PROWESS

Google™ Chromebook™ and the Google™ Chrome™ Ecosystem

A Map of the Landscape

Executive Summary

Though they made little more than a splash of curiosity in 2011 when Google announced its Google™ Chromebook™ plans, Chromebooks are now gaining marketplace momentum amongst some users with basic computing needs.

This paper is your map of the Google landscape. It will help you understand the differences between Google™ Chrome OS™, the Google™ Chrome™ browser, Chrome apps, and the Google™ Chrome Web Store™ marketplace. After reading this paper, you will understand how those components all come together inside the Chromebook and Google™ Chromebox™ cases. This insight will help you make better decisions about the suitability of Chromebooks for your organization's needs.

Making Sense of the Google™ Chrome™ Landscape

Chromebooks appeal to some users because they are simple, limited-function devices. They are also thin and light with battery life of up to 9.5 hours of active use (in newer models powered by Intel processors).[1] Furthermore, they offer an uncomplicated and hassle-free user experience at an attractive price, starting at around $200. Chromebooks are available from a variety of OEMs, with newer models from Dell, Acer, and HP featuring Intel processors.

With multiple configuration options and a computing model that is contrary to what most users are used to, it can be confusing to decide whether Chromebooks are right for you, and if so, to choose which one meets your needs. Adding to the confusion, terms related to Google Chrome are ubiquitous and sometimes unclear. What exactly is the Google Chrome OS, anyway, and how is it different from the Google Chrome browser? What are Chrome apps? And what do you buy at the Chrome Web Store?

To make informed decisions about Chromebooks, and to get the most from your investment, it helps to understand the larger picture. Chromebooks are just one component of a large Google ecosystem, and it is helpful to see all the pieces together. When you understand how all of the components fit, you can make better decisions about whether Chromebooks are right for you or your organization.

PROWESS

Google™ Chromebook™ and the Google™ Chrome™ Ecosystem

A Map of the Landscape

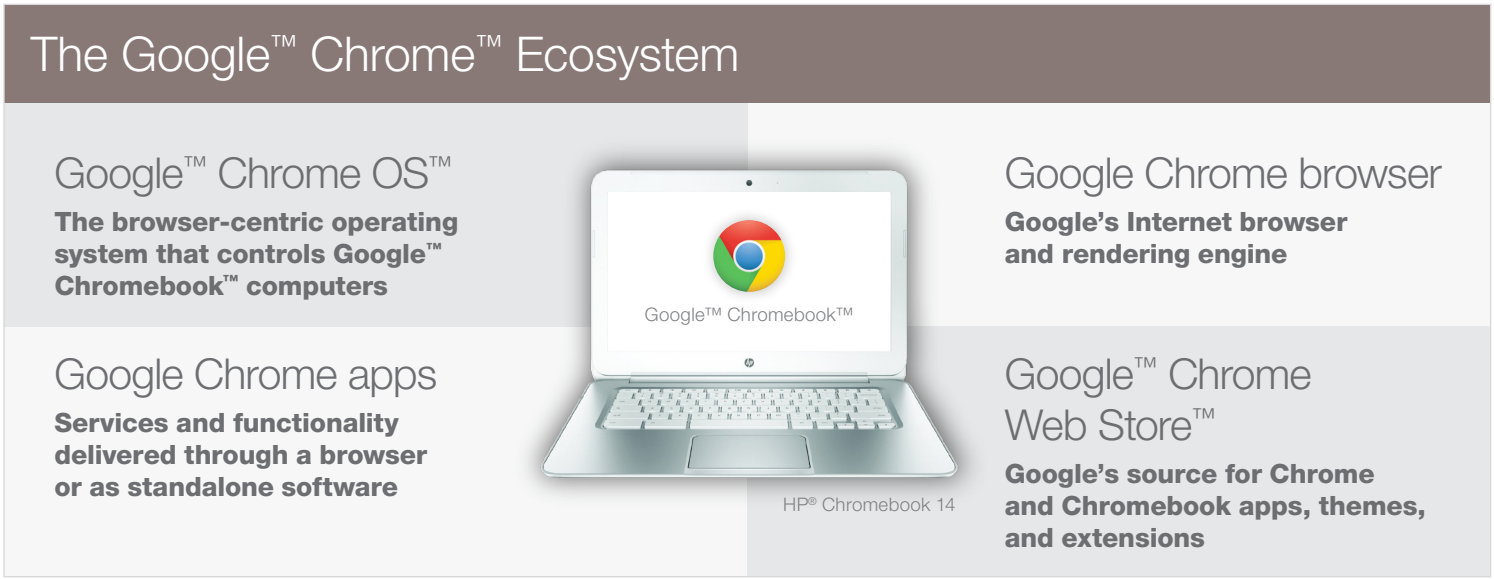


Figure 1. The Google™ Chrome™ ecosystem supports Google™ Chromebook™ devices

A New Computing Model

You know the traditional computing model well: each PC is a standalone entity with its own operating system. The OS supports individual programs, each of which uses resources on the computer—CPU and memory for execution of bits and disk for storage. While most modern programs have some online functionality, the programs usually do not require a network connection to operate. Connectedness is an "add-on" to offline core functionality.

Chromebooks represent an alternative computing model and an alternative type of computer. In this model, a computer's default state is connectedness. Core functionality is online, with offline capability for some apps added as a bonus. The device still has a resident OS, but the OS is very browser-centric, and application bits are executed through the browser rendering engine. This means that a Chromebook relies heavily on a broadband internet connection for optimal functionality.

The Importance of the Ecosystem

Google has built an ecosystem that aims to change the way you think about personal computers and computing. Chromebooks are the focal point of that ecosystem. Just as full Chromebook functionality depends on a broadband connection, it also depends on your participation in the Google ecosystem. It comprises several components as shown in figure 1. The next section discusses those components and shows how they combine to support the computing model that Google wants you to adopt.

Chromebooks: Who Uses Them and How?

Google and OEMs are positioning Chromebooks to serve a portion of the laptop user base—mobile, non-power users who primarily consume content. Through browser-based apps and the user's participation in the broader Google ecosystem, Google believes that Internet-connected Chromebooks can meet the basic digital needs of these users, as shown in figure 2.

Some of these features include an offline component. For example, users can edit a Google document (a document created with Google's productivity service, Google Apps™) while offline, then when the Chromebook is reconnected to the internet, changes synchronize back to the cloud. All of the capabilities on a Chromebook are delivered through a combination of apps, most of which are browser-based, and the Google ecosystem, which delivers online services (for example Gmail and Google Apps). Google believes that a portion of the mobile user base will not need applications or services beyond the basics provided by this Google-centric model. This means that some features you might be accustomed to in a web browser, such as Java® and Microsoft® Silverlight®, are not supported. Chromebooks also do not support Google™ Android™ apps or other popular programs and services such as Skype®, Microsoft® Office (including Microsoft® Outlook®), and Adobe® Photoshop®. Additionally, some apps and services provided through Chromebooks deserve some qualification and caveats:

- Basic productivity capabilities are provided by the Google Apps™ service. Users can create documents, slides, presentations, and more in the Chrome browser through Google's online service. Changes made while offline are synchronized when the device reconnects.
- Chromebooks support some peripherals that attach to the device through a USB port, such as external storage devices (with supported file structures) and mice. They also support Bluetooth® input and monitors with DisplayPort, DVI, HDMI, or VGA connections. However, peripherals that install software on the client device—a class that includes many modern peripherals—might not work with Chromebooks.
- Printers install drivers and other software on a client device, so users cannot simply plug a USB printer into a Chromebook and expect it to work. They must use the Google Cloud Print™ web printing service. To print a document, you must first register your printer with Google Cloud Print over your wireless network, and then the Chromebook must "see" that printer as a cloud-connected printer.

Google™ Chromebook™ Devices Meet the Basic Computing Needs of Some Mobile Users.

Figure 2. Google™ Chromebook™ devices meet basic computing needs

Google also positions Chromebooks for more demanding users as a lightweight secondary device such users can easily take with them anywhere. While these users won't be able to perform demanding work on a Chromebook, they will have a convenient gateway to the services and sites that they access most often.

Education Appeal

Chromebooks are enjoying growth in the education sector. IT administrators like their simplicity, centralized manageability, and easy integration with Google Apps for Education™ program already in use at many schools. Teachers like that students have access to Google's free productivity tools with no advertising, and that students can safely browse the web for educational content. According to IDC, Chromebooks are "easier to deploy and manage for Education than other machines" and are "well positioned to be a preferred educational connected computing solution."[2]

The Google™ Chromebook™ Device Range



	ENTRY LEVEL	MID-LEVEL	FULLY LOADED
	Acer® C720 Chromebook **$199**	HP® Chromebook 14 **$299**	Google Chromebook Pixel™ **$1,299 (Wi-Fi®); $1,499 (LTE)**
	Dual-core Intel® Celeron® processor	Dual-core Intel® Celeron® processor	Dual-core Intel® Core™ i5 processor
	Up to 8.5 hours**	Up to 9.5 hours**	Up to 5 hours**
	2.76 lbs	4.08 lbs	3.35 lbs
	11.6"	14"	12.85"
	1366x768	1366x768	2560x1700

**Battery life data represents hours of active use, and it may vary based on usage or other conditions.
Table based on information from http://www.google.com/intl/en/chrome/devices/chromebooks.html at time of publication.

Figure 3. Google™ Chromebook™ devices are available in a range of configurations

Chromebook Configurations

Chromebooks are currently available in a range of configurations. These configurations offer a low entry price and incremental increases in performance, screen and graphics capabilities, and battery life.

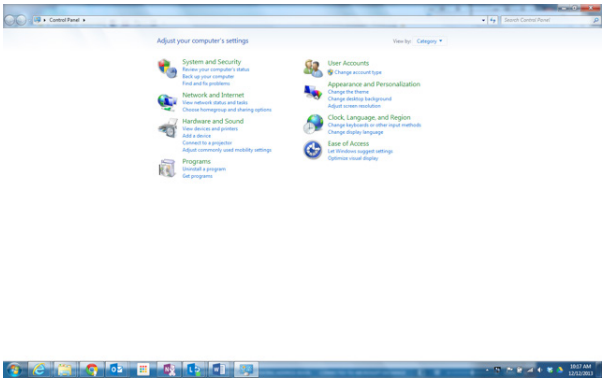
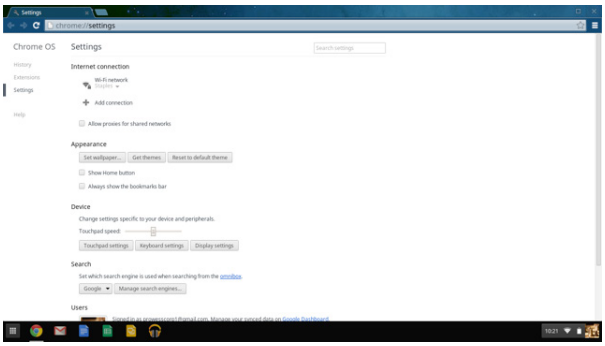
The preceding figure provides basic examples of entry level, mid-level, and fully loaded Chromebooks. The price within each category could increase based on configuration options. For example, while the base model of the Acer® C720 starts at $199, the touch-screen model would be more.

What Is the Google™ Chrome OS™?

Google Chrome OS is the operating system that resides on Chromebooks. Chrome OS does for Chromebooks what Windows® does for PCs. It allocates system resources and manages hardware and software behavior and settings. It also provides a user interface that allows users to interact with the device and the software on it. Finally, it provides a common set of standards that allows predictable behavior that is consistent from one device to another. The OS is the common foundation that allows developers to create software and have confidence that the software will run on any device running that OS.

Chrome OS provides a familiar, window-based interface including a customizable desktop, shortcut icons, and a system and task tray. However, Chrome OS differs from Microsoft® Windows® by being heavily centered in the browser. What does a browser-centric OS look like? When you want to change system settings, you do so through the browser. Most apps also open in the browser. This approach makes sense within Google's alternative computing paradigm, which assumes that the reason for turning the computer on is to get online as quickly as possible. This assumption is built into Chrome OS. Table 1 shows other important differences between Windows and Chrome OS. The table is not comprehensive because the differences really are vast, but it shows how the user experience differs regarding common tasks.

Table 1. Common tasks differences between Windows® 7 and Google™ Chrome OS™

Task/Function	Windows®	Google™ Chrome OS™
Change various settings and taskbar	 **Control Panel** interface and **taskbar** shows running programs, shortcuts, and system tray; customizable	 **Settings** interface in Google™ Chrome™ browser and **shelf** shows Chrome launcher, shortcuts to Google Apps™ service, Google Play™ service, and system tray; not customizable
Uninstall a program	**Control Panel** > **Programs** > **Uninstall a program**	Right-click the app in the Chrome launcher > **Remove from Chrome**
Manage user accounts	**Control Panel** > **User Accounts**	**Settings** > **Users**
Appearance and personalization	Robust options through **Control Panel**, downloadable themes	Set wallpaper, show or hide the **Home** button, show or hide the bookmarks bar, downloadable themes

The Chrome OS also has a lightweight file-browsing utility that supports a wide range of popular file formats, including PDF, PPT, DOC, ZIP, XLS and RAR. This file utility is helpful because Chromebooks—unlike Apple® iPad® devices—support local file storage and management on internal solid-state drives (SSDs) or on removable media (SD cards or attached USB devices). The OS also provides the following:

- Media viewer
- Calculator
- Lightweight photo editor
- System tray showing time, connectivity status, battery meter, and notifications from apps
- App launcher for quick access to apps
- Search bar to find apps (installed or in the Chrome Web Store) or to launch a Google web search

The Google Chrome Browser

You're probably already familiar with the Chrome browser, often referred to simply as Chrome. Like Internet Explorer® and other browsers, Chrome runs as a standalone application on various operating systems. Chrome also supports browser-based applications that you can install and run within the browser. You do not have to have a Chromebook to install and use these apps. They are fully supported by Chrome running on Windows devices powered by Intel architecture.

On a Chromebook, the Chrome browser is more than a window to the web. It is the launch platform for nearly all applications. When you start an application on a computer running a traditional OS, the system starts a standalone process that runs independent of other applications and regardless of connection status. When you start an app on a Chromebook, the app usually opens in a Chrome tab or window, and Chrome requests functionality that is delivered through the browser interface, typically over the Internet.

The Google™ Chrome Web Store™ and Chrome Apps

Traditional software to which you might be accustomed, including many custom or legacy enterprise applications, is not supported by Chromebooks. Some of these programs have web-based equivalents that interface with cloud storage,

so you might be able to use an online version of traditional standalone software. To address the need for supported applications, Google has developed an ecosystem of apps designed and optimized specifically for the Chrome browser and the Chromebook environment.

Chrome apps are usually web pages or web-based services that run in a Chrome tab. Unlike traditional desktop programs, Chrome apps are typically available only from the Chrome Web Store, where there are already more than 33,000 from which to choose. If you use mobile devices built on the Android OS, you have probably already used a similar storefront called Google Play™. These two storefronts are separate and have distinct purposes:

- **Google Play Store:** A hub for distributing Android apps to mobile devices and digital media to mobile and Chrome environments
- **Chrome Web Store:** A hub for free and paid apps, extensions, and themes for Chrome or Chrome OS

Most Chrome apps are designed to run within the browser window. You are familiar with this approach if you've ever used Pandora®, Google™ Gmail™, or Google Maps™. Another way these apps differ from traditional software is that, once you install an app, it is available when you run Chrome on any other device, provided you log on to your Google account. Chrome apps have a number of other advantages: they are secure, they remain up to date without user intervention, and they maintain isolation between your browser and OS in the event of an application crash. If a Chrome app crashes, you simply restart the tab running the affected app.

Offline Functionality and Packaged Apps

While Internet access is increasingly available, signal strength, connection speed, and reliability can vary widely and affect user experience. Simply put, there are still times when it is necessary or expedient to work offline. Google has addressed that concern to some degree by offering packaged apps, which differ from hosted apps by embedding all the necessary code elements within the application package file. With all components installed directly on the user's hard drive, a packaged app can be run offline, outside the browser, so that it behaves and looks like a native application. Unlike typical native apps, however, Chrome packaged apps can run on any supported operating system, including Chrome OS on Chromebooks or Windows on devices powered by Intel processors.

Hosted apps often have limited functionality when the Chromebook is not connected to the Internet. Some do not run at all while others, such as Google Apps, allow users to edit documents while offline. Then, when the device is again connected, the app syncs those changes to the cloud.

Customizing Chrome with Extensions and Themes

Chrome users can customize their environments using extensions and themes. Extensions let you extend functionality or modify how you interact with features within the Chrome browser. For example, you can add an extension to get instant directions or map information from an address on a web page. Other extensions provide e-mail alerts, give the ability to convert pages to PDF files, or block ads on web pages.

Themes are more about appearance than functionality. They give users a way to change the skin of Google Chrome to reflect their personality or style preferences.

As with Chrome apps, extensions and themes can be used on Chromebooks or in the Chrome browser in any supported environment, including Windows devices running on Intel processors.

Convergence Point: Chromebooks

These various components of the Google ecosystem—Chrome OS, Chrome browser, Chrome apps, and the Chrome Web Store—are all somewhat abstract when considered in isolation. But Chromebooks are a visible and tactile point of convergence: the best way to understand Chrome OS is to use a Chromebook for a day. Inside the Chromebook case, all the separate components of the Google ecosystem converge to provide an alternative personal computing experience.

Chromebook models are available from HP, Acer, Dell, and Samsung. The newest models as of publication, the Dell® Chromebook 11, Acer C720, and HP® Chromebook 14, feature Intel® Celeron® processors based on Haswell microarchitecture. They help provide the security, stability, and performance you need, along with battery life of up to 9.5 hours of active use.[1]

Keep this overview of the Google landscape in mind as you consider your Chromebook options. It is important to remember that a Chromebook purchase represents a commitment to an alternate online-first computing model and to the Google ecosystem of apps and services.

[1] Based on Chromium Power Test. Battery life may vary based on usage or other conditions.

[2] IDC. “Quantifying the Economic Value of Chromebooks for K-12 Education.” August 2012.