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Deliver Windows Apps and Desktops on Secure, Cost-Effective Devices

How to Revolutionize App and Desktop Delivery with Citrix and Google Chromebooks

Executive Summary

Growing numbers of organizations are deploying Google Chromebooks and Chromebox computing devices for work use because they are secure, easy-to-manage devices that can help organizations reduce the costs associated with end-user computing.

Citrix software can make Chromebooks even more attractive to enterprise IT departments. The joint Citrix and Google solution delivers Windows apps and desktops to Chromebooks quickly and cost effectively—without additional server infrastructure and without requiring a full virtual Windows desktop.

If your organization uses Citrix XenApp or Citrix XenDesktop, you can easily start to use Chromebooks to deliver Windows and line-of-business (LOB) applications or desktops to end users. With proven technology from Google and Citrix, you can implement a more secure app-delivery solution when you deploy the latest version of Citrix StoreFront. This paper describes the joint solution and provides guidance for solution architects as they evaluate Chromebooks for use in their environments.

Why Citrix and Chromebooks?

As the IT manager in charge of solutions and support for 7,500 users worldwide, Tara's mind was churning as she left the IT budget meeting. Her company's CIO challenged the IT department to reduce costs by 25 percent over the next fiscal year. He expects to see incremental progress as soon as the end of next quarter. Tara is responsible for a significant portion of the overall IT budget, and she knows her manager will come to her for ideas on how to cut costs. This pressure is not new for Tara, of course. Her IT organization is always expected to deliver services more efficiently and more cost effectively than they did the year before. Motivated by that pressure, Tara and her team have carefully evaluated virtualization and cloud technologies because of their potential to deliver both IT services and savings.

Virtualization has already transformed Tara's data center, but her strategy has not yet widely expanded virtualization to end users. She uses XenApp to deliver the company's most sensitive apps, such as its customer relationship management (CRM) application, to select user groups. However, most of her users rely on Windows applications to do their jobs, so it made sense to simply deploy PCs running Windows or, for some user groups, a lower-cost thin client to perform a specific task.

But now, with new pressure to find creative ways to cut costs, Tara is looking for new ways to expand her use of virtualization to more end users. She knows that any successful virtualization solution would have to meet two criteria:

- It would have to securely support user access to Windows and mission-critical LOB applications.
- It should be easily manageable, scalable, user-friendly, and should require minimal investments in new infrastructure.

That's why her mind was churning. Virtualization and cloud technologies hold enormous potential for efficient app delivery and cost savings, but those gains cannot impact user productivity.

DELIVER SERVICES AND SAVINGS WITH CITRIX XENAPP FOR CHROMEBOOKS
Does Tara's scenario sound familiar? IT professionals like you share many of the same challenges. You are probably familiar with market-leading **application** and **desktop** virtualization software from Citrix. But did you know that Citrix and Google have worked closely together since 2010 to help Chromebook users easily access Windows applications and desktops?

This joint engineering means that business users can access Windows and LOB applications on their Chromebooks without first having to launch a virtual desktop. Or, if your organization's use cases call for full Windows desktops, users can get those on their Chromebooks as well. It also means that IT administrators do not have to migrate apps and data to the cloud and learn a whole new desktop-as-a-service (DaaS) management model. The result is simple delivery of Windows applications and/or desktops to secure and manageable devices with a seamless, high-quality user experience over any network—hosted on premises or in any cloud.

This paper describes the technical framework of this solution to help you decide where the enterprise benefits make sense for your organization.

Assumptions
The following assumptions inform the content of this paper:

- You are familiar with application and desktop virtualization.
- You have a working knowledge of Citrix XenApp and XenDesktop, including how apps are packaged for execution in the data center and published to remote devices.
- You have a basic understanding of the Google Chrome ecosystem and Google Chromebooks.

Solution Overview
XenApp for Chromebooks uses Citrix software and services and the Google Chrome management console to deliver Windows and LOB apps and/or Windows desktops to Chromebooks and Chromeboxes. Each component of the solution is designed explicitly to provide a secure, high-quality user experience wherever people work.
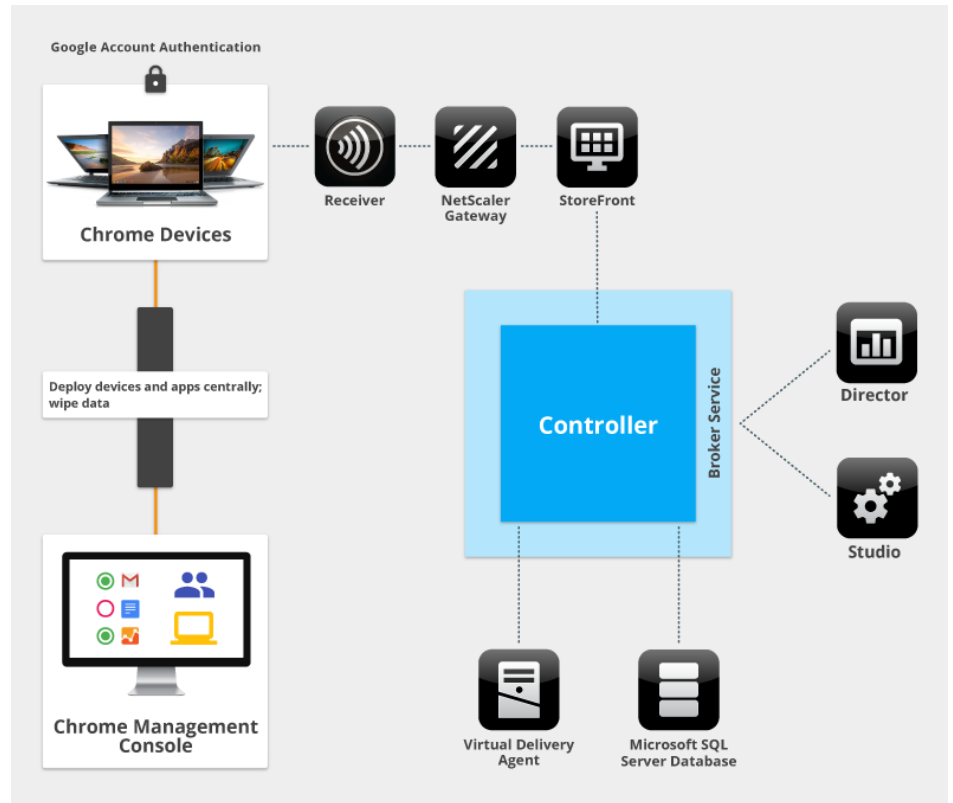
Figure 1. Citrix XenApp for Google Chromebooks uses Citrix StoreFront and Citrix Receiver for Chrome to deliver Windows apps to Chromebooks. The devices are centrally managed from the Chrome Management Console.

USE CASES

This flexible solution supports a variety of enterprise use cases. This paper focuses on application delivery, but you can expose new possibilities for the solution when you keep in mind the core strengths of Chromebooks:

- Speed: Chromebooks boot in 10 seconds to help users stay productive, and their user experience with published apps is comparable to a native app experience.
- Security: By design, Chromebooks remove many attack vectors that plague traditional PCs, and with Citrix XenApp, apps and data remain safe in the data center.
- Simplicity: Chromebooks are easy to learn and use, and Citrix Receiver presents packaged apps in an intuitive, familiar interface.
- Shareability: Users' apps and settings follow them from device to device.
- Any user segment for which these values are crucial could benefit from XenApp for Chromebooks. For example, the solution is a good fit when you want to let employees use the device for personal computing, but do not want corporate data on the device.

The solution lets you easily separate personal use from the work environment, which is isolated and protected in the Citrix Receiver session. The solution is a good fit for thin-client environments for fixed-function workers with limited computing needs or for kiosks. You can lock down the device so that only Citrix Receiver is accessible, and you can even customize the screen to your organization's brand.

TAKE ADVANTAGE OF BUILT-IN MANAGEABILITY AND SECURITY
The Google and Citrix solution gives IT the tools it needs to centrally manage and secure devices, data, and the user experience.

Manage Devices
The Google Chrome management console simplifies and centralizes managing Chromebooks. It gives IT administrators fine-grained control over device policies and configurations, extends administrators' support reach, and provides insight into device usage. When devices are enrolled in the management console before they are deployed to users, IT can configure Chrome features and settings for users, set up VPN and wireless network access, pre-install Chrome apps and extensions (including Citrix Receiver), and more.[1]

Manage Apps and User Experience
Centralized Citrix management tools, such as Director and Studio, help organizations quickly package and deploy Windows apps and then monitor the end-user experience for troubleshooting purposes. Director provides a detailed and intuitive overview of XenApp environments so that support and helpdesk teams can spot and troubleshoot system issues before they become system-critical. Citrix EdgeSight correlates data supplied by Citrix NetScaler Insight Manager to monitor performance at the endpoint and identify when network issues are disrupting the user experience.

Secure from the Foundation
Chromebooks are designed with "defense in depth" principles to provide multiple layers of protection. For example, each time they boot, Chromebooks perform a self-check to make sure the system hasn't been tampered with. All user data stored on the device is encrypted, including browser caches and any data written to the device from within a XenApp session. And Chromebooks automatically download app and operating system updates so the devices always have the latest security fixes.

Furthermore, Chromebooks can use policies and permissions similar to those in your directory-service environment. Users can then use their Active Directory credentials to log on to their devices, and you can apply policies to enforce access controls and other security precautions.

Apps published with XenApp and delivered to Chromebooks remain safe in the data center. Intellectual property and other sensitive data are not stored on users' devices, which helps protect your organization in the event of device loss or theft. In addition, XenApp and XenDesktop support Secure Sockets Layer (SSL) protection on the controller or between end users and the Virtual Delivery Agent (VDA). You can enable the Transport Layer Security (TLS) security protocol on a XenApp or XenDesktop site to provide server authentication, data stream encryption, and message integrity checks for a TCP/IP connection.

This secure foundation makes data loss or theft extremely difficult. If a Chromebook were stolen, the unauthorized user would have to present valid Google or Active Directory credentials and valid Citrix Receiver credentials to access any apps or data within the XenApp environment. In addition, connections between Chromebooks and Citrix Receiver are protected with SSL encryption, and Citrix recommends SSL certificates with key length of at least 1,024 bits.
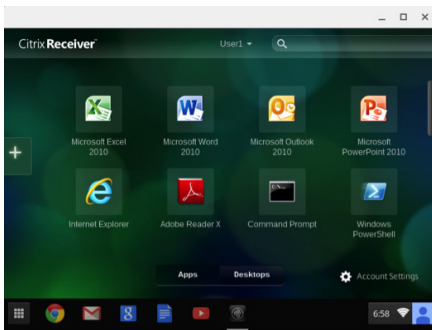
Figure 2. The Citrix and Google solution gives users simple, self-service access to Windows applications through Citrix Receiver, which interacts transparently with Citrix StoreFront.

KEEP YOUR DEPLOYMENT OPTIONS OPEN

You can keep your options open with the Citrix and Google solution because it is inspired by Citrix FlexCast, a delivery strategy that lets you take advantage of many different app and desktop virtualization models to support different use cases. The solution is powered by a unifying framework called FlexCast Management Architecture (FMA).[2] FMA is a cloud-ready, service-oriented architecture that accommodates open APIs, any virtual infrastructure, any storage infrastructure, and complex network topologies.

FMA lets Citrix technologies work together and helps you manage them more easily and efficiently, no matter which methods you choose to deliver services. It supports multiple flexible deployment models for your Chromebooks, including:

- Published applications: You can let users access the software they need to do their jobs in a familiar web app-like environment from the Google Chrome browser. They don't have to open a desktop within a desktop to use business-critical or LOB apps, or to use apps running on Windows.
- Published desktops: You can also deliver complete Windows desktops to Chromebooks with XenDesktop. The Citrix and Google solution supports multiple delivery models for desktops, including server-based virtual desktop infrastructure (VDI).

This paper focuses primarily on delivery of applications published with XenApp to Chromebooks in a deployment like that shown in Figure 1. For more information about other delivery models, please contact your Citrix or Google representative.

IT professionals who are evaluating Chromebooks for their users often wonder whether their app environment is a good fit for XenApp on Chromebooks. You can quickly find out with **Citrix AppDNA**. Included with XenApp Platinum, AppDNA application-management software lets you discover, automate, model, and manage six generations of Windows applications for faster application migration and streamlined application management. It is an essential tool for organizations that are evaluating or transitioning to Chromebooks.

The next sections of this paper describe the fundamental components of XenApp for Chromebooks as depicted in Figure 1.

CITRIX STOREFRONT

Citrix StoreFront is a web-based interface application that provides authentication and resource-delivery services for Citrix Receiver. It authenticates the user and enumerates and aggregates the available desktops and applications into stores, which users access through Citrix Receiver. Customizable through the StoreFront Store Customization SDK and web API, StoreFront is compatible with all versions of XenDesktop and XenApp supported by Citrix. Refer to the **product lifecycle matrix** from Citrix for more information.

CITRIX RECEIVER FOR CHROME

Citrix Receiver for Chrome is an app, packaged for Chrome, that interfaces with StoreFront and presents applications and desktops in an intuitive, desktop-like view (**see Figure 2**). Google and Citrix development teams continue to work together on new features that take advantage of Chrome APIs and the native hardware capabilities of Chromebooks. This joint engineering means Citrix Receiver for Chrome can deliver advanced capabilities for XenApp published apps. Some of the key native features enabled by Citrix Receiver for Chrome include the following:

- The low-cost Chromebook can give high-class performance with XenApp and XenDesktop with support for hardware-based decoding for graphics. You get fluid interactive experience with 2D and 3D graphics applications and smooth video playback on Chrome devices. The hardware decoding has full coverage of devices and works on Chrome devices with Intel, NVIDIA, and Samsung chipsets. Devices that have a low-power CPU but a powerful hardware decoder can show nearly 2x performance improvement.
- Multi-session aware printing: Within their XenApp sessions, users can use the native Windows print dialog to stream files down to the Chromebook, which in turn can print to any printer with Google Cloud Print enabled. This approach supports all sessions running from the same XenApp server.
- Transparent clipboard: Users can copy and paste different types of data, including text, tables, and images, directly between published applications, both within the same session and between different sessions.
- Seamless keyboard support: Users can use standard Windows keyboard shortcuts—such as Alt-Tab, Ctrl-C, and Ctrl-V—within their published apps because these shortcuts are passed from Chrome OS to published applications. Shortcuts specific to particular applications can also be used, provided they do not conflict with any Chrome OS shortcuts.
- App switching within same session: Applications running in the same session appear in the same window. Users can easily switch between them by using App Switcher. When App Switcher is installed on the XenApp server, viewers see a taskbar at the bottom of the window that displays all the applications currently running in the session. Users can then click apps to switch between them. Users can configure the taskbar to auto-hide and switch to small icons to minimize the amount of space taken up by the taskbar.
- Customizable: You can preconfigure Citrix Receiver for Chrome by repackaging it with a custom Citrix Receiver configuration file (.cr) to simplify setup. You can also customize the look of Citrix Receiver for Chrome, such as changing the application name or adding your company's branding, by editing the manifest file. You can easily publish the repackaged application for users through the Google Chrome management console.
- User experience monitoring: IT administrators can see details about session performance and user experience in Citrix HDX Insight on NetScaler or Citrix CloudBridge because Citrix Receiver for Chrome exposes Citrix HDX session metrics. Citrix Receiver also provides a unique client ID and IP address to the XenApp server, making it easier for administrators to monitor application and license usage.
- CloudBridge 7.3.1 or later in your deployment with Citrix Receiver for Chrome will give you additional benefits of compression and quality of service. Refer to **this blog** post for more details on Citrix CloudBridge.

- Legacy environments: You can use Chrome devices with Citrix Receiver for Chrome in Citrix legacy environments with Web Interface 5.4 or later. The rest of the deployment and configuration requirement remains the same as with StoreFront. You can also open the downloaded ICA file in Citrix Receiver for Chrome from your custom portal or using browser-based access to Web Interface or Citrix Receiver for web.
- Basic USB device support allows you to connect USB devices like printers and scanners to Chrome devices and use them inside the Citrix session. The devices that are claimed by the Chrome OS are not available to the Chrome packaged app, for example: USB flash drives, webcams, and headsets are not redirected to the Citrix session.

XenApp for Chromebooks also supports Citrix Receiver for HTML5—a clientless, browser-based access capability built into the Chrome browser. Citrix Receiver for HTML5 supports a subset of the features enabled by Citrix Receiver for Chrome, including:

- *Simple access*
- *Print to PDF[7]*
- *Assisted clipboard functionality*

Citrix Receiver for HTML5 is now installed with StoreFront.

Citrix Receiver for Chrome is available from either the **Google Chrome web store** (for users) or the **Citrix download page** for admins to customize and deploy by using the Google Chrome management console.[6]

Citrix Receiver for Chrome and Citrix Receiver for HTML5 both deliver a familiar and intuitive user experience with Windows or any LOB, web, or software-as-a-service (SaaS) application. However, because it is designed to take advantage of the Chrome API and hardware capabilities on Chromebooks, Citrix Receiver for Chrome presents advantages to users over the web-based Citrix Receiver for HTML5. For example, Citrix Receiver for Chrome offers seamless clipboard functionality, allowing users to copy from one published app and paste into another by using the keyboard shortcuts to which they are accustomed. Citrix Receiver for HTML5 also supports copy-paste functionality, but requires the in-session toolbar.

ADDITIONAL COMPONENTS
The Chromebook with XenApp solution is enhanced with the following additional components:

- Citrix NetScaler Gateway provides authentication and load-balancing services and brokers connections between StoreFront and the XenApp or XenDesktop server.
- Management and monitoring consoles give administrators the tools they need to centrally manage the XenApp for Chromebooks solution. For example, IT organizations can use the Chrome Management console to manage Chromebooks through their entire life cycle. Citrix EdgeSight 5 helps your administrators know what your end users are experiencing, how applications are performing, and how your infrastructure is affecting your end users' experiences.
- The VDA runs on the server and allows host resources to be made available to users.
- The application delivery controller (ADC) is the central management component of a XenApp or XenDesktop site. It comprises services that manage resources, applications, and desktops and that optimize and balance loads across user connections.

XenApp and XenDesktop run on Windows Server 2012, Windows Server 2012 R2, or Windows Server 2008 R2 SP1. All major hypervisors are supported and you can even host your apps and desktops on public cloud services.

How to Get Started

StoreFront and Citrix Receiver work together to deliver published apps (and desktops, if desired). When you have an operational XenApp environment, you can prepare StoreFront and Citrix Receiver for use with Chromebooks in three stages:[8]

1. Set up StoreFront: Deploy StoreFront and create a store to aggregate the desktops and applications you want to make available to Chromebook users. Your store will require a Citrix Receiver web site, but one is created automatically when you create a new store.[9] During this stage, you will also enable Citrix Receiver for HTML5 and select "Use Receiver for HTML5 if local install fails." This selection helps ensure that users can access StoreFront and their apps through Citrix Receiver for HTML5 if needed.

2. Configure access: Configure Citrix NetScaler Gateway to access your XenApp environment. Citrix Receiver for Chrome uses the WebSocket protocol to access virtual desktops and hosted applications. However, WebSocket connections are disabled by default on NetScaler Gateway, XenApp, and XenDesktop. To allow StoreFront to connect to your XenApp or XenDesktop environment, you must enable WebSocket connections on NetScaler Gateway. If you plan to allow users to access apps without connecting through NetScaler Gateway, you must also enable WebSocket connections on XenApp and XenDesktop.

3. Enroll and deploy devices: When StoreFront, Citrix Receiver, and XenApp are communicating, you can allow users to begin using their apps. You can do this in a variety of ways, but the simplest might be to take advantage of the centralized device-management capabilities of the Google Chrome management console.

   Make sure to enroll Chromebooks in the management console before deploying them to users to simplify management. Then, you could package Citrix Receiver for Chrome to be preconfigured with your StoreFront URL and customize the look and feel to suit your organization's brand. You would then simply push the packaged app to users' Chromebooks where users will see Citrix Receiver for Chrome in the apps list. Users click the icon to launch Citrix Receiver and enter their credentials—no additional configuration is required.
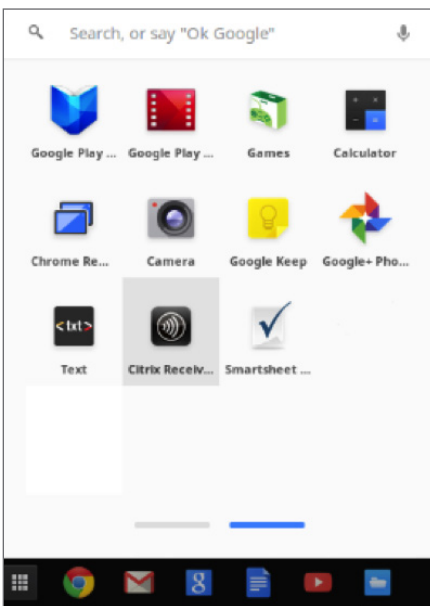
How to Deliver a Productive End-User Experience

Both Citrix Receiver for Chrome and Citrix Receiver for HTML5 work with **Citrix HDX technology** to deliver a productive user experience on Chromebooks. HDX technology is a set of capabilities that deliver a "high-definition" experience to users of remote Windows applications and desktops, on any device and over any network. These technologies use intelligent redirection, adaptive compression, and data deduplication to help XenApp deliver an optimized user experience.

When working on their Chromebooks, your users will enjoy the following benefits of HDX technology:

• Efficient bandwidth utilization: even when their Chromebooks are connected to a 3G or 4G network, the solution intelligently adapts to different network conditions.
• The codecs for graphics and audio and their tuning help ensure a high-quality user experience with efficient resource utilization.

Figure 3. Citrix Receiver for Chrome in the apps list on a Chromebook.

XENAPP FOR CHROMEBOOKS DESIGN AND DEPLOYMENT CONSIDERATIONS
The Citrix and Google solution enables capabilities that address concerns and leverage IT trends that are top-of-mind for most organizations. The following design considerations can help ensure that your deployment is successful.

Solution Planning
Plan in advance to take full advantage of the solution's manageability and security capabilities. In particular, it is smart to include Google Chrome management in your solution design up front—before deploying Chromebooks to users. Doing so unlocks the full spectrum of management capabilities built into Chromebooks, simplifies their provisioning, and allows you to use the policies and organizational unit structure already developed in your Active Directory environment. You can make the transition a smooth one by using the **Google Apps Directory Sync** tool. This Lightweight Directory Access Protocol (LDAP) tool selectively and intelligently synchronizes Active Directory data to the cloud so that you can apply policies to managed Chromebooks.

Assessment
It is important to carefully assess your users and the suitability of the Citrix and Google solution to their needs. Simply put, some use cases are better candidates for published Windows apps on Chromebooks than others. A careful assessment of your app environment can reduce IT hassle and accelerate time to value while minimizing end-user disruption. AppDNA, included with XenApp premium, delivers insight into your application portfolios with highly accurate application testing, compatibility, and remediation. You can then use the insight to design an implementation approach that makes the most sense for your organization and users.

Performance
Outstanding application performance on the end-user device is paramount. Users expect an experience from their virtualized applications that is comparable to the native performance to which they are accustomed.

The Citrix and Google solution supports a high-quality end-user experience with technologies discussed in this paper, such as Citrix HDX technology.

Fault Tolerance
Fault tolerance is built into the solution by design. Chromebooks are automatically updated with the latest OS version, so they are much more tolerant of endpoint failure than traditional PCs. If you manage all of your organization's Chromebook devices from the Chrome management console, you can immediately provision replacement Chromebooks in the time it takes for a user to log on to the new device and launch Citrix Receiver. When you combine that stability with published apps and data that are safely stored in the data center, the result is a degree of fault tolerance that brings peace of mind to both users and to IT.

Security
In addition to the built-in security features of the solution, you can further strengthen security through Citrix HDX SmartAccess policies. Configured and enforced through NetScaler Gateway, these policies let you control access to published apps based on changing conditions, such as the users' locations. This ability to dynamically adjust to changing conditions is crucial when users typically roam between different locations and devices. NetScaler Gateway also supports pre-authentication and post-authentication checks as a condition for access to published resources, along with other factors.

You can also use NetScaler Gateway to manage user authentication to all intranet sites so that users do not have to re-enter their Active Directory credentials each time they visit a secured internal site through a XenApp published app.

Education and Change Management

A successful implementation of XenApp for Chromebooks will include careful end-user training and change-management tactics. While the solution provides performance that is comparable to that of native apps, users need some coaching to manage the differences in work style. Accustomed to saving data and files locally on their PCs, users must learn how to access their apps and manage files in a cloud-based environment. Furthermore, Chromebooks are simple to use, but users must acquire new habits and adjust their assumptions about personal business computing.

Google provides guidance about change management to organizations that are adopting Chromebooks. Visit **www.google.com/work/chrome** to learn more about how to support your users during deployment and transition.

Take the Next Steps

Chromebooks are attractive to many organizations that are looking for ways to deliver IT services to mobile employees securely and cost effectively. XenApp for Chromebooks can help expand the benefits of Chromebooks to more users in your organization as it delivers a high-quality user experience with Windows apps on secure, manageable devices. If you already have a XenApp or XenDesktop environment, a simple app delivery solution might be a few short steps away. Simply install the latest version of StoreFront, connect it to your XenApp environment, and deploy your customized Citrix Receiver for Chrome app to your managed Chromebooks.

You can get started today by learning more and downloading StoreFront:
http://www.citrix.com/downloads/storefront-web-interface.html

1. Chromebook management is available for Chromebooks purchased directly from Google or an authorized reseller. To manage Chromebooks from third-parties, purchase Chromebook management separately from the Chromebooks for Work or Education sales teams. Administrators must create a Google account or Google Apps account (if they're Google Apps customers) for every Chromebook user in their organization. A user signs in to the Chromebook with their Google Apps username and password.

2. FMA is the default architecture for XenDesktop and XenApp 7.6. The Google and Citrix solution also supports IMA deployment architecture, which is the default architecture for XenDesktop and XenApp 6.

3. This feature requires Citrix PDF printer, which must be installed separately on top of Citrix XenDesktop and Citrix XenApp 7.6. You can get access to XenApp and XenDesktop resources through Web Interface 5.4 as well.

4. This feature requires Citrix PDF printer, which must be installed separately on top of Citrix XenDesktop and Citrix XenApp 7.6.

5. Only Unicode plain text can be copied and pasted between published applications and the local clipboard on the device.

6. Current versions as of publication date are: Citrix Receiver for Chrome 1.6, Citrix Receiver for HTML5 1.6, Citrix StoreFront 2.6, XenApp 7.6, XenDesktop 7.6.

7. Citrix PDF printer is available on the Citrix Receiver for HTML5 download page and it needs to be installed separately on top of Citrix XenDesktop and Citrix XenApp 7.6 or later to enable this feature.

8. Guidelines presented in this paper are for illustration purposes only. For detailed setup and deployment instructions, see the Citrix Receiver for Chrome documentation:
   http://support.citrix.com/proddocs/topic/receiver/receivers-chrome-os.html

9. For detailed instructions on how to create a store, see the product documentation:
   http://support.citrix.com/proddocs/topic/dws-storefront-26/dws-create-store.html