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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 7th Generation Intel® Core™ vPro™ processors, resulting in up to ten hours of battery life¹ and a new user experience. Intel IT's accelerated adoption of Windows 10 is helping us achieve the following business objectives:

- Single Windows-client environment
- 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
- 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 at the same time as we upgrade to Windows 10. To date, we have over 50,000 devices on Windows 10. The majority of these are new systems based on 6th Generation Intel Core vPro processors. We are now qualifying 7th Generation Intel Core vPro processor-based systems with Windows 10 and we will begin deployment in Q2'17. We have also made available a self-service upgrade process from Windows 8.1 to Windows 10, and are preparing for widespread deployment. We expect to have over 70,000 PCs running Windows 10 by end of 2017.

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

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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 (Intel® SSDs). 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 offers us the opportunity to establish efficient deployment and support tactics, identify application-compatibility issues, 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 60-90 minutes. We expect in-place upgrades between Windows 10 versions to take even less time.
- **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.



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

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. We just finished Phase 2, and have moved to Phase 3, providing general availability to larger groups of employees (see Figure 1).

In 2016, we deployed laptops based on 6th Generation Intel Core vPro processors and Microsoft Windows 10. We are now preparing to deploy laptops based on 7th Generation 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 performed 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 readiness
- Operational readiness
- Platform readiness
- Business intelligence

Change-management activities include providing training to end users and support staff as well as communicating at all stages with end users and stakeholders. Training, engineering, and communications are also important, as they are in any OS deployment.

Windows* 10 Rollout Phases

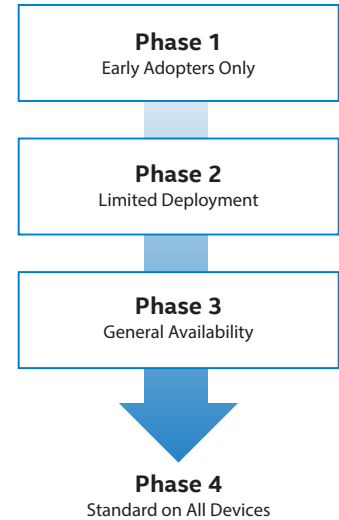


Figure 1. A phased deployment of Microsoft Windows* 10 helps enable a smooth transition to the new operating system.

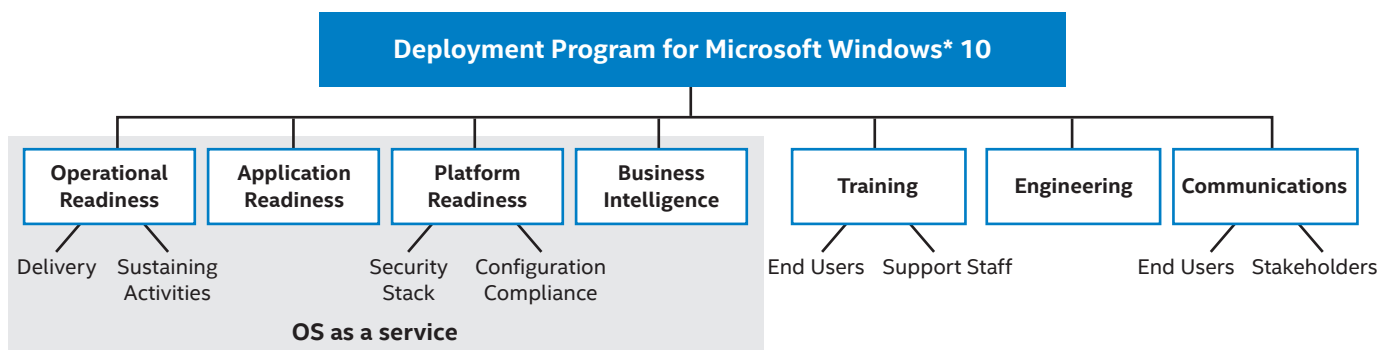
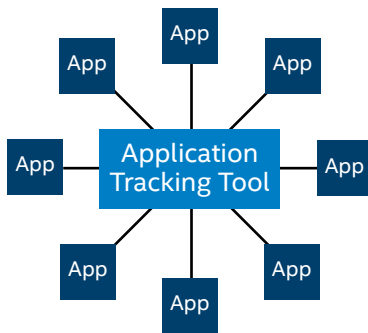


Figure 2. Our deployment program for Microsoft Windows* 10 involves many activities that must be closely coordinated. Adopting the OS-as-a-service model (shown in grey) requires special attention to application readiness, operational readiness, platform readiness, and business intelligence.



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 which 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 very 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 and/or multiple systems. Virtual machines will also serve as the core of our automated application-compatibility testing going forward.

Microsoft Windows* 10 and 7th Generation Intel® Core™ vPro™ Processors

Laptops based on 7th Generation Intel® Core™ vPro™ processors running Windows* 10 offer a new user experience to Intel employees. Here are a few examples:

- Provides support for 4K displays, built-in Intel® Iris™ Pro graphics technology, protected audio, and High Efficiency Video Coding (HEVC).
- 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.
- Creates a more personalized computing experience through the use of voice and biometrics.
- Uses Intel® wireless technologies, 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 will be able to 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.

Operational Readiness

We are migrating our fleet to Windows 10 using in-place, self-service upgrades, technician-assisted upgrades, and new PC builds. Which delivery method we use depends on the use case. For example, technician assistance may be required to upgrade the OS on platforms with older hardware or nonstandard configurations. Employees who are using Windows 8.1 can usually perform an in-place, self-service upgrade. We tested each type of upgrade separately and must continually verify that we can deliver the new OS in all three delivery scenarios.

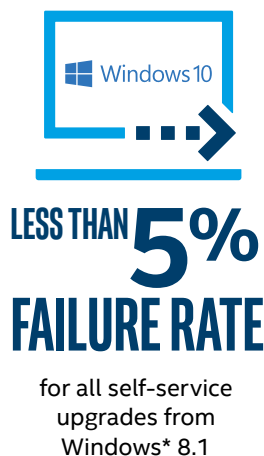
We conducted separate testing for different types of in-place, self-service upgrades:

- For in-place, self-service upgrades from Windows 8.1 to Windows 10, we conducted nearly a dozen small PoCs with eight to ten early adopters each. We then expanded testing to a pilot project with about 200 users.
- For in-place, self-service upgrades from one release of Windows 10 to the next, we completed several PoCs and a pilot of about 500 users. Participants in these projects represented a wide range of business units and job roles.

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

- **Network impact.** For our initial delivery efforts, we conducted extensive network stress testing to determine how many systems we could safely push the upgrade package to without an adverse performance impact to the user or other network-dependent applications. We balanced network-upgrade volume 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 health tools and have set a strict limit to contain failures rates at less than five percent for all Windows 8.1 self-service upgrades. Of the failures we have seen, the vast majority gracefully revert back to Windows 8.1 without negative impact to users. We then remotely address the issue and re-push the upgrade or invite the user for a technician-assisted 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.



Platform Readiness

To avoid user interruption and re-work, 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 ensure configuration compliance and component readiness across the fleet.

Business Intelligence

We developed instrumentation that enables us to see the status of upgrades—how many are complete, which ones are pending or partial, and so on. The new dashboard uses fleet-health monitoring, a practice that relays the health of each system we deploy instead of waiting for users to call in incidents.

Change Management

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

Because the in-place upgrade process intimidated some users initially, we have done several things to help manage change. For example, we have created training materials for our user community and IT customer-support team. These training materials detail new and modified processes, troubleshooting tips, and other information. The materials—presentations, social media forums, an online training center, and a virtual client—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.



“I was able to kick back and relax at home while the system upgraded itself - BEST PROCESS IMPROVEMENT EVER!”
— Internal Intel IT survey

Key Learnings

- **A new user experience.** Microsoft Windows 10 works synergistically with laptops based on 7th Generation Intel Core vPro processors, resulting in up to ten hours of battery life¹ and advancements in multitasking performance.
- **Solidified our deployment processes so that they are repeatable and predictable.** We integrated into our traditional build process new methods that support the new cadence of OS-as-a-service releases twice a year with monthly cumulative patching.
- **Made offline updates possible.** To increase user adoption and maximize user productivity, users should be able to choose when to upgrade their OS. Offline, in-place upgrades that run without supervision enable upgrades at home or while the user is at lunch.
- **Upgraded necessary platform components in advance.** To facilitate in-place, self-service upgrades, non-OS components of the platform, especially third-party security applications, must be updated a couple of weeks before the OS upgrade. For example, when we previously upgraded to Windows 8.1, we bundled all component upgrades into a single activity, which took a long time. By decoupling the other component upgrades from the OS upgrade, the OS upgrade becomes the final step and takes a predictable length of time. For upgrades involving new PCs, the build process must start testing for these component updates early in the work stream.
- **Addressed capacity planning.** We calibrated the delivery tools within our environment, accounting for the environmental constraints such as 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.
- **Recognized that Windows 10 represents a new, disruptive model for OS upgrading.** Much planning needed to happen long before the migration began. We learned that not only must we prepare for the OS upgrade itself, but we also need to prepare to 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.
- **Prepared for substantially different application-readiness processes.** Instead of testing all applications once every three years, application testing now occurs on a just-in-time basis (focusing on those applications that are failing). Testing must be supported by analytics and automation. We initiated a quick response process to mobilize resources in case a defect is found by users.
- **Collaborated with core application suppliers.** For core applications—those applications required for security, manageability, connectivity, and productivity—we needed to understand suppliers' roadmaps for Windows 10 support and their ability to meet the OS-as-a-service release cadence.
- **Participated in the Windows Insider Program for the OS release cycle.** For previous OS upgrades, our involvement in 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—something we could not have done if we had waited for the Current Branch or Current Branch for Business segment to be available (see [Figure 3](#)).

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

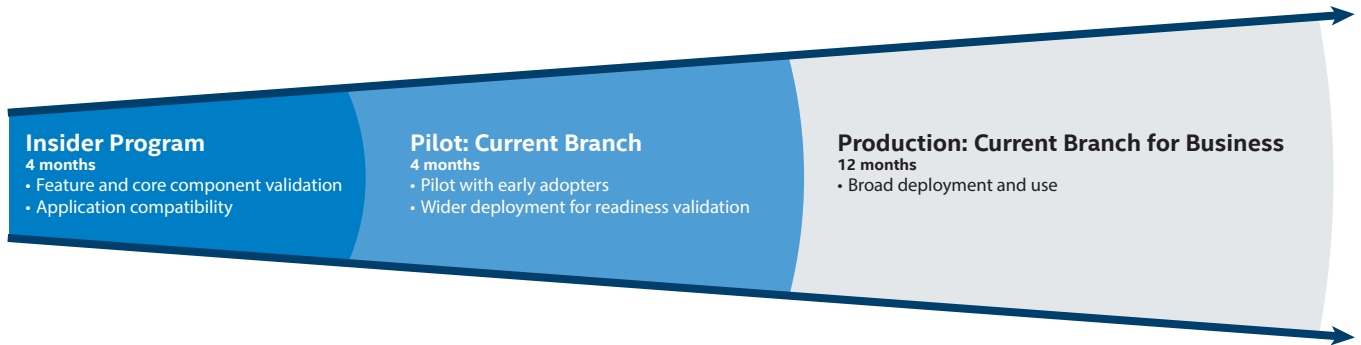


Figure 3. Starting deployment with the Microsoft Windows Insider Program enabled us to test the OS-as-a-service model while validating the stability of the platform.

Results

We created a build image that serves as the standard for new PCs and rebuilds, and we created an upgrade package to transition the existing fleet to Windows 10. To date, we have upgraded about 43,000 laptops to Windows 10 through our new PC delivery process and over 7,000 devices through in-place, self-service upgrades. In addition, our PoCs and pilots have demonstrated that the Windows 10 in-place, self-service upgrade design delivers a more efficient OS upgrade model than 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."



"It was remarkably easy, unlike any other IT migration that I've ever done."

— Internal Intel IT survey

Conclusion

We successfully completed Phase 1 and Phase 2 of our deployment process. We are now focused on two areas:

- **Application readiness.** Application testers are still working on adjusting to an every-six-month cadence for significant OS updates. Over time, however, the OS-as-a-service delivery model benefits testers, because there is a smaller amount of change between each release.
- **Network stress testing.** We continue to monitor the network as part of our semiannual upgrade process to help ensure no user impact, as we push upgrade packages that are each about 4 GB and monthly updates that currently are up to 1 GB. Our networks are primarily wireless, and constraints may vary by site.

Our users are seeing many new benefits with 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. Adoption of 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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