Balanced Computing

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Intel's Support for Software-as-a-Service

Executive Summary

Software-as-a-Service (SaaS) has been proposed as a viable alternative to traditional shrink wrapped software. Software-as-a-Service is a server-based computing model which uses the network for access, delivery and management of software.

Software-as-a-Service is one type of server-based computing.

Server-based computing models also include thin clients, virtualized desktop services, hosted web services and traditional application service provider models. These approaches all move a fraction of the workload associated with a business client workstation from the traditional personal computer to an infrastructure server physically residing in a corporate data center. Typical benefits associated with this shift in compute workload include lowering the cost of the edge device, improving data security by storing almost no data on the client, and ensuring uniformity of the desktop software used by all employees.

Intel's platform roadmap for server-based computing best supports a set of technologies collectively known as "streaming." Streaming can be done for either an application (such as Microsoft PowerPoint) or a complete operating system image (such as Windows XP). Essentially, streaming is the delivery of a series of executable bits in a secured way over a moderate to high bandwidth network from a server physically located in the corporate data center. Streaming is not uniquely an Intel technology, but instead is enabled by a broad collection of eco-system software vendors who build their solutions on top of standards-based platforms.

Intel's approach to streaming is called "Balanced Computing." The term "balanced computing" implies the workload for the client workstation is "balanced" between work best done in the data center, such as storing and securing software images, and work best done on the edge device, such as enabling rich content media or heavy computational work such as photo imagery or complex spreadsheet analysis.

Intel advocates Balanced Computing as the way to get the responsiveness of an Intel vPro™ PC with the improved security, manageability and reduced cost of server-based computing.

Applications delivered over the internet using the techniques known as Web 2.0 also give better end-user responsiveness when deployed with a full powered edge device such as an Intel vPro™ PC.

Intel's vision of balanced computing is to enable this rich model of end user interaction while not compromising on the improved security, manageability and reduced cost often associated with server-based computing.

This Whitepaper

This whitepaper describes Intel's on-going roadmap to support a balanced model of server-based computing commonly known as Software-as-a-Service. We believe Software-as-a-Service combines the best of computing on a rich, full-featured personal computer with the security and manageability associated with traditional thin-clients.

The paper will address:

- **Solving Real Business Problems**. We are motivated to make a real impact in technology support for business. Intel understands that security, manageability and cost issues degrade business agility and reduce operating margins.
- **The Landscape of Alternatives**. Software-as-a-Service can be viewed on a continuum of architecture alternatives, each with their own advantages and disadvantages.
- **Proposed Technology**. Streaming is a technology which can help achieve the benefits of both thin clients and more fully functional rich clients.

Solving Real Business Problems

Today, more than ever, businesses operate in an environment in which dependable, agile business processes require information technology to sustain lasting competitive advantage. Yet, the deployment of technology still remains a challenge in terms of cost, manageability and security. Intel has surveyed global business leaders across multiple industries and found a common need to solve these issues, especially in relation to the desktop and notebook personal computers.

One trend which brings a promising set of new technologies to address real world business problems has been labeled "Software-as-a-Service (SaaS)[1]" to distinguish it from legacy models of shrink wrap software delivery. The term implies a server-based computing model in which software is delivered on-demand from a central repository over an attached computer network.

Software-as-a-Service is a server-based computing model which uses the network for access, delivery and management of software.

Because Software-as-a-Service is server-based, the typical corporate Information Technology Department can administer a corporate software "golden image" on servers in their data center. The IT department sees benefits of ease of administration, improved supportability, and improved governance for licensed software.

While the technology benefits of Software-as-a-Service can be compelling from a cost reduction perspective, an even larger motivation accrues to line-of-business managers who estimate net positive return-on-investment when Software-as-a-Service is deployed in conjunction with modern business desktop computers such as Intel vPro™. Server

[1] Traudt, Erin; Amy Konary (June 2005). 2005 Software as a Service Taxonomy and Research Guide 7. IDC

based computing models including Software-as-a-Service can also yield intangible benefits in terms of increased employee productivity and reduced time-to-market for new business capabilities.

Our experience at Intel shows the following factors associated with Software-as-a-Service influence net positive return on investment: when measured by the line of business:

- **Improve Security**. Improving security enables new business opportunities based on mobile, distributed operations. Server based computing models, which tighten control over software images and the location of the repository for corporate data, reduce business risk in scenarios such as on-site sales and customer support, growth in emerging markets, and point-of-care health services.
- **Improve Manageability**. Improving manageability allows business processes to scale and reduces time-to-market for deploying new business capabilities. When server based computing is combined with the standards based manageability features of Intel vPro™, lines of business can measure improvements in quality of service and business service availability.
- **Improve Productivity and Reduce Total Cost of Ownership**. Improving TCO for desktops and notebooks directly transfers into reduced cost of operations for lines of business. When server based computing is combined with the productivity enhancements associated with a fully functional, standards based computing platform, operations are further enhanced.
- **Reduce End User Downtime**. Modern businesses must plan for business continuity in the face of unforeseen events. Server based computing makes it easier to implement business continuity plans for corporate desktops and notebooks.

The Landscape of Server Based Computing

There has been much discussion in the technology press about Software-as-a-Service since October of 2005, when the trade press reported that Microsoft was considering moving a significant portion of its software business to a business model based on the SaaS approach.

Not all authors agree on a common definition for SaaS, but there is commonality across the discussion that focuses around the delivery of a software image via the network and the sharing of the client workload between an edge device and an infrastructure server. The server is typically located physically in a corporate data center, but it could also be hosted by a third party application service provider.

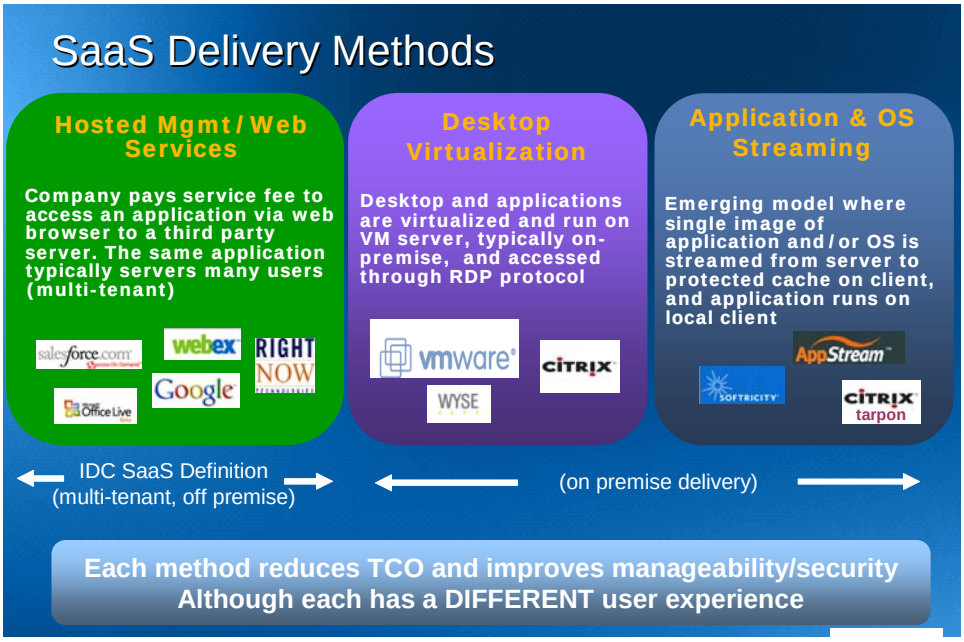
Some of the more important characteristics of SaaS include:

- SaaS applications take advantage of the benefits of centralization through a single-instance, multi-client architecture. The single-instance is often called the "golden image." The image may be for only one application, or it could be an

entire operating system or suite of applications. Also, the image may be shared or portions of it may be private to a particular user.

- When deployed on a fully functional, standards-based PC such as Intel vPro™, SaaS applications provide a feature-rich experience competitive with traditional applications. It should be noted that the SaaS model does not necessarily require an Intel vPro™ machine. One of the advantages of SaaS is that while it can benefit from an Intel vPro™ machine, the model can also be deployed on legacy, standards-based PC's.
- SaaS applications can be offered either directly by the independent software vendor or by an intermediary party called an aggregator, which bundles SaaS offerings from different vendors and offers them as part of a unified application platform.
- SaaS enables new business models for software sales and support. For example, SaaS applications can be sold using a subscription model, with customers paying an ongoing fee to use the application. Fee structures vary from application to application; some providers charge a flat rate for unlimited access to some or all of the application's features, while others charge varying rates that are based on usage.
- SaaS applications and data are typically hosted centrally, but peer-to-peer models are also emerging.
- Because the golden image is hosted centrally, manageability is made easier through central administration. For example, patches and upgrades to the golden image take place transparently, and are applied when the image is next streamed to the edge device.
- In some specialized applications, access can be delivered to end-users over the public Internet through a browser or smart-client application.
- SaaS applications often are built upon a published API that exposes application data and services to allow for developers to create composite applications.

Figure 1 shows a notional landscape of server based computing deployment methods on a continuum.

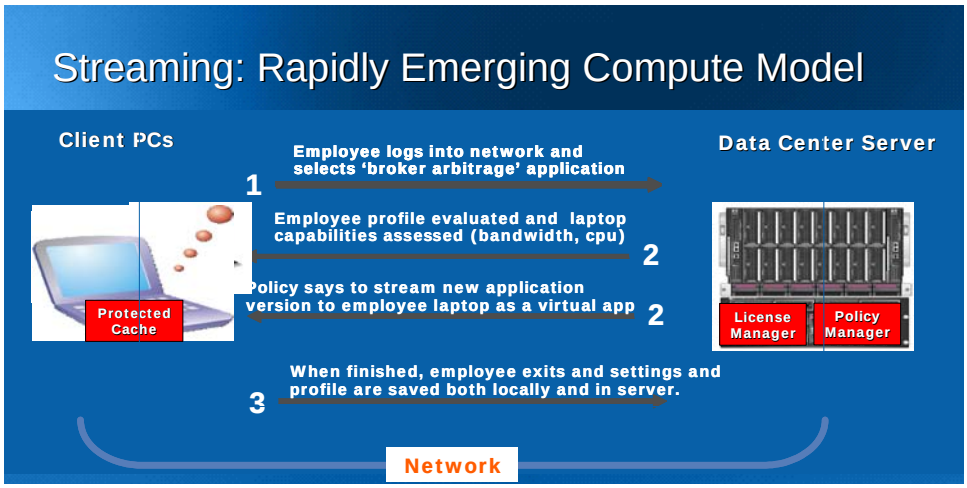


It is useful to consider each of these deployment models in turn:

- **Hosted Management and Web Services Model**. Exemplified by the well known Customer Relationship Management software vendor *SalesForce.com*, this model accesses a hosted application through standard web protocols. The client then runs in a browser or browser enabled applet on the client workstation. This approach is easy to deploy, relatively low cost to implement, and uses open protocols for the client to server interaction.
- **Desktop Virtualization Model**. Exemplified by recent product offerings by VMWare (Virtual Desktop Infrastructure or "VDI"), this approach uses a virtual machine running on an infrastructure server to run a complete client instance on in a data center server and then bi-laterally communicate the user mouse and keyboard inputs and video outputs via a remote display protocol such as Microsoft's Remote Display Protocol (RDP). This approach is more complex to deploy than web hosting because it requires use of the specialized virtual machine instance and the special purpose display protocol, but it offers the advantage of making it possible to run complex client processes in a highly secured manner in the corporate data center as compared to on a potentially vulnerable edge device.
- **Application and Operating System Streaming**. Exemplified by the approach advocated by Intel and its eco-system partners, streaming provides for a centralized golden image that is streamed to a full featured, standards based client as the edge device. The stream represents a series of executable bits that are transmitted under tight security to be executed on a device that has the computational and video horsepower necessary to display rich graphics, compute workload intensive applications and communicate using techniques such as Voice over Internet Protocol.

Proposed Technology: Streaming Explained

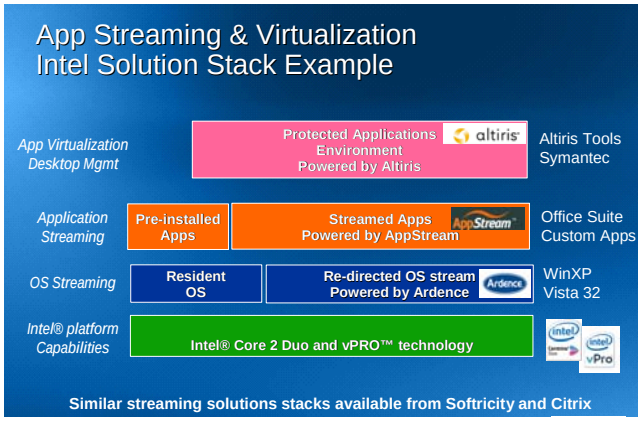
Figure 2 shows by example how the technology of streaming is implemented to support an end user client:



When using streaming, the end-user uses the device just as if he or she were using a software image installed on a physical hard drive integral to the device. But, instead the executable image is stored remotely on a data center server and transmitted ("streamed") on demand to the edge device.

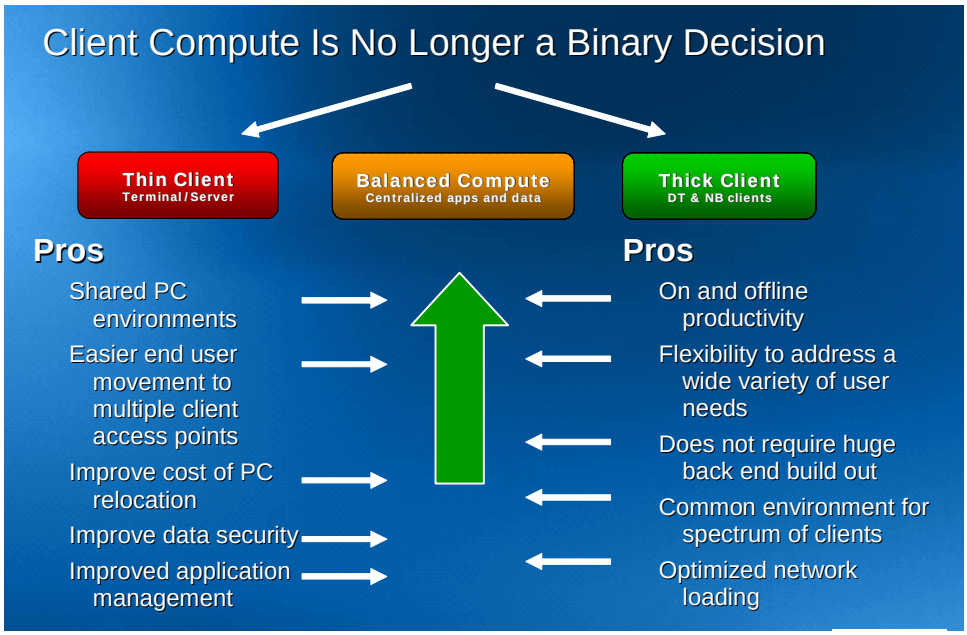
Streaming is the process by which an application or an OS is deployed over the network to the edge device. Streaming may require a special purpose loader which acts as a traffic cop to ensure the proper bits are assembled securely and in order on the client device.

Intel has chosen to work with three independent software vendors to build an example solution stack as a mechanism for demonstrating the business benefits of SaaS deployment. Our selection of these vendors for this example is meant only to be typical of the types of solutions that are available in the market place for SaaS delivery. The companies are:



- **Ardence**—which provides the ability to stream an operating system.
- **AppStream**—which provides the ability to stream applications on demand.
- **Altiris**—which provides the ability to stream the application into a manageable, secure virtual container which can sandbox the streamed application on the target client.

Drivers Influencing Adoption of Balanced Computing



As seen from the above figure, client computing is no longer a binary. The benefits of traditional thin clients include improved data security and manageability with reduced cost for common administrative functions such as PC relocation. The benefits of the "rich client" include a more satisfying user experience which improves productivity and adapts more flexibly to changing workloads.

Summary

Intel believes that large enterprise to medium business no longer have to choose between "thin and thick" clients. Applications streaming technology when combined with application virtualization provides a balanced computing methods that delivers on the best of both. It meets the challenge of central manageability and security while retaining the productivity benefits found with rich client computing. Application and OS streaming is the best balanced compute.