# The New CIO Agenda

Innovation Strategies for the
Cloud-Enabled Enterprise

intel ®

# Contents

# Editor's Note:
# The New CIO Agenda



When Intel published its first "New CIO Agenda" in 2011, most CIOs saw cloud as a promising way to streamline the data center and reduce operations costs. Skeptics were struggling to separate cloud hype from genuine potential.

Today, leading CIOs are deeply involved in cloud implementation, applying cloud-based innovation to transform the enterprise and provide strategic differentiation. Using public, private, or hybrid clouds, infrastructure as a service (IaaS), software as a service (SaaS), or a combination of these cloud-service models, CIOs are reshaping their IT shops into engines for service delivery.

Cloud services provide the means to manage the challenges and take advantage of the opportunities presented by big data, consumerization, and other mega-forces. Cloud services can help you deliver business value, whether you're the CIO of a company, government agency, healthcare delivery network, university system, global nonprofit, or some other organization.

This edition of the "New CIO Agenda" offers guidance to advance your cloud innovation strategies. In preparing for this issue, our team fanned out across Intel, gleaning insights from executives, technologists, and visionaries who are driving current and future solutions. We talked with Intel's own IT leaders and reached beyond Intel to include stories of how other organizations are moving forward. In this issue, we discuss:

- **The changing landscape.** What trends and issues are shaping cloud services and transforming IT? How does Intel's CIO view the opportunities?

- **End-to-end strategies.** From the data center to the consumer-influenced employee, how do you build a secure foundation for cloud-based innovation? What technologies can help?

- **Innovation in action.** How are healthcare leaders using cloud services to improve care and drive medical advances? What innovations is Intel IT focusing on? How does the safety science company, UL, utilize consumer-influenced client strategies to benefit their business, IT, and employees?

- **Accelerating the future.** What Intel research will drive the next generation of cloud-based innovation?

Cloud services are the future of enterprise IT and critical enablers of competitive advantage. We hope this publication provides practical information about current strategies, future directions, and ways to thrive—to help you make the most of the new CIO agenda.

— Billy Cox

General Manager, Service Assurance Management, Datacenter Software Division, Intel Corporation

"The lines between IT and the business are blurring. More and more, IT *is* the business. That phrase used to be solely reserved for tech companies like Google and Yahoo, but that's no longer the case. When I talk to CIOs I say, 'Your job is not to keep the business running, or to partner with the business. You *are* the business.' "

*— Kim Stevenson*
*CIO, Intel Corporation*

# Tectonic Shifts in a Changing Landscape

**IT Innovation Drives Enterprise Success. Are You Ready?**

It's a new world. From big data to social computing, large-scale forces have altered the landscape on which enterprises and IT organizations operate. Increasingly, IT-enabled innovation—delivered through agile cloud services to customers, employees, and business partners—is a source of business differentiation, competitive advantage, and mission success.

Cloud services are at the heart of the transformation. In a universe of technology-driven change and billions of connected lives, cloud services are how people and businesses engage, and cloud strategies are the catalyst of enterprise transformation.

Cloud-based innovation gives CIOs new opportunities to advance the enterprise and create business value. Through strategic cloud services, CIOs can change the scale of what the enterprise achieves, who it reaches, and how fast it operates. They can lead their companies in transforming processes and forging new relationships, moving toward a real-time, data-driven enterprise that provides instant responsiveness and personalized productivity.

Cloud is one of several interconnected mega-forces reshaping the landscape, and an important way to capture value from the pervasive forces of ubiquitous technology, big data analytics, consumerization, and social computing. Enterprise cloud strategies must encompass these forces as well as address the number one threat to cloud adoption: security.

## Ubiquitous Technology

Technology is central to all of our lives, and it plays a bigger role in every aspect of businesses. Mobility and constant connectivity are the norm, not the exception. Consumers use a growing variety of devices to connect, work, and play. Connected, embedded technologies are proliferating, creating the Internet of Things.

In the enterprise, desktop and laptop PCs are being supplemented with new form factors that bring security and management challenges but offer fresh ways to optimize productivity and deliver services. By 2015, Intel expects more than 3 billion connected users and 15 billion connected devices will be driving more than 1,500 exabytes of cloud traffic.[1]

Having billions of connected devices shifts the scale of enterprise computing. Through cloud services, businesses can reinvent the customer experience, interacting with customers everywhere from smart cars to social media channels. Cloud services can take advantage of increasingly powerful end-point devices and use advanced interface capabilities such as interactive perception and augmented reality. They also bring additional sources of data into the enterprise for smarter, faster decision making.

## Big Data Analytics

Big data is a result of supply meeting demand. Businesses have long amassed more data than they could use, and the growth of unstructured data from sources such as social media feeds and call center logs are adding to the flood. With billions of connected users, information flows faster, and trends can emerge and decline more quickly. The sensor-based devices that comprise the Internet of Things—from smartphone cameras to factory-floor robots to radio-frequency identification (RFID) tags in shipping containers—bring yet more data streams.

Advances in platform architectures and distributed analytics frameworks make it practical and affordable to extract actionable information from the new data sources—and do it with increasing speed. Traditional batch data processing

**The number of connected devices will grow 150% by 2015.[2]**

**90% of the data in the world today was created in the last two years.[3]**

**Only 11% of organizations have a procedure and policy for managing unstructured data in place.[3]**

can become near-real-time analysis of incoming data feeds, turning data into a revenue opportunity and a source of competitive advantage. Cloud infrastructure must scale to keep pace.

## Consumerization

Rapid innovation in the consumer space sets the pace for enterprise IT. Employees want greater choice in devices, with the same convenience and flexibility at work that they have at home and on the go. Business units are quick to consume external services if IT can't meet their expectations for speed, cost, and flexibility. Supply chain collaborators expect fast, frictionless interactions.

The upside for IT lies in harnessing consumer-side advances to improve employee productivity while meeting enterprise requirements for security and manageability. Modern device options can deliver personalized productivity and meet user-centric workflow needs. Well-designed bring-your-own-device (BYOD) models, crowdsourced technical support, and app store-based software distribution are among the options that deliver value for end users, IT, or both.

## Social Computing

Cloud-based social media services further accelerate the pace of change and bring new ways to learn about and deliver value to customers. Social tools, tailored to enterprise needs, offer powerful, cost-effective, and easy-to-deploy ways to improve collaboration, increase business efficiency, and streamline IT processes.

## Security

With threats rising in number, variety, and sophistication, security is a major concern. Leading CIOs are combining comprehensive policies, end-to-end security architecture, and multi-layer approaches to deliver appropriate security for cloud services without creating hardships for employees and customers.

In the data center, the dynamic perimeter of cloud computing exposes more systems to outside threats, but is offset in part by hardware-enhanced security technologies that help increase protection. On the client side, cloud-based approaches such as client-hosted virtualization can use hardware-enhanced security and local device performance to increase protection while keeping employees productive.

Context-aware services can apply varying forms of security, offering flexible access depending on the user's device, status, and environment at the time of access.

## IT at an Inflection Point

Cloud services are the key to navigating the shifting landscape and taking full advantage of its possibilities. To realize the potential, CIOs must lead IT through its own transformation. IT's traditional focus on control must expand to include a parallel emphasis on the agility and speed needed for delivering IT as a service. Flat budgets must stretch to cover new initiatives.

This transformation requires new skills and attitudes. It calls for deeper engagement with business issues and more collaborative relationships with business teams and employees. This shift also requires aligning your IT organization around business objectives.

In short, this transformation means getting ready: creating a secure scalable infrastructure, streamlined processes, and a culture committed to innovation, so your IT organization can collaborate strategically with the business to turn possibilities into reality.

## Disruptive Technologies

Intel experts expect the following technologies to have a disruptive impact in the coming year and beyond. Look for ways to apply them to your cloud services and IT environment.

### SSDs for Servers

Enterprise-class server SSDs, engineered to sustain the heavy demands of data intensive workloads, can increase application performance and reliability while reducing power consumption, floor space, and costs.

### Apache Hadoop* Software

The Hadoop framework makes it feasible to perform large-scale, distributed analysis of unstructured data. It is disruptive already, and is maturing rapidly with the introduction of comprehensive, off-the-shelf solutions that offer increased management and operations support.

### HTML5

This new paradigm for standards-based web development raises the bar for the web experience. Start adding it to your application development portfolio, and plan for its impact on your users and infrastructure.

### Business Intelligence (BI) for Security

Real-time, proactive analysis of data from routers, event logs, and other machine data can search for indicators of fraudulent activity, providing new ways to forestall threats or respond to them faster.

### Software-Defined Networking (SDN)

By abstracting the network control plane from the physical elements of the network, SDN dramatically increases the network's agility and scalability.

### High-Temperature Operation

New technologies and approaches, from processor silicon to industry energy initiatives, will enable data centers to operate at higher ambient temperatures and reduce energy use and power costs.

# Seizing the Opportunities:
# Q & A with Intel CIO Kim Stevenson

**Intel CIO Kim Stevenson embraces technologies and strategies that drive bottom-line and top-line results. Stevenson joined Intel in 2009 as vice president of Global IT Operations and Services and became the company's CIO in February 2012.**

"The single biggest problem many IT organizations have is that the business moves faster than IT. IT is all about speed and about helping the business move faster, so IT can't just work harder—we have to work differently in order to move that fast."

*— Kim Stevenson*
*CIO, Intel Corporation*

### How is the CIO's job changing?

We're at an enormous inflection point in our industry. It's creating tremendous opportunities for CIOs to add more value to their company, whether it's reinventing the cost structure by using cloud-based solutions or growing your business because you can be more nimble than your competition through automation. We have the opportunity to drive our businesses to levels never before achieved because we have the fundamentals of big data, cloud, social, and other new capabilities at our disposal.

The lines between IT and the business are blurring. More and more, IT *is* the business. That phrase used to be solely reserved for tech companies like Google and Yahoo, but that's no longer the case. When I talk to CIOs I say, "Your job is not to keep the business running or to partner with the business. You *are* the business."

Our IT organizations have to embed with the business; The business comes up with the rules and objectives, and IT determines how you make it happen and monitor the progress.

### How does a CIO do that?

You start with a business problem and a clear understanding of your business. You have to know the economics of the business you're in and then decide where that drives you. So a company that's growing may react differently to certain situations than a financially challenged company would. That's always been true, but the options are different now for what CIOs can bring to the table.

### What are some of those options?

Start by looking at consumerization. Most innovation today happens in the consumer market, because that market is big and profitable. Those of us in enterprise IT apply the big innovations. We don't invent or create them.

So as a CIO, you accept that consumerization has happened, and it's probably never going back because the business economics are pretty attractive. So let's figure out how to bring the consumer set of services into the enterprise, either by developing your own Dropbox* or your own Skype*, or by finding somebody that does an enterprise-capable version of it. That's a huge shift, and it's very different today from what it was just a few years ago.

We're seeing similar changes around cloud. Outsourcing used to mean 5- to 10-year contracts. You owned me, and it was expensive. Now, I can go to Amazon and in the same day I can be up and running. If I don't want to be there anymore, I tell them, and in 30 days, I'm done.

The agility and flexibility you have today is so much greater than you've ever had. It gives you the ability to experiment, to handle bursting, and to be much more responsive to your business.

My contention is the single biggest problem many IT organizations have is that the business moves faster than IT. IT is all about speed and about helping the business move faster, so IT can't just work harder—we have to work differently in order to move that fast.

### What if the culture doesn't welcome IT's involvement in this collaborative way?

If the business units don't accept IT as a partner, it's almost always driven by a lack of a successful track record. So you build the track record.

Think about it in terms of moving up the relationship model with your business unit colleagues. The bottom of the relationship model is: Keep the business running. Do new projects that the business units ask you to do; that's your reason to exist.

If you're embedded in the business, you become more relevant, and you get a license to influence inside the organization. At that level, you're listening to their business problems and offering IT solutions that help solve them. You're influencing and collaborating and adding

incremental value, but it's still not enough because most businesses need real transformation.

The pinnacle is to move up to that transformation space. You help the business do what they think is impossible. As an IT organization, you can't live on the expectations of your business. You have to build on the expectations of the business by bringing them new ways to think of what they're trying to accomplish. You understand strategically where they're going, and ask questions like: In an ideal world, what would you do? In an ideal world, what would have to be true for this to happen?

Then put some smart IT people on with business people guiding them, and they'll figure it out. As that happens, IT becomes more and more relevant to the business. You get to be in the inner sanctum.

*Kim Stevenson*
*CIO, Intel Corporation*

# Laying the Foundation for Transformative Cloud Services

### Cloud Services Framework

Cloud success comes from deploying the right blend of internal and external services to create technology-enabled differentiation. To support this blend of services, your strategies and tactics should flow from a comprehensive framework. Intel's vision is that this framework should drive toward a federated, automated cloud environment with client-aware services.

Cloud-based innovation can start with small but critical projects that deliver compelling return on investment (ROI), build expertise, and establish credibility. As your cloud services portfolio expands, you'll need to systematically map your plan for public, private, and hybrid clouds.

Business needs, ROI analysis, security needs, and regulatory requirements should all factor into the decisions.

Core competencies and sources of competitive advantage should remain on secure private clouds, so you retain IT expertise and can innovate quickly in areas that are critical to the business. Commodity functions are candidates for SaaS solutions, either deployed internally or acquired through enterprise-focused service providers. This hybrid approach helps you move quickly and generate savings to fund disruptive business innovation. Your cloud mapping may also identify services you can offer externally to generate additional revenues.

### Cloud-Capable Workforce

The rapid pace of innovation can produce skills shortages, but the shifting landscape also creates opportunities to nurture new talents and competencies, starting with the CIO's own expanding role. Today's CIO may be teaming with the chief marketing officer to deliver innovative customer experiences or brokering a complex web of service provider relationships, among other new responsibilities.

Additional IT leadership positions are emerging. For example, the need to derive business value from data analytics is making the roles of data wranglers and data scientists a top priority, with some organizations establishing the position of a chief data officer. Similarly,
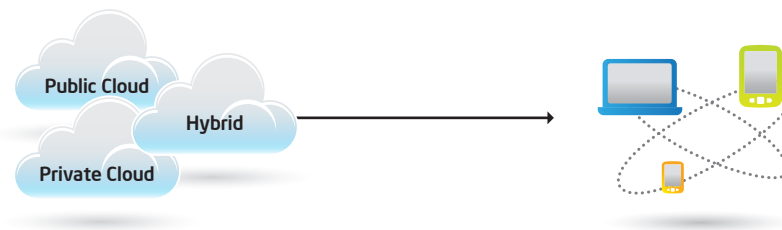
**Automation**
Scalable scheduling and management capabilities enable services and resources to be specified, located, and securely provisioned with little or no human intervention

**Federated Environment**
Allows for secure sharing of communications, data, and services across interoperable private and public clouds

**Client-Aware Services**
Can detect and utilize a device's capabilities to deliver an outstanding user experience anywhere, anytime

Public Cloud · Hybrid · Private Cloud

"Don't become complacent and think the big advances have already been made. We're going to see enormous improvements in server management, energy efficiency, and performance. You need to continue to refresh your infrastructure and tools to take advantage of these advances."

*– Phillip Gibbons, Intel Principal Investigator,*
*Intel Science and Technology Center for Cloud Computing*

chief information security officers and enterprise security architects play critical roles in designing end-to-end security frameworks and policies.

Traditional IT positions are also evolving. As your innovation strategies change, you may find it effective to move staff away from traditional silos of servers, networks, and storage, and instead emphasize broader disciplines such as cloud engineering, cloud system administration, and services brokering. Software developers may need new skill sets to build fault-resilient applications for a hybrid cloud environment, work with open source technologies, and create context-aware services for a range of devices, hardware platforms, and service providers.

New collaboration tools and development processes can help CIOs make the most of skilled resources, but for most IT shops, workforce retraining is an essential part of the transition to differentiated cloud services. Above all, a culture that promotes possibility thinking and continuous learning can empower IT organizations and enterprises.

## Agile Data Center: Building on Platform Innovation

To handle the growth of data, devices, and services, scale must extend across all dimensions: servers, storage, networks, power, security, and manageability.

Moore's Law continues to deliver CPU and server performance for scalable cloud services. Advances enabled by Moore's Law also support platform innovations such as cost-saving power management technologies. These advances also turn servers into vital elements of the security solution stack, with hardware-enhanced capabilities that reduce data loss, guard against hidden malware, and support other security tasks.

New processor and platform architectures give IT organizations greater flexibility in matching infrastructure to cloud service requirements. Options range from efficient, high-performance processors optimized for a range of cloud workloads, to micro-servers that increase rack-level density and reduce power consumption.

Big data workloads can take advantage of platform advances and frameworks that improve processing data from embedded systems, such as point-of-sale (POS) terminals, digital signage, and surveillance cameras used in retail chains. These frameworks make it easier to bring this data into manageable, distributed cloud environments where it can be analyzed, integrated, managed, and incorporated into cloud services.

To reduce total cost of ownership (TCO) and avoid fragmentation, you'll want to deploy these heterogeneous technologies within a unified architectural framework. This lets your organization benefit from specialization while maintaining a consistent, manageable IT environment and enhancing business agility.

Also effective are policies that favor open industry standards, giving you greater agility and a broader range of choices as you combine internal cloud-based innovation with the best available external services. In addition, because they draw from a larger developer base, standards-based solutions provide rapid innovation, which can help you create differentiated services.

## Storage and Network Modernization

Storage and network growth have reached crisis proportions within many organizations, and the demands keep rising. Cisco predicts that global data center traffic will grow fourfold by 2016, to a total of 6.6 zettabytes.[4] Cloud traffic is the fastest-growing component, and three-fourths of the traffic results from data exchanges and requests within the data center.

With server virtualization well underway at most enterprises, the next step is modernizing and virtualizing the network and storage infrastructure. Traditional storage solutions lack the performance and flexibility to handle growing cloud and big data storage requirements. Legacy networks are ill-equipped to accommodate the I/O growth generated by cloud services, distributed analytics, greater virtual machine (VM) density, and other factors.

By implementing policies that support storage and network modernization and virtualization, CIOs can reduce costs, floor space, and energy requirements in the data center while gaining the speed, flexibility,

**IT professionals' three greatest security concerns with private cloud computing relate to the need for greater control and visibility. 63% were concerned about the availability of controls to ensure access to corporate data and services is provided only to authorized users. 61% were concerned about lack of visibility and control over cloud resources. 60% were concerned about adequate firewalling.[5]**

**60%**
Adequate firewalling

**61%**
No visibility into abstracted resources

**63%**
Access control availability
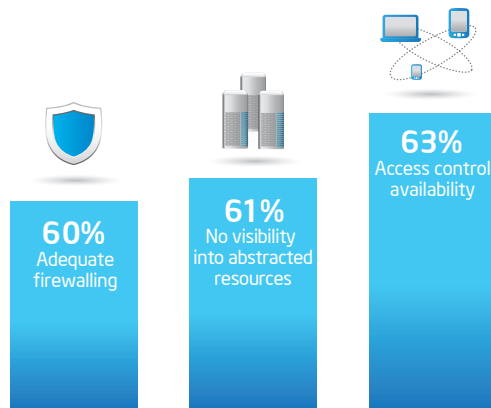
*"'See my audit results' is not an acceptable answer to security questions. Look for a service provider who can show you right now that they are secure. If they can do a real-time health check and confidently attest to real-time integrity, that goes a long way toward telling you that they're committed to leadership on security."*

*— Greg Brown*
*Vice President and Chief Technology Officer,*
*Cloud and Data Center Solutions, McAfee*

and scalability for cloud workloads. Tiered storage architectures, which combine traditional storage-area networks (SANs) and mass storage with scale-out storage platforms and server-attached solid-state drives (SSDs) for performance-sensitive databases and applications, help balance cost with flexibility.

Modern storage controllers need more intelligence to support advanced management techniques such as thin provisioning and storage reduction techniques such as compression and data de-duplication. These approaches make it feasible to scale capacity on demand and help reduce storage management costs. Scale-out storage also supports the big data trend of distributing server and storage capacity to the edge of the enterprise, so data can be processed where it originates or when it arrives at the enterprise.

Network strategies for cloud infrastructure start with upgrading and standardizing both LAN and storage traffic on high-bandwidth, industry-standard technologies such as 10 Gigabit Ethernet or Fibre Channel over Ethernet (FCoE). A unified high-bandwidth fabric simplifies the environment, delivers balanced high performance for cloud services, and reduces both hardware and operations costs. Network virtualization and software-defined networking further advance the network fabric. With the ability to

manage and control more network functions by using software, these approaches can increase agility, provide the scale for rising data volumes, and help drive down costs even more.

## Security and Manageability

Planning for cloud infrastructure and services provides an opportunity to reexamine security from every angle, strengthening both cloud and non-cloud security. CIOs should take a holistic approach that avoids traditional silos in favor of end-to-end, multi-layered methods. Policies, technologies, and controls should encompass data, applications, services, end-point devices, and all aspects of infrastructure. To reflect business needs, approaches should balance proactive security with critical needs for flexibility and productivity, and should include plans for rapid responses.

Given the diversity of the threats and the variety of attack points, the solutions to cloud security are highly varied. CIOs should establish security as a factor in purchase decisions throughout the solution stack, and create a flexible security architecture that can adapt to the ongoing evolution of hosts, services, enterprise requirements, and threats. Standards-based approaches, such as those being developed through the Open Data Center Alliance (ODCA) and the Cloud Security Alliance (CSA), can help build an open, flexible security architecture.

A growing trend is moving security functions into the hardware, where attacks are more difficult to carry out. Hardware-based solutions can:

- Speed encryption of data that resides or moves in public or private clouds or on client devices.

- Establish trusted server pools to run sensitive workloads.

- Demonstrate that host software has not been compromised.

In using external cloud platforms and services, lack of transparency becomes a security concern in its own right. CIOs must work with service providers to retain the visibility, control, and audit capabilities the enterprise needs. The goal should be full transparency, with the same real-time, granular control of cloud workloads, security, and TCO that IT teams have within their enterprises. This degree of control is critical for effective management and meeting compliance requirements. Leading cloud service providers are able to demonstrate real-time integrity, showing that they are using the latest hardware-enhanced security technologies to strengthen their security portfolio.

## Client Strategies for Personal Productivity

Consumerization is pressuring IT organizations to rethink their client computing strategies. Today's tech-savvy employees aren't content with one-size-fits-all enterprise

clients or policies that restrict access to personal services. If IT is slow to provide the desired capabilities, employees find their own solutions, adding management challenges and security risks.

Yet consumerization also provides significant opportunities for innovation to enhance employee satisfaction, streamline business processes, and increase both IT and end-user productivity. Cloud services, as part of effective client strategies, can help CIOs achieve these benefits while minimizing the management and security downsides.

### User-Centered Policies

Effective client strategies start with recognizing that consumerization goes beyond BYOD. This requires a user-centered approach that keeps employees productive on both employee-owned and employer-provided devices. Your goal should be to give employees flexibility to access enterprise resources from multiple devices as well as to access personal cloud solutions from the enterprise platform.

User-centered strategies place less emphasis on devices and more on enlisting employees as collaborators—both to educate them on enterprise needs and to understand their goals and concerns. For optimal productivity, the user experience should be front and center, with a robust segmentation model that aligns devices and form factors with

users and their tasks. Device choices and methods of client virtualization should use local performance to optimize the user experience.

### Client Security and Management

Security and management must evolve to meet the needs of a diverse, mobile workforce. Client-centered virtualization can help by providing centralized management and data isolation. This approach is particularly powerful when paired with hardware-enhanced solutions for security, management, and virtualization. Client strategies may also protect corporate data by allowing different levels of access depending on the user's device and location.

Having a solid strategy and a scalable approach to device management is a necessity in a diverse client environment. Built-in anti-theft technologies can further secure a mobile environment, for example, by automatically disabling a device that meets policy-based indicators of possible theft.

### Context-Aware Development

Cloud services and applications should be optimized for users and their environments. Context-aware cloud services and applications can increase satisfaction by customizing experiences for the user's device capabilities, network connections, and personal preferences rather than delivering one-size-fits-all experiences. Context-sensitive security can offer greater information access to employees

in secure environments. In addition, as smartphones, tablets, and embedded devices become increasingly powerful, context-awareness services can use them to perform analytics and other processing "at the edge," on the devices themselves.

### Social Tools for the Enterprise

Innovations from the consumer space provide new ways to enhance collaboration and productivity. For example, social tools ranging from blogs to wikis can be used to share knowledge across the enterprise, accelerating project timelines. These tools are often quick and inexpensive to procure or deploy. Enterprise-capable app stores, instant messaging, synchronization services, and other solutions can enhance efficiency while meeting employees' expectations for friendly, self-service interactions with IT.

### Get Ready for More

User-focused policies are well worth developing, because today's BYOD requests are just the beginning. Intel and other innovators will continue to advance consumer technologies and experiences, including the creation of self-aware devices that use perceptual computing technologies to make computing more natural, intuitive, and compelling. Enterprise IT must be ready. If you develop collaborative, user-focused approaches to smartphones and touch-enabled devices now, you'll be poised to gain further productivity as the next wave of augmented-reality platforms and gesture-based wearables emerges.

*Christian Anschuetz, CIO of UL*

## UL's CIO on His Consumer-Influenced Client Strategies

One way to reduce bring-your-own-device pressure is to provide mobile devices that are just as cool as the ones employees have at home. Christian Anschuetz, CIO of UL, the global independent safety science company, took this approach in a modernization initiative that aligned with UL's business strategy of closer collaboration with its customers.

Anschuetz' IT organization issued new laptops to nearly all of UL's PC users, defining system requirements based on consumer expectations as well as the company's communication and collaboration requirements. "We wanted to avoid the situation where you have the latest and greatest technologies at home, and then you come to work and you're stepping backwards," Anschuetz said. "Our goal is to reflect modernity, because of what it says to customers and because it helps UL hire and retain the best employees."

Response to the initiative has been highly positive. "The halo effect was so great that the IT organization has gotten more credit for being progressive and modern than anything else that we could have done, including changing fundamental business processes," said Anschuetz. "Our engineers are happier and more productive. Our IT organization is increasingly seen as being ever more credible. And we're all better able to fulfill UL's mission, which ultimately is to make the world a safer place."

# Innovation in Action: Driving Value at Intel

Intel IT supports a global design and manufacturing enterprise of more than 95,000 employees. Intel's mission is to create and extend computing technology to connect and enrich the lives of every person on Earth. Intel IT's goal is to create business value and accelerate the company's business growth. Here is a cross-section of recent projects.

## Cloud

Intel IT is making rapid progress toward our goal of a secure, interoperable, and open hybrid cloud. In one example, we've developed a self-service, application life cycle management solution that lets Intel software engineers start designing packaged applications for devices within minutes. About 10,000 software engineers use the service, which we implemented as an SaaS and PaaS solution.

## Big Data

Partnering with the business, Intel IT is enabling big data insights that can drive operational efficiencies and shape business strategies. We're also applying big data analytics to enterprise security challenges. We've developed an analytics solution that uses Intel® Distribution for Apache Hadoop* to give us early warning of new information security threats. Our platform can scrutinize 200 billion server events and provide results in less than 30 minutes.

## Security

Intel's security strategy is designed to protect and enable the business. We're moving into production with a dynamic trust calculation model that gives employees different levels of access privilege depending on their risk profile. Granular levels of trust are based on employee privileges, device type, and location, allowing us to embrace consumerization while reducing risk.

## Social Computing

Intel is embracing social computing for building relationships with customers and encouraging the flow of information within the company. Our internal social collaboration platform supports hundreds of technology groups, forums, wikis, and enterprise RSS feeds. We're using crowd-sourcing and gamification to aggregate knowledge and inform decision making.

## Mobility and BYOD

Driving to increase productivity, Intel IT has established a mobile application development framework and supports more than 40 mobile apps. We offer optimized mobile PC platforms, giving employees the choice of a security-enhanced laptop or Ultrabook™ device. Our BYOD program includes more than 23,500 smartphones and other devices; it delivered annual productivity savings of about 5 million hours in 2012.

The number of connected users will grow 55% by 2015.[2]

IT professionals are concerned about the inability to measure the security services their public cloud providers are offering.[5]

Approximately one-third of IT managers think BYOD programs position IT as a stronger partner in the business.[6]

## Transforming Healthcare

Healthcare leaders are implementing a wide variety of cloud services to deliver higher-quality, more efficient care. Here are a few examples, all implemented with Intel® technologies to improve cloud-based performance, scale, and security.

### Medical Center Private Clouds[7]

Gwinnett Medical Center (GMC), a top-ranked U.S. hospital system, took a systematic route to its secure, private IaaS cloud by virtualizing its servers and storage controllers, and now is virtualizing and standardizing its networks on 10 Gigabit Ethernet networks. The cloud's density and performance enabled GMC to avoid building an additional data center as capacity needs grew, and the operational savings are helping fund innovative services such as a health information exchange (HIE) for area physicians.

### Mobile Clouds for Smart Ambulances[8]

Industry innovator Cornerstone Integration uses fanless edge servers in a compact mobile cloud providing EMTs the ability to securely and simultaneously use multiple applications and voice-enabled systems, as well as geolocation and streaming video services in rural environments. Results include improved physician and hospital specialist collaboration, both at the scene and en route. The solution includes hardware-enabled technologies that simplify remote management.

### Genomics Research

Personalized cancer treatments tailored to an individual's unique DNA profile are a big focus of biotechnology and pharmaceutical research. But representing a single person's DNA can require up to 10 million rows in a traditional database. NextBio's SaaS solution combines a sophisticated analytics engine with a performance-optimized distribution of Apache Hadoop software to support a range of genomics customers.

### Big Data for Coordinated Care

HIEs provide a backbone for hospitals and other organizations to securely share clinical data as they collaborate on patient care. Informatics Corporation of America (ICA) provides cloud-based HIE solutions that focus on analyzing and presenting relevant information to improve collaborative care. ICA uses a distributed, Not Only SQL (NoSQL) operational database technology, with hardware-enhanced encryption to help protect sensitive data at lower cost.

### Medical Imaging from the Cloud

Carestream Health, a company with a 100-year history in medical imaging, has provided SaaS solutions in its product portfolio for the past five years. Carestream's cloud services help healthcare organizations reduce operational costs and improve care coordination by securely archiving, viewing, and sharing CT scans, MRIs, and other digital images. Carestream's latest addition, a patient imaging portal using the cloud, can help engage patients and improve patient satisfaction by providing secure access, easy management, and sharing with other users such as referring physicians.
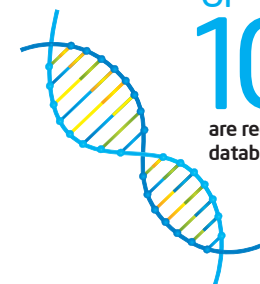
**30%** of medical practices have transitioned to cloud computing services.[9]

**20%** AVERAGE REDUCTION in annual IT costs for 88% of healthcare organizations that use cloud computing.[9]

UP TO **10** MILLION ROWS are required in a traditional database for DNA.

# Accelerating the Future

## Research Leadership for IT-Fueled Innovation

What's in store for tomorrow's clouds? What's next for big data? Intel follows a disciplined innovation process to deliver strategic advances for next-generation clouds and enterprise workloads, as well as experiences to delight the next generation of end users. Our approach, unique among corporate research labs, balances an open academic model with a proven process for turning research results into product development.

In addition to our own multidisciplinary research teams, Intel Labs has established a global research community to advance innovation in critical technology areas. Seven Intel Science and Technology Centers (ISTCs) in the United States and Intel Collaborative Research Institutes (ICRIs) in the U.K., Germany, and Israel form a network of Intel-funded, jointly-led collaborations with top academic researchers. Centers emphasize open collaboration,

and contributions are generally offered to relevant open source communities to facilitate rapid, broad adoption.

Each ISTC focuses on a specific area or discipline, including cloud, security, big data, embedded computing, social computing, visual computing, computational intelligence, and sustainability connected cities. Here are a few areas where ISTC teams are working to advance the scalability, security, and robustness of tomorrow's enterprise computing.

### Optimized Performance and Efficiency
- Specialized platforms designed to deliver best-case efficiency and performance for critical workloads
- New power states that enable dynamic load balancing
- Implications of non-volatile main memory
- New architectural tiers to support cloud-based analytics
- New approaches to enable low-latency interaction with cloud services

### Heightened Security
- Using data analytics to improve risk assessment and response planning
- Keeping data safe no matter where it's used
- Creating stronger isolation between environments in the cloud and on client devices

### Big Data Analytics
- Auto-tuning frameworks and advanced management approaches to make Hadoop software easier to adopt and use
- New and faster algorithms and frameworks for big data, including parallel machine learning and database management systems for analytics used with social networking
- Additional architecture tiers for data caching and analytics
- Scalable approaches for visualizing and interacting with streaming data and massive data volumes

### Scalable Cloud Management
- Unified and increasingly automated solutions to allocate, optimize, manage, and troubleshoot massive jobs

"Ask any venture capitalist if he or she is lacking for ideas. They'll tell you the same thing. Ideas are cheap: a dime a dozen. Innovation, not ideation, is where we need to focus."[10]

*— Justin Rattner*
*Chief Technology Officer, Intel Corporation*

# Conclusion: Thriving in the New World

Cloud computing has rapidly evolved from a method for optimizing your data center to a way to transform your business. By delivering innovative cloud services with agility, creativity, and scale, CIOs gain unprecedented opportunities to drive strategic business value.

Intel technologies are the foundation of cloud infrastructure, and we continue to advance the capabilities needed for technology-fueled transformation. We are addressing cloud challenges throughout the solution stack to enable optimized user experiences and solutions that are more open, secure, scalable, robust, affordable, and exciting. In addition to our R&D programs, we collaborate with cloud and technology providers, the open source community, standards bodies, and industry groups such as the CSA and ODCA. Intel Capital, our global investment arm, has fostered innovation by investing more than USD 10.7 billion in over 1,250 companies in 53 countries since 1991.

Building your cloud infrastructure with effective strategies and Intel technologies can help your IT organization create a more secure, scalable platform on which to innovate. But that's just the beginning. As a CIO, the real leadership opportunities lie in inspiring your enterprise to embrace the transformative changes that are underway—to engage more deeply in creative collaboration with business teams and design services that turn ideas into reality.

**The sky's the limit.**

## For More Information

Stay in touch, learn about new solutions, and see what's on the horizon:

**Join the Intel IT Center**
Gain insider access to insights, research, third-party reports, and more. www.intel.com/itcenter

**Read and Respond**
Nearly two dozen Intel leaders actively blog on topics ranging from cloud access security to national and international policy. blogs.intel.com

**Connect with Intel IT**
Intel IT professionals share strategies and best practices. www.intel.com/it

**Join the Open Data Center Alliance**
Influence the evolution of seamless, secure cloud computing. www.opendatacenteralliance.org

**Follow us on Twitter**
@IntelNews, @IntelITS, @IntelResearch, @KimStevenson www.twitter.com

# Tomorrow's Technology. Today.

## www.intel.com/cloud

1  Extrapolated by Intel from industry data sources.

2  Source: Cloud Computing Roadmap Infographic. http://communities.intel.com/docs/DOC-19288

3  Source: Big Data Infographic: Solve your Big Data Problems? www.intel.com/content/www/us/en/big-data/solving-big-data-problems-infographic.html

4  Cisco Global Cloud Index: Forecast and Methodology, 2011–2016. www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns1175/Cloud_Index_White_Paper.html

5  Intel Peer Research Report, "What's Holding Back the Cloud?" May 2012. www.intel.com/content/dam/www/public/us/en/documents/reports/whats-holding-back-the-cloud-peer-research-report2.pdf

6  Intel Peer Research Report, "Insights on the Current State of BYOD." October 2012. www.intel.com/content/dam/www/public/us/en/documents/white-papers/consumerization-enterprise-byod-peer-research-paper.pdf

7  Intel Case Study, "Gwinnet Medical Center Manages Data Explosion with Intel® Xeon® Processors," 2012.
www.intel.com/content/dam/www/public/us/en/documents/case-studies/healthcare-xeon-e5-gwinnett-medical-study.pdf

8  Intel Case Study, "Designing a Mobile Cloud for Ambulance Services," 2012. www.intel.com/content/www/us/en/cloud-computing/mobile-cloud-cornerstone-ambulance-study.html

9  CDW Survey, "From Tactic to Strategy: The 2011 Cloud Computing Tracking Poll." May 26, 2011. webobjects.cdw.com/webobjects/media/pdf/Newsroom/CDW-Cloud-Tracking-Poll-Report-0511.pdf

10  Read the transcript of Rattner's remarks to the U.S. CIO Summit, June 2012. blogs.intel.com/intellabs/2012/06/20/intel-labs-21st-century-industrial-research