White Paper

Intel Information Technology

Computer Manufacturing

Client Management

Managing Training Rooms with Intel® vPro™ Processor Technology

Intel IT conducted a pilot to explore the potential of PCs with Intel® vPro™ processor technology, with ISV management software, to address management and performance challenges across Intel's geographically dispersed training rooms. We remotely performed rebuilds, installs, and security updates that previously required on-site support. We estimate that by deploying this technology across our production environment, we could reduce on-site support requirements and overall support costs. We also anticipate other benefits such as running more demanding applications and using training rooms more efficiently.

Randy Nystrom, Intel Corporation

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IT@Intel

Executive Summary

Intel IT conducted a pilot to explore the potential of PCs with Intel® vPro™ processor technology to address management and performance challenges across Intel's geographically dispersed training rooms. We estimate that we could substantially reduce on-site support requirements for specific tasks, which would reduce our overall support costs.

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Intel training rooms represent a demanding IT environment in terms of both management and performance. We require considerable on-site support because we need to frequently rebuild, update, and repair PCs, and because compute-intensive courses challenge the capabilities of our desktop machines.

We conducted a pilot project to explore the potential of PCs with Intel vPro processor technology, together with ISV management software, to address these challenges. We installed 22 PCs in a production training room environment and managed them remotely using Intel® Active Management Technology (Intel® AMT) and the ISV management software.

- Using Intel AMT, we were able to remotely wake and boot systems to deliver software updates.
- We remotely performed rebuilds, installs, and security updates that previously required on-site support.
- PCs with Intel vPro processor technology ran as many as five virtual machines (VMs) without significant degradation, allowing them to support demanding technical courses.

We analyzed the potential benefits of deploying our pilot environment in all Intel training rooms. As well as reduced support costs, we also anticipate additional potential benefits such as more efficient use of training rooms and the ability to run applications such as Voice over IP (VoIP).

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Business Challenge

Each year, tens of thousands of Intel employees use our PC training rooms to learn software applications and other technology. The training rooms are demanding IT environments: Training groups throughout Intel use the PCs in these rooms to run hundreds of different courses, covering diverse subjects such as office productivity applications, OSs, development tools, factory-specific tools, and enterprise resource planning applications.

Technical courses aimed at developers tend to be particularly complex and compute-intensive, requiring powerful PCs that can run these courses without slowing down, hanging, or crashing. Adding to the load on desktop machines, many technical courses simulate production environments by creating multiple VMs on a single PC. Each VM might run an application image representing a different element of the target environment such as server or client software.

PCs in training rooms must also handle multiple applications simultaneously, including training videos, anti-virus software, and security and compliance tools. We are also interested in adding VoIP, which could reduce costs and improve convenience for employees by letting them participate in instructor-led courses conducted at distant sites.

Managing our worldwide training room environment also represents a major challenge. We support approximately 40 training rooms on four continents, with an average of about 20 desktop PCs per room. Maintaining these systems requires a support group to keep OS builds up to date, deploy the latest security and other critical patches, track assets, and install a large variety of applications.

Three years ago, we reduced the cost of supporting our environment by approximately 29 percent by increasing automation. We accomplished this by scripting and by reconfiguring one PC in each training room as a local server used to monitor and update the other PCs. We have maintained costs at approximately this level, even while supporting a growing number of training rooms.

However, challenges remain. Despite our increased level of automation, technicians still perform many functions manually on site; as a result, on-site support accounts for about 50 percent of the total cost of supporting our environment.

This is largely because we typically rebuild the training room environment every six to eight weeks, installing or refreshing the software images on each desktop machine. This helps ensure systems are up to date with the latest security and OS updates, and also allows us to install the specific applications and even OSs required for different classes. After a class, we need to "refresh" or restore the images on PCs so they are ready for the next class. Traditionally, technicians have performed this process on site using tools developed in-house.

Combining multiple software updates into a single build means that we can implement them more quickly than if we installed them separately. Even so, we typically schedule four hours of on-site support time for each install, and in some cases the process can take as long as one business day. We already have third-party tools for remotely delivering security updates and remotely diagnosing and fixing problems. However, our tools cannot typically access a machine that is powered off, whose OS is unresponsive, or whose management agents are missing. In these cases, we need to dispatch technicians to fix problems on site.

We are continually challenged to keep costs low. As a result, desktop machines sometimes remain in service beyond Intel's standard three-year refresh cycle. This can contribute to performance issues and, if machines are still in use after standard warranties have expired, additional hardware maintenance costs when failures occur.

To address our performance and manageability concerns, we conducted a pilot to investigate the potential of desktop PCs based on Intel vPro processor technology. Our pilot also included software that we believed could enhance our ability to perform automated remote management, rather than using on-site support technicians. If we could manage PCs from a central location, we could substantially reduce the cost of supporting our worldwide environment.

The desktops included Intel® Core™2 Duo processors designed to deliver substantially better performance when running multiple applications and VMs than the Intel® Pentium® 4 processors in our older machines. The newer machines also included integrated graphics capabilities that we hoped would let us run graphics-intensive courses without the need for discrete graphics cards, reducing hardware purchase costs. We were particularly interested in Intel AMT, which includes out-of-band (OOB) capabilities that let administrators remotely boot, inventory, diagnose, and repair desktop machines even when they are powered off or the OS is down.

Training Room Pilot

To evaluate the technology in a production environment, in late 2006 we conducted an eight-week pilot in an Intel training room. We used desktop machines based on Intel vPro processor technology, together with ISV management software for remotely monitoring and administering the PCs. During the pilot, we used the new technology to support live classes.

We installed 22 PCs, each with a 2.4 GHz Intel Core2 Duo processor and 1 GB of memory. Twenty of these machines were for student use, one was for the instructor, and the remaining machine acted as a management server.

During the pilot, we tested Intel AMT capabilities such as the ability to remotely wake, boot, and power down PCs in order to perform management tasks. We used the ISV management software to package, schedule deployment of, and automatically install software images containing critical OS patches and updates, current virus definitions, and applications required by users.

Instructors and students then used the PCs with the updated software images in classes. We evaluated the performance of the PCs in live classes and when running multiple VMs.

We subsequently analyzed and quantified potential benefits of deploying the technology within Intel's training rooms. Our analysis relied primarily on two data sources:

- The pilot results.
- Tickets documenting on-site support for our existing production training room environment in the United States, excluding the pilot, during a period of approximately four months from late 2006 to early 2007. This data, from 22 training rooms, helped us to measure how we currently allocate resources to specific problems. We used this to analyze the potential effect of using new technology to address those problems.

Pilot Results

- Using Intel AMT, we were able to access PCs remotely and power them on and off four times. In each case, we verified that the OS on each system loaded successfully.
- We remotely rebuilt the training room desktop environment. In testing, we remotely packaged OS images and scheduled jobs that installed the images on single machines, on several machines at once, and on all the machines in the training room. We ran each of these jobs four times and verified that the images installed correctly in each case. We also verified that we could successfully push individual security updates to PCs. As we continued to use the technology to support live classes, we installed or refreshed the images on all the machines a total of five times.

- We asked instructors about their experiences with the new environment. They verified that typical courses ran successfully on the desktops, with no issues that required deskside support. They also said that the systems performed well.
- We generated multiple VMs on PCs using technical courseware in order to determine the effect on performance. The machines handled up to five VMs without significant degradation. Even with five VMs running, CPU utilization was less than 25 percent, although memory utilization approached the limit of the 1 GB installed memory.

Support in the Current Environment

We analyzed 74 tickets documenting on-site support for our existing training room environment in the United States during a period of approximately four months from late 2006 to early 2007. This helped identify the current most frequently required support categories, and it provided a measure of the resources they consume. We found that:

- Sixty-four percent were software installs. This category included rebuilds and refreshes, as well as OS and security updates.
- Thirty percent were attributable to hardware problems.
- Three percent were network connectivity problems, typically disconnected network cables or power cords.

Analysis

We estimated potential benefits by examining how we perform specific tasks in our current environment and how much time those tasks consume. Then we analyzed how those tasks would change in a production environment based on our pilot technology, and the potential reductions in support effort. We assumed a production environment based on a version of the ISV management software integrated with Intel AMT, so that we could schedule jobs that would run after business hours and use Intel AMT to wake machines as necessary. The benefits are summarized in Table 1.

Rebuilding PCs and Installing Software

Traditionally, rebuilding the PCs in our training rooms has required a technician to be present on site. The technician installs or refreshes software images and renames and validates systems, ensuring that they are fully configured and security compliant. We typically schedule four hours for this process and rooms are unavailable for classes during this time. Technicians typically spend between 1.5 and 4 hours on the task, depending on its complexity. Analysis of our on-site support data indicates that rebuilds and other installs, including security updates, account for about 64 percent of on-site support visits, with an average of three hours per visit.

Our experience indicates that deploying software remotely can deliver substantial savings. With our pilot technology, a build requires a total of 45 to 60 minutes of technician time, on average,

to schedule the job, validate that systems are receiving images, and then verify that the job ran successfully. During the two-month pilot, we verified the effectiveness of this approach by completing five builds or refreshes on all machines without the need for technicians to physically enter the training room.

We anticipate further benefits by using the ISV management software integrated with Intel AMT across our worldwide production environment.

A central support team could package OS and application images and schedule them for remote installation over the network in training rooms after standard business hours. The software would use Intel AMT to remotely wake any systems that are not powered up. With management software integrated with Intel AMT, technicians would need to perform on-site rebuilds only when systems are unavailable due to hardware failures or an unplugged network or power cable.

Table 1. Current Challenges and Anticipated Benefits of Intel® vPro™ Processor Technology

Challenge	Old Environment	Pilot Results	Anticipated Benefits
Rebuilds, Application Installs, and Security Updates	On-site technicians rebuild rooms approximately every six to eight weeks, which takes three hours on average.	We deployed software remotely, requiring 45 to 60 minutes of technician time for job scheduling and validation.	Ability to perform most installs remotely using a centralized team instead of on-site support technicians; approximate 65 to 75% reduction in technician time per remote software install; installs and updates would occur after business hours.
Asset Management	We currently spend about 100 hours per year manually tracking assets.	We were able to remotely view inventory information and transfer it to asset management software.	Automated inventory, resulting in an approximate 80 to 90% reduction in manual effort.
Energy Conservation	Systems must be on 24X7 to allow online delivery of updates.	We remotely powered systems on and off using Intel® Active Management Technology (Intel® AMT).	Because we can wake systems as needed with Intel AMT, we could switch machines off about 12 hours a day, with an approximate 35 to 45% reduction in energy costs.
Performance	Current desktops can run only one or two VMs concurrently, limiting our ability to run demanding technical courses.	Systems ran up to five VMs without significant degradation.	Ability to run more demanding technical courses and other applications such as Voice over IP (VoIP) concurrently.
Room Availability and Student Disruption	Rooms are unavailable for training during times scheduled for software installation; on-site security updates disrupt classes.	We were able to remotely schedule software installations and security updates.	Ability to install and update software after hours, increasing availability of rooms and reducing disruption to students.

We anticipate similar benefits by remotely deploying critical patches and urgent security updates. We have traditionally used Intel's corporate automation tools to do this, but sometimes we cannot access PCs because they are not powered on or because agents are missing. In these cases, we use an on-site technician to install the latest updates. This often disrupts classes.

We also believe that we could automate BIOS updates and deliver them remotely to some or all of our systems as a single task, improving system reliability. Currently, we typically do not perform BIOS updates except when systems fail because of the cost of on-site support.

Hardware Asset Management

Traditionally, we have tracked hardware assets manually, a process that typically requires about two hours per week, or 100 hours a year. Manual asset management can also be problematic because we cannot always capture component failures or other changes to hardware properties. We have usually relied on people in classes to report these problems.

Our pilot technology automatically captures hardware information, and in a production environment, would update that information when hardware configurations change. In tests, we verified that we could gather this data and transfer it to asset management software. Based on this preliminary testing, we estimate that we could substantially reduce the time required for data entry to one to two hours per month, a reduction of about 80 percent.

Problem Diagnosis and Repair

In our current production environment, we use existing corporate support tools, including remote-control software, to remotely diagnose and repair problems. However, if the OS hangs or desktop management agents are disabled, we must dispatch a technician to troubleshoot and repair the system on site. With more effective remote management tools using the OOB capabilities of Intel AMT, a small central support team could troubleshoot and repair software problems remotely, taking an estimated one hour or less. In addition, a specialized support team familiar with typical training room problems should be able to respond more quickly and more accurately diagnose and repair problems.

We could also improve resolution of hardware problems, which accounted for about 30 percent of the tickets that we analyzed. Today, fixing hardware problems typically requires two desk-side visits: one to diagnose the problem and another to install the failed hardware. Our new management technology would proactively monitor the hardware, potentially allowing us to identify and troubleshoot hardware problems remotely. We would still need one desk-side visit to repair failed hardware, but this would represent a 50 percent reduction from the two visits required previously.

Energy Conservation

Traditionally, we have asked users to leave PCs in training rooms powered up 24 hours a day to improve the likelihood that we can apply updates and critical patches after hours. Using

PCs with Intel vPro processor technology, we will be able to switch machines off at the end of the day's classes because we know that we can reliably wake them remotely before the next class or when we need to apply critical updates. By switching machines off 12 hours a day, we estimate that we could save 35 to 45 percent of training room power costs.

Performance

In the pilot, instructors reported good performance during a variety of classes, indicating that the integrated graphics in desktops with Intel vPro processor technology were capable of handling our class workload. Previously, we typically purchased discrete graphics cards.

The older desktops in our current environment perform best with one to two VMs, which limits their ability to run demanding technical courses. In contrast, the PCs with Intel vPro processor technology ran up to five images in separate VMs, with considerable CPU capacity to spare. With the improved performance, we expect to be able to run a wider variety of classes in training rooms. The additional CPU power would also enable us to run other applications such as VoIP, potentially letting employees participate in instructor-led courses conducted at other sites.

Technician Training

We continually need to train new contract support technicians around the world, because they are so extensively involved in the daily activities of the training room environment. In our new environment, we anticipate that most support could be managed remotely by a small team from a central location. This would reduce the need to train local technicians at different sites.

Increased Availability of Training Rooms

On-site support takes place during business hours. To ensure images are in the appropriate state for a class, we typically need to perform on-site rebuilds on the business day before a class. This can be difficult to schedule. Technicians may perform smaller tasks such as urgent patches during classes, but this can result in disruption to students. With our pilot environment, we were able to perform these tasks remotely and to schedule them to take place outside business hours. In a production environment, we could schedule remote rebuilds in advance so that they take place just before a class, reducing potential problems of room availability and scheduling. It would also result in less disruption to students.

Conclusion

Our pilot revealed considerable potential efficiencies and cost savings that we could achieve by adopting Intel vPro processor technology and new management tools. The benefits of remote automated management apply to any large organization, but are enhanced in our case by the geographically distributed nature of our training-room environment.

After our successful pilot, we expect to deploy PCs with Intel vPro processor technology more widely across our training rooms in 2007.

Currently, about 50 percent of the cost of supporting our worldwide training room environment is attributable to on-site support. By implementing Intel vPro processor technology together with new management tools, we expect that we could substantially reduce this figure by replacing desk-side visits with lower-cost remote support that is faster, more automated, and less disruptive. We anticipate significant cost reductions in the areas of OS and application installation, security and critical updates, asset management, problem diagnosis and repair, and energy consumption.

We also expect other business benefits. We expect to be able to use training rooms more intensively because there will be less need to perform maintenance and updates during business hours, and users may experience less disruption. We also expect to spend less time training support technicians because we will be able to deliver more support remotely using a small, centrally located, specialized team rather than using local contract staff.

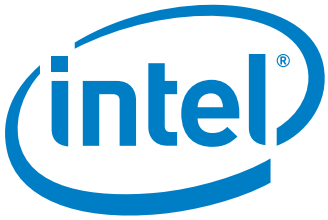
The additional power of PCs with Intel vPro processor technology will allow us to run more performance-hungry technical courses, including those that generate multiple VMs. It would also support new applications such as VoIP that would enable us to enhance our offerings and make them more accessible to employees at lower cost.

Authors

Randy Nystrom is the training room support manager with Intel Information Technology.

Acronyms

Intel® AMT	Intel® Active Management Technology
OOB	out of band
ROI	return on investment
VM	virtual machine
VoIP	Voice over IP



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