Hybrid AI 201: How AMD Ryzen™ AI PRO 300 Series Processors Work "Under the Hood"

Lenovo | AMD

Executive Summary

In today's rapidly evolving technology landscape, IT and business decision makers face the challenge of charting the right AI path for their organizations. Despite the proliferation of hardware options, the market is moving towards a hybrid AI model that strategically integrates public and private cloud resources with on-device processing to better optimize AI implementation and adoption.[1]

Hybrid AI is expected to unlock enhanced productivity and data security while promoting the democratization of AI across business sectors. It represents a crucial advancement for both consumer and enterprise environments.[2]

This white paper explores the transformative potential of hybrid AI through the lens of AMD Ryzen™ AI PRO 300 series processors and Lenovo's next generation ThinkPad T14s. It explains their architecture, capabilities and comparative performance before discussing real-world AI PC use cases and the associated long-term implications across a range of business sectors.

Introduction to Hybrid AI

Historically, AI processing has relied heavily on cloud-based infrastructure due to the substantial computational resources required for model training and execution. However, the rapid escalation in AI compute demands, growing security and privacy concerns, latency limitations, and innovations in chip architecture as well as hardware like the Lenovo ThinkPad T14s are encouraging businesses toward a hybrid AI approach.

[1] Lenovo: Achieve Better Economics and Performance Through Hybrid AI
[2] TBR: Hybrid AI- Lenovo Builds a Portfolio Ready to Address the Confluence of Personal, Enterprise and Public Data

What is Hybrid AI?

Hybrid AI combines cloud-based and on-device processing to strategically distribute AI workloads, enhancing efficiency and adaptability across environments. By utilizing both public/private cloud resources and local processing capabilities, hybrid AI optimizes performance, cost and latency.

Traditional cloud-only AI systems often face limitations, including high operational costs, bandwidth constraints, latency delays, and data security vulnerabilities. Hybrid AI mitigates these issues by intelligently offloading workloads. Computationally intensive tasks, such as model training, are executed in the cloud, while real-time inference, lightweight processing, and decision-making run locally. This approach delivers faster responses, minimizes data transmission overhead, and preserves sensitive information.

The Ryzen AI PRO 300 Series processors, now powering many AI PCs, offer the performance and features hybrid AI deployments are likely to require. These processors are equipped with a dedicated AI engine known as an NPU and enable real-time AI execution, even for complex tasks, without relying solely on the cloud.

Tangible Benefits of Hybrid AI

Hybrid AI enables AI to operate closer to the data and provides organizations with the means to leverage AI across both cloud and on-device environments. Additional benefits include:

- **Optimized Cost and Resource Efficiency** - Shifting workloads to hybrid AI-enabled devices minimizes costs related to data transfer, storage, and cloud compute resources. A recent study suggests that re-allocating 20% of generative AI processing to local devices could save organizations up to $16 billion by 2028.[3]
- **Responsive Performance Through Tailored Workload Management** - Hybrid AI strategically allocates workloads to the most suitable environment, whether it's on the Lenovo ThinkPad T14s, on prem, or in the cloud. Tasks requiring real-time decision-making or low latency—such as inventory updates, device-level analytics, or user-facing AI features—are processed locally. Meanwhile, computationally heavy functions like model training or long-term optimization remain in the cloud. For example, in logistics, edge devices can provide immediate updates on inventory, while cloud-based AI optimizes delivery schedules.

[3] Tirias Research GenAI

- **Enhanced Data Security and Privacy** - Hybrid AI processes sensitive data locally, minimizing the risk of exposure during transmission to the cloud. Critical information remains under the organization's control and directly on the device like the Lenovo ThinkPad T14s, reducing vulnerabilities and improving compliance with data privacy regulations. This is particularly valuable in highly regulated sectors like healthcare, finance, and government.

The Role of Advanced AI Processors in Hybrid AI

The expansion of AI workloads is reshaping both how and where data is processed. By 2025, more than 50% of all data is expected to be generated on edge devices.[4] To meet this demand for low-latency, high-efficiency AI processing, a new class of specialized AI processors has emerged.

These advanced processors integrate dedicated Neural Processing Units (NPUs)—specialized engines optimized for accelerating AI workloads. Unlike traditional CPUs and GPUs, which are general-purpose compute engines, NPUs are purpose-built to handle AI model operations like inference and matrix multiplications with exceptional energy efficiency.

AMD Ryzen™ AI PRO 300 Series Processors include an XDNA™ 2 NPU and deliver an industry-leading 50 TOPS. AMD's design enables efficient execution of complex tasks such as natural language processing, computer vision, and predictive analytics without relying solely on cloud infrastructure. This localized processing not only improves performance but also aligns with hybrid AI strategies by reducing latency, bandwidth usage, and operational costs.

Figure 1 – Benefits of Hybrid AI

[4] Deloitte, WSJ: AI and the evolving consumer device ecosystem

Use Cases

When combined with edge computing, IoT devices, and backend systems, AMD Ryzen™ AI PRO 300 Series processors can optimize real-time processing and dynamic resource allocation for hybrid AI workloads. Below are several cross-industry applications for AI PCs which the Lenovo ThinkPad T14s is bringing to life: (See *Figure 2 – Industry Use Cases*).

Healthcare

- **Smarter Consultations for Healthcare Providers:** Imagine a healthcare provider using an AI PC like Lenovo ThinkPad T14s during a patient consultation. As the conversation progresses, the AI assistant analyzes newly reported symptoms against the patient's known family medical history and suggests follow-up actions, all in real time.
- **Instant Imaging Insights:** In radiology, AI PCs equipped with Ryzen AI PRO processors and XDNA™ 2 NPU can analyze imaging scans like MRIs on the spot, while ensuring patient data remains private by eliminating the need for cloud uploads. The NPU accelerates AI processing to highlight subtle anomalies in seconds, helping radiologists identify conditions while saving valuable minutes. Paired with advanced rendering from the RDNA™ 3.5 iGPU, the scans appear in crystal-clear detail, ensuring rapid, confident diagnoses.

- Smarter Consultations for Healthcare Providers
- Instant Imaging Insights
- Continuous Chronic Care Monitoring
- Proactive Hospital Management

- Real-Time Fraud Detection and Prevention
- AI-Driven Investment Management
- Regulatory Compliance Automation
- AI-Enhanced Productivity for Finance Teams

- Personalized Shopping Recommendations
- Real-Time Inventory Management
- Dynamic Pricing Optimization

- Defect Detection with Smart Computing
- Collaborative Robots for Precision Tasks
- Predictive Maintenance for Manufacturing Assets

Figure 2 – Industry Use Cases

- **Continuous Chronic Care Monitoring:** Real-time monitoring is critical for chronic care patients. An AI PC can connect to wearable devices, offering clinicians live insights into vital data. For example, during a remote check-in, the doctor notices a spike in glucose levels, flagged instantly on their Lenovo ThinkPad T14s. This allows for quick treatment adjustments without waiting for cloud-based analysis, improving patient outcomes and reducing potential expenses from delayed interventions.
- **Proactive Hospital Management:** Beyond patient care, hospitals face operational challenges like staffing and resource allocation. An administrator using an AI PC-based analytics platform connected to real-time operational dashboards can forecast peak emergency room hours by utilizing both historical time-series data and real-time data from IoT devices and hospital systems. These insights allow them to adjust staffing schedules and manage equipment readiness.

Finance

- **Real-Time Fraud Detection and Prevention:** Financial institutions can keep sensitive data protected by combining on-device AI acceleration with AMD Memory Guard. For instance, a bank teller using fraud detection software can analyze anomalies—like mismatched transaction locations or unusual account behavior—directly on an AI PC, flagging suspicious activity instantly without relying on external servers. Additionally, this localized processing reduces operational costs associated with cloud services and enhances privacy by keeping sensitive data on-device.
- **AI-Driven Investment Management:** Investment firms can benefit from real-time risk assessment and portfolio optimization with Ryzen AI PRO processors. The Zen 5 cores handle complex simulations, while the RDNA™ 3.5 iGPU facilitates smooth data visualization and data sharing across AI-driven analytical models. On an AI PC like Lenovo ThinkPad T14s, investment managers can process market data on-device, ensuring privacy, while

rapidly rebalancing portfolios based on live trends. This localized, AI-enhanced capability minimizes reliance on the cloud while allowing split-second decisions for risk mitigation.

- **Regulatory Compliance Automation:** Compliance automation tools running on Lenovo ThinkPad T14s powered by Ryzen AI PRO processors continuously monitor regulatory updates and generate actionable insights. Features like Microsoft Pluton Security and Cloud Bare Metal Recovery safeguard credentials, personal data, and encryption keys directly on the AI PC. For example, an insurer can verify that all systems comply with regional data protection laws while mitigating exposure of sensitive customer data.
- **AI-Enhanced Productivity for Finance Teams:** Tools like Microsoft Excel and PowerPoint are integral to finance professionals, but cloud-based AI features often carry significant operational costs and latency. With Ryzen AI PRO processors powering on-device AI capabilities, finance teams can easily execute computationally intensive tasks. Imagine a financial analyst leveraging AI tools to analyze massive datasets, predict future cash flows, or generate Monte Carlo simulations in Excel, with all of it processed entirely on their AI PC. This type of data locality ensures secure, real-time operations and faster insights without burdening the company's cloud expenses.

Retail

- **Personalized Shopping Recommendations:** An AI-powered kiosk running on an AMD Ryzen AI PRO processor can analyze customer purchase patterns and preferences directly on-device. For instance, a shopping browser display in a department store could receive tailored suggestions for accessories or outfits without waiting for cloud processing. The RDNA™ 3.5 iGPU displays product visuals and recommendations instantly, creating a secure shopping experience that keeps sensitive data local.
- **Real-Time Inventory Management:** AI PCs powered by Ryzen AI PRO processors can analyze data from IoT-connected sensors and smart shelves locally, reducing costs associated with cloud services, while automating restocking decisions in real

time. A convenience store equipped with AI PCs could monitor beverage stock levels and trigger an automated restocking order when supplies dip below a specific threshold, without relying on external networks. Coupled with Wi-Fi 7 connectivity, this allows for instant updates across the supply chain, reducing latency and maintaining product availability.

- **Dynamic Pricing Optimization:** Pricing decisions often demand quick reactions to change with market conditions. With Ryzen AI PRO processors, AI PCs can analyze vast datasets—including market trends, competitor pricing, and live purchasing behavior—on-device. For instance, during seasonal sales, a retailer can use AI-powered pricing tools to dynamically adjust the pricing of overstocked inventory.

Manufacturing

- **Defect Detection with Smart Computing:** Early defect detection is crucial for maintaining quality on the production line. With AMD Ryzen AI PRO processors and on-device AI capabilities, AI PCs like Lenovo ThinkPad T14s can analyze IoT sensor data in real time to identify defects before they happen. This ensures reduced costly rework and waste associated with undetected errors. In a bottling plant, an AI PC running quality control software might flag subtle flaws immediately—like surface defects in containers or irregular fill level. Powered by the RDNA™ 3.5 iGPU, the system processes vast sensor inputs with speed and precision, to deliver uninterrupted workflows and high-quality output while minimizing dependence on cloud-based analysis.
- **Collaborative Robots ('cobots') for Precision Tasks:** While broader cobot coordination often relies on edge or server infrastructure, AI PCs running AMD Ryzen™ AI PRO processors play a critical role in localized decision-making and precision adjustments. The Zen 5 CPU executes complex algorithms for task management, while the XDNA™ 2 NPU processes real-time environmental inputs, enabling cobots to adapt to dynamic conditions. On a smart assembly line, for instance, AI PCs assist cobots

in performing repetitive tasks like fastening screws with millimeter precision. Real-time localized data processing also allows cobots to detect and avoid human workers, creating a safer work environment.

- **Predictive Maintenance for Manufacturing Assets:** Unplanned downtime can be costly, and predictive maintenance mitigates this risk. AI PCs equipped with AMD Ryzen™ AI PRO processors analyze metrics—such as temperature, pressure, and mechanical load—directly on the factory floor. As one example, a factory running IoT-integrated software on AI PCs can dynamically adjust conveyor belt speeds based on load fluctuations, reducing mechanical stress. This localized processing extends equipment lifespan, optimizes energy use, and avoids costly disruptions, all without relying on cloud services or external systems.

These cross-industry examples underscore the transformative role AI PCs play in enabling Hybrid AI.

AMD Ryzen™ AI PRO 300 Series Processors & PRO Technologies Deep Dive

Designed specifically for enterprise applications, AMD Ryzen AI PRO 300 Series processors include a 3x faster NPU compared to previous generation Ryzen 8040 Series processors.[5] These processors are designed to support Microsoft Copilot+ to enhance workplace productivity and efficiency.

In addition, devices like the Lenovo ThinkPad T14s equipped with AMD Ryzen™ AI PRO 300 Series Processors deliver a robust and reliable experience built on the secure foundation of AMD PRO Technologies. AMD PRO provides enterprise-grade multilayered security features, simplified manageability, and long-term reliability needed to support enterprise-scale IT management.

AMD PRO Technologies offer a comprehensive suite of management and security features designed to meet the demands of hybrid AI environments. These technologies support organizations in deploying, managing, and securing AI-powered solutions.

[5] AMD Newsroom - *'3x faster NPU performance for AI workloads when compared to an AMD Ryzen 7040 series processor.'*

- **AMD PRO Security:** Hybrid AI workflows often involve processing sensitive data across distributed systems. AMD PRO Security embeds multi-layered protection directly into the hardware, operating system, and system levels, reducing exposure to vulnerabilities. Integrated technologies, such as the Microsoft Pluton Security Processor, safeguard credentials, encryption keys, and sensitive data during AI tasks. This hardware-derived security allows enterprises to run AI applications without compromising privacy or control.
- **AMD PRO Manageability:** AMD PRO Manageability provides the highest level of compliance with open standards for remote systems management.[6] It simplifies device lifecycle management by offering robust tools for remote monitoring, asset tracking, and secure control of AI PCs. Features like KVM (Keyboard, Video, and Mouse) enhancements enable IT teams to securely manage devices across on-premises and cloud environments, optimizing resource utilization and reducing system downtime. With this capability, AI PCs powered by AMD Ryzen™ PRO processors remain operational and secure across dynamic enterprise landscapes.
- **AMD PRO Business Ready:** Supplies platform consistency and quality assurance to support mission-critical AI workloads. With long-term platform stability, enterprises can confidently integrate AMD Ryzen PRO processors into their infrastructures, optimizing performance, minimizing disruptions, and reducing total cost of ownership.

AMD Ryzen™ AI Pro 300 Series Processors **Delivering multi-layered security from hardware, OS to the system level**
AMD Memory Guard: Helps protect the company's sensitive business data when an employee's PC is lost or stolen.
NEW Cloud Bare Metal Recovery (cBMR): Communicates PreOS to recover the system (via cloud) without shipping the system.
NEW Supply Chain Security (AMD Device Identity): Authenticates genuine AMD SoCs in customer platforms and its traceability across the supply chain.
NEW Watchdog Timer: Augments resiliency support through detection and recovery of hung SoC processes.

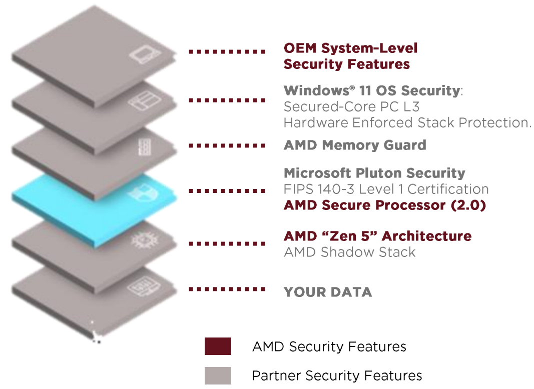

Figure 3 – AMD PRO Security

[6] *Compared to Intel vPro, AMD PRO Manageability implements more profiles of the DASH Management Initiative to support multi-vendor management for desktop and mobile systems. KRKP-7*

Technical Specifications and Performance Metrics

The AMD Ryzen™ AI PRO 300 Series processors deliver cutting-edge performance, AI acceleration, and energy efficiency, setting a new standard for enterprise AI PCs.[7,8]

The AMD Ryzen™ AI PRO 300 Series processors demonstrate a significant performance advantage over Apple's M3 processors. With up to 33% faster CPU performance[9], AMD Ryzen™ AI 9 HX PRO 375 CPU offers superior responsiveness and efficiency for multitasking and complex workflows, compared to Apple M3 Pro 12-core CPU.

In terms of battery life, AMD Ryzen™ AI 9 HX PRO 375 CPU processors provide up to 64% better battery life compared to the Apple M3 Pro 12-core CPU, delivering 23.6 hours vs. 14.4 hours of playback time.[9] For enterprise workloads like Microsoft Teams, AMD Ryzen™ AI 9 HX PRO 375 CPU ensures 9.2 hours of runtime vs. 7.5 hours on Apple M3 Pro 12-core CPU, making AMD the superior choice for both performance and longevity.[9]

Beyond Intel and Apple, the AMD Ryzen™ AI 7 PRO 360 CPU achieves up to 7% faster performance compared to the Qualcomm Snapdragon X Elite X1E-78-100 CPU, while the AMD Ryzen™ AI 9 HX PRO 375 CPU delivers even greater gains, outperforming Qualcomm by up to 14% in the same productivity tests.[10]

Performance Category	Specification of AMD Ryzen™ AI PRO 300 Series	Performance Metric
AI Engine (NPU) Performance	• Up to 55 TOPS via XDNA™ 2 NPU	Superior LLM responsiveness and real-time AI execution
CPU Performance	• Up to 12 cores, 24 threads • 5.1 GHz max clock • Zen 5 architecture	Performance for thin and light Enterprise AI PCs System performance for Enterprise
iGPU Performance	• Radeon™ 890M iGPU • RDNA™ 3.5 • 16 compute units	System Performance for Enterprise
Productivity Enhancements	• 256 GB DDR5 support • Up to LPDDR5X-8000 memory	Productivity Performance for Enterprise Productivity Performance for thin and light Enterprise AI PCs
Power and Thermal Efficiency	• 15W-54W configurable TDP • Max Operating Temperature is 100°C	Video Playback Battery Life Enterprise Battery Life

Figure 4 – Performance of AMD Ryzen™ AI PRO 300 Series vs. key competitors

[7] AMD Ryzen™ AI PRO 300 Specs
[8] AMD Ryzen™ AI PRO 300 World Tour Deck - Public Statement
[9] AMD World Tour Deck
[10] Testing as of Sept 2024 by AMD performance labs

In PassMark 11 benchmarks, AMD processors further extend their advantage by delivering up to 78% faster CPU performance. They also achieve 86% better overall system performance, through greater responsiveness and efficiency for multitasking and complex operations. For graphics-intensive tasks, AMD Ryzen™ processors excel with 3.2X faster iGPU performance, leveraging the power of RDNA™ 3.5 architecture to deliver unmatched visual and compute capabilities.[10]

Outlook

Advancements in AI capabilities and the expanding range of AI-driven use cases are accelerating the need for powerful, efficient, and scalable on-device processing. AI processors like the AMD Ryzen™ AI PRO 300 Series are at the forefront of this shift, enabling real-time data processing and decision-making directly at the edge.

Implications for IT Decision Makers (ITDMs)

AI processors such as the AMD Ryzen™ AI PRO 300 Series are no longer just incremental upgrades—they are a strategic differentiator for organizations navigating increasing AI demands and they are perfectly designed to power latest cutting-edge AI PCs like Lenovo ThinkPad 14s. As AI applications scale, IT leaders must evaluate infrastructure that supports real-time processing, advanced analytics, and intelligent automation to maintain agility and competitive advantage. Key considerations for ITDMs include:

- **Data Privacy and Security:** Are your current data security measures sufficient to handle the growing risks associated with storing and transmitting sensitive information, particularly Personally Identifiable Information (PII)? Localized AI processing on AMD Ryzen AI PRO processors minimizes exposure by keeping data on-device.
- **Cost of AI Compute:** What are the financial implications of relying on cloud-based AI compute for mission-critical operations? On-device AI enabled by Ryzen AI PRO processors helps reduce operational costs by shifting workloads to local processing without sacrificing performance.
- **Latency and Bandwidth Requirements:** How critical is real-time data processing for your organization? Cloud-dependent systems often face latency issues that impact decision-making and user experience. With AMD Ryzen AI PRO processors, AI workloads are executed locally, ensuring low latency and reducing dependency on bandwidth-heavy cloud operations.

[10] Testing as of Sept 2024 by AMD performance labs

- **Customization for Specific AI Use Cases:** Can your existing infrastructure adapt to the unique performance requirements of specific AI workloads? AMD Ryzen AI PRO processors provide the flexibility and compute power needed to optimize diverse AI applications, from predictive analytics to advanced automation, directly on AI PCs.

The AMD Ryzen™ AI PRO 300 Series processors are purpose-built to offer robust performance, enhanced security, and cost-efficient AI processing. By integrating these processors into their existing IT systems, ITDMs can build a modern, hybrid AI infrastructure that is better positioned for resilience and growth.

Conclusion

The AMD Ryzen™ AI PRO 300 Series Processors represent an advancement in hybrid AI technology. With advanced AI capabilities directly embedded into the processor, these chips enable real-time AI applications with minimal latency and on-device data privacy. For IT and business decision-makers, adopting AMD Ryzen AI PRO processors translates into:

- Enhanced Operational Productivity through accelerated AI workloads and streamlined workflows.
- Secure Data Processing with localized AI execution that keeps sensitive business data.
- Seamless Connectivity enabled by advanced integrations like Wi-Fi 7, which unlocks low-latency communication for critical tasks.

As businesses tackle the complexities of AI integration, the AMD Ryzen™ AI PRO 300 Series Processor offers a scalable, reliable, and future-ready solution that meets diverse enterprise needs.

Next-gen AI performance is here. Unlock the benefits of AI for your organization—without compromise—with the Lenovo ThinkPad T14s Gen 6, powered by the AMD Ryzen AI 7 PRO 360 processors.