



IT@Intel

Conference Room Collaboration Using Intel® vPro™ Technology

Our collaboration technology uses manageable, secure hubs and the new Intel® Unite™ software to enable conference participants to share content and ideas across multiple devices and platforms.

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Executive Overview

Employee collaboration across the globe plays a vital role in Intel's ability to innovate quickly and respond to marketplace opportunities. Over the years, Intel has invested in collaboration technology to increase collaboration, build stronger teams, and enable greater employee productivity.

As part of Intel IT's vision for workplace transformation to support greater innovation, velocity, and openness, we are creating a model for next-generation conference rooms. Our collaboration technology uses manageable, secure hubs and the new Intel® Unite™ software to enable conference participants to share content and ideas across multiple devices and platforms.

Our solution takes a software-defined infrastructure (SDI) approach, deploying Intel® Core™ vPro™ processor-based PCs as the hub for in-room and remote collaboration experiences. In its fullest implementation, this solution will enhance global collaboration by bringing data, audio, and videoconferencing together, allowing participants to wirelessly share room resources like displays and multitouch interactive whiteboards.

We expect to benefit in the following ways:

- Faster, easier meeting starts for shorter time to productivity
- Wireless connections to room displays for easier sharing
- Intuitive user interactions and immersive audio and video experiences
- Faster introduction of collaboration technologies and customization
- Vendor independence for greater selection and future proofing
- Lower total cost of ownership (TCO) through remote management
- Improved security and intellectual property protection

We are already seeing results. Pilot implementations showed a reduction in meeting-start times from several minutes to seconds, and 89 percent of survey respondents said they would recommend the solution to others. Based on this success, we are finalizing our design and planning a gradual rollout worldwide.

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Acronyms

- NUC** Next Unit of Computing
OPS Open Pluggable Specification
SDI software-defined infrastructure
TCO total cost of ownership

Business Challenge

Like many large companies, Intel has conference rooms equipped with a variety of technology for sharing audio, data, and video. Employees and guests collaborate remotely and in person through conferencing software, softphones on their laptops, and in-room conferencing equipment. However, this complex environment can intimidate participants, and the time it takes to configure connections leads to slow meeting startups and frequent interruptions while collaborating.

As part of our ongoing workplace transformation initiative, Intel IT looked for ways to improve the conference room experience. Our immediate goal was to remove obstacles to effective meeting collaboration as reported by employees and as we observed. These obstacles can be grouped into three categories:

- Factors leading to slow meeting startups
- Challenges in achieving rich, immersive collaboration
- Tasks requiring time-consuming manual activity

Intel IT also sought to bring greater affordability, manageability, scalability, reliability, availability, and security to conference rooms.

Factors Leading to Slow Meeting Startups

Connecting multiple people in multiple locations (onsite, at home, in transit) was often time-consuming and delayed meeting start times. Two main contributing factors were connectivity challenges in accessing the room display and connecting remote participants to the conference.

Establishing connections between computers and devices (such as wall display panels and projectors) was often tedious and inefficient. Presenters frequently did not have the correct display dongle or did not use it correctly to connect their computers to in-room projectors or display panels. The numerous display connections (HDMI, Micro-HDMI, DisplayPort, DVI, Mini-DVI, Micro-DVI, VGA, and Mini-VGA) compounded the problem. Connection difficulties began all over again when it came time to hand over the presentation to another person. Often a new dongle search ensued.

Connecting to the online conference software required participants to perform manual activities ranging from clicking URLs to dialing phone numbers and entering bridge and meeting codes. These activities normally involved referencing information stored on their personal devices. Activating the devices and getting the necessary information affected the productivity of everyone in the conference.

Challenges in Achieving Rich, Immersive Collaboration

Audio and video was often available but suboptimal in quality. Quality issues especially arose when conference participants used their devices and the room systems simultaneously and when remote participants joined from locations with low bandwidth, such as from home or on the road. In addition, remote participants found it hard to participate effectively because of poor audio and visual isolation caused by what was going on in the room. They could not view whiteboards and missed seeing valuable information written on them, resulting in further inefficiency and loss of context.

Our videoconferencing environment provided an excellent solution to visual isolation. However, equipment expense limited videoconferencing to select rooms on each campus, making them available only with prescheduling, which affected conference spontaneity.

Tasks Requiring Time-Consuming Manual Activity

Conference participants had to do everything manually—from scheduling people and resources to joining the conference using information in the calendar invitation. They also had to take notes on meeting decisions and future assignments for each participant. In a world of smart, connected devices, conference room devices remained relatively isolated and unintelligent; they had minimal integration with business processes and the ways employees collect and exchange information. Room devices could not recognize participants, their devices, or the context of a meeting; they also could not offer relevant information, such as the last meeting's results. Whiteboards could not record and secure information for later distribution, and capturing information from them required physical note taking or photography.

Using Technology to Drive Workplace Transformation

Intel IT views technology as a key differentiator in enabling a business to thrive. We continually seek new ways to use technology to enhance employee productivity, facilitate business growth, and drive business efficiency and bottom-line results.

Today's workplace is shifting as businesses realize the need to champion the ability of employees to do business anywhere, anytime. We consider the ways employees initiate and conduct meetings as part of this changing landscape. To support today's mobile workforce and enhance collaboration and productivity, meeting initiation and operation must accommodate an environment of always-on information access, flexible working styles, and multiple types of mobile devices.

To empower employees with resources designed to foster greater workplace flexibility and collaboration, Intel IT is using technology to drive workplace transformation. By providing more intelligent technology, we seek to increase employee productivity, help employees build stronger global teams, and reduce training costs. Our efforts to create next-generation conference rooms and technologies contribute to our workplace transformation program.

IT Considerations

To solve conferencing shortcomings with next-generation collaboration technology, we defined the following IT objectives:

- **Reliability.** We sought solutions with appliance-like reliability. Solutions that are designed to minimize failure can also reduce maintenance costs and help ensure positive conference room experiences.
- **High availability.** To meet our goal of speeding up meeting startups and improving conference room experiences, devices needed to offer nearly instant startup and deliver high mean time between failure for minimal downtime.
- **Manageability.** With hundreds or even thousands of conference rooms, we wanted the ability to do all of the following remotely: monitor conference room devices, manage their configurations and software versions, keep them secure, and power them on and off. Remote manageability is critical in ensuring high availability and reducing total cost of ownership (TCO).
- **Scalability.** With more than 107,000 employees located on Intel campuses all over the world, we needed a solution we could easily implement, replicate, and scale.
- **Supportability.** With a fleet of existing client devices characterized by different product generations and operating systems, we needed a solution that could support the complete fleet and not only the latest or most common devices.
- **Extensibility.** Different Intel campuses and business units may have different needs for their conference rooms. We wanted a solution that could be customized and upgraded easily.
- **Affordability.** Facing the cost of equipping so many conference rooms with new solutions, we wanted to avoid having to integrate expensive, function-specific devices. Our goal was to minimize costs by using established PC-support channels and off-the-shelf hardware with standard protocols for integration
- **Vendor neutrality.** With both internal and external collaboration using various tools, we needed the flexibility to support collaboration solutions from multiple vendors.
- **Security.** Intel's intellectual property, confidential data, and the privacy of our employees must be protected at all times. For our conference rooms, security had to encompass on-premises conference room activities as well as remote participation.

“To solve conferencing shortcomings with next-generation collaboration technology we focused on software innovation and off-the-shelf vPro PCs.”

—Omer Ben-Shalom

Solution

Intel IT not only supports Intel business units but also collaborates with them on potential solutions to solve universal business challenges and develop marketable products. In developing our next-generation conference rooms, we collaborated with other business groups to help shape and test technology they were already working on. Together, we sought to create a solution for next-generation conference rooms that would deliver improved meeting experiences, scale and extend easily, reduce TCO, and provide security (Figure 1).

4 Goals of Next-Generation Conference Rooms

1. Deliver improved meeting experiences
2. Scale and extend easily
3. Reduce TCO
4. Protect Intel intellectual property and employee privacy

We based our solution on five elements:

- Intel® vPro™ technology-based platforms¹ with appliance-like reliability
- Software-defined infrastructure (SDI)
- Multitouch interactive whiteboards
- Collaboration software from Intel IT and other business groups with plug-ins for existing collaboration applications
- Security and privacy protection

Intel® vPro™ Technology-Based Platforms with Appliance-Like Reliability

To deploy our SDI solution and enable affordable, scalable conference rooms, we needed a computing platform that could function as a central hub for running both local room resources and software to drive remote collaboration. To reduce maintenance costs, ensure high availability, and deliver a seamless experience, we wanted a flexible, reliable platform designed for fast startup with ample compute and graphics performance.

¹ Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at [intel.com](https://www.intel.com).

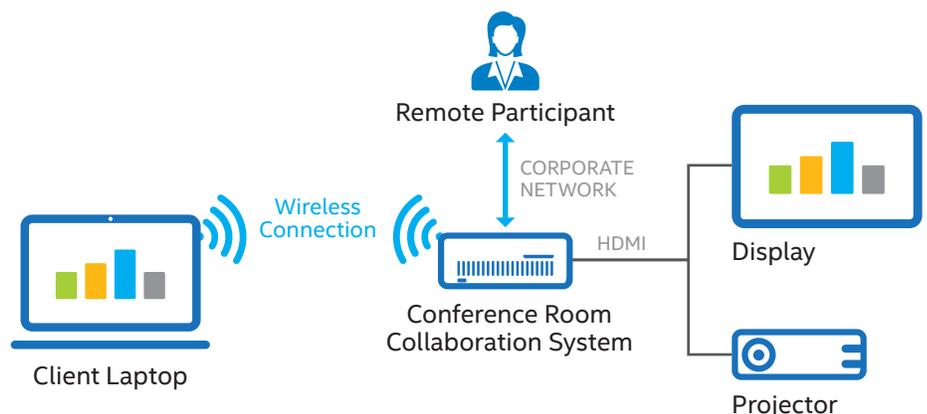


Figure 1. The technology solution used in Intel's next-generation conference rooms is scalable and secure.

To fulfill these requirements, we chose two Intel® processor-based platforms: a mini-PC, in this case the Intel® Next Unit of Computing (Intel® NUC), and an Open Pluggable Specification (OPS)-compliant media player. Both of these platforms are available with an Intel® Core™ vPro™ processor-based PC and can be networked to our existing enterprise collaboration back-end system.

The integrated graphics of the selected Intel® Core™ processors in these systems handle high-quality, high-frame-rate video, and high-definition audio. In keeping with our focus on natural, intuitive, and immersive user interfaces (touch, gesture, and voice), we eliminated any external interaction devices, such as keyboards, mice, or remote-control devices for both platforms. We focused instead on providing natural user interfaces including touch, gesture, and voice. We implemented these with peripherals such as touchscreens, cameras, and microphones.



The Intel® NUC combines cost-effectiveness, appliance-like reliability, and comprehensive management capabilities.

The Intel® NUC

Available through standard channels, Intel NUCs typically measure 4 inches by 4 inches, taking minimum space in a conference room. They are ideally suited for small spaces, such as behind a display. The Intel NUC combines cost-effectiveness, appliance-like reliability, and comprehensive management capabilities. By using Intel NUCs and touchscreens, we provide the performance of a full PC with touch-centric ease of use.

We find mini-PCs like the Intel NUC more versatile and readily available than a dedicated audio/video system. The Intel NUC's wireless capabilities enable us to minimize physical interfaces and cables. Less hardware and fewer components mean fewer devices to track, maintain, and potentially fix if they fail. Wireless connectivity enables convenient connections to room peripherals and participant devices.

In addition, we can provision an Intel NUC the way we would any corporate PC, using our existing tools and practices, including enterprise wireless configuration and credentials.

OPS-Compliant Media Players and Displays

OPS is an open standard that modularizes the integration of display panels and PC-based "media players." OPS-compliant displays have a built-in slot for the OPS-compliant media player. The player and the display connect through an 80-pin JAE connector that supports commonly used interfaces such as DisplayPort and USB. With displays that support OPS, the use of OPS players further reduces the need for cables. Same as the Intel NUC, the OPS media player PC can be provisioned and managed as any other standard vPro-enabled corporate PC.



Open Pluggable Specification-compliant media players are designed to be inserted in any OPS-compliant display. (Photo courtesy of NEXCOM)

Remote Management and Control

A component of Intel vPro technology, Intel® Active Management Technology² (Intel® AMT), enables remote power control, support, and software updates. Intel AMT includes keyboard, video, and mouse (KVM) remote control, allowing authorized Intel IT support staff in any part of the world to take control of the conference room PC to diagnose and repair problems even if the device is powered off or the operating system is unresponsive. We supplemented these abilities with an admin web portal that enables support staff to view all conference room deployments for status (in use or not in use), uptime, and other parameters.

We find that for a fleet of devices to scale and be cost-effective in our enterprise environment, extensive remote maintenance capabilities are essential. Centralized management and control enable us to proactively and cost-effectively maintain high availability of room resources and minimize calls to the Intel® help desk. Such manageability contributes to our ability to provide and maintain the improved user experiences that are a key goal of our next-generation conference rooms.

Software-Defined Infrastructure

A common concept in data center technology, SDI is part of the trend of software-based technologies that allow business operations to be more agile, scalable, extensible, and efficient. For our next-generation conference rooms, we applied a scaled-down SDI concept, creating a flexible platform to rapidly deliver services.

Instead of depending on function-specific devices and integrating them physically, software integration allows us to use a single software environment and support multiple supplier end-point collaboration software plug-ins that run on a single Intel vPro technology-based PC to enable our use cases. It also allows cross-supplier choice and operation for peripherals.

With our SDI implementation, we reuse existing client software and software development kits to create plug-ins for the software environment we created. The solution also enables us to support a flexible mix of internal and cloud back-end options.

To provide consistent customer experiences when interacting with multiple existing supplier back-ends (see Figure 2), we developed an integration framework as a plug-in architecture. This framework provides common look and feel in standard functions such as “click to join,” while enabling the specific “best of breed” conference experiences provided by the plug-ins.

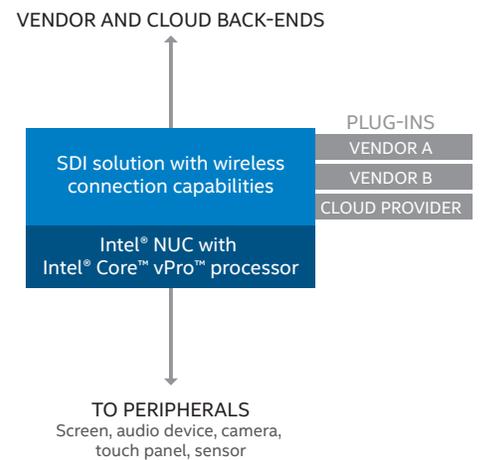


Figure 2. Our software-defined infrastructure (SDI) solution gives us a flexible platform for delivering conference room services and supporting a mix of internal and cloud back-end options.

² Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at [intel.com](https://www.intel.com).

Cost Savings

Cost is a significant consideration as we transform hundreds of conference rooms. Our SDI approach minimizes physical components and interfaces to significantly reduce equipment and setup costs. By combining all functionality into a single PC platform and using cross-supplier peripherals as needed, we realize the following benefits:

- Only one operating system to maintain, support, secure, and manage
- Vendor-independence for greater selection of back-end systems of which we can interface
- Lower peripheral costs compared to peripherals that require their own compute elements
- Reduced physical cabling complexity and costs through the use of wireless technologies
- Improved reliability and flexibility, as well as lower installation costs, by using software integration rather than hardware integration

We find the incremental cost of a software-based approach scales better than relying on hardware update cycles (Figure 3). The shorter and less expensive design cycles of software versus hardware help expedite the adoption of new features and capabilities. Additional savings come from our preference for off-the-shelf, open platforms and protocols, as well as standard PC-support channels, all of which offer significant savings.

Multitouch Interactive Whiteboards

Multitouch interactive whiteboards enable multiple participants at different locations to draw or write on the whiteboard simultaneously. This multitouch interactivity promotes better collaboration and creativity. Since the interactive whiteboard includes software running on the room PC, it is easy to capture and send the results to participants. This improves the ability for remote participants to follow whiteboard-aided discussions and frees them from having to take notes or photos of the whiteboard to preserve content.

Collaboration Software

Intel's IT solution includes SDI implementation, software integrations, the Intel NUC, as well as Intel® Unite™ software, which enables us to implement flexible combinations of collaboration services. These services can include wireless display, audio and videoconferencing, interactive whiteboards, data sharing, and other capabilities. Intel Unite software also helps us to address the three obstacles to meeting effectiveness and efficiency discussed earlier: slow meeting startups; challenges in achieving rich, immersive collaboration; and tasks requiring time-consuming manual activity.

Overall Cost of Components

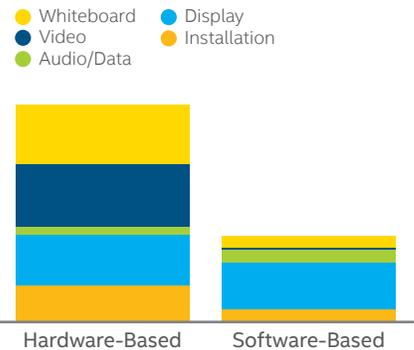


Figure 3. This graph compares the overall cost of each component. The incremental cost of a software-based approach scales better than relying on hardware update cycles.



A shared connection to the room's PC hub greatly accelerates meeting start time by making screen sharing and handover effortless and nearly instantaneous.

Faster Meeting Starts and Richer, More Immersive Collaboration

Forget dongles. A big advantage of Intel Unite software is its wireless display capability. All conference participants can connect to each other and conference room displays through this software running on the room's PC platform and the participants' devices. Presenters can easily share their screens on the room display as well as on the screens of remote participants. This shared connection to the room's PC hub greatly accelerates meeting start time by making screen sharing and handover effortless and nearly instantaneous.

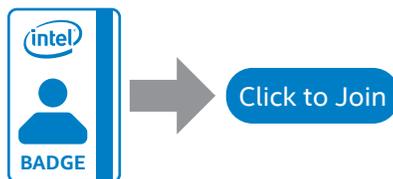
The collaboration solution is connected to the same back-end environment that hosts the room and remote participants' computers. Integrated microphones, speakers, and cameras enable a rich and immersive collaboration experience. Using the common connection, participants can share audio, video, data, application screens, and interactive whiteboard sessions through their usual enterprise collaboration software. The software's interface includes tools to give all participants equal ability to share and present on the room's display. Remote participants can also view content on the interactive whiteboard as well as sketch and write on the whiteboard as if they were in the room.

Making Conference Rooms Intelligent to Reduce Manual Work

Our Intel IT solution includes context-awareness capabilities. Sensors detect the presence of participants in the room and automatically activate the room's displays or projector to present instructions for using the system. Activation by sensors also helps conserve power and avoid screen burn-in or projector bulb burn-out.

The Intel IT solution enables in-room employee identification through a card reader for employee badges. A quick badge swipe tailors the conference experience to the participant, including mining meeting materials and providing a "click to join" experience across multiple conferencing back-ends. Remote employees also have an instant "click to join" feature that enables them to quickly join their in-room colleagues with the relevant materials.

As we move into our next wave of innovation, we are looking to significantly improve room intelligence by introducing more sensing and context awareness. These improvements will make user and device identification easier and enhance interactions between people, their compute devices, and the room's system. For this effort, we plan to integrate an open-source software stack currently in development by the Open Interconnect Consortium³. The goal of this stack is to enable free data flow between devices regardless of operating system, device type, or wireless communication technology.



Security and Privacy Protection

Designed and operated by Intel IT, our next-generation conference rooms conform to Intel IT security and privacy protection standards. We provide an appliance-like level of security through controls that lock the system from unauthorized or unexpected usage. We achieve this security level

³ For more information about the Open Interconnect Consortium, visit openinterconnect.org.

using a mix of our enterprise standard hardware and software controls. We complement these measures with additional dedicated controls designed for this use case.

For our security, we use Intel vPro technology’s security features. PCs using this technology integrate a combination of embedded technologies and hardware-based features designed to strengthen security and help us be more proactive and responsive to potential threats.

Pilot Studies

In the first half of 2015, we are performing two pilot studies of our next-generation conference rooms. The first pilot focuses on Intel Unite software for wirelessly connecting to existing room projectors and wall display panels. Along with these capabilities, a second, smaller pilot adds the multitouch interactive whiteboard and the audio and videoconferencing capabilities described in this paper.

- **Pilot 1.** This pilot includes about 100 conference rooms equipped with wireless display and participant sensing capabilities. This number will increase to about 350 when the first full version of Intel Unite software is available.
- **Pilot 2.** This pilot uses an IT extension of Intel Unite software. It starts with about 20 conference rooms and will increase up to 50, providing audio, videoconferencing, and multitouch interactive whiteboard services, as well as wireless display and participant sensing.

In the second half of 2015, we plan to perform a third pilot focusing on larger room systems, greater context awareness, and more advanced interactions with users and their devices.

Results

Initial results in the first two pilots of our next-generation conference rooms running Intel Unite software indicate success in two key areas: enhancing the conference room experience for users and demonstrating the value of the technology from an IT perspective.

User Experience

Pilot 1

A key success metric was the increased use of Intel Unite software over time (shown in Figure 4). Of the survey respondents who tested the wireless display and participant/device sensing capabilities using an Intel NUC as the conference room PC, 89 percent said they would recommend the solution to others. On a seven-point scale, 75 percent gave the wireless display capabilities a five or higher rating (Figure 5).

Use of Intel® Unite™ Software



Figure 4. Employees' use of Intel Unite software increased week-over-week.

User Ratings of Wireless Display Capabilities

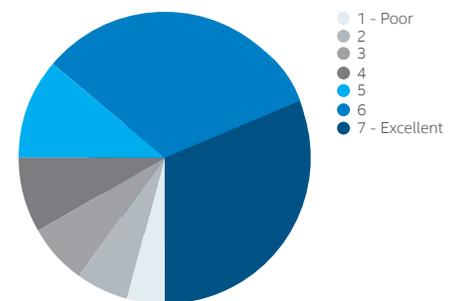


Figure 5. On a seven-point scale, 75 percent of users gave the wireless display capabilities a five or higher.

Pilot 2

Feedback from the second pilot is still coming in. Initial results show that employees like the badge swipe for identification and the “click to join” experience. Demonstrators of the technology reported that badge swipes enabled meetings to start in only a few seconds. Users like having video-collaboration capabilities that did not exist before. So far, there has not been enough interaction with the multitouch interactive whiteboard to gather significant feedback from users, but the employees who have used it report that it is a valuable resource.

IT Experience

Our pilots demonstrate that a cost-effective SDI solution running on standard hardware scales easily and is more flexible and readily available than vendor-specific display, audio, and video solutions.

These pilots demonstrated that a Windows*-based PC solution can be secured to the highest level, properly locked down, and patched to meet all our enterprise security requirements. In manageability, we used Intel AMT’s utility for remote support, including diagnosis and resolution, using the existing Intel vPro technology already available in our business mobile PCs and in many Intel Core processor-based computing devices. From a support perspective, we have not experienced any cases that required physical interaction from an onsite technician.

Conclusion

Our pilot studies demonstrate the value that Intel IT’s next-generation vPro-enabled mini-PC-based conference rooms can contribute to our workplace transformation initiative by improving the conference experience. We found that conference rooms running Intel Unite software enable us to deliver the following improvements:

- Faster meeting starts
- More-effective use of room resources
- Improved collaboration by all participants, including those attending remotely
- Enhanced employee productivity through greater room intelligence

By using an SDI approach that enables software integration on a single Intel vPro technology-based platform, our solution enables us



Field Report: IT Israel in Action

During the second pilot a support team in Israel received an automated alert indicating that two remote machines in the U.S. did not send their “keep alive” message after hours in the U.S. and were down. An Israeli engineer connected remotely to these machines using Intel AMT and found that a misconfigured UEFI (BIOS) setting had caused these machines to remain off after a power outage. The engineer remotely fixed the UEFI setting and brought the machines back online before people returned to the office. As a result, no users were affected by this outage. Standard software-based remote admin tools would not have been able to provide the necessary remote access since they require an operating system to be online to connect with the remote devices.

to avoid supplier lock-in and inexpensively add new collaboration technologies in the future. Through remote-management and security features, we see the potential for a lower TCO while delivering valuable protection for Intel intellectual property and confidential information.

In the near future, we plan to expand our vision for next-generation conference rooms, offering more ways to provide contextual assistance. We anticipate implementing next-generation conference rooms in Intel campuses around the world starting later in 2015. In the next couple of years, we plan for this solution to become the new standard for conference rooms at Intel.

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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.

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