Zen" cores and Radeon™ graphics in the Ryzen Embedded processors within Embedded+ delivers advanced graphics and multimedia capabilities to the edge market, a growing critical requirement for many embedded applications.

### Market and Customer Impact:

- **Reducing Time-to-Market:** By simplifying the qualification and build processes for ODMs, AMD's Embedded+ platform addresses one of the critical challenges in product development - speed. This advantage could make AMD a preferred choice for ODMs looking to expedite product launches.
- **Cost Efficiency:** Embedded+ offers the potential for reduced R&D costs, which is a significant consideration for companies in the current economic landscape.

AMD's introduction of the Embedded+ platform will undoubtedly expand the company's footprint in the embedded systems market. It showcases AMD's innovation capabilities and commitment to delivering tailored solutions that meet specific industry needs.

With Embedded+'s focus on efficiency, performance, and reduced time-to-market, AMD is well-positioned to compete strongly in the embedded systems arena and could see increased adoption of its technologies across various industries.



# RESEARCH NOTE

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