

IT@Intel Brief

Intel Information Technology

Computer Manufacturing
Cloud Computing

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Better Together: Rich Client PCs and Cloud Computing

Cloud computing poses new questions about the optimal enterprise client computing strategy. With more and more services delivered from the cloud, which combination of client platforms and service delivery models best meets the needs of users and IT organizations?

The Intel IT environment contains a mixture of conventional and cloud computing services, delivered primarily to rich client PCs.

We have found that whether services are kept in-house or outsourced to the cloud, the ability to perform local computing on the client offers the best user experience and the flexibility to run different types of applications. Only rich clients support the full range of service delivery methods, as shown in Figure 1. In addition, rich clients deliver full mobile computing capabilities for our users, including the ability to work offline.

Rich clients remain an important part of our IT strategy as we work toward our future direction of migrating services to the cloud, supporting a wider range of client platforms, and enabling client virtualization.

Profile: Rich Clients and Cloud Computing

- Users can access both cloud and conventional computing services
- All service delivery models supported

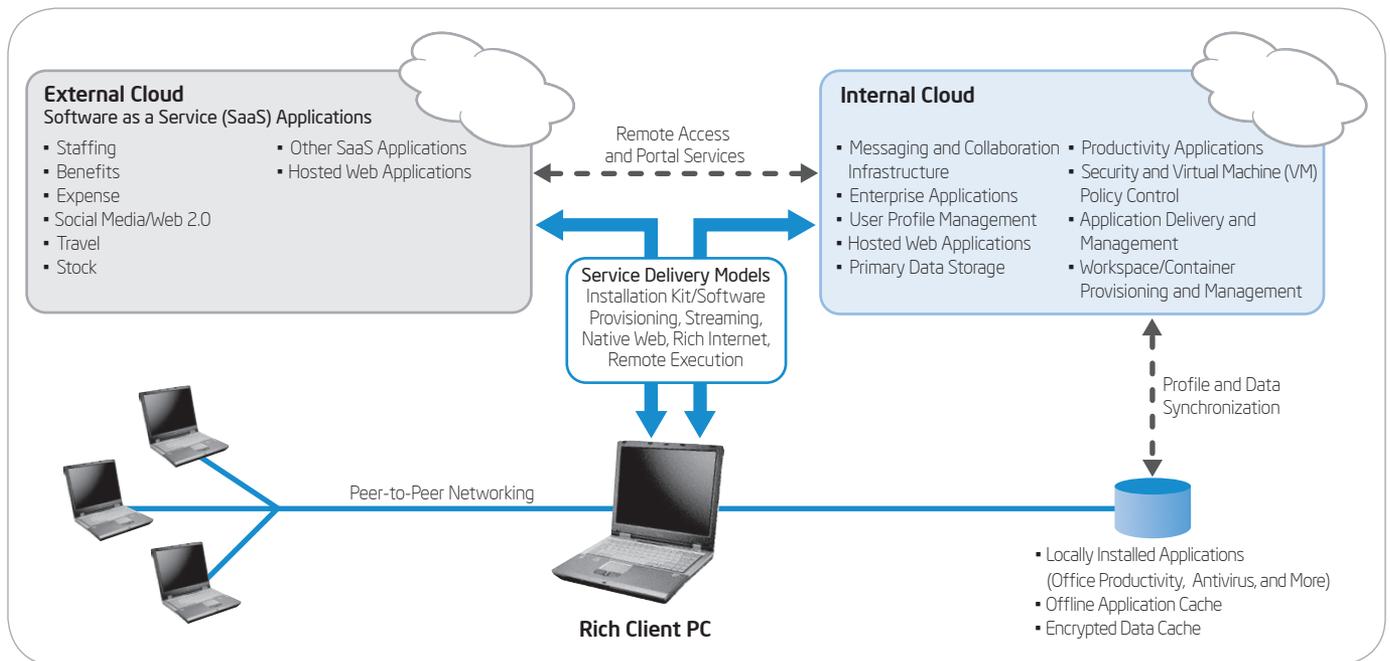


Figure 1. Rich clients support both cloud and conventional computing, as well as new delivery models such as application streaming.

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. In order to control the end-to-end user experience, thin clients are typically used for intranet applications.

Differences between the two concepts are summarized in Table 1.

Table 1. Differences Between Thin Client and Cloud Concepts

	Thin Client	Cloud
Key Characteristic	Software processing takes place on back-end servers	Pay-as-you-go, on-demand software and infrastructure
Network	Primarily intranet	Internet (external cloud) or intranet (internal cloud)
Network State	Always connected	Connected and offline use
Clients	Low-cost, low-power devices; usually terminals or diskless low-end PCs	For the most part, any device; requirements are dictated by the service
Processing	Server	Client and/or server
Implementation	Typically traditional enterprise licensing, with software installed and maintained on internal IT servers	Typically outsourced, subscription-based service delivered and maintained by provider

Background

Cloud computing is a significant trend with the potential to increase agility, lower costs, and enable access to services from any location. Key attributes that distinguish cloud computing offerings include:

- Abstracted and offered as an on-demand service
- Easily purchased and billed by consumption
- Multi-tenant solutions on shared, massively scalable infrastructure
- Accessible over the Internet

Today, we have identified three main categories of cloud computing service:

- **Software as a service (SaaS).** On-demand software applications.
- **Platform as a service (PaaS).** On-demand software development platforms.
- **Infrastructure as a service (IaaS).** On-demand computing infrastructure such as servers, storage, and network.

At Intel, we are 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 our employee expense reimbursement tool. SaaS use is growing organically, although we continue to address security, manageability, and data interchange challenges.

Our 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.

Evolution of Clients

As cloud computing evolves, clients evolve too. Today, Intel's highly mobile work force uses traditional rich clients. About 83 percent of employees have notebook PCs, deployed in a one-size-fits-all configuration. We are deploying PCs with Intel® Centrino®2 with vPro™ technology, which is providing increased notebook manageability and data security. The PCs run a standard IT software build that supports Intel's security requirements.

Consumerization of Technology and New Client Form Factors

The consumerization of technology drives user choice. Employees want the smallest, lightest, fastest platform that meets their needs. They have access to powerful consumer technologies and want to use these tools in the workplace, blurring the boundary between personal and business use.

The client market is fast-changing, complex, and confusing. 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.

Intel IT testing has shown that local processing is essential for graphics, multimedia, animation, real-time collaboration, and a range of other compute-intensive tasks. We found that using a server-hosted, thin-client

virtual hosted desktop model to support these applications resulted in high server utilization and unacceptable response-time delays for our users.¹ To mitigate these problems, vendors are using more powerful servers and adding graphics processing capabilities to thin clients—making them look more like rich clients. This increases the cost of the thin-client approach.

As client technology evolves, we need to focus on matching users with the right platforms. Potentially, users might have multiple, complementary client devices in a variety of form factors, simultaneously accessing different services over the Internet and within the enterprise.

Intel IT Client Strategy

For at least the next several years, the Intel environment will incorporate a mixture of services delivered to clients, ranging from traditional computing with locally installed applications to services delivered from internal and external clouds.

For both internal and external clouds, we are moving towards new service delivery methods that provide the benefits, including reduced total cost of ownership (TCO), of centralized application and resource management. These models include application streaming, Web access, and remote execution.

¹ "Streaming and Virtual Hosted Desktop Study." Catherine Spence and Christian Black. Intel Corporation, January 2008.

At the same time, we are deploying Intel® vPro™ technology across the enterprise to improve client PC manageability and security. Intel vPro technology enables us to reduce client TCO by automating and improving essential management functions such as PC inventory, detection and prevention of malicious activity, and troubleshooting and repair. We can manage PCs even when the OS is unresponsive or the PC is powered off. These manageability and security capabilities remain just as relevant and important as we move to cloud computing and centralized delivery methods.

With a strategy based on rich clients, we can take advantage of new capabilities while continuing to provide users with the traditional benefits of the rich client:

- **Access to all conventional and cloud-based applications.**
- **Support for all delivery methods.** Including peer-to-peer and those that require local execution.
- **Mobility and offline use.** Fast Internet access is still not pervasive. Users can work with locally installed applications even when offline.
- **Performance and additional capabilities.** Users can run graphics and compute-intensive workloads on the client. Without local execution, this would be slow or impossible.

These benefits are shown in Figure 2.

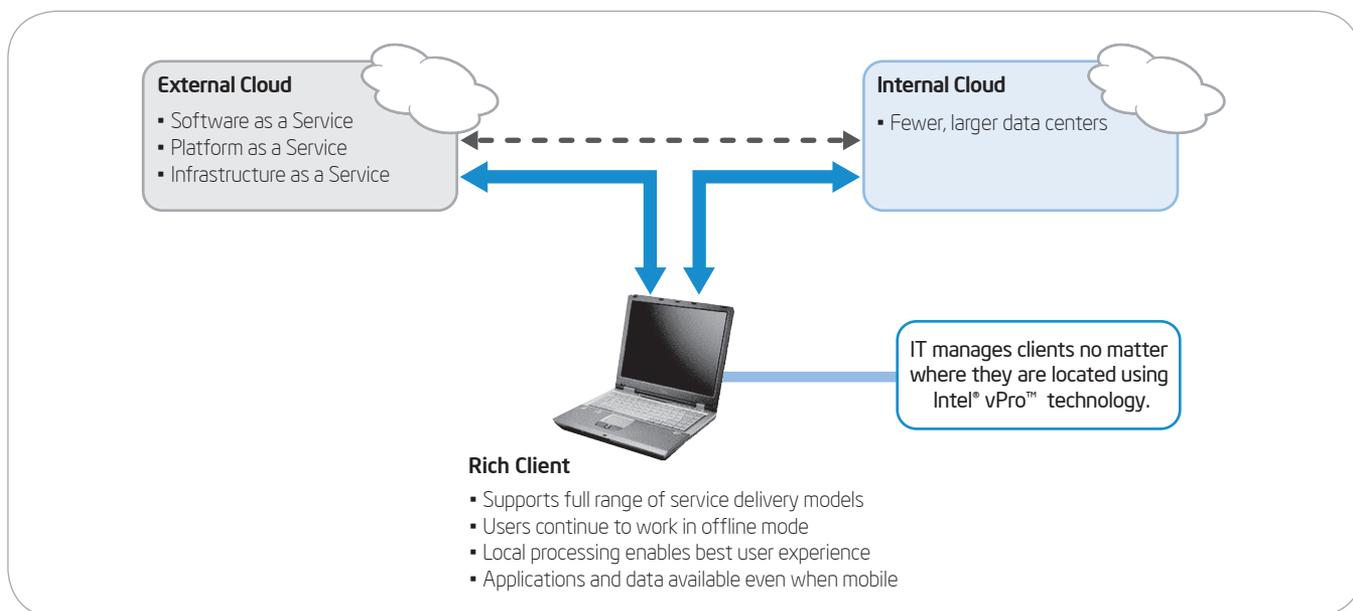


Figure 2. Rich clients complement cloud computing, providing localized processing to optimize the user experience as well as mobile and offline computing.

Strategy Evolution

We believe that combining well-managed rich client PCs with new service delivery methods such as streaming will provide the benefits of server-side computing models without significant loss of end user productivity and will result in lower TCO. Our rich-client approach enables us to adopt cloud-based services while continuing to take advantage of our existing infrastructure, support model, and business processes, and without the need for an expensive retrofit of the existing environment.

Over time, as we shift from an enterprise-centric to a more Internet-centric view of client computing, more services will be delivered from external clouds. Our long-term goal is to enable virtualized, managed IT environments downloaded on demand to capable devices.²

By building new services on top of our existing rich-client environment, we help ensure that users will be able to access both traditional applications and new cloud-based services using a single rich client PC platform that delivers the performance and mobile computing capabilities they need.

² "Client Computing with a VUE." Ed Jimison, David Buchholz, and Jim Sutorka. Intel Corporation, May 2008.

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Further Reading

The IT@Intel studies referenced in this paper can be found at www.intel.com/it.

"Streaming and Virtual Hosted Desktop Study." Catherine Spence and Christian Black. Intel Corporation, January 2008.

"Client Computing with a VUE." Ed Jimison, David Buchholz, and Jim Sutorka. Intel Corporation, May 2008.

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