intel.

IT@Intel: Secure Cloud Printing and Imaging

Intel IT shares best practices for achieving a more streamlined and cost-effective enterprise-wide secure cloud printing and imaging policy, while moving toward a paperless office

Authors

Jay Krishen
Industry Engagement Manager

Frank Ma, Sr.
Imaging Service Owner

Nitin Muttin
End User Computing, Greater Asia Region, Regional Manager

Executive Summary

Intel employees expect easy-to-use, seamless and effective printing. Intel IT has the responsibility to find the most cost-effective, secure and technically viable solution. Marrying these two goals is an art, and Intel IT's best practices can demystify this process, provide insights about the selection of devices, help evaluate different modes of ownership and balance user and business needs.

Our printing and scanning services have evolved over time. Initially, we used a decentralized management model. To improve efficiency, we adopted a more centralized model, where Intel IT, not the business units, procured and managed devices. More recently, we have implemented a highly secure, private-cloud-based model and work with a single vendor to manage the devices and services.

This secure, cloud-based managed print services (MPS) model provides the following benefits:

• Significant reduction in printing costs

• Security improvements

• Enhanced user experience

In addition, the MPS model brings Intel closer to "The Workplace of the Future," with greener printing policies. The MPS approach has been successful and is a useful example of Intel IT best practices. Moving forward, we will continually analyze data from all printing and imaging devices to gain insights about printing behaviors across the enterprise. We will strive to fine-tune the MPS model and policies to improve cost and efficiency even more.

116,000 Employees	37 Million Pages	147 Sites in 53 Countries	True "Follow Me" Printing
5.67 Million Scans	Single-Source Supplier	Secure Authentication	Paper Reduction

<div style="border:1px solid #00aeef;padding:10px;">

Contributors

Jennifer Delgado, Intel IT

Acronym

AES Advanced Encryption Standard
DTLS Datagram Transport Layer Security
MPS managed print services
PIN personal identification number

</div>

Business Challenge

Starting in 2008, Intel IT began to identify issues with the company's enterprise printing infrastructure and policies. Limited standardization and security measures were not optimal and syncing up to printers was difficult, all of which impacted the user experience.

In this environment, each business unit owned its own printers sourced from multiple vendors. This created a challenging procurement process due to varying pricing agreements and complicated maintenance with multiple printer models and warranties.

Solution Overview

Intel needed a deeper understanding of cost, control, security and efficiency, so the company implemented a centralized managed print services (MPS) model and transitioned to secure private cloud printing. Streamlining Intel's printing and scanning services represented a change in the strategy to establish cost-effective, flexible and secure printing for our 116,000+ employees at 147 sites in 53 countries using disparate systems worldwide.

Cloud printing enables employees to walk up to any printer and use their ID badge to access their print job at any Intel location worldwide. Not only is this process more convenient, it also improves Intel's security by helping prevent documents from getting into the wrong hands.

In addition, the MPS policy defaults to monochrome for color devices across the company. Previously, employees used color printing as a default whether they needed it or not, which unnecessarily increased cost. Now, if employees need to print in color, they must change the setting manually.

Duplex printing is also set as a default for all printers. These measures reduce costs dramatically. Finally, the MPS model greatly simplifies procurement because we use a single vendor to manage all devices, which helps reduce cost and maintenance issues and increases the lifecycle of the devices.

Evolution of MPS

The evolution of Intel IT's printing and imaging services over the last decade can be viewed as three distinct phases.

Phase 1: Open Model

Early on, business units bought their own printers and scanners. Some devices were managed by IT, some by business units and some were managed by users themselves. This scenario made it complicated to track costs and usage. In this phase, employees simply sent print jobs to the nearest printer where the printed document sat in a tray until it was picked up—raising security concerns.

There was little or no brand and model standardization. Disparate systems throughout the organization meant IT had little control over purchase prices and maintenance agreements. It was clear that we needed to standardize the printing and imaging environment to control costs and address security while still delivering the quality experience users wanted. Our goal was to provide a secure and predictable service that provided the same user experience across the enterprise.

Phase 2: Centralized Model

We transitioned from the open model to a centralized print environment that was consistent with security and legal requirements. Our aim was to provide complete visibility and accountability for printing and imaging services at Intel. By centralizing equipment purchasing, we could select standard brands and models. As a result, we had better control over purchase prices and maintenance agreements.

However, this phase had its own set of challenges. Managing a global fleet of printers and scanners across multiple offices and sites was an expensive and resource-intensive operation.

Phase 3: MPS Model

To implement private, cloud-based printing and imaging, we engaged in a significant infrastructure build-out. Cloud printing is defined as the ability to print from a device by routing a print job from a computing device (PC, smartphone, or tablet) to an internet-connected printer.

MPS goes beyond centralized services. With MPS, a third party owns and controls Intel's printing and imaging equipment. All services are covered by a worldwide contract with fixed rates. MPS provides users with a globally consistent printing experience while eliminating the need for Intel IT to service or maintain devices at the 147 sites where Intel has offices.

Having a single contract provides many benefits, including easily adding and removing devices, better lifecycle management and centralizing the remote monitoring of devices. Brands and models are chosen based on user needs, and the equipment is now governed by a highly sophisticated, cost-efficient and secure process.
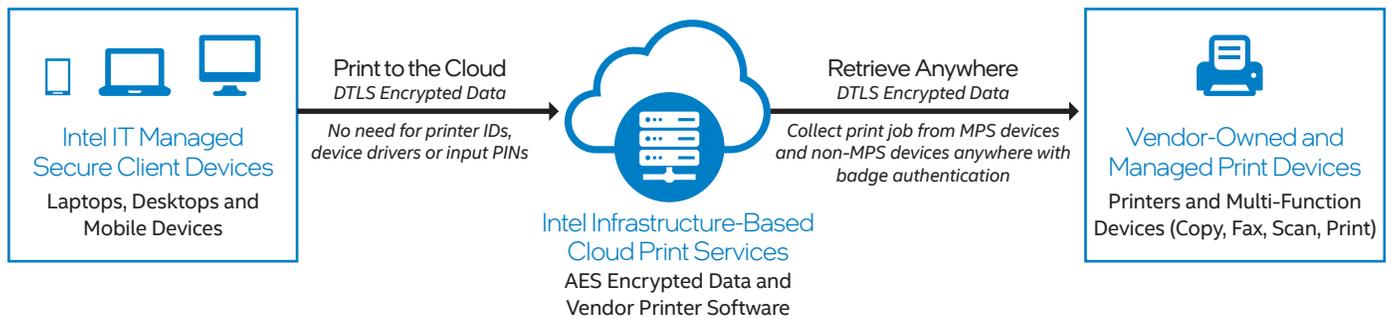
Secure Cloud Printing Architecture

Figure 1. Intel IT's secure cloud printing architecture (owned, managed, maintained and secured by Intel).

Solution Architecture

Mapping print jobs to the cloud and retrieving documents is easy. Instead of mapping to a specific printer, users map to the print cloud and retrieve documents from any Intel printer (see Figure 1). The cloud stores documents for up to one business day. If jobs are not retrieved during that period, the MPS system sends employees two deletion confirmation emails, and then if the print job is still not retrieved, it is automatically deleted from the cloud.

Cloud printing is secure because employees must use a form of identification to initiate printing. Originally, PINs were required to release print jobs. Today, employees authenticate their identity by swiping their ID badge in a badge reader to access print and scan jobs.

Intel employees are required to wear their identification badge at all times. Using the badge reader to access print jobs not only makes it convenient to retrieve jobs from any printer, it also adds an additional layer of security. Specific security and privacy parameters are defined for each employee in accordance with our worldwide privacy policy.

MPS includes three types of services:

- Print allows users to collect printed documents either through the private cloud or through the secure personal identification number (PIN) print option.
- Scan sends a soft copy of a scanned document to either the user or another Intel employee.
- Imaging services (copy, fax, etc.) provide users with a variety of options to make copies in different formats and utilize standard imaging services from the cloud-based printer, without actually accessing the cloud.

Results and Benefits

Implementing the MPS model provides the following benefits:

- **A reduction in the overall cost of printing at Intel.** Cost-efficient pricing and maintenance, fewer unclaimed printouts, along with savings enabled by default monochrome and duplex printing have lowered the cost of printing and imaging across the enterprise.
- **Maintained security of Intel's information and intellectual property.** Secure authentication for accessing print and scan jobs reduces security exposure and helps maintain a strong security posture process despite moving to an MPS model.
- **A greatly enhanced, consistent user experience.** The transition from "print to a specific device" to "print to the cloud" and "collect anywhere (any Intel office in the world)" means that users no longer need to take note of and enter complex printer IDs, install device drivers, input PINs or reprint if the specific printer they have selected is inoperable.
- **Improved transparency.** A single vendor is responsible for managing all devices under one agreement and covers costs of spares including toner cartridges.
- **Reduced personnel, added security and support.** A reduced Intel IT headcount (only three people) supports worldwide printing and scanning services at Intel and primarily focuses on addressing security concerns and anti-vulnerability actions. After-office hours and weekend support are provided as part of the MPS policy, including monitoring of the printing and imaging infrastructures and supporting mobile device cloud printing.

As we continue to explore ways to reduce overheads and increase efficiency, we are evaluating MPS deployment to a public cloud. This will require us to evaluate the user experience, security requirements and cost benefits as well as other factors.

Creating the Workplace of the Future

Triggered by the COVID-19 pandemic, Intel IT has seen a dramatic drop in the amount of printing. Employees working from home tend to be more conservative about printing out white papers, reports and charts, and instead are moving to a higher degree of virtualization. As employees return to work, Intel is establishing what the future of work will look like.

We want to make printing and imaging more efficient and effective to enhance the employee experience. This plays an important role in creating our workplace of the future where we are also focusing on persona-based work solutions, smart buildings, telemetry and solutions compatible with Intel vPro® platforms such as Intel® Endpoint Management Assistant (Intel® EMA).

Secure cloud printing is enabling Intel to move towards an office of the future that includes reduced printing and a decrease in the number of printers required due to a new hybrid work model. Conversely, we expect to see an increase in the number of scans so we're considering enhancing the scanning features and facilities available on the device.

Greener Printing Policies

Indicators show that Intel's imaging solutions are significantly above the industry average from a green computing perspective. Intel's commitment to corporate responsibility includes its 2030 "RISE" strategy and goals, which aim to create a more responsible, inclusive, and sustainable world, enabled by technology and our collective actions.

Today, the "green dream" is highly relevant because remote cloud printing supports Intel's green goals. For example, by using more environmentally friendly practices, including toners, we estimate we've reduced our carbon footprint by taking 39 cars off the road and saving 1,631 trees.[1]

Approaching the Paperless Office

Secure cloud printing is enabling Intel to move towards a secure-enabled, paperless office. For example, Intel is an industry leader when considering the number of employees and printers and the percentage of duplex printing in use. The company tracks its usage of duplex printing and digital scan ratios. These aspects help save both money and trees, ultimately producing a positive effect on the environment.

Figure 2 breaks down Intel's printing and scanning usage versus the industry:

- The industry average for duplex printing is 35.5 percent; we achieve 44 percent and have a target of 60 percent.
- For color prints, we achieved 7 percent with the goal of 5 percent; the industry average is 22.7 percent.
- Currently, 15 percent of documents are being shared as a soft copy for digital scans with a target of 20 percent; the industry average is only 11.5 percent.[1]

A higher percentage of those indicators means we are using less paper and therefore getting closer to achieving a paperless office. For example, in some countries, before the COVID-19 pandemic, Intel required employees to print expense reports and attach receipts. Now they have instated a new policy requiring reports to be completed digitally.
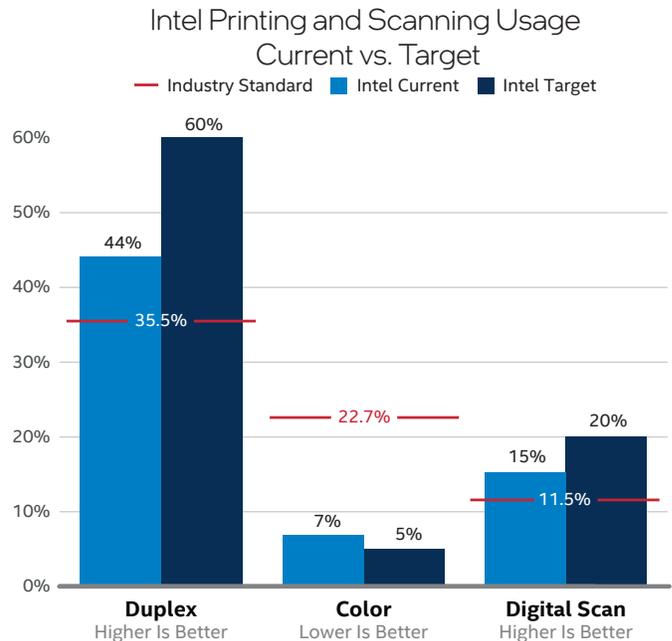
Figure 2. Intel's printing practices vs. industry averages.

Intel is well on its way to achieving a paperless office and has reduced the number of printouts per year by nearly half since 2015 (see Figure 3). This has been achieved through the utilization of managed printing services as well as the recent pandemic with users printing less at home. The reduction in printing means that less paper and toner are required resulting in a positive impact to the environment.
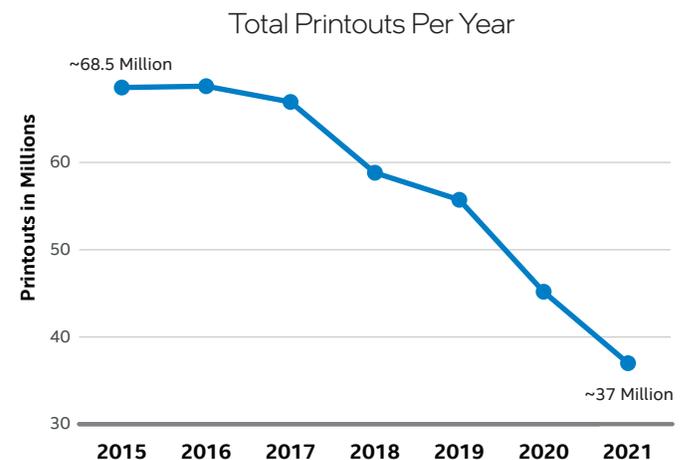
Figure 3. As a result of implementing MPS and secure cloud computing and going digital, Intel globally reduced the number of printouts by nearly half.

---

[1] Source: data collected by Intel IT's MPS third-party vendor.

Securing Printing Services

Making sure that printing is not the weak link in network security

Security is critical to Intel, and securing printing and scanning services is part of the overall network security plan. We allow only approved devices to connect to the network. All devices are on Intel's local area network, and the vendor solution infrastructure (software and hardware) is always on-site. In addition, all security functions such as upgrades and OS patching are also on-site.

Although our managed print services (MPS) private cloud is completely on-site, all printing (including the printer servers) is managed by a third party, while Intel IT manages security issues with information security reviews and the necessary precautions. This "hybrid" model means Intel IT retains ownership of the network, but the devices and solutions belong to the third party.

Six Best Practices from Intel IT's Experience with MPS

During our years of designing, deploying and using the MPS model, we have developed and adopted several best practices based on Intel IT's own experience.

Best Practice #1: Evaluate Whether MPS Is Optimal

Intel's pre-assessment of costs, security, efficiency and user experience clearly indicated that MPS could provide significant business value. However, the value of the MPS model will be different for each company and the decision to adopt it should be based on careful evaluation of parameters such as the scale of operations, expected print volumes, number and spread of offices and criticality of printing to business.

It is equally important to evaluate the MPS vendors' maturity, offerings and scalability in order to match them against the company's printing and imaging roadmap. For Intel, the cost savings, carbon footprint savings and employee experience advantages have served as compelling reasons for us to continue using MPS.

Best Practice #2: Address All Information Security Gaps

Intel applies the same scrutiny to printing and imaging services as we use for other aspects of the business. Our system of authentication through employee badges or PINs is a reliable way to secure the printing and scanning process. We also ensure that all third-party access to devices is wholly controlled, and that internal Intel employees with access to devices are trained to respect confidentiality boundaries and to dispose of any unwanted printed material per Intel's security policies.

Best Practice #3: Determine Most Important Criteria for Device Selection

While selecting a printing and/or imaging device, Intel balances a number of selection criteria, as shown in Table 1. For example, we may not be able to optimize for cost if high resolution or a specialty paper tray is required. But in other cases, we may determine that cost is the most important factor and choose a device with lower resolution and a standard tray.

Table 1. Criteria for Selecting a Printer or Imaging Device

Criterion	Rationale
Volume	The volume of prints/scans determines the required durability of the printer or scanner.
Speed	The print or scan speed determines the size of job backlogs and potential queues at the device.
Color or Monochrome	Color printing is more expensive, so color devices should be reserved for workloads that require color.
Print Resolution	The printer's resolution should meet the highest dots-per-inch needed for the most demanding print jobs.
Scan Resolution	The scanner's optical resolution should meet the highest pixels-per-inch needed for the most demanding scan jobs.
Mission Criticality	If the device supports a mission-critical process, device redundancy and back-up plans must be considered.
Page Size	The need for variable paper sizes should be assessed and accommodated when selecting printers and scanners.
Feeder	Scanning multiple pages requires a document feeder and printing on specialized paper requires manual feeders.
Paper Storage	The paper tray capacity must be aligned with workload volumes to avoid frequent paper outages.
Cost	The effective cost per print must be determined for each printer model and appropriately matched to needs.

Best Practice #4: Classify Users by Persona

Reprographic needs vary across the company. We find it helpful to classify Intel's printing and imaging device users into separate personas, while assessing the various selection criteria. Each persona has a defined set of characteristics, such as the print volume, paper type or whether color is needed (see Table 2). For example, printing may be considered mission-critical for certain workers but less critical for other workers.

Table 2. Example Personas

	Sales Executives	Product Designers	Factory Engineers	Supply Chain Services
Users	~100	~1000	~500	~500
Reprographic Volume	Low	High	High	Very High
Security	Medium	Very High	Very High	Very High
Print Speed	Low	High	Medium	High
Color	Color	Mono + Color	Mono + Color	Mono
Paper Type	A4, Legal	Variable	A4, A3	A4, A3
Criticality	Low	High	Mission Critical	Critical

Best Practice #5:
Choose Between Multi- and Single-function Devices

It is important to weigh the advantages and disadvantages of multi-function devices when choosing which model to deploy. Multi-function devices are generally more expensive than single-function devices. Also, with a multi-function device, users lose all functions during outages that may occur due to loss of power or network access or a paper jam.

Another potential issue with multi-function devices is that a large job can prevent other users from using other functions. However, in our experience, multi-function devices take up less footprint than several single-function devices. Also, we have found that they provide better performance, require fewer spare parts, have more features and deliver a better user experience. Based on this comparison, in general, we deploy multi-function devices.

Best Practice #6:
Establish a Robust Business Continuity Plan

Like other business functions, such as data backup or network infrastructure, Intel's printing and imaging needs are addressed in our business continuity plans. Users can access the "Add a Printer" tool to locate a specific printer, add it to their list of available printers and print documents to that printer using a PIN (assuming the network is still functional). In this way, we can help ensure that secure printing and scanning services continue even if the private print cloud fails.

Conclusion

Working with a single-source provider, Intel IT has established a standard printing experience across the company using MPS. The MPS model provides flexibility and a consistent experience to employees, who can send print jobs to a private cloud and access them from any printer at any Intel site worldwide. MPS also increases Intel IT's efficiency by using fewer resources to manage the printing and imaging infrastructure. In addition, our approach to MPS maintains Intel IT's stringent security requirements, using techniques such as requiring a PIN or employee badge to access print jobs. And finally, our MPS model is approved for Intel confidential merger and acquisition integration and is well received by companies without comparable capability by making printing easier for users.

Related Information

If you liked this paper, you might also be interested in these related papers:

- Intel IT's Multi-Cloud Strategy: Focused on the Business
- Next Step to Multicloud: Native Cloud Security Controls

For more information on Intel IT best practices, visit www.intel.com/IT.

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.

Follow us and join the conversation on Twitter or LinkedIn. Visit us today at intel.com/IT if you would like to learn more.