Taking Advantage of Cloud Computing

"It's what's under the hood that counts."

—Nigel Ballard
Director of Federal Marketing at Intel

According to Federal CIO Vivek Kundra, cloud computing is a strategic direction for federal agencies. Cloud computing offers significant potential benefits—enabling agencies to better fulfill the mission of government by deploying new services more quickly, scaling services to meet demand, and realizing operational flexibility. However, according to Gartner, cloud computing also has "unique attributes that require risk assessment in areas such as data integrity, recovery, and privacy."[1] Thus, government agencies must assess the best way to take advantage of cloud computing—balancing benefits, risks, and other agency requirements and goals, such as telework and continuity of operations (COOP).

Intel has a long-term commitment to addressing top IT issues that the government faces. By investing more than USD 69 billion in research, development, and manufacturing capacity since 2000, we have built a solid technology foundation. To specifically address the challenges faced by our federal customers, we offer a variety of innovative technologies that shape the IT landscape.

In fact today, Intel® Xeon® processor-based servers are the engines powering many of the largest clouds. The latest Intel Xeon processors are ideally suited for the uniquely intensive demands of cloud computing: They provide the intelligent, scalable performance to handle dynamic workloads while maximizing efficiency with industry-leading performance per watt.

Highly manageable and secure laptops based on Intel® Centrino®2 with vPro™ technology help protect critical data and privacy while government employees access cloud services. These mobile PCs support teleworking and COOP, allowing federal employees to continue working even when they do not have reliable network access.

THIN CLIENTS AND CLOUD COMPUTING

In some cases, cloud computing has been interpreted as the use of thin clients alone. This is because external cloud services are delivered through the Internet, and the basic Internet access tool is a Web browser that can run on a thin client. In fact, thin-client and cloud concepts are distinct and independent. Cloud services support a variety of client devices and delivery methods. In fact, some cloud services use delivery methods that thin clients cannot support. For example, a cloud service may download an application such as a real-time collaboration tool that can only execute efficiently on a rich client.

The distinguishing feature of thin clients, in contrast, is that they are designed to support a single delivery method: remote execution. All processing occurs on back-end servers, leaving users entirely dependent on the network and server configuration for application access and performance. This presents a problem for the continuity of operations required for critical federal agency services.

Cloud Computing Defined

Cloud computing is a rapidly evolving area that offers the potential for federal agencies of all sizes to increase flexibility and efficiency. With cloud computing, services and data are provided by shared computing resources in scalable data centers and are accessible over the Internet. Key advantages are that services are easily available on demand and can rapidly scale both up and down as needed. Current types of cloud service include applications (software as a service); development tools (platform as a service); and virtualized computing resources such as servers (infrastructure as a service).

Developing a Cloud Strategy that Makes Sense

For federal agencies and other organizations, the key questions to ask in developing a cloud computing strategy are how to best support the agency mission, which services should be moved to cloud computing, and how to map a path to cloud computing from the current IT environment.

Some cloud services are available from external suppliers, through resources such as the www.apps.gov government storefront. However, many cloud services are still immature, and there are important concerns to address such as security and interoperability between clouds. "Our

customers are already asking us to help create an open cloud computing standard to enable interoperability," says Nigel Ballard, director of federal marketing at Intel. "Disparate cloud-based networks must be capable of seamless and secure data transfer."

Partly because of these issues, many organizations are developing internal, private clouds for their mission-critical services—an approach that can offer many cloud advantages with fewer risks. An internal cloud is an ideal place to start proving cloud-related technologies and is a logical first step before attempting more widespread migration to an external cloud.

Powering the Cloud with Intel® Xeon® Processor-based Servers

Though cloud computing makes it easier for federal agencies to add new services quickly and scale them as needed, it also places new demands on data center computing resources, which must scale affordably to meet increasing demand and handle dynamic workloads that may spike and drop erratically—all while maximizing energy efficiency. This requires a virtualized server infrastructure that provides the flexibility to quickly allocate capacity in response to demand. Indeed, analysts describe virtualization as the bridge to cloud computing.

Intel Xeon processors are the ideal foundation for this cloud computing infrastructure,

NASA'S NEBULA CLOUD COMPUTING PROJECT

Nebula is a cloud computing pilot under development at NASA's Ames Research Center in Silicon Valley. It integrates a set of open-source components into a seamless, self-service platform, providing high-capacity computing, storage, and network connectivity using a virtualized, scalable approach to achieve cost and energy efficiencies. When completed, Nebula will offer cost-effective software as a service applications and other cloud computing services.

Nebula is currently being used for education and public outreach, for collaboration and public input, and also for mission support. For example, amateur astronomers are informally working with NASA scientists and uploading high-resolution photos that help build up a better view of the moon using a Web site built on the Nebula platform.

offering not only high performance and scalability but also world-class efficiency and intelligent platform capabilities. Servers based on Intel Xeon processors include Intel® Virtualization Technology (Intel® VT), a platform of virtualization technologies that optimize virtualization performance at the processor, chipset, networking, and I/O level. Intel® Xeon® processor 5500 series extends this leadership with capabilities including:

- Excellent performance per watt—up to 2.25x the computing performance at roughly the same system power compared to the previous generation processor.

- Twice the virtualization performance of previous generations.

- High performance across a wide range of different workloads—essential in federal cloud data centers that must support multiple applications and services. Figure 1 shows performance improvements on server benchmarks.

- Adaptability: Cloud computing environments are highly dynamic, as some applications scale rapidly while others shut down. Intel Xeon processor 5500 series is designed from the ground up to adapt to changing conditions, increasing performance when needed and reducing power consumption when demand falls.

Accessing the Cloud Securely with PCs based on Intel® vPro™ Technology

A broad spectrum of clients is emerging, including thin clients capable of little or no local processing, handheld and other mobile form factors including netbooks, and full-featured mobile and desktop rich-client PCs. When considering the best client device for accessing cloud services, government agencies should consider a variety of factors, including security and data integrity, user experience, and other existing agency goals such as teleworking, COOP, and the need to run all existing applications.

Laptops based on Intel Centrino 2 with vPro technology provide access to new cloud services while meeting all these requirements:

- Hardware-assisted security and remote management with Intel vPro technology.

- Teleworking and offline use, supporting federal teleworking and COOP mandates. PCs provide local storage and processing if network access is not available.

- Performance and graphics: With a powerful laptop PC, federal employees can run graphics and compute-intensive applications.

Designed specifically for mobile computing, Intel Centrino 2 processor technology gives

INTEL IT
CLOUD COMPUTING STRATEGY

Intel supplies the server processors that power many of today's commercial cloud offerings, and our close experience with cloud computing is the result of our own IT organization's cloud computing strategy.

Intel IT is already taking advantage of external clouds for well-defined, commoditized, low-risk applications that do not require significant data integration with other applications. An example is Intel's employee expense reimbursement tool.

The strategy for more complex, sensitive, and customized applications is to grow solutions within an internal cloud and then extend them to external clouds. This approach offers many of the benefits of external clouds without the drawbacks and positions us to move more services to external clouds as technology and standards mature.

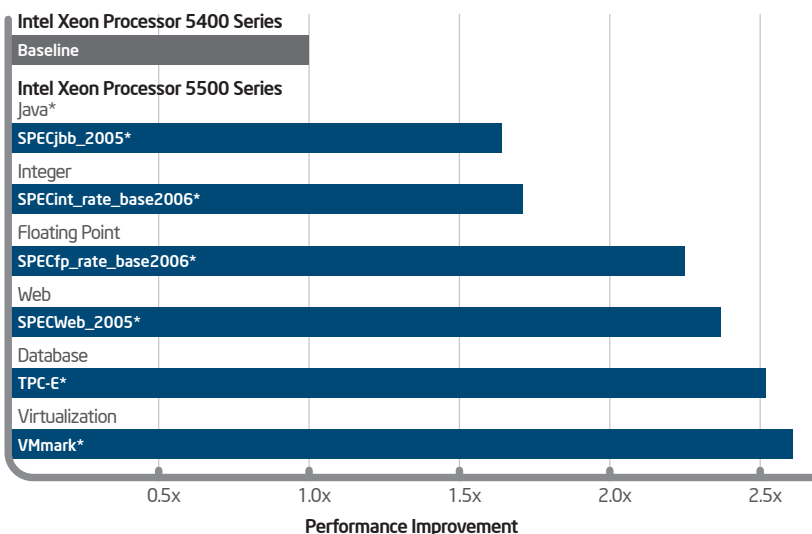**Intel® Xeon® Processor 5500 Series vs. Intel® Xeon® Processor 5400 Series on Server Benchmarks**

Figure 1. Servers based on Intel® Xeon® processor 5500 series offer significant performance increases across a wide range of different workloads—an essential capability for federal cloud data centers that must support multiple applications and services.[2]
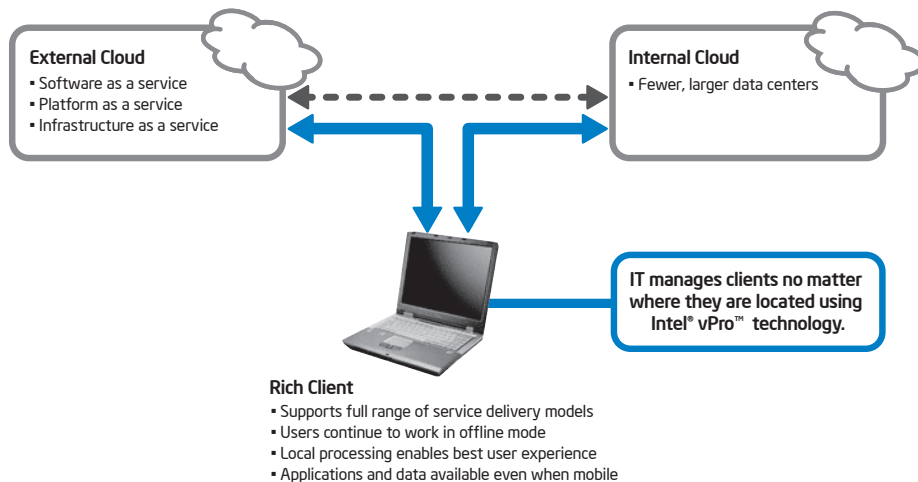
External Cloud
- Software as a service
- Platform as a service
- Infrastructure as a service

Internal Cloud
- Fewer, larger data centers

IT manages clients no matter where they are located using Intel® vPro™ technology.

Rich Client
- Supports full range of service delivery models
- Users continue to work in offline mode
- Local processing enables best user experience
- Applications and data available even when mobile

Figure 2. Rich clients complement cloud computing, providing localized processing to optimize the user experience as well as mobile and offline computing.

laptops unprecedented performance capabilities with faster, more powerful multitasking and exceptional high-definition visuals—all delivered in lightweight laptop designs.

Built-in security and manageability capabilities in PCs with Intel vPro technology let federal IT staff remotely perform many functions that previously required on-site support, including deploying automated patch updates and securely fixing problems. This greatly increases operational efficiency and also means that federal employees benefit from increased uptime and productivity. See Figure 2.

Moving to the Cloud

It's time for federal agencies to assess how to take advantage of cloud computing. Though the technology has great potential to increase operational efficiency and flexibility, there are also challenges such as security, interoperability, and the need to accommodate requirements such as teleworking. Intel, a leader in cloud computing technology, can help federal agencies solve these challenges and gain the rewards.

Check out more solutions for government at: http://ipip.intel.com/go/fedgov

[1] www.infoworld.com/d/security-central/gartner-seven-cloud-computing-security-risks-853

[2] See the white paper "Why the Intel® Xeon® Processor 5500 Series is the Ideal Platform for Cloud Computing" at http://ipip.intel.com/go/wp-content/uploads/2009/06/why-intel-xeon-5500-is-the-ideal-foundation-for-cloud-computing.pdf for details on Figure 1 performance benchmarks.