

Moving the OS to the Web

George Lawton

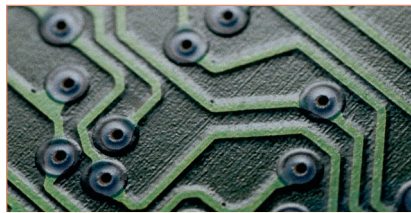
With the increasing use of high-speed Internet technologies during the past few years, the concept of cloud computing has become more popular. In cloud computing, users work with Web-based, rather than local, storage and software. These applications are accessible via a browser and look and act like desktop programs.

With this approach, users can work with their applications from multiple computers. In addition, organizations can more easily control corporate data and reduce malware infections. Also, cloud computing makes collaboration easier and can reduce platform-incompatibility problems.

Now, a growing number of organizations are adding to the cloud concept by releasing commercial and open source Web-based operating systems. While the idea isn't new, the proliferation of users and applications distributed over the Web, including those at scattered corporate sites, has made it more interesting, relevant, and, vendors hope, commercially viable.

The Web OS goes beyond basic desktop functionality. It also includes many of a traditional OS's capabilities, including a file system, file management, and productivity and communications applications.

As is the case with Web-based applications, the Web OS functions across platforms from any device



with Internet access. In addition, distributed groups can collaborate via the technology.

Currently, available Web OSs include G.ho.st Inc.'s Global Hosted Operating System (<http://g.ho.st>), Fearsome Engine's Zimdesk (www.zimdesk.com), WebShaka Inc.'s experimental YouOS (www.youos.com), the eyeOS Project's open source eyeOS (www.eyeos.com), Sun Microsystems' Secure Global Desktop (SGD, www.sun.com/software/products/sgd/index.jsp), and Sapotek's Desktoptwo (English language, <https://desktoptwo.com>) and Computadora.de (Spanish, <https://computadora.de>).

Of course, the Web OS won't replace the traditional operating system any time soon. But as users become more comfortable working over the Web, the Web OS could become more popular.

Nonetheless, the technology still has several important shortcomings that proponents must address.

DRIVING THE WEB OS

The Web OS—which functions much like a traditional operating system, although it doesn't include

drivers for computer hardware—is becoming a subject of increasing interest. One contributing factor is Internet technologies' increasing bandwidth, which enables the faster movement of applications and data via the Internet to and from Web OSs.

Early developments

One of the Web OS's predecessors was Tarantella, which the Santa Cruz Operation launched in 1993. It was a Unix-based X Window System that worked over corporate networks and let PCs display a Unix desktop. However, the technology never caught on commercially. Sun acquired Tarantella in 2005 and integrated it into the SGD.

In 1992, University of California, Berkeley, researchers began work on what, four years later, became WebOS. The system delivered OS-like functionality via the Internet.

The effort demonstrated the feasibility of technologies that could be used in Web-based operating systems, such as a file system that identifies data by URLs, a location-independent resource-naming system, and secure remote execution, noted UC Berkeley professor David Culler, who worked on the project.

Advent of Web apps

A key driving force behind the development of Web OSs has been the rise of Web-based applications.

Several of these applications have started gaining traction in recent years, particularly those for e-mail (such as Hotmail and Gmail), instant messaging, and storage (like Xdrive). Recently, there have also been Web-based word-processing and spreadsheet applications (such as Google Docs and Number).

With the first generation of Web applications, implementing even some modest functions—like dragging and dropping files, making minor changes to documents without having to refresh the entire page, and caching data locally—was difficult.

However, this has changed with technologies such as Ajax (Asynchronous JavaScript and XML), Adobe Flash, Adobe Integrated Runtime (AIR), Google Gears, and Microsoft Silverlight, which enable the development of rich Web applications, noted Guy Creese, analyst with the Burton Group, a market research firm.

One of the Web OS's key challenges has been working around security limits, such as browsers' sandbox functionality, designed to restrict the local execution of Web applications.

INSIDE THE WEB OS

Web OSs bring together Web-based applications using the browser as the interface, which is designed to look like a traditional operating system's interface, as Figure 1 shows.

They work with a URL-based file system that lets a Web-based application access files from the OS provider's server online via a domain-name-system query. Similarly, the technology uses a location-independent resource-naming system that lets applications make calls to services and resources on remote servers.

Architecture

Web OSs use variations on the same basic architecture.

The SGD uses a three-tier architecture, noted Mark Thacker, Sun's group product manager for security and virtualization. The application server hosts virtual machines that run programs and push them to a presentation server, which manages the client connection. The thin client runs the application and passes user input back to the application server.

Either the Web OS provider or a host company or data center can house the application and presentation servers.

Simpler Web operating systems such as eyeOS use a two-tier architecture in which one machine acts as both application and presentation server. The client is the second tier.

More complex systems, such as G.ho.st, use a group of servers in

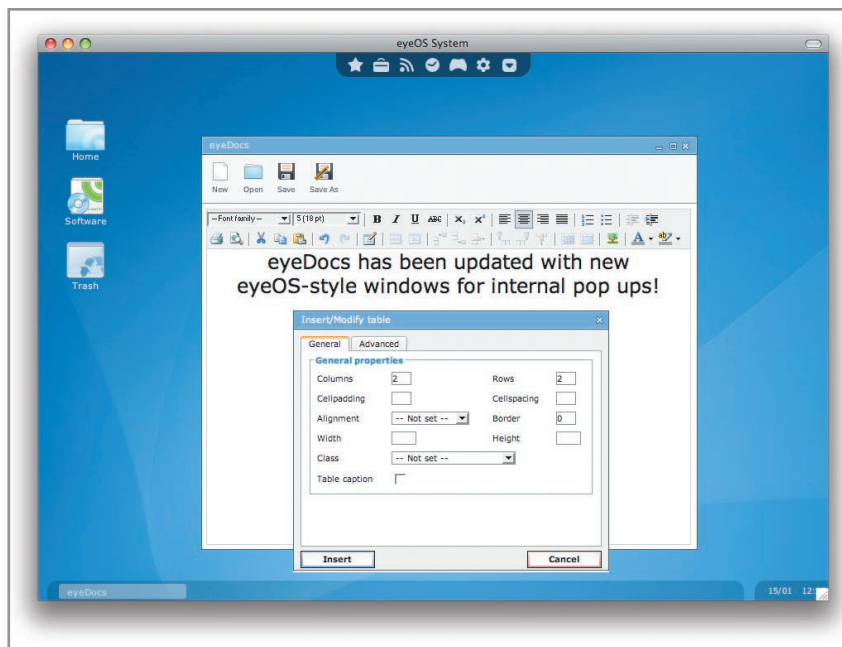


Figure 1. Web-based operating systems, such as eyeOS, have interfaces designed to look like those of traditional OSs, to make using them easier and more familiar.

place of a single application server and a single presentation server. In this case, the group of servers looks like one machine to the user. This type of system leverages the multiple servers' computing and storage capacity to provide more scalability and reliability.

Nuts and bolts

Because browsers are built to work across different operating systems, the Web OSs that run on them are also platform-independent.

Depending on the OS, the user can either execute applications locally via a program such as Flash, or the Web OS servers can execute the program remotely and display it in the client's browser window.

Either way, users modify data locally and the client uploads the modified data via the Internet back to the Web OS server.

When Web applications need overall changes or updates, the Web OS provider uploads them within its servers. These changes appear the next time clients download the programs, without users having to do anything.

In G.ho.st, users have the option of storing data in a local cache so

that they can work with it offline.

Communications between the browser-based interface and the Web OS server, between the server and applications being used, and between programs that must interact with one another while clients are working with them occur via standard protocols such as HTTP and FTP.

Generally, the Web OS providers' back-end servers handle file management and security, and help integrate applications with one another so that they can interact.

Web OSs use encryption to obfuscate data sent between the client and server. The providers also run a standard suite of intrusion detection and antivirus applications. Users add security to their Web OS operations via their own applications.

Unless users choose to run applications or save data locally, they leave no trace of their work on the computers they use.

Applications

Most Web OSs, such as eyeOS and Desktoptwo, feature APIs that let programmers write new programs for the operating system.

Sapotek sponsors the Sapodesk open source software community. About 50 projects are under way to develop desktop-like customer-relationship-management, calculator, and other Web-based applications, including those that work with the company's two Web OSs, noted Sapotek CEO Joshua Rand.

Some Web OSs, such as the SGD, deploy standard Windows or Unix applications online via servers that run the programs in virtual machines that handle them as if they were in their native OS.

G.ho.st works with various Web applications already on the Internet, such as Zoho for word-processing, spreadsheet, presentation, and other office-productivity functions; Zimbra for calendaring and messaging; Pandora for playing music; and Flickr for displaying and managing photos, noted G.ho.st CEO Zvi Schreiber.

The Burton Group's Creese said Microsoft's release of Silverlight—a cross-browser, cross-platform plug-in that allows development of rich Web applications—could encourage the many programmers familiar with Microsoft-based development tools to also begin creating software for Web OSs.

ADVANTAGES

A Web OS runs on any Internet-enabled computer or device. This is important for mobile workers or people who don't have their own computers and must work out of Internet cafes, libraries, or schools. Also, Web OS users can work, log out, and then log in later from a different computer.

In addition, because the same Web OS can run on different computers, the technology facilitates collaboration among multiple work centers.

The traditional OS runs on only one computer. Extensions such as the *Network File System*—a way for different machines to import and export local files—and *remote desktop*—a way to control one computer by using another device—allow eas-

ier access to information from multiple locations and better user collaboration. However, these techniques are limited to a set of machines on the same network or specific computers that have been linked.

With a Web OS, users can store, find, and otherwise manage files and services, such as calendars and e-mail, from a Web desktop. And storing applications, files, and services on an OS provider's servers, rather than on the user's computer, makes them harder for a PC or laptop thief to use.

Web OS users don't have to back up or archive work because the provider's remote server handles these functions.

The technology also promises to reduce users' long-term computer and device costs because much of the heavy processing is concentrated in providers' remote servers, Sun's Thacker said.

Because the Web OS operates across platforms, it eliminates compatibility issues between applications and operating systems. Thus, the same Web OS will run on a Windows, Mac, or Linux machine.

Application developers create an application only once for a Web OS, rather than many times for each of the traditional operating systems. And system administrators have to deploy an application only once for a given Web OS. They can then easily distribute it online to users.

Because the Web OS and its applications are generally based in servers that can be monitored and secured from one location, they provide centralized malware protection.

SHORTCOMINGS

A number of shortcomings threaten to slow the adoption of Web OSs.

For example, they face network bandwidth and latency constraints that traditional OSs don't encounter. They also require extra layers of overhead—including power demands and the additional processing of keyboard, mouse, audio, and video inputs—because they operate via a browser that runs on

top of the host machine's operating system.

If Web OS users choose to locally cache data they're working with, the browser would have access to the information. This could cause security concerns if a hacker compromises the browser.

Web OSs generally come with a limited number of applications. And, the Burton Group's Creese said, the applications might not have features that users like in their traditional programs. Also, users may be too unfamiliar with the software to want to use it.

Web OS platforms are relatively immature and don't always offer as much functionality, such as native device-driver access, as traditional OSs. This has hurt the Web OS's adoption by corporations, according to Creese.

Most users can't easily transfer data and settings between different Web OSs because they don't use the same data formats, although some technically sophisticated users could manually do so. Proponents still must develop standards and tools to handle interoperability. Companies such as G.ho.st and Sapotek are working on such projects.

Most Web OS providers are small companies, and corporations might be reluctant to trust their sensitive data to such firms, Thacker said. And they may not want to either use an unfamiliar OS or trust their applications and data to a third party's computers.

Generally, users must be online to work with a Web OS, a major problem for those who never or rarely connect to the Internet or who lose access temporarily.

Companies such as Sapotek and Zimdesk are working with developers to add more applications—such as photo albums, jukeboxes, and personal-information managers—to their Web OSs.

Currently, G.ho.st's Schreiber said, companies aren't targeting their Web

OSs for mobile devices because their screens and networks aren't big or fast enough to consistently deliver an optimal experience. However, he noted, this is beginning to change.

In the future, UC Berkeley's Culler predicted, the Web OS may be based in a distributed set of servers, rather than just a single server. This creates redundancy that helps if problems occur somewhere in the system, and moves applications closer to users to reduce latency.

The Web OS's success may depend on how easy it is for developers to create applications for the various platforms, said Sapotek's Rand.

Initially, he added, younger people might be more willing than others to adopt the technology because they're already familiar with the Web and Web-based systems. But as Web-based applications gain popularity, other users may become more comfortable with the Web OS.

Amin Vahdat, professor at the University of California, San Diego, said, "I think that right now, we are at an inflection point with respect to the ability to deliver rich functionality over the network. The lack of ubiquitous, high-performance network connectivity will keep the [Web OS] infrastructure from being widely adopted in the next few years. I believe that most people will use traditional operating systems over the next five-year period but that increasingly, people will transition many of their productivity applications to Web operating systems." ■

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