

IT@Intel: Embracing Windows 11 Upgrade to Realize Intel® Architecture Benefits

To gain the performance benefits of running Windows 11 on Intel® Core™ processor-based hybrid architecture, Intel IT is upgrading the enterprise OS using Microsoft’s native upgrade features, resulting in a smooth, accelerated process

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Executive Summary

Intel IT manages over 180,000 client devices at Intel sites worldwide. As a result, we spend considerable time evaluating new versions of Microsoft Windows when they become available. Our evaluation of the performance benefits of Windows 11 on newer Intel® Core™ processors—as well as enhanced security, new capabilities and end of life for Windows 10 support—have prompted us to upgrade the entire enterprise to Windows 11 by the end of 2025. So far, we have upgraded nearly 95% of the systems that can support Windows 11 (approximately 60% of the entire fleet). The remaining systems will need to be replaced with new systems.

By upgrading to Windows 11 and taking advantage of cloud-managed, native upgrade features such as Windows Update for Business (WUfB), we can:

- Maximize user experience with the hybrid architecture available on 12th Generation and newer Intel Core processors.
- Deliver a stable and reliable platform.
- Enable high-velocity OS upgrades (13 weeks instead of 9-12 months).
- Reduce technical debt by retiring custom upgrade tools and processes.

Background

As Microsoft Windows continues to evolve and mature, Intel IT embraces updating the enterprise to the latest version after carefully evaluating the business benefits and optimal timing of such an upgrade. Some of the aspects we consider are improved user experience through better performance and additional features, lower support costs, greater IT efficiency and enhanced security capabilities. All of these have influenced our OS upgrade decisions over the years, such as from Windows XP to Windows 7, and from Windows 8.1 to Windows 10. Between major migrations, we also deploy patches and minor upgrades, especially since Microsoft adopted the OS-as-a-service model in 2016. Soon after the announcement of Windows 11 in May 2021, we began investigating the business benefits of upgrading to Windows 11.

A primary benefit of upgrading to Windows 11 is providing users with excellent performance while conserving battery life when possible. While Windows 10 has foundational support for Intel® Thread Director, Windows 11 is fully optimized for this performance-enhancing and energy-saving technology. As a result, employees using 12th and 13th Generation Intel® Core™ processor-based devices can obtain the best user experience with Windows 11.¹ (See “How 13th Gen Intel® Core™ Processors Work” for more information.)

Other considerations also influenced our decision to upgrade to Windows 11:

- Windows 10 will reach end-of-life (EOL) in Q4 2025. Unsupported software poses security risks because security patches will no longer be available. An outdated OS can also become unstable and increase support costs and degrade the user experience.
- Windows 11 includes security enhancements, such as requiring Trusted Platform Module (TPM) 2.0.
- Windows 11 also offers new features that can lead to high productivity and increase user satisfaction (see the sidebar, “Windows 11 Enterprise Benefits”).
- Windows Update for Business (WUfB) can provide users with a familiar upgrade experience (see Figure 1), as well as remove the overhead of managing custom upgrade task sequences and OS images.

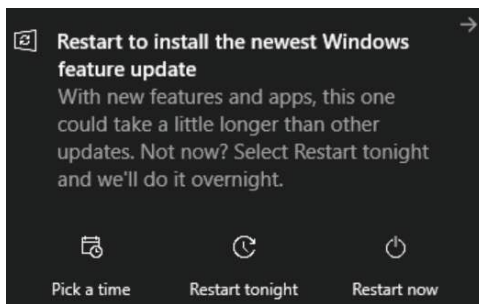


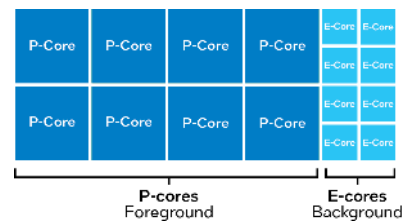
Figure 1. WUfB enables users to choose when the upgrade restart occurs, just as they can do for personal devices.

¹ Although Windows 10 is supported on 13th Gen Intel Core processors, our internal testing revealed significant issues that would increase our support costs.

How 13th Gen Intel® Core™ Processors Work

Along with higher clock speeds and more cores than previous generations, 13th Gen Intel Core desktop processors contain technologies that further heighten performance.

Intel introduced its hybrid architecture design in 12th Gen Intel Core processors. This breakthrough technology increases core efficiency and delivers intelligent workload optimization by integrating two core microarchitectures into a single die. P-cores and E-cores deliver improvements for single-threaded and multi-threaded workloads.



Foreground — Performance-cores (P-cores) are:

- Physically larger, high-performance cores designed for raw speed while maintaining efficiency.
- Enhanced for gaming and productivity workloads.
- Tuned for high turbo frequencies and high instructions per cycle.
- Ideal for crunching through heavy single-threaded work.
- Capable of hyper-threading.

Background — Efficient-cores (E-cores) are:

- Physically smaller, with multiple E-cores fitting into the physical space of one P-core.
- Capable of minimizing interruptions from background task management.
- Designed to maximize CPU efficiency, measured as performance-per-watt.
- Ideal for scalable, multi-threaded performance. They work jointly with P-cores to accelerate core-hungry tasks (such as rendering video).
- Optimized to run background tasks efficiently. Smaller tasks can be offloaded to E-cores—for example, handling antivirus software—leaving P-cores free to drive performance.
- Capable of running a single software thread.

Built directly into the hardware, Intel® Thread Director² uses machine learning to schedule tasks on the right core at the right time (as opposed to relying on static rules). On 13th Gen Intel Core processors, Windows 11 provides even more capability to Intel Thread Director. For example, AI threads get preference on P-cores and spin loops can be moved from P-cores to E-cores when necessary. [Read more](#) about 13th Gen Intel Core processors.

² Built into the hardware, Intel® Thread Director is provided only in performance hybrid architecture configurations of 12th Gen and newer Intel® Core™ processors; OS enablement is required. Available features and functionality vary by OS.

Our Windows 11 Upgrade Journey

Many aspects of our Windows 11 upgrade were similar to previous upgrades. For example, we performed application readiness testing (discussed later in this paper) as usual. We also used deployment rings to mitigate the risk of significant productivity impacts. However, the upgrade to Windows 11 differed from our previous upgrade experiences in two important ways:

- We determined that WUfB is mature enough for enterprise use. We worked closely with Intel’s Information Security group to help ensure low risk and high security.
- A recently deployed PC client telemetry solution called Aternity helped us monitor the environment. This application provides crucial, real-time information about client health, performance and stability across all the client devices equipped with Aternity.

To maximize the number of devices using Windows 11 (currently 103,000), while keeping costs under control, our strategic plan is as follows:

- **Deploy.** All new PCs are being deployed with Windows 11 installed.
- **Upgrade.** As of the writing of this paper, we have upgraded nearly 95% of the devices that can support Windows 11 (about 60% of the entire fleet—those running 10th and 11th Gen Intel Core processors).³
- **Replace.** We plan to replace 70,000 older devices (7th and 8th Gen Intel Core processor-based PCs) with new devices running Windows 11 by the end of 2025. At the writing of this paper, we had already replaced 20,000 devices.

For single-user devices in a deployment ring, the Windows 11 update is automatically downloaded from the internet and staged (see the “Lowering the Network Impact” section and the “WUfB is Configurable” sidebar for more information).⁴ Then, we notify the users that they have seven days to complete the reboot. If the seven-day period passes without a reboot, the reboot is forced. The remaining systems require a hardware upgrade.

Streamlining the Upgrade Process with WUfB

Historically, a major OS upgrade, such as Windows 8.1 to Windows 10, took us 9 to 12 months to complete. Our prior upgrades were performed on-premises using time-consuming task sequences and a custom upgrade user interface that took weeks for our engineers to design and test.

In contrast, using cloud-based WUfB enabled us to retire these task sequences and the custom user interface—reducing engineering time from four weeks to just a few days. We completed most of the Windows 11 in-place upgrades in only 13 weeks, once application readiness testing and the pilot project was complete (see Figure 2).

The WUfB update process is familiar to users, because it is similar to the process they use to update their personal devices over the internet. The intuitive interface enabled us to proceed with the upgrade with less emphasis on user notifications and training, again streamlining the process and lowering total costs.

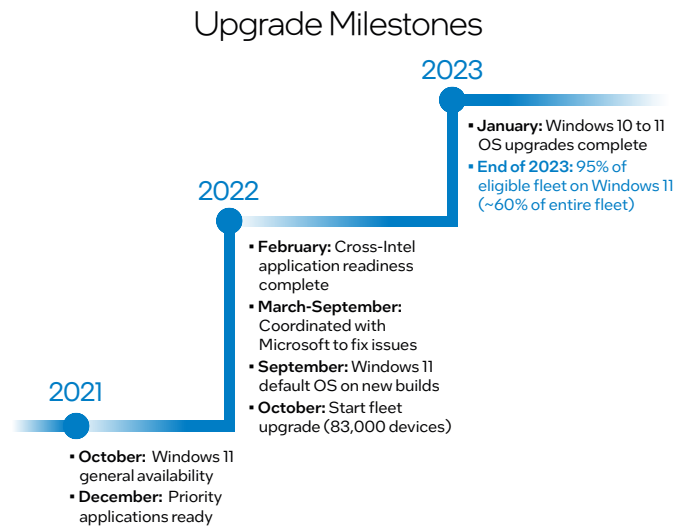


Figure 2. A cloud-based WUfB approach to OS upgrades substantially accelerated the update process.

Intel IT’s Recommendations for Client PCs

Our hardware specifications and refresh schedule are designed to best support Intel’s employees job functions.

Optimizing PC refresh is a priority for Intel IT. It is imperative that Intel employees have up-to-date technology and devices that enable them to perform their jobs efficiently. We have analyzed system cost and return on investment, as well as information garnered from employee satisfaction surveys and insights gained from client telemetry. The result of this analysis is a three-year PC refresh cycle with the following standard specifications for devices running Windows 11: Intel® Core™ i7 processor; 16 GB RAM; SSD; and Intel vPro® platform for Enterprise for performance, manageability and security. We particularly benefit from Intel® Stable IT Platform Program (Intel® SIPP), which helps improve device stability.

³ Our client device fleet does not include any 9th Gen Intel Core processor-based PCs; however, if we did have any of these devices, we would include them in the Upgrade category, not the Replace category.

⁴ We decided to not push the windows 10 to Windows 11 upgrade to shared PCs, because the majority of those devices do not meet our minimal requirements for Windows 11. These devices will be replaced over time.

Lowering the Network Impact

For previous OS upgrades, we used distribution servers, and all updates were performed over the corporate network. To ensure the corporate network wasn't overwhelmed, we used as many as 15 deployment rings. With WUfB, we can do things differently so that the upgrades are as seamless as possible, no matter where users are working (most Intel employees work from home or in a hybrid model).

If the user is working remotely and is connected to Intel's virtual private network (VPN), the content is downloaded directly from the cloud and does not use Intel's VPN. This split tunnel approach means the downloaded content does not affect the corporate network.

If the user is working in the office, updates use Delivery Optimization, which is built into the OS. Client devices can use Delivery Optimization to share content with each other. So, instead of 100,000 systems downloading the update, only a small number reach out to the internet, and Delivery Optimization sends updates and apps from those PCs to other PCs on the local network. Sharing this data between PCs helps reduce the internet bandwidth that's needed to keep more than one device up to date and can help make downloads more successful. In our experience, only 30% of the overall content is downloaded from the internet by devices in the office; up to 70% of the upgrade content is sourced from other clients through Delivery Optimization. This substantial reduction in network traffic enabled us to deploy the Windows 11 upgrade using only five deployment rings (see Figure 3).

WUfB is Configurable

We had the flexibility to turn WUfB on and off when necessary.

Our IT End User Computing Manageability team defined two policies within Microsoft Intune that enabled WUfB specifically for the Windows 11 update:

- **Windows Update Ring policy** includes the following requirements:
 - Automatic updates scanning
 - Active hours (8am-5pm)
 - Download over metered networks
 - Feature Update Deadline – 10 days
 - Deadline Grace Period – 2 days
 - Defer Quality and/or Feature Update – 0 days
 - Feature Update Uninstall/Rollback – 10 days
- **Windows Update Feature Update policy** specifies which OS (Windows 10 or Windows 11) and version (21H1 or 21H2, for example) a device should upgrade to.

Next, the Computing Manageability team created groups (rings) of devices and assigned them to a Feature Update policy for deployment. The devices in the ring received the policies, enabling them for WUfB. Device security patches and cumulative updates were downloaded from Windows Update as needed, allowing the user to restart or schedule necessary restarts. When all the patches/updates completed, the Windows 11 upgrade occurred.

Currently, we are not using driver/firmware updates in our WUfB configuration for OS upgrades. We still use the pre-patch model to deliver any prerequisite drivers or firmware, prior to putting the device into an upgrade ring. See "Next Steps" for our plans to manage drivers and firmware via Intune and WUfB, which helps improve device stability.

Upgrading From Windows 10 to Windows 11

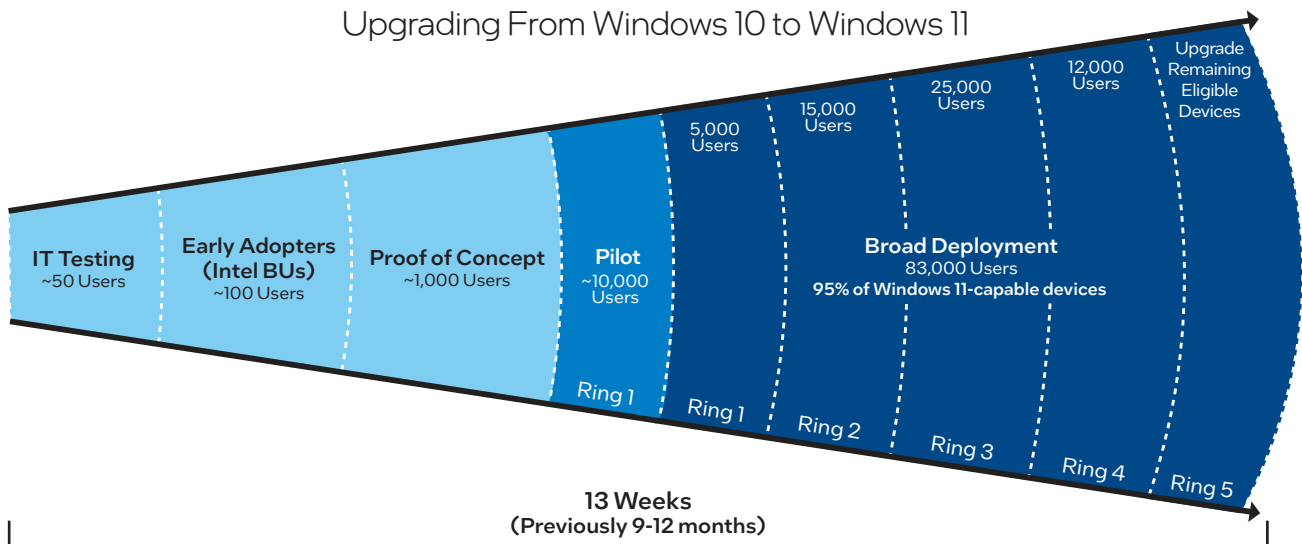


Figure 3. The ability to use a VPN split tunnel and Delivery Optimization to deliver updates from the cloud enabled us to reduce the number of deployment rings; we only needed five rings for the Windows 11 upgrade.

Testing Application Readiness

For the Windows 11 upgrade, we used an application readiness testing approach that is similar to what we've done in the past. (See "Next Steps" for details on how we plan to modernize and streamline this process.)

Our application repository stores information about all enterprise applications in use at Intel—about 5,000 currently. This repository helps us to identify which applications are most important and to contact the application owners to initiate testing.

As with previous OS upgrades, we first tested applications in a specific order:

1. First, we tested the 31 "core applications" that are included by default in our PC setup process, which includes minimum security tools and productivity applications required by all users in the company. Once these core applications were verified, we released the build to the remaining testers to assess their applications with all of the components that will be part of the build.
2. Next, we tested "priority apps," which are typically considered Tier 1 or 2 (that is, mission-critical or business-critical) or have a user base of more than 10,000. Before releasing a major OS upgrade, we require that at least 75% of the priority applications pass the compatibility test for the new OS. For the Windows 11 upgrade, we identified 1,751 priority applications.
3. Finally, we tested the majority of the remaining applications; as of the writing of this paper, we had tested 84% of all applications.

Overall, only 35 of the total 4,892 tested applications failed the compatibility test; of those, only a single application remained unmitigated (the application owner did not respond to our request for a fix). We notified all application owners in advance, so they could allocate resources to the testing activity, and gave the application owners two months to complete the testing. We followed up with six reminders and offered six office hours that included question-and-answer sessions and assistance with VM configuration.

Results

As of the writing of this paper, we had a total of 103,000 devices deployed with Windows 11: 20,000 new devices (12th Gen Intel Core processor-based PCs) and 83,000 upgraded devices. Overall, we have had minimal issues:

- 0.29% failures
- 1.4% incidents
- 80% reduction in help desk calls compared to Windows 10 21H2 in-place upgrade

Users are happy with the WUfB process because it works just like their personal PC upgrades. User surveys revealed that nearly all users rated the upgrade experience as better than previous upgrade experiences and most were "satisfied" or "very satisfied" with the overall upgrade experience. Users also reported that our notifications were informative and the option to defer or schedule the upgrade was flexible enough to minimize workflow interruptions.

Next Steps

In our continual pursuit of operational efficiency and enhanced user experience, we will continue to refine our best practices for OS deployment. For example, we intend to modernize our application readiness process. Currently, we take a "test everything" approach, which is a lot of overhead for all the application teams considering that such a small number of applications fail the compatibility test. Our goal is to move to a risk-based approach, where we focus on the following:

- Applications that have failed in the past
- Applications that use technologies that could be a risk
- Other factors that raise the risk of an application having compatibility issues

Another area of future operational improvement is our PC setup and driver management methodologies. There is an opportunity to transition to more modern processes and tools by the end of the year, comparable to how we are now able to take advantage of WUfB. Today, our processes for driver and firmware updates involve substantial, time-consuming manual work involving packaging, testing and deploying these updates. As more time passes, systems are more likely to become unstable and may be exposed to security risks for longer periods. We plan to move to a more automated patching process by taking advantage of new driver and firmware update features in WUfB. This will result in faster, more efficient deployments using the same standard Windows Update user experience.

Windows 11 Enterprise Benefits

Our end users appreciate the new features in Windows 11 that can enhance the user experience and productivity.

Below are some of the aspects of Windows 11 that we believe provide the greatest business value across the enterprise:

- Hybrid work features remember window location and desktop icon layout across monitor connections.
- Windows 11 gives foreground applications (such as video calls) higher CPU priority, resulting in an OS that feels more responsive.
- Because Windows 11 is built on the same foundation as Windows 10, existing tools and processes continue to function, with high compatibility for applications.
- Support and management enhancements include one release per year (instead of two), three years of support per release (up from 2.5 years) and extensive new cloud management features that enable Modern Client Computing.⁵

⁵ For more information, visit <https://www.intel.com/content/www/us/en/events/on365/future-of-work.html>.

Conclusion

We aim to provide the best possible IT environment to Intel employees while honing our IT processes to be more efficient. An integral part of that environment is the enterprise OS and how it interacts with employees' client devices. Upgrading to a new OS has always been a priority when it provides business value in terms of performance and user experience. However, in the past, OS upgrades have been time-consuming. Our recent adoption of modern, cloud-based upgrade tools such as WUfB has enabled us to complete the upgrade to Windows 11 far faster than previous upgrades. As a result, our users have been able to quickly gain access to the benefits of the new OS, such as the hybrid Intel® architecture on 13th Gen Intel Core processors and a more user-friendly upgrade experience. We hope that sharing our Windows 11 upgrade journey inspires other organizations to explore how they might also embrace Windows 11 with minimal disruption to the enterprise.

Related Content

If you liked this paper, you may also be interested in these related stories:

- [Optimizing PC Refresh](#) brief
- [Using PC Client Telemetry Insights to Deliver a Premium User Experience](#) white paper
- [Aternity Digital Experience Platform](#)
- [Intel IT Tests Aternity's Digital Experience Management Solution](#) video

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Acronyms

E-cores Efficient-cores

P-cores Performance-cores

WUfB Windows Update for Business

IT@Intel

We connect IT professionals with their IT peers inside Intel. Our IT department solves some of today's most demanding and complex technology issues, and we want to share these lessons directly with our fellow IT professionals in an open peer-to-peer forum.

Our goal is simple: improve efficiency throughout the organization and enhance the business value of IT investments.

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