FROM THE BACKROOM TO THE BOARDROOM

IT Propels Intel Business Value

2015–2016 INTEL IT ANNUAL PERFORMANCE REPORT

FROM THE BACKROOM TO THE BOARDROOM:

IT Propels Intel to Insight and Excellence

Welcome to the Intel IT Annual Performance Report. In the last 12 months, we have seen massive amounts of disruptive change driven by technology. Business is different and has forever changed. Nowadays every business is a technology business, where data is the key asset and services drive monetization. As industries completely reinvent themselves, leading companies are effectively exploiting technology to transform markets, relationships and processes. With the number of connected devices projected to grow from 15 billion to 200 billion by 2020, enterprise IT shops have more opportunity than ever before to influence how companies will innovate through technology. This edition highlights technology trends driving rapid innovation across our enterprise. Take a look at how Intel IT is capitalizing on new technology to create business value and be a catalyst for organizational transformation. For us, moving from the backroom to the boardroom is placing Intel IT at the heart of business success, and enabling the right level of oversight and governance as we focus on security and protecting our assets. This increased responsibility comes with opportunity to provide thought leadership on key strategic decisions that generate new streams of business value.

In order to accelerate growth, trust by our business partners is essential and is earned through ongoing operational excellence in the backroom. Aligning to the goals of the business, Intel IT creates strategic investment plans that are achieving desired business results and revealing new opportunities to increase business value. These opportunities are providing Intel IT a voice with the business, transforming how they work while achieving the main objective – driving growth for Intel.

From productivity solutions, to the rapid digitization of business and an increasing focus on cybersecurity, Intel IT shares insights that are driving growth and innovation for Intel. Looking ahead, I see extraordinary opportunities for IT leaders in every industry to contribute their unique point of view, in the backroom and the boardroom. We invite you to take a look inside this report at how Intel IT is seizing new opportunities to meet ever-changing market demands around the world. See how we are doing it with our partners. Please share your insights and reactions with me on Linkedin.com/in/kimsstevenson, and on intel.com/IT.

Kim Stevenson, Intel Chief Information Officer

Table of Contents

INTEL: FROM THE BACKROOM TO THE BOARDROOM

Balancing Growth with Budget Demands, While Creating Business Value

Intel IT successfully supports 104,820 **employees** at **153 Intel sites** in **72 countries** with our **71 IT sites** and **6,319 IT employees**

TOP 100
#81 Ranked Fastest Supercomputer Globally

EQUIPPING OUR EMPLOYEES FOR PRODUCTIVITY

149,632 MOBILE PCs
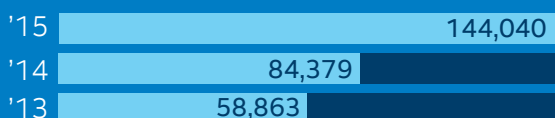
50,100 SMART PHONES

15,355 DESKTOP PCs

4,800 TABLETS

DOUBLING STORAGE CAPACITY

'15	143 PB
'14	106 PB
'13	72 PB

IT SPENDING PER EMPLOYEE IN USD*
Goal 12,900

* '13/'14 were restated to include IT spending in wholly owned subsidiaries that have since been integrated.

'15	13,000
'14	13,500
'13	13,600

DRIVING DATA CENTER EFFICIENCY
# of servers running in our data centers

'15	144,040
'14	84,379
'13	58,863

% OF IT SPENDING AGAINST REVENUE*
Goal 2.4%

'15	2.5
'14	2.6
'13	2.7

Productivity

500+ INNOVATIVE WIRELESS CONFERENCE ROOMS
Effective meetings made easy

3-4 WEEK IMPROVEMENT
Time for product qualification reduced using the cloud

MOBILE APPS DEVELOPED
Putting technology at the point of attack to a mobile workforce

'15	238
'14	164
'13	57

Digitization

USD 800 MILLION
Efficiency and cost savings contribute big business value for Intel

JUST DAYS
Interconnected datasets reduced insight latency from months to days

25–30%
Faster product design cycle by optimizing global server capacity

Cybersecurity

225 MILLION
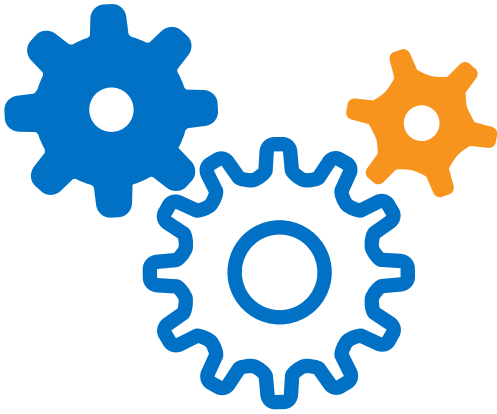Blocked malware to **protect** against attacks

13 BILLION
Security events logged per day to **detect** threats

12.2 MILLION
Security events remediated to **correct** vulnerabilities

BUILDING A BETTER WAY TO WORK

Harvesting Innovations to Elevate Productivity

Like most global companies with employees and customers around the world, we are presented with the challenge to elevate productivity in a way that is easy, secure, and wireless. Innovation that pulls together our global network of employees, partners, and resources to drive collaboration and productivity remains a business priority at Intel. Intel IT, through advances in conferencing capabilities and collaborative product validation and testing solutions, has earned the trust of the business by delivering services that remove barriers to achieving strategic business goals. Across the enterprise, Intel IT embeds in the business units and participates in boardroom conversations to contribute technology expertise that drives strategic direction for Intel and builds a better way to work together.

Share

Meetings Made Easy

Innovative technology solutions within highly-visible areas of our workplace, such as conference rooms, yields positive employee feedback and boosts Intel IT's perception internally. Employee collaboration across the globe plays a vital role in Intel's ability to innovate quickly and respond to marketplace opportunities. Solutions that enable fast, easy, wireless, and secure collaboration are in high demand. To that end, Intel IT influenced an innovative collaboration capability with enterprise-class security, remote manageability, and improved total cost of ownership (TCO) that enables professionals to easily initiate and conduct meetings.

Wired connections and multiple adapters delay information sharing in conference rooms and require significant overhead to maintain. To enable an increasingly mobile workforce as well as enhance collaboration and productivity, meeting initiation and operation must accommodate an environment that includes always-on information access, flexible working styles, and multiple types of mobile devices. To support greater velocity, we created an entirely new model for Intel conference rooms. Our collaboration technology uses manageable, secure hubs, and the new Intel® Unite™ software as the "PC in the room" to allow conference participants to easily 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. Plug-ins for existing collaboration applications enable vendor independence for greater selection, customization, and future-proofing. In its fullest implementation, this solution enhances global collaboration by bringing data, audio, and videoconferencing together in a secure environment. This will allow participants to wirelessly share room resources, like displays and multi-touch interactive whiteboards.

Our conferencing program demonstrates that a cost-effective SDI framework running on standard hardware scales easily, and is more flexible and readily available than vendor-specific display, audio, and video solutions. We found that a Microsoft* Windows-based PC solution can be secured to the highest level, properly locked down, and patched to meet all our enterprise security requirements. For manageability, we incorporated the Intel® Active Management (AMT) utility for remote support, using existing Intel® vPro™ technology already available in many of our business computing devices.

From a support perspective, we have not experienced any cases that required physical interaction from an on-site technician. Through remote management and security features, we see the potential for a lower total cost of ownership (TCO) while delivering valuable protection for Intel intellectual property and confidential information.

Meeting start times have gone from several minutes to just seconds, accelerating the time to productivity for meeting participants. In fact, 89 percent of survey respondents said they would recommend this solution to others. Based on this success, we now implement these new conference rooms on Intel campuses around the world with a vision to expand our ability to provide contextual assistance just around the corner. Conference room innovation continues to remain as a big opportunity for IT to contribute to employee productivity and collaboration. By enabling creative solutions in highly-visible aspects of our workplace, employees win, IT wins, and CIOs win by emulating these concepts within IT shops around the globe.

500+ INNOVATIVE WIRELESS CONFERENCE ROOMS

Effective meetings made easy

JUST SECONDS MEETING START TIME

Reduction in meeting start times from several minutes to just seconds

89% WOULD RECOMMEND

Conference room users said they would recommend our conferencing solution to others

Using the Cloud to Extend Test Capabilities and Accelerate Product Cycles

Product leadership in any industry means bringing quality products to market ahead of the competition. Coordinating the product validation process across the many players involved in releasing a new product can be challenging. Lengthy validation cycles can delay time to market. With our product acceleration program, Intel IT applied cutting-edge technologies to extend emerging cloud technologies and marry them with hardware and software to create an end-to-end global validation capability. By doing so, Intel IT removed the barriers from the "as is" state to enable testing extended screen scenarios not possible before. Bringing together different business groups and companies in a collaborative environment where they can work faster to accelerate product time to market transforms our business.

This "always connected" validation environment gives validation and design engineers on-demand, real-time access to validation platforms. Product development teams use various validation engines to test product quality before releasing them to the market. Previously, expensive emulator resources were hosted locally with individual development teams. Intel IT collaborated with the design teams to deliver these as pooled and shared resources in the Intel cloud. This allows optimal sharing and the ability to meet demand spikes across multiple product development teams. As a result, validation throughput time (TPT) improves.

With the introduction of iLab, Intel IT created an innovative solution that puts the testing lab in the cloud. Using iLab the enterprise can create complex validation environments in minutes rather than days or weeks. Intel IT deployed a virtual infrastructure and combined it with physical lab systems under test to create an on-demand global validation cloud. Engineers from anywhere in the world can access and collaborate in real-time to reduce time to find and resolve issues, and improve the overall time to validate and release products.

Intel IT expanded this concept to include device manufacturers and other external partners. Starting with the desired outcome to shave three to four weeks off the product certification process, we created an out-of-the-box solution enabling Intel's Client Computing Group and Intel IT to work in real time with the device manufacturers and Microsoft to reduce product validation TPT. This process contributed to the ability for Intel's Client Computing Group to achieve aggressive tablet sales goals, while protecting proprietary information for Intel and our partners. Based on the proven success from collaborating, Microsoft and Intel expanded to also have a point of presence at Microsoft's lab in Redmond. The two teams can now work as a single validation and debug group to further reduce product time to market.

Intel IT deployed a virtual infrastructure and combined it with physical lab systems under test to create an on-demand global validation cloud.

3-4 WEEK IMPROVEMENT

Three to four week improvement in product qualification TPT

REVOLUTIONIZING IT SERVICE DELIVERY THROUGH "ONE IT"

IT departments in any organization need to know the business to align goals, establish a foundation for service excellence, and foster an environment for trusted collaboration. Intel IT takes this alignment seriously and has created a culture of "One IT" as a result. One IT addresses accountability to the deliverables with the highest business value and establishes efficiency through single points of contact. Time to market acceleration across platforms, education and communication, and platform cost reduction are key outcomes of One IT. We orchestrate One IT through assigning IT business relationship managers (BRM) to each business unit. BRMs become knowledgeable in the business strategies and influence IT to align priorities accordingly. As an example, Intel IT assigned a BRM to Intel's Federal business unit leading to a significant improvement in Partnership Excellence scores, receiving perfect scores across the board. Solving business problems together builds trust in the backroom and increases the opportunity for IT to gain a seat at the boardroom table. This provides solutions that help deliver our corporate goals.

## Intel IT's Role in Improving Intel Product Quality

The consumerization of wireless computing products becomes increasingly important in the enterprise environment. Intel's customers expect their wireless infrastructures to support their personal devices across multiple access points. Moreover, these wireless infrastructures need compatibility with multiple devices and connectivity protocols. Complex computing environments and manual in-house testing can lengthen product release cycles. Intel IT has the capability to help our business units meet market demands by acting as early adopters and testers of new Intel wireless products.

A strategic partnership between IT, the Intel Wireless Connectivity Solutions (WCS) group, and the Intel Internet of Things (IoT) group drives productivity and streamlines maintenance for wireless client health through automated in-house testing. This collaboration drives timely, real-world insights to WCS and IoT that leads to higher product quality and faster time to market.

Manual testing processes that once consumed 60 minutes to identify and analyze each bug in the system now take only about 5 minutes with automated in-house testing. That translates to a savings of 37,500 engineer hours saved per 1,000 users. In the first six months using the automated testing system, we resolved more than 30 issues, which equates to a savings of nearly USD 128,000 that we would have spent on recreating conditions to cause and debug issues. Information visualization from multiple data sources allows for better prioritization and timely resolution of high-impact problems.

Success with improving wireless client health and the product release cycle for Intel wireless products prompted us to initiate partnerships with other product development groups. As we expand the initiative, we will consider complexities such as cross-product impacts on users and multiple configuration subsets. Automated in-house testing provides a real world environment offering insights not possible in a controlled test lab.

IT Leadership Pyramid

Business Transformation

Business Value

Operational Excellence
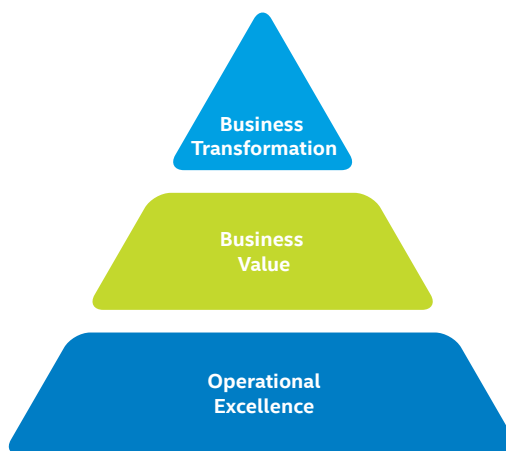
Programs like One IT build a strong foundation of service delivery
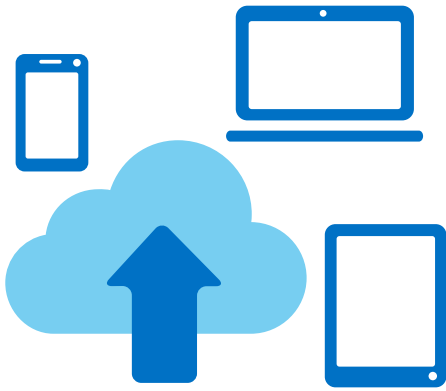
TRANSFORMING THE DIGITAL ENTERPRISE

Advancing Solutions to Sense and Respond to Market Needs

In response to the continual pressure for faster time to market, Intel IT makes investments in multiple big data analytics technologies to drive an integrated, cost-effective approach to business intelligence (BI). For Intel, the steep ramp in chip design complexity provides a challenge and an opportunity to use analytics to expedite our time to market. We continue to evolve how we gather, ingest, transform, compute, and render data to advance our ability to sense and respond to market and partner needs. Intel IT uses technologies that reduce cost, optimize equipment utilization, increase data center performance, and deliver high-value strategic insight through advanced analytics. A cultural transformation takes place across our company as we embrace the power from advanced analytics, and work with our business partners developing strategic investment plans to enable their vision. Advanced analytics reveal timely opportunities for sales and marketing as they personalize the customer experience and maximize our investments in marketing automation and customer relationship management (CRM). Using enhanced sensory capability and large-scale data analysis, manufacturing can harness large volumes of real-time data to increase factory efficiency. In-memory processing provides predictive analytics capability, creating millions in inventory savings. Globally recognized for speed and efficiency, our data centers thrive at the heart of Intel's ability to get products to market faster. Intel IT, through proven expertise delivering on business priorities, brings strategic value to the boardroom conversations in our business groups and reveals opportunities across functional boundaries to propel the business forward.

Share

Faster Decision Making with Interconnected Data

The ability to make better, faster decisions starts with the business need. This is only fully realized through a cultural transformation when business partners, working alongside IT, embrace the power of analytics. Together, the Sales and Marketing Group (SMG) and IT teams utilized the disruption from advanced analytics in a way that created millions in revenue generation, productivity, and efficiency for Intel.

Across the sales and marketing pipeline, advanced analytics solutions connect data to maximize our investments in marketing automation and customer relationship management (CRM). Data analytics projects, using an integrated analytics platform that connects disparate datasets with a data lake model, have saved an estimated USD 170,000 per quarter. We have realized, through a USD 576,000 design win, how interconnected marketing and sales datasets reveal opportunities that extend our reach in the channel and lead to final sales through design wins.

To effectively and affordably manage a growing and more complex set of channel customers, SMG and IT created a predictive analytics solution, SMART, to extend Intel's reach, relationship, and revenue in the channel. The SMART application uses advanced analytics and machine learning capabilities to recommend strategies for optimized campaigns that allow our sales teams and resellers to target the right customers with the right products. This effort has increased revenue by USD 175 million over the last two years. To increase design win revenue, our cloud CRM transformation uses descriptive analytics where our sales teams can now learn from opportunity losses. Our sales teams can apply that knowledge to tailor sales methods that drive future wins. Interconnected data enables analytics insight to improve account segmentation leading to improved engagements with customers on content that matters to them. Further insights, derived via text mining from community blogs, help resolve customer support issues faster, increasing customer loyalty, and generating productivity savings for our customer service representatives.

With traditional business intelligence (BI) data warehousing, we spent 70 percent of our time defining schema prior to data ingestion and then performing extract-transform-load (ETL) processes to deliver data to business users. In fact, we found that it took approximately three headcount and six weeks to add a single attribute to our data collection and distribution process. With the Integrated Analytics Hub (IAH) platform, we utilize dynamic schema evolution, and it now costs zero headcount and zero weeks for us to ingest an additional attribute for an existing data source. The business value multiplies as IAH ingests sales and marketing data in various formats from more than 140,000 sources. IAH transforms how we do business by providing self-service BI to Intel's sales and marketing organizations, reducing insight latency from months to days—often just 24 hours. IAH supports accessibility across multiple BI front-end tools, addressing a business imperative that allows users to work in their favorite tools when consuming data. Self-service visualization, reports, and dashboards speed the time to discovery.

50% LESS TIME REQUIRED

Time to align data definitions and model data for complex queries, after implementing IAH

MONTHS TO DAYS IAH REDUCES LATENCY

IAH reduces insight latency from months to days—often just 24 hours
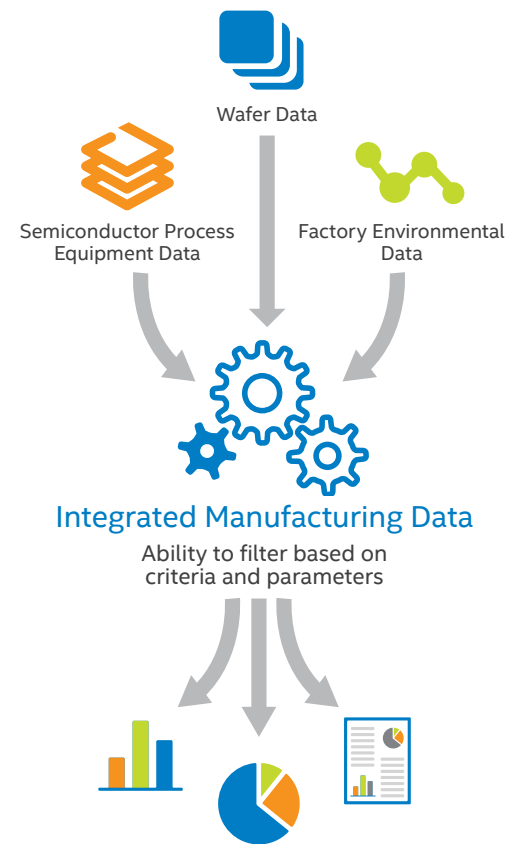
$ USD 170,000 SAVINGS PER QUARTER

Marketing digital media expenditures using IAH

Unleashing the Potential of Data to Improve Manufacturing

For decades, Intel's factory system continues to achieve more and more computing functionality at increasingly lower unit cost. Intel's Manufacturing IT engineers utilize the sensory capacity in the Internet of Things (IoT), together with large-scale data analysis, to continue Moore's law delivering faster, smaller, more affordable products to market. Coordinating global manufacturing operations, collecting and integrating data, and adapting analytic methods to cope with exploding data volumes creates significant business value. Manufacturing IT helps prioritize factory decisions that deliver the greatest return on investment for Intel. The factories' IT engineers realize the value of IoT and large-scale data analytics in three ways: analyzing large volumes of data, identifying the most useful data, and reporting that data in a way that meets the needs and expectation for process engineers, yield engineers, and factory managers.

With sensor data collected from the equipment in each factory, the Manufacturing IT data analysis team developed a tool able to process over five billion points per day of sensor data. This tool detects faults and delivers visual HTML-based reports to any platform, anywhere, to help factory engineers distinguish between critical errors and noncritical errors. HTML5 supports point-and-click access to information—the most popular way for users to select and manipulate content. Advanced analytics reports identify opportunities to make meaningful improvements within the manufacturing line. Instead of looking at thousands of graphs to manually identify manufacturing issues, factory engineers have the data analyzed and automatically prioritized. This increases efficiency and speeds resolution of high priority manufacturing issues that impact equipment availability and yields. With this tools-based approach, factory engineers and managers can now perform analyses that used to take 4 hours in just 30 seconds. Furthermore, through advanced analytics and long-range planning, Intel IT contributes business value to the factory planning process through "what-if" modeling capabilities, helping decrease wafer production time. This capability is expected to save 160 hours per quarter and reduce spending by approximately USD 100 million through 2017.

The IoT fuels exponential growth in potentially useful data. Harnessing large data volumes to gain actionable manufacturing insight creates business value for the factory and is a competitive advantage for Intel. By continually enhancing Intel's IoT sensory capacity, Intel IT drives analytics ever closer to the edge, speeding time to insight and delivering millions in cost savings. IT, together with manufacturing, continues on pace to deliver a manufacturing environment in which every sensor wirelessly connects to the network, and the analysis tool uses edge analytics to find impending equipment failures and automate factory maintenance as well as inventory management processes.

Wafer Data

Semiconductor Process Equipment Data

Factory Environmental Data

Integrated Manufacturing Data
Ability to filter based on criteria and parameters

30 SECOND ANALYSES

Factory engineers and managers can perform analyses that used to take 4 hours in just 30 seconds

Accelerating Decision Making with In-Memory Processing

In this fast-paced business world, making rapid, data-driven decisions remains crucial to keeping a competitive edge. Intel, like most companies, needs cost-effective, meaningful, real-time data that can drive faster, better business decisions.

Intel IT deployed an in-memory data processing platform to consolidate, simplify, and deliver significant efficiencies across the enterprise application and business intelligence (BI) landscapes. In-memory processing provides real-time predictive business analytics that enable immediate response to market adjustments, delivering millions in inventory savings. Inventory optimization is expected to achieve USD 37 million in savings over 2015–2016. We also anticipate reducing the number of people required to manage data processing by 45 percent, enabling these employees to focus on using real-time data in innovative ways across the enterprise.

A Deeper Look at In-Memory Processing

Intel IT's in-memory data platform combines database software with pre-tuned Intel® Xeon® processor E7 v3 servers, storage, and networking hardware. Analytics, spatial processing, and stream processing run in a single environment. The platform can help accelerate business intelligence, anticipate future opportunities and risks, and swiftly react to business change.

The platform operates completely in-memory compared to traditional databases, which store data on disk. In-memory data is accessed and calculated more quickly since it does not have to be reloaded or rewritten. The memory capacity of the Intel® Xeon® E7 family servers, with 72 cores (18 cores in a 4 socket server), can support 1.5 TB of memory per socket, which translates to an astounding 252 billion row scans per second and 900 – 1,080 million aggregations per second. That, quite literally, drives scanning at the speed of light. With the Intel® Xeon® E7 family servers and the in-memory data platform, we found transaction processing and data could be analyzed nearly as fast as the users and devices generated that data.

The first Intel IT implementation of in-memory processing addresses traditional supply chain management (SCM) limitations—multiple data hops, data latency, and siloed information that requires data reconciliation and offers only hindsight business intelligence. This solution is transforming SCM at Intel across the board by offering an opportunity to converge towards a single, end-to-end SCM solution that increases efficiencies in finance analytics, supply chain planning, and business warehouse data processing. Our planned SCM landscape, using the new in-memory data platform, will feature real-time business intelligence and well-connected applications.

Key Results with In-Memory Processing

- 63 percent reduction in database size
- 40 percent faster processing chains
- 24 percent reduction in key business application runtimes
- 24 percent average decrease in runtime of batch jobs
- 62 percent overall faster data warehouse queries
- 47 percent reduction of average response time for top ten transactions

Inventory optimization is expected to achieve USD 37 million in 2015–2016.

45% FEWER RESOURCES NEEDED

Fewer resources needed to manage data processing

Taking High Performance Computing to the Next Level

Designing Intel microprocessors is extremely compute intensive and demand is growing for each generation of silicon process technology. Intel IT adopted high-performance computing (HPC) to address this very large computational scale and realized astonishing improvements in computing performance, reliability, and cost. Since deployment, our HPC environment has supported over a 90x increase in compute demand with more than a 64x increase in stability.

As part of our effort to transform data centers to achieve these significant business results, Intel IT used design best practices to convert two vacant silicon-wafer-fabrication building modules into extremely energy-efficient, high-density, 5+ MW data centers. We equipped each data center with its own unique design and cooling technologies. These data centers operate at the lowest cost per kilowatt (kW) and are designed to be environmentally sustainable through creative use of unused building space and prevailing site environmental conditions. Higher cooling and electrical densities enable us to support the large growth in compute demand associated with electronic design automation tools, while delivering high performance for application needs. Our newly designed water-cooled data center has a total power capacity of all the existing high-density and Intel legacy data centers combined.

The Santa Clara data center, using free-air cooling, saves 44 million gallons of water per year that would otherwise be needed to keep the servers cool and yields an annual savings of more than 10 million kilowatt hours of power. This data center houses the No. 81 system on the TOP500 list of the world's most powerful supercomputers, and operates at an average Power Usage Effectiveness (PUE) of 1.06 PUE. The industry average is 1.80 PUE. With an industry leading server rack density of 43kW per rack, the 60,000 Intel Xeon processor-based servers installed in these new facilities offer 51 percent higher performance per core than previous models, which enables us to significantly increase compute density.

Intel IT runs the Santa Clara data center, dedicated mainly to chip design, at an extremely high server utilization rate—over 90 percent. This utilization rate becomes possible through an investment in software that queues computing workloads to release into the computing environment when server capacity is available. Maximizing every computing workload eliminates the need to build in extra capacity for when traffic unexpectedly peaks.

Five generations of HPC at Intel have successfully enabled continually more complex Intel silicon tape-out, reducing tape-out time from 25 days to less than 10 days. Intel silicon products taped-out with HPC1 alone, delivered a return on investment of USD 44.72 million. The success of HPC to get new products into production at a market-driven pace starts with aligning technology with business requirements, and acting as a single team to take informed risks and collective responsibility for disciplined execution.

1.06 POWER USAGE EFFECTIVENESS

Energy-saving data center design leads to lower operation costs

130,000+ XEON SERVERS

With 1,000,000+ Cores and a 25 percent year-over-year compute growth, see how Intel IT keeps up with demand

70 MW IN 2018 LOAD POWER

Intel IT Data Center's load power is predicted to be 70 MW by 2018, as compared to 43.5 MW today

Accelerating Time to Market with High-Performance Computing and Advanced Analytics

In today's competitive landscape, our business remains under pressure to deliver differentiated, cost-competitive new products to market faster. Market leadership belongs to those who outpace competitors with products that customers want, offered at the right price. Intel IT contributes significant business value by delivering computing platforms and solutions that accelerate the product development cycle as much as 15 weeks.

To achieve continually faster time to market (TTM) improvements, given the ever-growing complexities in Intel silicon design, Intel IT provides a global framework for parallel hardware and software design of numerous System on a Chip (SoC) platforms and IP blocks. Intel-based storage, infrastructure components, and computing capabilities deliver a reliable, scalable, high-performance computing (HPC) environment that increases capability approximately 25 percent year-over-year.

Matching single-socket servers and highly scalable server configurations in our data centers yields 25 to 30 percent faster product design and architecture validation processes. By leveraging a global emulation framework pooling compute capacity of over 120,000 servers at multiple sites around the world, our design HUB provides burst capacity and delivers optimal memory and compute capability in a shorter amount of time. Machine learning and predictive analytics drive optimization of test cases to reduce total test effort while maintaining optimal test coverage and quality. Parallel design and testing of SoC hardware and required software makes it possible to catch 15 to 20 percent of bugs early in the product development cycle for improved product quality that eliminates the need for redesign and assures platform readiness.

Working in tandem with product development teams, Intel IT brings insight and actionable intelligence to the table via real-time data analytics, and informed business decision processes that speed time to market. In 2014, Intel IT, in collaboration with key design and manufacturing teams, reduced Intel's silicon product TTM by 12 weeks. In 2015, after doubling the number of project development teams inviting us to collaborate, we achieved over 15 weeks TTM improvement for a major new design project. Excellence in executing solutions that bring data driven insight has earned Intel IT a seat at the boardroom table with our business partners across the enterprise. From that perspective, in partnership with the strategic product development team, Intel IT internalizes the goals of the team to continue expanding our menu of solutions that drive velocity in the business.

The pace with new product development drives ever-increasing compute demand with High-Performance Computing capability increasing ≈25% per year.

25-30% FASTER ⏻
DESIGN CYCLE

Optimizing computing workload with server capacity yields 25 to 30 percent faster product development cycle

MAXIMIZING THE VALUE TO COST RATIO FOR STORAGE DEVICES

Intel IT has Intel® Solid State Drives (SSDs) fully deployed throughout our client environment and they are being adopted at an accelerating pace in our data centers. Reliability, security, and performance remain well known attributes of Intel® SSDs but, looking deeper, we found Intel® SSDs had a larger impact than initially expected. Intel® SSDs simply provide a better computing experience for employees, contributing to higher employee satisfaction with the devices provided by IT. Examples include faster boot time, smoother multi-tasking, and the ability to analyze larger data sets due to the increased IO performance of Intel® SSDs. Our service desk has fewer service requests with SSDs, when contrasted to Hard Disk Drives (HDDs), due to an 8x reduction in drive failures. The security benefits of Intel® SSDs include immediate data encryption going from hours to minutes, and manageability across a diverse ecosystem from a single administrative console with McAfee ePO. On the server side, SSDs are increasingly used in our HPC environment for electronic design automation (EDA), delivering cost reductions and increased capacity. We use a single SSD, rather than dual mirrored HDDs, in our virtualized servers for local storage. Because SSD technology improves both performance and TCO in many applications, we are actively evaluating new opportunities to take advantage of SSDs in our highly diverse data center environment.

Increasing Agility and Cost Efficiency through Software-Defined Infrastructure

CIOs face continual challenges to reduce capital expenditure, improve IT efficiency and service quality, and increase the IT-provided service flexibility and agility. Intel IT evolves toward software-defined infrastructure (SDI) to increase agility and cost efficiency and better serve our business groups across the compute, networking, and storage environments.

Our SDI journey began with software-defined compute (SDC), moving from a proprietary fixed-function RISC Unix* compute environment to an agile Intel® architecture and Linux* compute environment. Within the first five years, accumulated capital expenditure savings attributable to this conversion had reached USD1.4 billion. Server segmentation further enables automation of computing workloads in line with the critical business functions of Design, Office, Manufacturing, and Enterprise (DOME).

To further our vision, we work on software-defined networking (SDN) and software-defined storage (SDS). SDN helps increase the business value of the virtual machines in our data centers by reducing network-provisioning time from days to minutes and simplifying network creation through task automation in a self-service environment. We transitioned our network from proprietary to commodity hardware, resulting in a cost reduction of more than 50 percent. Intel IT helps to develop enterprise-class open-standards-based SDN controllers. Open-source switch software is a priority for advancing SDN cost savings and management efficiency. While we began to test open source SDN software in a pilot environment, we continue to multisource OEMs until commodity hardware and software with acceptable enterprise-class support is available.

The final data center environment to evolve toward SDI is storage. SDS will help us automate routine tasks and move from a proprietary hardware-software integrated appliance model to a standards-based decoupled hardware-software model. In the early stages of our SDS evolution, our pilot for shared file storage achieved a 50 percent reduction in equipment costs compared to using proprietary equipment, without any decrease in performance.

SDI transforms our data centers into consolidated, energy-efficient facilities containing open standards-based, agile, and cost-effective systems that support the business need of Intel's critical business functions: DOME.

SDI Maturity in Data Center Environments

Storage
Network
Compute

Fully Mature
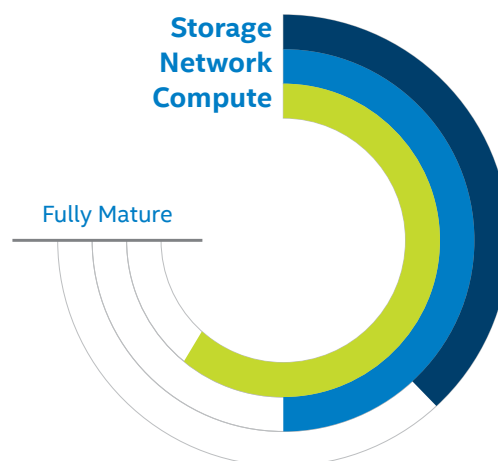
SECURING
THE FUTURE

Taking an Integrated Approach to Enterprise Security

Cyber Insecurity is now the new norm. Security threats continue to increase at an exponential rate across all industries, breaking records in the number of breaches and records exposed. Intel Security's McAfee Labs 2016 Threat Predictions reports a predicted 1 billion more users, 2.6 billion additional smartphone connections, and 8.1 billion more IP-connected devices by 2019. Coupled with this massive explosion of potential targets, we continue to see an increase in the level of malware sophistication and attack methods intended to bypass security defenses.

Cybersecurity can no longer remain just an IT issue. It is an enterprise-wide risk management issue. The heightened value of data to a variety of threat actors requires cyber risk management at every level of the business, up to the board level. Intel IT's board conversation starts with our information security strategy. Our strategy is based on three pillars: an architecture we can trust, employee security training and awareness, and agility to meet the needs of the business.

CYBERSECURITY

Share

Targeted Threats Require Advanced Security Defenses

Cyber threats can be described as falling into one of two categories: traditional threats, such as malware and their variants, and the extremely sophisticated Advanced Persistent Threats (APTs). Developing and maintaining strong security defenses, using a combination of technology, tools, and processes, is required to defend against the majority of attacks. This year Intel IT's security infrastructure blocked 225 million malware events, logged over 13 billion security events per day, and applied 12.2 million system patches. We also patch web services, lockout users after multiple failed login attempts, filter mail attachments, inspect documents going to and from the cloud, continually update anti-virus software, and more.
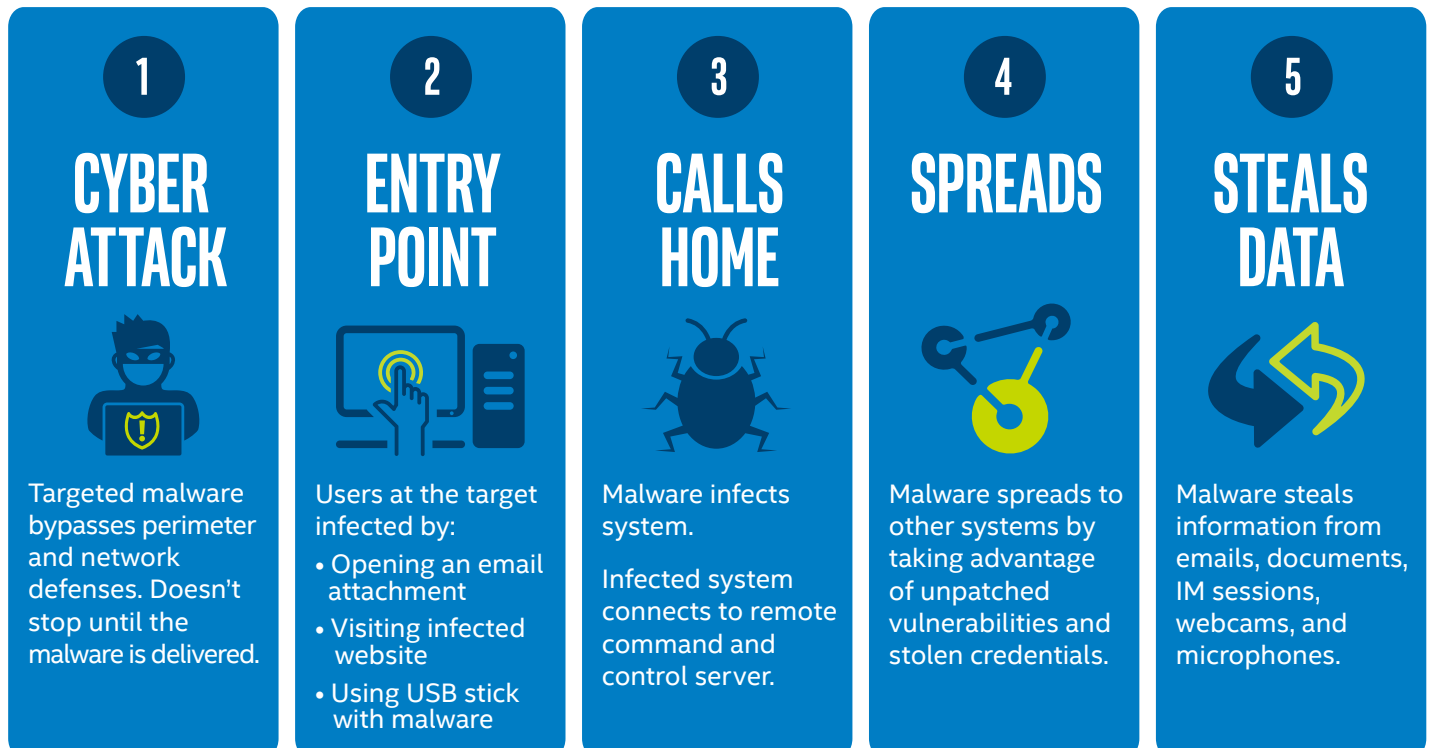
Intel IT thinks of traditional threats as the 99 percent we can defend against with a trusted security architecture. A robust security architecture allows us to focus our resources on the remaining 1 percent - the sophisticated and continually evolving APTs. These APTs are typically a set of orchestrated and continuous hacking processes using custom malicious code, targeting particular companies, user data, or intellectual property. In addition, these advanced threats by design leave no tracks, and may not be detected for many days, or even months.

As new attack methods increase in sophistication, so must our approach to defend against these threat actors. We proactively hunt for targeted, sophisticated threats using new technologies, processes, and skill sets. We expanded our monitoring capabilities across the enterprise and enhanced our incident response and investigation capabilities. We use threat intelligence and indicators of compromise from both internal and external sources. Sharing threat intelligence with public and private parties, combined with behavioral analytics, enables faster identification and response to complex and well-hidden threats.

PROTECT

CORRECT   DETECT

Resilience requires a balance of security capabilities

Anatomy of an Advanced Threat

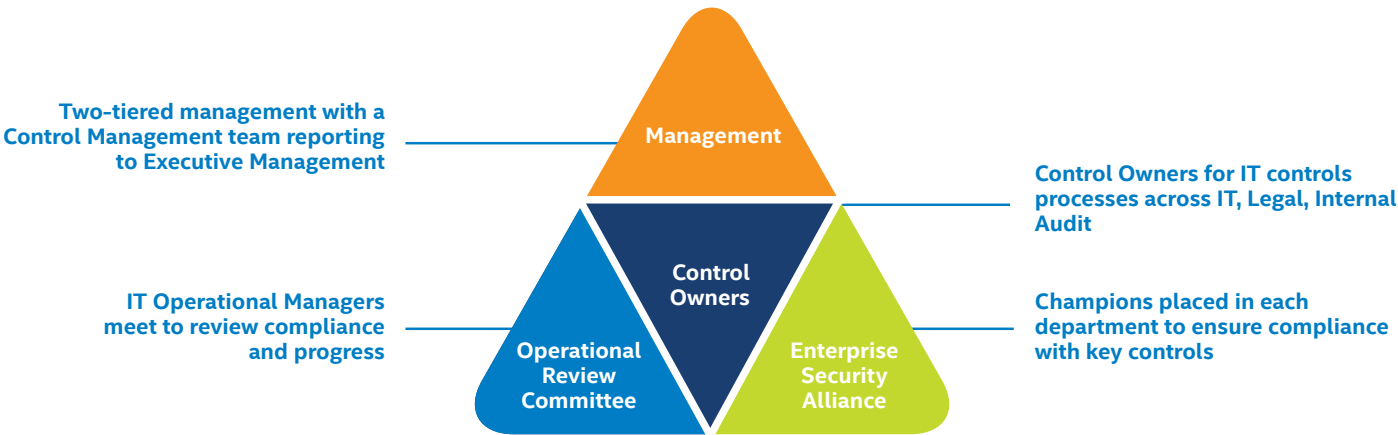| 1 CYBER ATTACK	2 ENTRY POINT	3 CALLS HOME	4 SPREADS	5 STEALS DATA
Targeted malware bypasses perimeter and network defenses. Doesn't stop until the malware is delivered.	Users at the target infected by: • Opening an email attachment • Visiting infected website • Using USB stick with malware	Malware infects system. Infected system connects to remote command and control server.	Malware spreads to other systems by taking advantage of unpatched vulnerabilities and stolen credentials.	Malware steals information from emails, documents, IM sessions, webcams, and microphones.

The Human Defense Perimeter

Enhancing security architecture, proactively hunting for advanced malware, and sharing threat information does not address the risk associated with unknowing employees. The Verizon 2015 Data Breach Investigation Report calls out that 90 percent of all data breaches are caused by individuals, through both intentional and unintentional activities. Attackers often enter an organization's network through spear phishing and social engineering campaigns that uncover user passwords.

Embedding cybersecurity knowledge and diligence in our culture is a foundational element to any cybersecurity strategy, and making security awareness meaningful to individuals is the key. Intel is a global company with many types of products and services, and a diverse set of employees spanning several generations. Each employee population learns differently and requires varying approaches to engage and understand security's value. Intel's Security Awareness offerings cater to these varying needs by providing fun and creative means to continuously engage our employees. Some examples involve monthly newsletters, executive interviews, collaborative community discussions, videos, games, and contests. Training is designed to be simple and tailored to the job role of the employee. Intel IT shares security operations metrics, threat intelligence trends, and case studies that employees can relate to and incorporate within their organizations. We go a step further by educating our employees on how to extend these learnings into their personal life, along with tips, articles, and blogs that can be shared with family and friends. All of these techniques help protect us from falling prey to bad actors; adding another protection in our multi-layered security approach.

Our security professionals also speak in ways our business partners can understand. We clearly articulate the value of security. What does the security control protect? Why does it matter? What is the end user's role? It is imperative to communicate how embedding security controls protects users, data, and intellectual property for the company. Our security professionals learn how risk profiles vary across business units and service organizations. Then they form a partnership with each business unit to develop the appropriate balance of risk and security controls. This is where a structured information security governance framework becomes critical. Our governance structure enables strategic information security alignment to business strategy, a standardized risk management approach, consistent understanding of security knowledge, and appropriate information security investments to support organizational priorities.

> Security education and awareness never stops. Training and awareness campaigns, conducted in partnership with business units, make security relevant to everyone.

Achieve Governance through Partnership

Two-tiered management with a Control Management team reporting to Executive Management — Management

Control Owners for IT controls processes across IT, Legal, Internal Audit

IT Operational Managers meet to review compliance and progress — Operational Review Committee

Control Owners

Enterprise Security Alliance

Champions placed in each department to ensure compliance with key controls

We're making it safe to "go fast" when adopting new SaaS solutions.

Security is an imperative regardless of which model you use to deliver cloud services

Business Agility - Securing the Cloud

Balancing security in the organization's critical assets while empowering the business to keep pace with market-leading innovation is a universal concern for corporate leadership. The Intel workplace is dynamic, with a highly mobile workforce rapidly adopting new technologies. Our employees expect the organization to support new devices and applications for the enterprise. Many technical innovations and business practices that enhance productivity and increase profitability can also pose security challenges. Cloud computing is a great example. Business oriented cloud offerings became the new normal. Applications, data, and devices that were once primarily on the corporate network and data center now live in the cloud. The cloud becomes another attack vector we need to protect by extending our security controls.

Software-as-a-service (SaaS) applications provide efficiency and agility, cost savings, and enhanced collaboration, especially with suppliers and customers. To support our business demand for SaaS applications Intel IT must take a balanced risk approach. To that end, we developed best practices that help protect Intel's intellectual property by focusing on security controls in three primary areas of risk:

Identity and access management controls. A combination of several controls helps ensure that SaaS applications are accessed by the appropriate users in the appropriate computing environment.

Application and data controls. Data encryption and tokenization help protect the data, while data loss prevention techniques help keep sensitive information from leaving the Intel premises. Application controls register applications and emulate code auditing through our supplier assessment or by third-party validation.

Logging and monitoring controls. We use our security intelligence infrastructure and advanced analytics to log, monitor, alert, and respond to information security violations. Actionable alerts are sent to our IT security information and event management system for incident response and remediation purposes.

Intel IT constantly reevaluates providers and controls because the public cloud, especially the SaaS ecosystem, constantly evolves. Continuous, short review cycles of the SaaS landscape reveal security solutions to enhance access controls, data protection and encryption, and device posture.

Looking Ahead

As technologies become smarter and more connected and the aforementioned 1 percent creates more and more risk, the explosion of data will continue to escalate cybersecurity threats. Cybercrime becomes so easy that even criminals who don't have software programming skills, can now purchase attack toolkits and reap the rewards. The toolkits are readily available, inexpensive, and advanced enough to evade detection. The initial cybercrime investment is low, and the payoff can be in the millions. Advanced attacks will increase in sophistication with cybercriminals tailoring their attack to penetrate the network, often switching ports, reducing traces left on infected systems, and remaining undetected for long periods of time while they target and steal intellectual property. Knowing our organization's high value assets, where they reside, how they are accessed, and who has access is foundational. With this knowledge, Intel IT makes ongoing investments in monitoring, threat intelligence, end user training, and proactive threat response to improve resiliency in today's insecure cyber world.
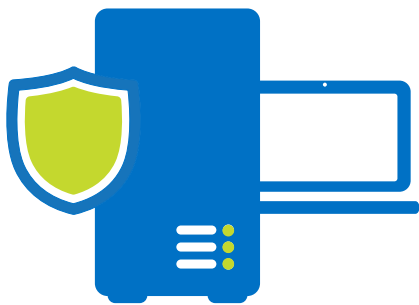
IN CONCLUSION

The Journey Ahead

The massive changing rate across all industries creates an insatiable need for IT innovation. At Intel, IT must deliver on the promise to bring big business value and rapid year-over-year growth for Intel. With a focus on customer needs and market trends, Intel IT enables the business to capitalize on market opportunities while simultaneously maximizing value through cost savings. Having earned business trust, Intel IT continues to have a growing presence in the boardroom to influence strategic investments that make it possible for IT to:

Grow the business through digitization. Intel IT rapidly grows its strategic investments in digitization as a matter of competitive advantage. Using machine learning and analytics, we improve sensory capacities to deliver meaningful customer insights. From 2014 to 2015, these insights gained Intel USD 175 million in revenue and brought critical innovation to the customer experience. It's no wonder that over half of IT industry spending in the next five years will be tied to digital experiences and over two-thirds of CEOs of Global 2000 enterprises see digital as a core part of their corporate strategy. (IDC)

FUTURE

Share

Operate with velocity to drive business value. Intel IT supports the business by increasing operational performance and leading in continuous improvement. In 2015, cloud computing efforts have allowed for 25 to 30 percent faster product design through optimized global server capacity, and placed critical systems into the hands of our engineers from anywhere on the planet. We are a living example of why, over the next 3 years, 60 to 70 percent of industry spending in software, services, and technology will be cloud-based. (IDC)

Make protecting our assets our no.1 priority. Intel IT works cross-functionally to build and grow a trusted security architecture. We take an active role in enlisting employees and partners to be trusted assets in an ever-increasing threat landscape, and work with agility to proactively protect the business. Across any industry, cybersecurity is a hot topic. Nearly 8 out of 10 boards of directors are concerned with cybersecurity. (ISACA and RSA)

These areas in strategic investment for Intel IT represent great change for Intel. Change that led to advancements in brand reputation, supplier relationships, factory optimization, market leadership in data center performance, and much more.

Top IDC predictions for the coming year underscore the importance for Intel IT leadership to continue advancing digital transformation in our business. The top 20 companies in every industry will be disrupted by digitally transformed competitors, costing them revenue growth, margin, market share, and stunted supply and distribution networks – and Intel IT plans to stay ahead of the disruption.

As Intel IT pursues innovations to meet our business needs, we will share them to help you formulate ideas for building a boardroom conversation of your own. We look forward to learning from your experiences and challenges, too.

What's the big thing for next year?

In a word - SCALE. Massive flipping of the switch in the next few years on the path to Digital Transformation (DX).

FOLLOW ME

on **Linkedin.com/in/ kimsstevenson** and join the journey taking IT from the backroom to the boardroom.

FOR MORE INFORMATION
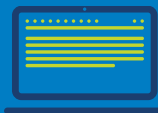
on Intel IT best practices, visit **intel.com/IT**

RECEIVE ADVICE

Receive objective and personalized advice from unbiased professionals at **advisors.intel.com**. Fill out a simple form and one of our experienced experts will contact you within 5 business days.

ADDITIONAL RESOURCES

Take Action and Learn More about Intel IT Innovation

Conference Room Collaboration Using Intel® vPro™ Technology

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Delivering Strategic Business Value with Automated In-House Testing

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How Intel IT's Integrated Analytics Platform Helps Sales and Marketing

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Joining IoT with Advanced Data Analytics to Improve Manufacturing Results

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Integrating IoT Sensor Technology into the Enterprise

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Optimizing Intel's Supply Chain with an In-Memory Data Platform

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Extremely Energy-Efficient, High-Density Data Centers

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How Software-Defined Infrastructure Evolves at Intel

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Adopting Software-Defined Networking in the Enterprise

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A Field Guide to Insider Threat

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SaaS Security Best Practices: Minimizing Risk in the Cloud

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