

White Paper

# What Is an AI PC and Why Should You Care?

## An Overview of Built-in AI Solutions for Laptops

### Hype Versus Reality

AI is everywhere today, in mobile devices, cloud services, software, and even operating systems, such as Windows. Now, PC chip makers are going all in on AI processors to help support and accelerate specialized AI workloads. For example, AMD offers AMD Ryzen™ AI (AMD XDNA™) chips. Intel has countered with its Intel® Core™ Ultra (“Meteor Lake”) chipset, which includes a built-in neural processing unit (NPU) to relieve the central processing unit (CPU) of AI processing tasks. Qualcomm, Apple, and other chip and hardware vendors have their own stakes in the game.

All of these companies are touting AI PCs with the promise of “AI everywhere.” But what does that actually mean? What will these new capabilities enable in our day-to-day lives? For businesses, will AI PCs increase worker productivity or free up highly paid professionals to focus on more demanding tasks? Or are AI PCs just the latest fad designed to motivate us to upgrade our hardware and software?

To answer that question, we need to look at how PCs make use of AI today and what new capabilities will be unleashed by new AI-focused chips in the near future.

### How PCs Use AI

AI has already been in use for years across myriad industry sectors. From medical diagnostics to astrophysics research to fraud detection and much more, AI has become integral to business and research workloads in countless ways. But these AI-based tasks are typically performed on servers running graphics processing units (GPUs) or other specialized accelerators on data center servers or in the cloud.

More recently, there’s been a surge in the use of AI tools for business and consumer workloads. Office workers are relying on Chat-GPT to help with research and writing tasks. Content creators use generative AI fill features when working with photos and illustrations. Programmers rely on AI tools to write and analyze sections of code.

AI is also used in less obvious ways to enhance our day-to-day work and personal lives. Examples of such uses include image and speech recognition, natural language processing (NLP), facial recognition, videoconference image blurring, enhanced gaming experiences, and personal digital assistants such as Amazon Alexa® or Google Assistant™.

These end-user AI-based workloads might be run in the cloud or on standard consumer-level PCs using the system CPU. For some use cases, cloud or CPU-based AI computing might be adequate. But as AI workloads become ever more complex, the demand on the underlying hardware or network connection increases, leading to performance lags or unacceptable levels of latency.

In response to growing performance demands, PC and chip makers have leaned into developing AI PCs: laptop computers that include chips that are purpose-built to run and accelerate AI workloads.

With an AI PC, AI models operate entirely on the device instead of in the cloud, with no latency and no need for an Internet connection. This makes it possible to perform much faster inferencing while also providing other benefits for businesses. For example, many organizations have been reluctant to adopt AI workflows due to concerns over sensitive data being moved to the cloud for processing. By running workloads directly on AI PCs, businesses can help keep sensitive data local, within a company's domain and security infrastructure. In addition, Microsoft has begun rolling out Copilot in Windows® 11 and Microsoft 365® applications. Copilot is designed to provide answers to questions, offer inspiration for creative projects and tasks, automatically adjust PC settings, create images, and assist with generating code.

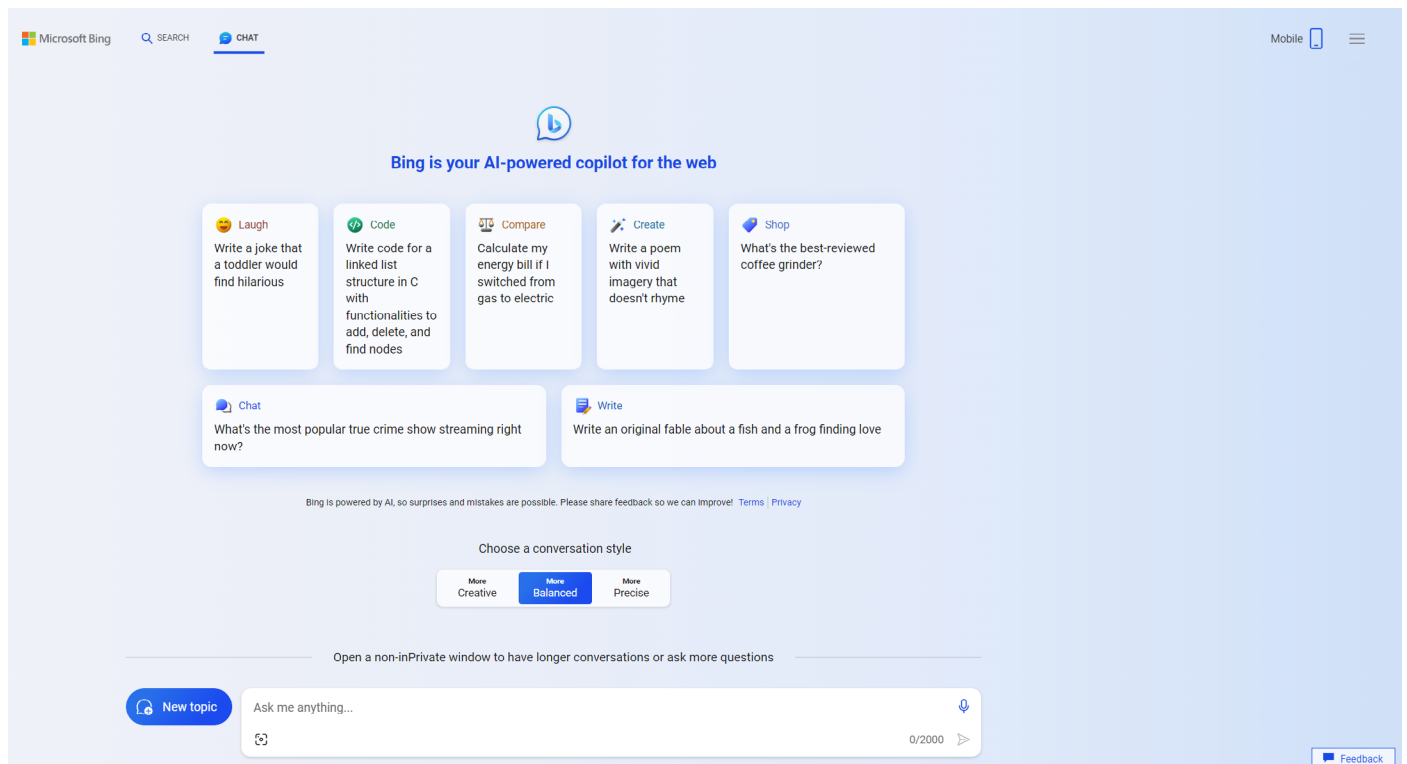


Figure 1 | Microsoft is including Copilot as an AI solution in Windows and Microsoft 365 apps.

AI PCs can make use of newer AI-based videoconferencing features in Windows, including suppressing background noise, maintaining eye contact, automatically adjusting framing, and adding background blur effects.

Microsoft also works with a vast ecosystem of PC and hardware vendors, which has led to several coordinated AI products or solutions designed to enhance or accelerate AI workloads in Windows. For example, many PCs built by popular vendors are powered by GPUs that can support transformer models like Dall-E 2.0, Stable Diffusion, and NVIDIA NeMo™, which are pre-optimized for Windows.<sup>1</sup>

Software vendors are also responding to new capabilities offered by AI PCs. Case in point: Intel Core Ultra infrastructure combines the CPU, GPU, and NPU into a single package. As a result, applications can be architected to use whichever processor provides optimal performance for a given workload.

## How Major Chip Makers Are Supporting AI

Many top CPU vendors are adding AI capabilities to their silicon to support Windows-based AI features and to accelerate other AI workloads. Each chip manufacturer is taking a different approach to enabling or enhancing AI, but all of them need to provide or support both hardware and software components in their AI PC solutions.

For example, vendors might build AI accelerators into the CPU. They also might provide a separate GPU, NPU, or other dedicated chips for AI processing.

In addition, the same chip makers frequently provide software, frameworks, libraries, or APIs that are designed to make optimal use of their hardware capabilities and to support industry standards for application development.

To see how different chip makers are addressing AI workflows in their hardware, we'll take a look at the current AI PC options offered by four major players in the laptop PC market: Intel, AMD, Qualcomm, and Apple.

### Intel AI PC and NPU

Intel offers enhanced performance for AI applications on laptops powered by its recently released Intel Core Ultra mobile processors. These processors feature a dedicated NPU for local AI processing. Intel provides AI Boost technology that can also tap into the CPU when speed is needed and use the GPU when generative AI workloads are performed. In addition to efficient AI, Intel Core Ultra devices promise to bring large power-efficiency improvements for AI-based workloads, compared with Intel's previous-generations of processors.

### AMD AI Ryzen and XDNA

AMD's AI solution for laptops is based on its XDNA architecture, which is integrated into AMD Ryzen chips, such as the Ryzen Mobile 7040 Series. The XDNA architecture is a dataflow architecture, designed to move data from one compute array to another without the need for large, power-hungry caches. Eliminating caches reduces latency that's typically caused by cache misses.

### Qualcomm AI Engine

Qualcomm dominates in the mobile phone segment but also offers PC chips. Qualcomm's AI solution for laptops is based on its Qualcomm AI Engine, which provides on-device AI processing. The Qualcomm AI Engine includes dedicated hardware, such as the Hexagon NPU and the micro NPU, which can run complex AI models at high performance and low power.

The Hexagon NPU is a dedicated chip for AI processing that is integrated into Qualcomm Snapdragon® processors, such as the Snapdragon 8cx Gen 3 5G Compute Platform. The Qualcomm Hexagon™ NPU is designed to run complex AI models at high performance and low power on laptops powered by Qualcomm processors.

### Apple's AI Solution

The Apple® AI solution for laptops is based on its Neural Engine, which is a dedicated hardware component that enables on-device AI processing. The Neural Engine is part of Apple's custom-made chips, such as the M3, M3 Pro, and M3 Pro Max (as well as their M1 and M2 variants), which power MacBook Air®, MacBook Pro®, and iMac® devices.

The Neural Engine can run complex AI models at high performance and low power, and it's used by Apple to power several of their proprietary features offered by Siri®, Face ID®, the Apple camera app, Apple Photos, and ARKit®. The Neural Engine can also work with other hardware components, such as the CPU, the GPU, and the Secure Enclave, which helps secure AI experiences.

## What can I do with an AI PC today?

Although each PC chip maker takes a different approach to AI processing, all of them are working to enhance similar AI capabilities so that they can run faster and more efficiently on a PC, compared to when they're run in the cloud. Some of the most common AI-based workloads that are relevant to business and consumer laptop users include:

- Generative AI: Create realistic and personalized AI-generated content such as images, videos, audio, and text.
- Speech Recognition: Interact with devices using natural language speech interfaces for document or email creation and summarization.
- Audio, Video, and Photo Processing: Enhance, edit, and transform media files.
- On-Device Personal Assistants: Access services and information using voice or text commands, without relying on cloud servers or an Internet connection.
- Productivity Enhancement Tools: Improve work efficiency and quality using AI-powered grammar and spelling checks, text summarization, data analysis, and presentation design.
- Healthcare and Financial Software: Use PC-based AI applications to monitor people's health and to track and manage finances, with personalized recommendations.
- Gaming: Enjoy AI-enhanced gameplay.
- Videoconferencing: Improve video and sound quality for meetings in applications like Zoom or Microsoft Teams.

## Benefit Today and Prepare for the Future

Despite the uncertainties and rapid changes in the tech industry, all roads point to AI becoming critical for business success—either as a differentiator or as table stakes. If your company isn't taking advantage of AI to streamline productivity, content creation, software development, and data analysis, it will likely lose out to the competition.

With all the major chip makers jumping on the AI bandwagon, businesses have several options to choose from when they refresh aging laptops. For Windows-based organizations, PCs built on Intel Core Ultra silicon or AMD XDNA architecture might be the best choice for covering the widest range of current AI workloads and providing enough headroom for emerging AI capabilities. Qualcomm is making inroads into the PC market but is still more focused on mobile devices and low-powered PCs with 5G and long battery life. If you aren't a road warrior looking for that enhanced mobility, Intel and AMD AI PCs will provide more options and a much better Windows experience than an Arm®-based Qualcomm device.

Users and businesses already invested in the Apple ecosystem will likely want to continue using MacBook Air or MacBook Pro devices. Compared to Intel and AMD, Apple's roadmap for AI is less clear, but Apple will almost certainly continue to build increasingly powerful AI capabilities into their Neural Engine.

Regardless of the device you choose, all roads lead to an AI-enhanced destination. Investing in an AI PC today will help your business quickly embrace new applications and workloads that help streamline processes, enhance user experiences, and accelerate time to insights and results.

If you want to explore more in this rapidly changing arena, the following links can get you started.

- [Copilot in Windows](#)<sup>2</sup>
- [Intel AI PC](#)<sup>3</sup>
- [AMD Ryzen AI PCs](#)<sup>4</sup>
- [AI on Qualcomm Snapdragon](#)<sup>5</sup>
- [Does Apple Have AI?](#)<sup>6</sup>

## Learn more about how your business can benefit from AI by reading [this Prowess Consulting research study](#).

<sup>1</sup> Microsoft Windows Blog. "Bringing the power of AI to Windows 11 – unlocking a new era of productivity for customers and developers with Windows Copilot and Dev Home." May 2023. <https://blogs.windows.com/windowsdeveloper/2023/05/23/bringing-the-power-of-ai-to-windows-11-unlocking-a-new-era-of-productivity-for-customers-and-developers-with-windows-copilot-and-dev-home/>.

<sup>2</sup> Microsoft. "Discover the power of AI with Copilot in Windows" webpage. 2023. <https://www.microsoft.com/en-us/windows/copilot-ai-features>.

<sup>3</sup> Intel. "The AI PC powered by Intel is here. Now, AI is for everyone." <https://www.intel.com/content/www/us/en/products/docs/processors/core-ultra/ai-pc.html>.

<sup>4</sup> AMD. "The Future of AI PCs Gets Even Better with AMD". 2023. <https://www.amd.com/en/products/processors/consumer/ryzen-ai.html>.

<sup>5</sup> Qualcomm. "AI on Snapdragon Compute Platforms". 2023. <https://www.qualcomm.com/products/mobile/snapdragon/pcs-and-tablets/features/computeai>.

<sup>6</sup> PC Guide. "Does Apple Have AI?" July 2023. <https://www.pcguidance.com/apps/does-apple-have-ai/>.