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IT@INTEL

Advancing the User Experience with Intel® Architecture-Based Laptops and Microsoft Windows* 10

The latest generation of Intel® architecture-based laptops running Microsoft Windows* 10 bring new advancements in multitasking performance and battery life to Intel employees.

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Executive Overview

Microsoft Windows* 10 works synergistically with laptops based on 6th, 7th, and 8th generation Intel® Core™ vPro™ processors, resulting in up to 10 hours of battery life[1] and a new, intuitive user experience. These capabilities provide increased performance when multiple applications are running on a user's machine as well as features such as Modern Standby, Timeline, and Fluent Design.

Intel IT's accelerated adoption of Windows 10 is helping us achieve the following business objectives:

- A single Windows-client environment
- The ability to transition to a continually updated OS model, avoiding the disruption and downtime associated with major OS upgrades
- Smooth deployment of new OS features through our new in-place, self-service upgrade process
- The foundation for a more modern cloud-friendly IT services platform

To provide the highest value, we refresh a user's PC with the latest Intel® architecture-based platform when we upgrade to Windows 10. To date, we have more than 90,000 devices on Windows 10. The majority of these are new systems based on 6th and 7th gen Intel Core vPro processors.

We are now qualifying 8th gen Intel Core vPro processor-based systems with Windows 10, and we will begin deployment in the second quarter of 2018. We have also made available a self-service Windows 10 in-place upgrade process and have upgraded over 50,000 devices using this method. We expect to have over 100,000 PCs—nearly our entire fleet—running Windows 10 by the end of 2018.

[1] As measured by Windows* 10 EEMBC Browsing Bench Component Average Power.

Contents

Contributors

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Windows 10

- **A single, standardized enterprise OS**
- **Faster, more efficient upgrades**
- **A future-ready enterprise**

Background

Supporting our employees' desire to use the right clients for their jobs, Intel IT manages over 120,000 enterprise Ultrabook™ devices, 2-in-1 detachables and convertibles, and laptops all equipped with Intel® Core™ vPro™ processors. We continually seek ways to maximize employee productivity while minimizing support costs.

To accomplish these objectives, we maintain a standard hardware refresh cycle of two to four years. When appropriate, we deploy the latest Microsoft Windows* OS on that new hardware. For example, several years ago we found that deploying Microsoft Windows 7 provided significant productivity improvements for employees when deployed on the latest Intel® processor-based PCs with Intel® Solid State Drives. Similarly, when we deployed Windows 8.1 in 2014, we accelerated the deployment of touch-enabled Ultrabook devices and tablets to maximize the new OS benefits for both users and IT.

In 2016, we made a strategic decision to deploy Windows 10 across our enterprise environment. For many users, that means also upgrading hardware at the same time. One reason we are deploying Windows 10 is because it has a large and expanding application and driver ecosystem that can bolster employee productivity. Older versions of the Windows OS do not offer the breadth of choice available for Windows 10.

Exploring a new OS as soon as it becomes available lets us establish efficient deployment and support tactics, identify issues with application compatibility, and develop best-known methods prior to widespread deployment. We can also influence OS changes that benefit enterprise deployment, support, and manageability. In short, we gain a deeper understanding of the technology, which helps us achieve our business objectives faster and more effectively.

Windows 10 provides the following benefits:

- **A single, standardized enterprise OS.** We currently support three Windows operating systems. Our goal is to rapidly move to Windows 10 to efficiently manage a single enterprise Windows OS.
- **Faster, more efficient upgrades.** The Windows 10 in-place, self-service upgrade process provides IT with the flexibility to manage deployment logistics while enabling employees to upgrade when they are ready (at home or offline), saving time for both IT and employees. A typical IT technician-assisted OS upgrade takes at least a half-day, compared to an in-place, self-service upgrade, which can be completed in 60 to 90 minutes.
- **A future-ready enterprise.** Widespread deployment of Windows 10 enables us to lay the foundation for smooth adoption of cloud-friendly IT services and the OS-as-a-service delivery model.

Solution

Our Windows 10 deployment program required careful planning, diligent monitoring and control, and a fail-fast-and-learn agile mindset to develop the most effective processes. We adopted a phased implementation model: In Phase 1, we provided the new OS first to early adopters along with new hardware. We recruited business unit champions early in the migration process so that all testing of critical applications would be complete before rollout began to larger audiences in Phase 2. We are now in Phase 3, providing general availability of Windows 10 through in-place self-upgrades and hardware refreshes (see Figure 1).

Since 2016, we've deployed laptops based on 6th and 7th generation Intel® Core™ vPro™ processors and Microsoft Windows 10. We are now preparing to deploy laptops based on 8th gen Intel® Core™ vPro™ processors with Windows 10. The Windows 10 migration, which significantly changes the OS-delivery model from past OS versions, is changing the makeup and focus of how we invest IT migration resources (see Figure 2). OS upgrades used to be a large project that we undertook about every three years, requiring a significant investment. With the new cadence of twice-yearly major updates and the regular monthly security and stability updates, we are paying special attention to the following aspects of OS migration readiness: application, operational, platform, and infrastructure readiness, in addition to business intelligence.

Change-management activities include training end users and support staff, coordinating with engineering, and communicating at all stages with end users and stakeholders.

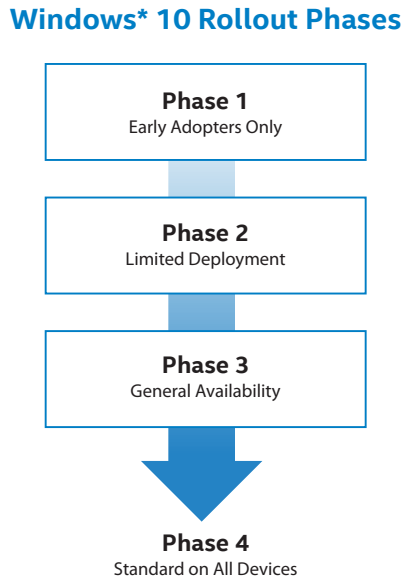

Figure 1. A phased deployment of Microsoft Windows* 10 helps enable a smooth transition to the new operating system.

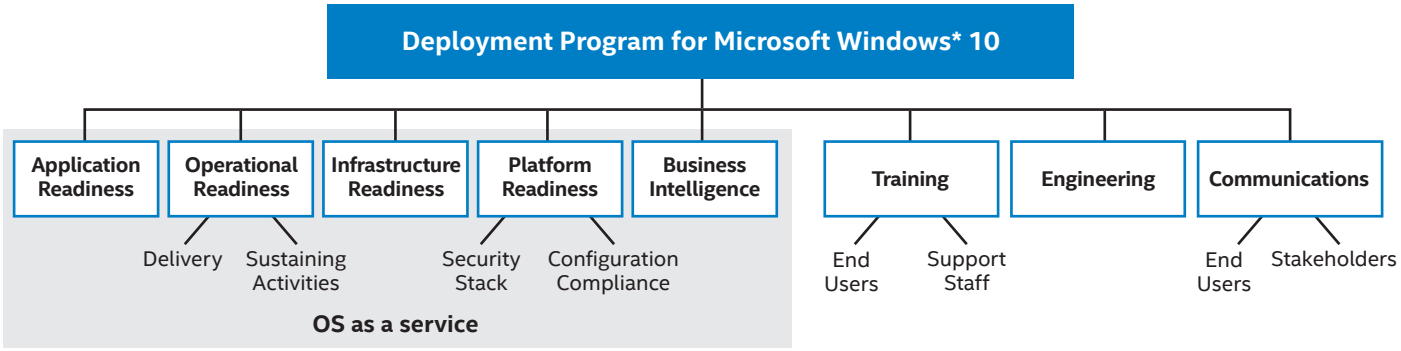

Figure 2. Our deployment program for Microsoft Windows* 10 involves many activities that must be closely coordinated. Adopting the OS-as-a-service model (shown in grey) requires special attention to application readiness, operational readiness, infrastructure readiness, platform readiness, and business intelligence.

Application Readiness

More than 3,000 enterprise applications are in use at Intel, representing hundreds of application owners across many business units. We have strong relationships with our user community, and we strive to account for all business unit applications in our central application tracking tool. This central location for application information makes it easier for us to accelerate our application-testing processes from a once-every-few-years model to one that supports testing twice a year. Accelerated testing is foundational to adopting the OS-as-a-service model to keep up with the faster cadence of OS updates.

To accommodate faster, more frequent testing, we no longer test all applications every time Microsoft releases a new version of the OS. Instead, we now focus on mission-critical applications and applications with known dependencies on specific OS changes. We also test a representative sample set of other business-critical applications.

Overall, we found that few applications failed the early compatibility testing that we performed for the transition from Windows 8.1 to Windows 10. As we move into widespread deployment, many of the applications that did fail the compatibility testing have already been removed from the environment or replaced with newer versions that are compatible. Based on our initial testing of upgrading from one Windows 10 release to the next, we expect few applications to be negatively impacted. Also, because there has been no change to Internet Explorer* from 8.1 to 10, we can be more confident that most applications will continue to work as expected.

For much of our application-compatibility testing we provide virtual machines running in our data centers as test environments for application owners. This allows accelerated testing for our hundreds of application owners without having to give them all new hardware or multiple systems. Virtual machines will also serve as the core of our automated application-compatibility testing going forward.

Microsoft Windows* 10 and 8th Gen Intel® Core™ vPro™ Processors

Laptops based on 8th gen Intel Core vPro processors running Windows 10 offer a better-together user experience to Intel employees. Here are a few examples:

- Increases productivity performance related to using Microsoft Office 365* products, Skype*, and multi-tasking by up to 40 percent compared to 4th gen Intel® processors.[2]
- Provides uncompromised, all-day battery life: 10 hours.[3]
- Offers the ability to immediately wake up Intel® architecture-based laptops with Windows Modern Standby at the push of a button, eliminating wait times. The device remains active when the screen is off, allowing downloads, music streaming, phone calls, and alerts to occur in a low-power state.
- Provides support for 4K displays, built-in Iris® Pro graphics technology, protected audio, and High Efficiency Video Coding, enabling seamless streaming of 4K ultra-high-definition content.
- Boosts office productivity by up to 37 percent with 8th gen Intel Core vPro processors compared with a 4th gen Intel processor or a five-year-old CPU, resulting in significant gains when launching large presentations and toggling between data-intensive spreadsheets, collaboration, and word-processing applications.[4]
- Delivers a seamless experience with full access and compatibility to more than 15 million Windows apps.
- Uses Intel® Speed Shift Technology, which works in tandem with Windows 10's new Disconnected Standby to improve battery life and promote sleek form factors, while allowing the 8th gen Intel Core vPro processor to quickly select the optimal operating frequency and voltage.
- Boosts hardware-based security protection through enhanced authentication and login with facial and fingerprint recognition. This feature is currently in limited deployment.
- Creates a more personalized computing experience through the use of voice and biometrics.
- Uses Intel® wireless technology, USB 3.1 Type-C ports, and Thunderbolt™ 3 technology to enable scalability across multiple devices including desktop PCs, Ultrabook™ devices, 2-in-1s, and tablets. For example, employees can charge their PC, use two 4K displays, boost the power of the PC with an external graphics card, and connect several high-speed USB devices all at the same time.

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[2] intel.com/content/www/us/en/benchmarks/benchmark

[3] As measured by Windows* 10 EEMBC Browsing Bench Component Average Power.

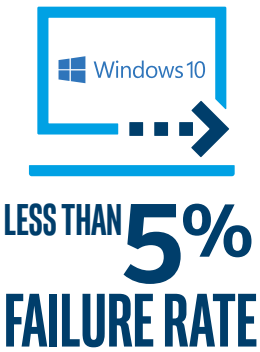
[4] intel.com/content/www/us/en/benchmarks/benchmark

Operational Readiness

We are migrating our fleet to Windows 10 using in-place, self-service upgrades and new PC builds. The choice of delivery method we use depends on the use case. Employees eligible for PC refresh would get a new Windows 10 PC build. Employees already running Windows 10 can usually perform an in-place, self-service upgrade to the latest version of Windows 10 on their existing system. We tested each type of upgrade separately and must continually verify that we can deliver the new OS in all delivery scenarios.

We conducted separate testing for different types of in-place, self-service upgrades:

- For in-place, self-service upgrades from Windows 8.1 to Windows 10, we conducted nearly a dozen small proofs of concept (PoCs), each with 8 to 10 early adopters. We then expanded testing to a pilot project with about 200 users. Using the lessons learned in the earlier phases, we rolled out the in-place, self-service upgrade to several thousand client devices.
- For in-place, self-service upgrades from one release of Windows 10 to the next, we completed several PoCs and a pilot of approximately 3,000 users. Participants in these projects represented a wide range of business units and job roles. After a successful pilot, we deployed the in-place, self-service upgrade to more than 40,000 users.



for all self-service upgrades from Windows* 8.1

We also evaluated what changes were needed to support the new OS both during and after the migration, as shown by the following examples.

- **Wireless network impact.** For our initial delivery efforts, we conducted extensive wireless network stress testing to determine how many systems and at what speed we could simultaneously push the upgrade package without adversely affecting performance of other network-dependent applications. We balanced wireless network-download volume and speed thresholds with our technical support capacity constraints to set our upgrade volume pace.
- **Success tracking.** We closely monitored in-place upgrade activities using our system tracking tools and have set a strict limit to contain failures rates at less than 5 percent for all Windows 10 self-service upgrades. Of the failures we have seen, the vast majority gracefully revert back to the previous version without negative impact to users. We then remotely address the issue and retry the upgrade.
- **Continuous deployment.** Once our entire client fleet is on Windows 10, we must be prepared for continuous deployment of the next OS updates. This requires an ecosystem of security, platform, and core application partners aligned to a common timeline with regular communication to stay in sync. We must also mature and scale our processes and tools to deliver the upgrades for our entire fleet as we gradually migrate away from older operating systems.

Because an entire OS migration may take months, support agents may need access to both the old and the new OS, so we often use client-hosted virtualization, using Intel® Virtualization Technology, to provide support agents with multiple operating systems on the same hardware.

Infrastructure Readiness

As we moved from PoC toward production, we designed our infrastructure to deliver the upgrade solution to more than 50,000 clients and, eventually, more than 100,000 systems. Achieving such goals required keeping the infrastructure up-to-date. If the infrastructure failed at any point, Intel and its employees would be unable to benefit from the latest Windows features. We planned all infrastructure updates so they would not affect our client systems upgrade deployment plans. To make the upgrade package available to clients around the world, we provided an appropriate number of global content repositories. We also made sure that client systems are seamlessly connected to our configuration management solution and are ready to receive the upgrade when it becomes available to them.

Platform Readiness

To avoid user interruption and rework, the drivers, BIOS, and WLAN must be ready for the latest OS upgrade, and each PC slated for upgrade must have the proper configuration. The security stack must also be ready—each PC must have the most recent upgrades to security applications before starting the OS upgrade process. We implemented monitoring tools to achieve configuration compliance and component readiness across the fleet of targeted devices before a specific system could receive an upgrade.

Business Intelligence

We developed instrumentation that enabled us to see the status of upgrades at each step. It provided visibility into how many PCs are ready to be upgraded, how many users completed the upgrade, which upgrades are pending or partial, and which systems have failed. The new dashboard uses fleet-health monitoring, a practice that relays the health of each system we deploy instead of waiting for users to report incidents. We automated the collection of system logs to accelerate troubleshooting and resolution of upgrade issues in an agile fashion.

To make this process more user-friendly, we developed solutions that notify the user once the upgrade is ready to be triggered on their system. We also provided reports that allow users to understand their system upgrade readiness by indicating any necessary steps to rectify compatibility issues or disk-space limitations that may prevent them from upgrading their systems.

Change Management

To minimize work disruption due to a change in the OS, we raised user awareness through general communications and by making available to users reference guides containing tips to navigate the new OS.

Because the in-place upgrade process intimidated some users initially, we have taken several steps to help manage change. For example, we have created an online training center and materials for our user community and IT customer-support team. They detail new and modified processes, troubleshooting tips, and other information. The materials include presentations, social media forums, and a virtual client, which all help create desire for Windows 10 among the user community and prepare users for tactical rollout by building user confidence in the in-place upgrade process.

We also identified business-unit champions, who helped manage change by reinforcing the adoption message locally.

Lessons Learned

We gained much from our experience during the last year and a half. Here are some of the most crucial lessons:

- **A new user experience can improve productivity.** Microsoft Windows 10 works synergistically with laptops based on 6th, 7th, and 8th gen Intel Core vPro processors, resulting in up to 10 hours of battery[5] life and advancements in multitasking performance.
- **Solidifying our deployment processes enables them to be repeatable and predictable.** We integrated into our traditional build process new methods that support the new cadence of OS-as-a-service releases on a twice-a-year rollout with monthly cumulative patching.
- **Windows 10 servicing use cases require different approaches.** To support different users' needs, we set up both Push and Pull deployment methods. The Pull method enables our users to initiate the upgrade any time at their convenience as long as their system satisfied the upgrade requirements. This method tends to appeal to our Early Adopters group. The Push method notifies the user of the upgrade availability and allows them to postpone it up to a specified deadline (usually two weeks), after which the upgrade launches automatically. This allows us to upgrade the entire PC fleet within the specified timeline to support the OS-as-a-service cadence.
- **Phased deployment minimizes risk.** This approach helped us identify any issues with the upgrade solution and to rapidly contain them. Any fixes were tested and released in the subsequent phase to prevent issues from recurring.
- **Ring management smooths deployment.** We applied criteria to target deployment groups in a specific sequence to create a smoother process. For example, we allowed sufficient time—six months—between upgrades for each user. We also paid attention to application readiness statuses and scheduled specific business groups using these applications accordingly.
- **System health monitoring lets us proactively address failures.** Monitoring deployments and identifying failures instead of waiting for users to report them was beneficial. To help us identify, troubleshoot, and remediate issues, we automated the collection of required information from the affected systems..
- **Putting the users at the center increases success.** We realized that by informing users about the process, we increased the likelihood of success and reduced the volume of calls to the IT help desk. We empowered users to self-track their system upgrade readiness and to receive any remediation information, and also enabled automated notifications to address any missing prerequisites and steps they needed to take.
- **Upgrading necessary platform components in advance improves predictability.** To facilitate in-place, self-service upgrades, we updated any non-OS components of the platform, especially third-party security applications, at least two weeks in advance. We learned that bundling all component upgrades into a single activity can make it difficult to anticipate how long it will take to complete. By decoupling the other component upgrades from the OS upgrade, we made the OS upgrade the final step. This enabled us to inform users of the approximate amount of time needed to complete an upgrade. For upgrades involving new PCs, we tested the build process for component updates early in the work stream.
- **Capacity planning helps avoid network issues.** We calibrated the delivery tools within our environment, accounting for constraints such as wireless network bandwidth. This helped us understand how to batch the streaming of the upgrade packages to users' PCs, with respect to both time and volume.

[5] As measured by Windows* 10 EEMBC Browsing Bench Component Average Power

- **Windows 10 represents a new, disruptive model for OS upgrading.** Significant planning needed to occur long before the migration could begin. We learned that we must prepare for the OS upgrade and keep up with the OS-as-a-service delivery model. It is also important to communicate with key stakeholders, including application owners, security owners, and platform component owners.
- **Just-in-time testing promotes application readiness.** Instead of testing all applications once every three years, our application testing now occurs on a just-in-time basis (focusing on those applications that are failing). We support testing through analytics and automation. We also initiated a quick response process to mobilize resources in case users find a defect.
- **Collaborating with core application suppliers improves understanding.** For core applications—those applications required for enhanced security, manageability, connectivity, and productivity—we needed to understand the suppliers' roadmaps for Windows 10 support and their ability to meet the OS-as-a-service release cadence.
- **Participating in the Windows Insider Program for the OS release cycle saves time.** Involvement during our previous OS upgrades at this stage of the process was limited. Engaging with Microsoft early helped us to understand the release roadmaps, which enabled us to get a head start on infrastructure, process, and application readiness (see Figure 3).

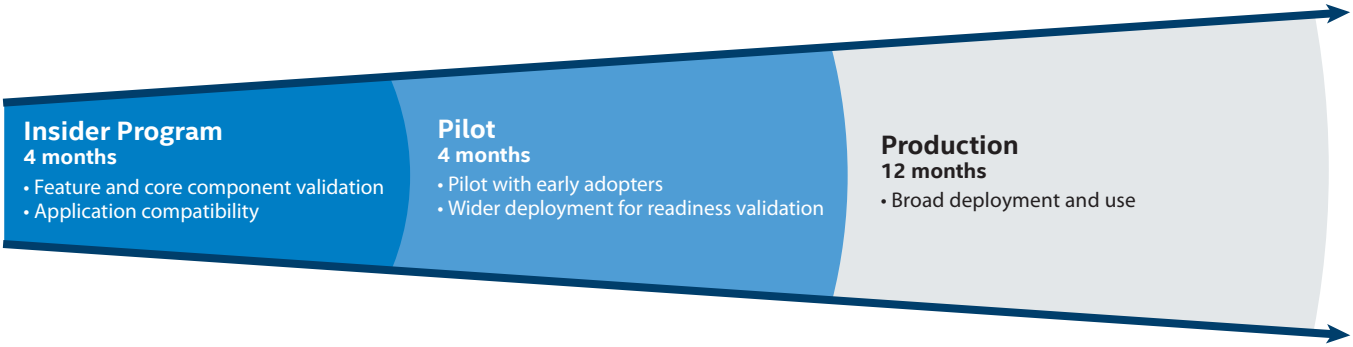


Figure 3. Starting deployment with the Microsoft Windows Insider Program enabled us to test the OS-as-a-service model while validating the stability of the platform.

Results

We created a build image that serves as the standard for new PCs and rebuilds. We also created an upgrade process to transition the existing fleet to Windows 10 and keep it current by continually upgrading it to the latest release in support of the Windows as a Service semiannual cadence. To date, we have upgraded approximately 43,000 laptops to Windows 10 through our new PC delivery process and more than 50,000 devices through in-place, self-service upgrades. In addition, our PoCs and pilots have demonstrated that the Windows 10 in-place, self-service upgrade process increases efficiency compared to a traditional wipe and rebuild performed by an IT technician.

We will continue to broaden our deployment. Through our surveys and forums, many users responded that they are pleased with the new OS and ability to remain productive. Additionally, 95 percent of users provided positive feedback about the upgrade process, and 88 percent would recommend the process to a friend or colleague. One user stated, "I was able to kick back and relax at home while the system upgraded itself—BEST PROCESS IMPROVEMENT EVER!" Another user said, "It was remarkably easy, unlike any other IT migration that I've ever done."

Conclusion

We successfully completed all phases of the process of deploying Windows 10. Current areas of focus:

- **Application and platform readiness using telemetry.** Application testers are adjusting to an every-six-month cadence for significant OS updates. Using Windows telemetry enables us to quickly identify and prioritize the highest impact platform and application dependencies as well as potential obstacles. It also allows application owners to focus on those high-priority areas while increasing the confidence level regarding applications that appear to be compatible and do not require in-depth repeat testing.
- **Network monitoring and support for users connecting remotely.** We continue to monitor the network as part of our semiannual upgrade process to help avoid negative user impact, in particular for those connecting remotely, as we push upgrade packages that are approximately 4 GB and monthly updates that currently are up to 1 GB. Our networks are primarily wireless, and constraints may vary by site.
- **Cloud-based distribution.** We are piloting cloud-based distribution methods to address the above network constraints and to make upgrades available outside the office.

Our users are seeing many new benefits with the use of PCs based on the latest generations of Intel Core vPro processors running the Microsoft Windows 10 OS. Users like the advancements in the compute experience. Adopting the OS-as-a-service model and migration to Windows 10 enables us to continue integration of enterprise and cloud services, while increasing employee productivity and IT efficiency.

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