IT@INTEL

Remote PC Management Cuts Factory Costs and Increases Efficiency

Remote management of factory PCs with Intel® AMT helped speed incident resolution and significantly reduced production downtime.

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Executive Overview

Intel's factories rely on thousands of PCs for manufacturing automation; keeping these PCs up and running can prevent expensive downtime. To manage these systems, Intel IT is using the Intel® vPro™ platform's hardware-based feature, Intel® Active Management Technology (Intel® AMT), to help reduce production downtime caused by PC incidents by 87.5 percent.

For practical and security reasons, many of these PCs are housed in data center racks and configured without a keyboard, video monitor, or mouse. When issues arise, an IT technician must physically retrieve peripherals from a storage room and connect them to the affected PC before identifying the problem and resolving it. At one Intel factory, we estimated that the process averages 40 minutes per incident and is susceptible to human error.

Our goal was to reduce our mean time to resolution (MTTR) from 40 minutes per incident to just five minutes using Intel AMT, which provides remote access to PCs in any power or OS state. This capability was already integrated into the Intel® Core™ vPro™ processor-based systems in our data center, so activating it required no additional hardware cost.

We conducted a proof of concept (PoC) that rapidly produced successful results. The Intel® vPro™ Platform Solution Manager web-based console can help identify problems early, remotely manage the PC (including power and OS states), and remotely diagnose and repair problems. This cost-effective solution was simple to deploy and has delivered outstanding benefits to the factory. We have now activated Intel AMT on over 1,000 PCs in the PoC factory, and also reached our 5-minute MTTR goal.

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Acronyms

KVM	keyboard, video, mouse
MTTR	mean time to resolution
OOB	out of band
PoC	proof of concept

Business Challenge

At Intel, we have different types of factory PCs connected to our manufacturing execution system (MES) that are housed in data center server racks and accessed by Windows* Remote Desktop users. These PCs are often called "headless" because they generally do not include a keyboard, video, or mouse (KVM). Headless systems help enhance information security, especially in the demilitarized zone (DMZ), and they often have specific, unique configurations.

When issues arise, an IT technician must physically go to the data center and pick up the necessary peripherals, locate the affected PC, and connect the devices (sometimes referred to as physical KVM) before checking the error message and correcting the issue. The technician also carries a laptop for troubleshooting. Once the problem is resolved, the technician must then disconnect the peripherals and return them to storage. Each incident takes an average of 40 minutes to resolve.

Many of these factory PCs require physical maintenance for hard rebooting, collecting hardware status, and running batch PowerShell* scripts. The frequency of physical touch maintenance also increases the risk of human error, such as connecting peripherals to the wrong PC, increasing downtime.

Because many of these PCs are critical for controlling factory tools or supporting factory engineering work, downtime is expensive. In a proof of concept (PoC), we set a goal to reduce the mean time to resolution (MTTR) from 40 minutes to five minutes. To achieve this, we identified the following requirements:

- **Keyboard, Video, Mouse (KVM) Remote Control.** Rather than physically connecting peripherals, we needed to remotely diagnose and repair problems, even when the OS was not functional.
- **Remote power.** We needed to control power shutdown and restart remotely.
- **ISO mounts.** We also wanted to boot from an ISO image and load Windows* Preinstallation Environment (WinPE) for system-level troubleshooting.

The Intel® vPro™ platform's hardware-based feature, Intel® Active Management Technology (Intel® AMT), provided remote access regardless of OS or power state. It enabled easy remote monitoring, maintenance, and management of our headless PCs.

Solution

The Intel vPro platform provides stability, enhanced security, and performance; it also offers manageability features at no additional hardware cost. All PCs at Intel factories, including headless PCs, use Intel® Core™ vPro™ processors, which means these systems offer the premium feature set to help us achieve our goal of decreasing MTTR from 40 to five minutes per incident. The Intel® vPro™ Platform Solution Manager provides a framework application that allows us to launch plugin applications to remotely manage the embedded Intel vPro platform endpoints using Intel AMT. The preconfigured plugins perform the following tasks, making it an ideal solution:

- **Pingable.** Intel AMT helps manage the fleet of devices through pinging capabilities to identify problems early.

- **Remote power.** Even without a functional OS or when the PC is shut down, Intel AMT out-of-band (OOB) capabilities allow technicians to access, power on and off, or reboot PCs.

- **Remote diagnosis and repair.** KVM Remote Control provides full control of the PC, even when the OS is not functional.

Intel vPro Platform Solution Manager also includes a convenient web-based console that can be accessed from a variety of platforms, including tablets and smartphones, with easy navigation.

Proof of Concept

We conducted a PoC beginning with just a few PCs. We provisioned Intel AMT on five clients in September 2015, then an additional 95 in October, for a total of 100. We experienced early success and rapidly provisioned 500 more in January 2016 and an additional 58 in July 2016 (see Figure 1). By March 2017, over 1,000 clients in the data center were provisioned with Intel AMT.

We manually provisioned the PCs using Intel AMT rather than using Intel® Setup and Configuration Software (Intel® SCS), which is our policy for pilot tests and PoCs. Next, we will evaluate Intel® Manageability Commander, a lightweight console used to connect with and utilize the features of Intel AMT.

Intel® vPro™ Platform

The Intel® vPro™ platform is a set of hardware, technologies, and solutions utilized by system manufacturers to build premium business computers with advanced security and manageability features.

The Intel vPro platform features Intel® Core™ vPro™ processors and includes technologies such as Intel® Active Management Technology (Intel® AMT), Intel® Trusted Execution Technology (Intel® TXT), Intel® Virtualization Technology (Intel® VT), and Intel® Virtualization Technology for Directed I/O (Intel® VT-d).

Intel AMT enables better remote management of PCs by:

- Providing full control of the power state of the entire managed fleet

- Reducing costly desk-side support visits and speeding diagnosis and repair times

- Enabling remote, out-of-band (OOB) management of wired and wireless PCs, even when the OS is non-functional

- Allowing Service Desk agents to remotely manage PCs using a management console

These capabilities reduce IT costs and improve business continuity of PC fleets.

Schedule of Machines Provisioned
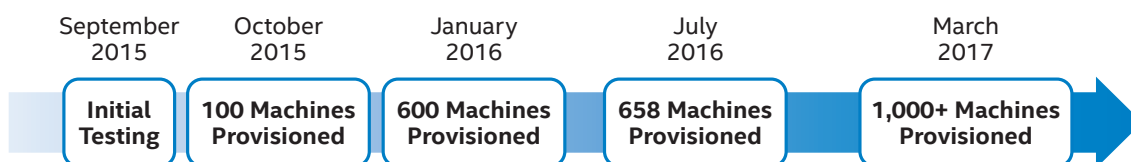
September 2015	October 2015	January 2016	July 2016	March 2017
Initial Testing	**100 Machines Provisioned**	**600 Machines Provisioned**	**658 Machines Provisioned**	**1,000+ Machines Provisioned**

Figure 1. We used Intel® Active Management Technology (Intel® AMT) to provision more than 1,000 PCs in just over a year.

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We tested other Intel AMT options as a part of the PoC. Using the publicly available instruction to activate the capabilities on all clients, we tested the following when the PC was shut down:

- **Visibility.** The PC IP remains visible and responsive to pinging.
- **Manageability.** The PC can be remotely manipulated, including powering on, powering off, and reset.
- **Remote configurability.** The boot sequence can be viewed in real time and the BIOS can be remotely configured.

With successful completion of the PoC, we have moved into full production where the solution was tested. Intel AMT's Remote Scheduled Maintenance feature makes off-hours patch updates easy to deploy for high-availability enterprise environments such as Intel factories, as well as for PCs outside the firewall.

Supporting Factory Clients

Intel factory technicians are responsible for supporting and maintaining tool operations. Prior to provisioning client PCs with Intel AMT, Infrastructure Engineer, Eric, used to do a large portion of his operations job manually. This included rebuilding systems, troubleshooting incidents, and upgrading PC BIOS, as well as other PC-related activities. Often, the process required multiple trips between the data center, storage room, and his work space (see Figure 2). With Intel AMT, Eric can easily troubleshoot incidents and maintain the data center PCs without needing physical access.

> "With Intel AMT, I can fix a system that is hung from my cube, at home, or on the bus—anywhere I have Internet access. It's not only efficient, but it improves the user experience and factory productivity."
>
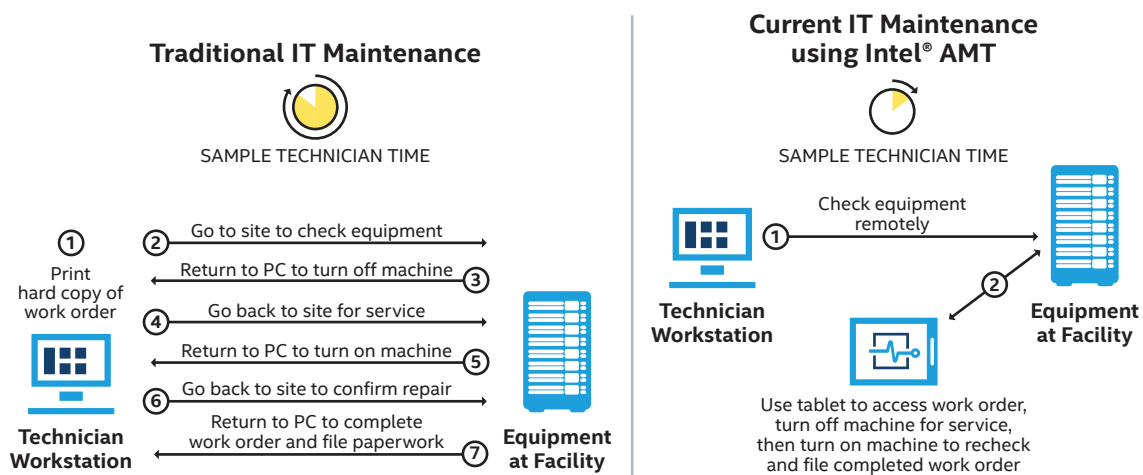> **–Eric Martins**
> *Infrastructure Engineer*

Figure 2. Intel® Active Management Technology (Intel® AMT) – already part of Intel® vPro™ platforms deployed for factory automation – enables remote management and troubleshooting of headless devices.

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Setup and Configuration

The setup and configuration process includes installation of software keys necessary for mutual authentication and encrypted communication between the PC and the Intel vPro Platform Solution Manager web-based console. This allows only authorized IT consoles to use the Intel vPro platform features. The steps for deploying PCs include:

1. Establishing the management console, including configuration services
2. Generating unique key pairs for each Intel vPro platform-compliant PC
3. Entering Intel AMT networking and security information into the PC
4. Configuring Intel AMT policies

For in-network configurations using Dynamic Host Configuration Protocol (DHCP), OOB communication with Intel AMT is conducted through a separate port number at the IP address shared with the OS, and no additional IP addresses are needed. It only requires its own separate IP address for OOB communication in network configurations where static IP addresses are used.
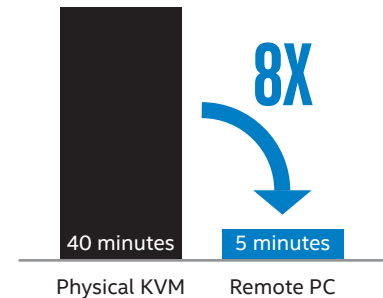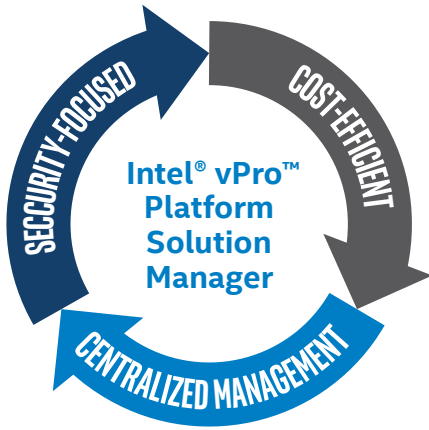
MTTR Improvement
Using Remote PC Management

Figure 3. With remote management of our headless PCs, we decreased mean time to resolution (MTTR) by more than 8 times, for a savings of 87.5 percent.

Results and Benefits

The Intel vPro Platform Solution Manager with Intel AMT capabilities enables remote management of PCs, including diagnosis, repair, and shutdown, reducing the number of time-consuming physical touches from IT technicians. This also includes managing PCs with encrypted hard drives.

Results

The solution has been in place for 18 months and has demonstrated excellent stability. We encounter about six incidents per week. In three of these incidents the OS is hung, and we can now simply reboot remotely, saving 35 minutes per incident. The remaining issues can also often be fixed remotely, saving additional time that was not part of our original metric.

We have achieved our MTTR goal of five minutes per incident, an 87.5 percent efficiency increase compared to the physical KVM approach, reducing costly downtime and enabling factory engineers to return to work faster (see Figure 3).

The ability to remotely manage PCs with Intel AMT allows us to refresh the systems by proactively installing updates and patches, as well as rebooting them. It has eliminated other problems, such as software memory leaks and OS hangs, which are more common on clients that run for weeks at a time. We no longer need to reconfigure Intel AMT on these PCs.

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Intel® vPro™ Platform Solution Manager

SECURITY-FOCUSED

COST-EFFICIENT

CENTRALIZED MANAGEMENT

Benefits

With its hardware-assisted manageability and security, the Intel vPro Platform Solution Manager helps boost productivity, enhance information security, and improve IT efficiency. The benefits include:

- **Cost-efficiency.** No touch means at least an 87.5 percent shorter MTTR, for a significant cost savings.
- **Centralized management.** The web-based console makes remote PC management simple for troubleshooting, including power and OS issues. It also enables 24/7 support without requiring technicians on-site.
- **Security-focused.** Headless systems help maintain security and remote management improves IT's ability to address security concerns quickly.

Simplified resource management improves system reliability and reduces hardware costs. It also prevents technicians from accidentally connecting to the wrong PC, as well as other human errors.

Intel AMT uses integrated platform capabilities and third-party management and security applications, which allow us to better discover, repair, and protect networked computing assets. The remote maintenance and wireless manageability is especially suitable for high-availability production environments where serial-over-LAN remote management control allows I/O communications and USB redirection provides access to resources on the network (see Figure 4).

IT Console
Provides full-control over
entire PC managed fleet

Remote Management Control
Serial-over-LAN allows
I/O communications and
Keyboard, Video, Mouse (KVM)
Remote Control

Transport Layer Security

Network

ISO Mount
allows IT to access
resources on the network

Client PC with
Intel® Active Management Technology
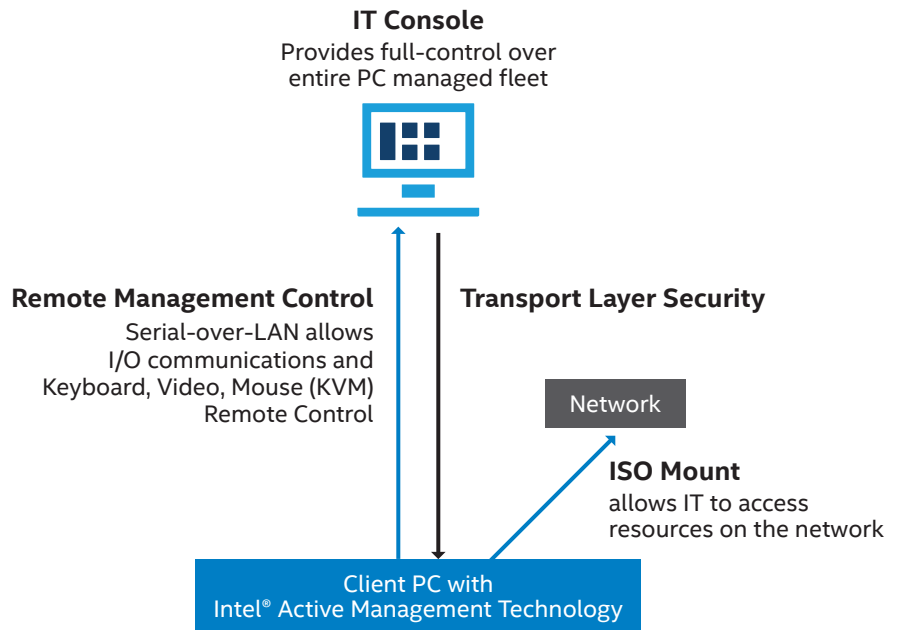
Figure 4. Remote management of network PCs in high-availability environments (such as factories) is simplified with Intel® Active Management Technology (Intel® AMT).

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Conclusion

Resolving headless PC incidents in our factory data center traditionally required physically touching the affected client. These headless PCs often required a technician to make multiple trips to the data center to physically locate and troubleshoot the issue. Each incident took an average of 40 minutes and introduced the possibility of human error. At one of our factories, we set a goal to reduce the MTTR to just five minutes per incident by using Intel AMT, which was already embedded in our Intel Core vPro processor-based systems. Our requirements included KVM Remote Control, remote power control, and booting from an ISO image.

We conducted a PoC in which we activated Intel AMT in five clients. Within a year we had activated 1,000 clients in that factory and achieved our goal of five minutes per incident on average. We estimated that we reduced costly production downtime due to PC issues by 87.5 percent. The Intel vPro Platform Solution Manager includes a cost-efficient, web-based console that helped maintain system security. Remote management has improved our ability to quickly and securely address concerns.

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