



Clear Ballot

## **ClearVote 2.3**

### **ClearCount Build Procedures**

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# ClearCount Build Procedures

Clear Ballot Part Number: 100009-10020

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## Preface

This section defines the purpose of this document.

### About this document

This document describes the build procedures for the ClearCount software.

This document corresponds to the requirements for the technical data package (TDP) described in the *Voluntary Voting System Guidelines (VVSG)*, 2005, Volume 2, Section 2.2.

### Scope of this document

This document contains the following chapters:

- Chapter 1. Overview
- Chapter 2. Setting up the build environment
- Chapter 3. Copying the source code
- Chapter 4. Downloading the Windows third-party libraries
- Chapter 5. Building the ClearCount Windows applications
- Chapter 6. Downloading the third-party libraries for the CountServer
- Chapter 7. Building the CountServer

### Intended audience

The document is for state and federal election officials and their voting system test laboratories. This document is part of the Technical Data Package (TDP) required to certify the ClearVote system for use. Clear Ballot personnel also use this document to support election officials and staff.

### Conventions

This section describes conventions used in this document.

### References to ClearVote products

A ClearVote® system can comprise the ClearAccess®, ClearCast®, ClearCount®, and ClearDesign® products. Jurisdictions are not required to purchase all products. You can ignore references to any ClearVote products that are not part of your voting system. Also ignore implementation options that are not relevant to your policies and procedures.



## BDF and ADF

ClearAccess imports an election definition contained in an accessible definition file (ADF) created by ClearDesign. ClearCount and ClearCast import an election definition contained in a ballot definition file (BDF) created by ClearDesign.

Versions of ClearDesign earlier than 2.0 created unencrypted ADFs and BDFs. ClearDesign 2.0 and later versions produce encrypted ADFs and BDFs. You can distinguish between unencrypted and encrypted ADFs and BDFs by the ending of the filename.

File type	Filename ends in
Unencrypted accessible definition file	adf.zip
Encrypted accessible definition file	adfx.zip
Unencrypted ballot definition file	bdf.zip
Encrypted ballot definition file	bdfx.zip

In this document, the general terms ADF and BDF can refer to both the unencrypted and encrypted versions of these files.

For the specifics of the ADF and BDF file formats, see the following:

- *ClearDesign Accessible Definition File Guide*
- *ClearDesign Ballot Definition File Guide*

## Chapter 1. Overview

ClearCount uses a client-server model that includes one CountServer computer, one or more CountStations, and one or more ScanStations. The CountServer computer runs the Ubuntu Linux operating system and contains all files that make up the ClearCount system. The CountStations run the Windows operating system and read their software at run time from the CountServer.

The output of the build procedure is a bootable image file, also referred to as an ISO. The ISO contains a single CountServer installer with everything necessary to run an instance of the ClearCount, including the Ubuntu operating system, server-side Linux executables, and client-side Windows executables.

### 1.1 Environments required for the build procedure

The ClearCount build procedure requires the following:

- An Internet-connected Windows download environment
- A Windows trusted build environment
- An Internet-connected Ubuntu download environment
- An Ubuntu trusted build environment

These environments can be physical computers or virtual machines (VMs) running Windows or Ubuntu. This document assumes the use of VMs.

### 1.2 Phases of the build procedure

The ClearCount build procedure has the following phases:

1. Setting up the build environment
2. Copying the source code to the USB drive that will be used throughout the build process
3. Downloading the Windows third-party libraries and tools used by the CountStation and the build process
4. Setup the Windows build VM
5. Building the ClearCount Windows application
6. Downloading the Ubuntu 3rd party libraries and tools used by the CountServer application and the build process
7. Setting up the VM for building the CountServer
8. Building the CountServer

## Chapter 2. Setting up the build environment

This chapter describes how to set up the build environment.

### 2.1 Recommended host operating system

The recommended operating system is Windows 10 for the host computer where you set up the VMs for the build procedure.

### 2.2 Downloading the ISOs for the operating system

#### Microsoft Windows

On an Internet-connected computer, download the Microsoft Windows ISO from the Microsoft download site at:

<https://www.microsoft.com/en-us/evalcenter/evaluate-windows-10-enterprise>

#### Ubuntu

On an Internet-connected computer, download the Ubuntu ISO from the Ubuntu download site at:

<http://cdimage.ubuntu.com/releases/18.04.5/release/ubuntu-18.04.5-server-amd64.iso>

### 2.3 Downloading and installing VirtualBox

VirtualBox is a free, open-source, third-party application for creating and managing VMs. This document describes how to use VirtualBox to set up the VMs and their attributes.

Using a 64-bit host computer, install VirtualBox from:

<https://www.virtualbox.org/wiki/Downloads>

**Note:** In addition to VirtualBox, download and install the VirtualBox Extension Pack so that USB 3.0 features function correctly.

## 2.4 Creating the VM for Windows 10

To create the VM for Windows 10:

1. Run VirtualBox and create a VM with the parameters listed in Table 2-1.

**Table 2-1. Parameters for creating a VM for Windows 10**

Parameter	Description
Name	Windows 10
Machine folder	Leave as the default.
Type	Windows
Version	Windows 10 (64 bit)
Memory Size	2048 MB
Hard disk	Create a virtual hard disk now.
Hard disk file type	VDI (VirtualBox Disk Image)
Storage on physical hard disk	Dynamically allocated
File location and Size	1. Leave the location as the default. 2. Set the size to 20 GB.

2. Do the following to install Windows on the VM:
  - a. Power on the Windows virtual machine.
  - b. Select start-up disk.
  - c. Click the folder icon and select the Windows ISO that you previously downloaded.  
The installation process begins.
3. To install Windows:
  - a. Enter preferences and begin installation.
  - b. When prompted for the installation type, choose **Custom (advanced)**.
  - c. Choose to install to the empty (unallocated) disk.
  - d. After restarting, enter a user name, PC name, and password.
  - e. Skip the prompt to type your Windows product key.
  - f. Set your time zone when prompted.

## 2.5 Creating and setting up the VM for Ubuntu 18.04.5

To set up the VM:

1. Run VirtualBox and create a VM with the parameters listed in Table 2-2.

**Table 2-2. Parameters for creating a VM for Ubuntu 18.04.5**

Parameter	Description
Name	Ubuntu 18.04.5
Machine folder	Leave as the default.
Type	Linux
Version	Ubuntu (64 bit)
Memory Size	2048 MB
Hard disk	Create a virtual hard disk now.
Hard disk file type	VDI (VirtualBox Disk Image)
Storage on physical hard disk	Dynamically allocated
File location and Size	1. Leave the location as the default. 2. Set the size to 20 GB.

2. Select the following to install Ubuntu on the virtual machine:
  - a. In Virtual Box, select the machine that you just created.
  - b. Right-click and select **Settings**.
  - c. When the Settings dialog appears, select **USB** on the left side and select **USB 3.0 (xHCI) Controller**.
  - d. Press **OK** to close the Settings dialog.
  - e. Press **Start (Normal Start)** to begin the installation process.
  - f. When the Select Startup Disk dialog appears, select the **Choose virtual optical disk file** icon.
  - g. When the Optical Disk Selector dialog appears, choose **Add** and navigate to the Ubuntu ISO that you previously downloaded.
  - h. Press **Open**, and when the chooser dialog closes, press **Choose**.
  - i. Press **Start** to continue installing Ubuntu.

- Follow the prompts on the screen to install Ubuntu on the virtual machine. Use the settings in Table 2-3.

**Table 2-3. Settings for installing Ubuntu**

Parameter	Setting
Language	English
Install	Ubuntu Server
Select a language	English
Select your location	United States
Detect keyboard	No
Configure keyboard - County of Origin	English (US)
Configure keyboard - Keyboard layout	English (US)
Configure the network - Hostname	CBGBuild
Set up users and passwords - Full name for the new user	ClearBallot
Set up users and passwords - User name for your account	cbg
Set up users and passwords - Choose a password for the new user	build
Set up users and passwords - Re-enter password to verify	build
Set up users and passwords - Use weak password	Yes
Configure Clock	Select time zone.
Partition disks - Partitioning method	Guided - use the entire disk and set up LVM.
Partition disks - Select disk to partition	Press <b>Enter</b> .
Partition disks - Write the changes to disks and configure LVM	Yes
Partition disks - Amount of volume to group to use for guided partitioning	Press <b>Enter</b> .
Partition disks - Write changes to disk	Yes

**Table 2-3. Settings for installing Ubuntu (continued)**

Parameter	Setting
Enter name of proxy server	Press <b>Enter</b> .
Configuring tasks - How do you want to manage upgrades to this system	No automatic updates
Software Selection - Choose software to install	Press <b>Enter</b> .
Install the GRUB boot loader	Yes
Finish the installation	Press <b>Enter</b> .

## Chapter 3. Copying the source code

The USB drive stores all the source files and third-party libraries that are used to build ClearCount.

Using a USB drive that is formatted to FAT32, follow these steps:

1. Create a directory called **CBGBuild** on the USB drive.
2. Copy the following source directories to the CBGBuild directory on the USB drive:
  - openssl-fips
  - apache2-fips
  - src
3. Copy the Ubuntu ISO that you previously downloaded to the CBGBuild directory.  
See "Downloading the ISOs for the operating system" on page 8.

## Chapter 4. Downloading the third-party libraries for Windows

This chapter describes how to download the third-party libraries used by ClearCount.

### 4.1 Creating the VM for downloading Windows

To create the download VM, use the Windows 10 host computer that you set up in Chapter 2 to run VirtualBox. Follow these steps:

1. Start VirtualBox.
2. Right-click the machine name **Windows 10** and select **Clone**.
  - a. Set the name to **ClearCount Windows Download**.
  - b. Leave the default values in all other fields and click **Next**.
  - c. Leave as **Full Clone** and click **Clone**.

### 4.2 Downloading the files for Windows

To download the files, do the following:

1. Insert the USB drive created in Chapter 3 into a port on the Windows host computer.
2. Start the ClearCount Windows Download VM created in the previous section by double-clicking it in the VirtualBox application.
3. Attach the USB drive to the ClearCount Windows Download VM by selecting the **Devices** menu item and then **USB**.
4. From the list of USB devices, select the USB drive to attach.
5. Log in to the ClearCount Windows Download VM by entering the username and password that you set up in Chapter 2.
6. Use File Explorer to navigate to the folder `CBGBuild\src\setup\build-client-setup` on the USB drive.
7. Right-click the file **download.ps1** and select **Run with PowerShell**.
8. When the download is complete, shut down the Windows download VM.

## Chapter 5. Building the ClearCount Windows application

This chapter describes how to create the build VM and then build the Windows application for ClearCount. The build procedure uses a VM that is not connected to the Internet.

### 5.1 Creating the VM for building the ClearCount Windows application

To set up the build VM, follow these steps on the Windows 10 host computer that you set up to run VirtualBox in Chapter 2:

1. Start VirtualBox
2. Clone the VM named Windows 10 by right-clicking the machine name and selecting **Clone**.
  - a. Set the name to **ClearCount Windows Build**.
  - b. Leave the default values in all other fields as default and click **Next**.
  - c. Leave as **Full Clone** and click **Clone**.
  - d. When the new machine has been created, right-click it and select **Settings**.
  - e. Select **Network** from the list on the left side.
  - f. Change the **Attached to** value to Host-only Adapter.

### 5.2 Setting up the VM for building the ClearCount Windows application

To set up the VM for building the ClearCount Windows application, do the following:

1. Insert the USB drive created in Chapter 3 into a port on the Windows host computer.
2. Start the ClearCount Windows Build VM by double clicking it in the VirtualBox application.
3. Attach the USB drive to the ClearCount Windows Build VM by selecting the **Devices** menu and then **USB**.
4. From the list of USB devices select the USB drive to attach.
5. Log in to the ClearCount Windows Build VM by entering the username and password that you set up in Chapter 2.
6. Click the Start button on the Windows taskbar, type *command prompt*, and select **Run as administrator** from the pop-up window of search results.

7. At the prompt (>) in the Command Prompt window, enter the following commands:

```
> cd D:  
> cd CBGBuild
```

8. To run the setup script, enter the following:

```
> src\setup\build-client-setup\setup.bat
```

### 5.3 Building the Windows application for ClearCount

To build the ClearCount Windows application, do the following:

1. If you do not still have the Command Prompt window open and running as Administrator in the ClearCount Windows Build VM, follow steps 1 through 7 in the previous section.

2. In the Command Prompt window, enter the following to build the ClearCount Windows application:

```
> src\setup\build-client-setup\build.bat
```

3. Use File Explorer navigate to the folder D:\CBGBuild\depends\ClearCount\client and verify that the following files and directories are there:

- profiles
- archive\_manager
- BallotDeleteBox
- BallotTabulator
- CurrentElection
- DeleteBox
- GetScannerInfo
- ResultsUploader
- SetupScanner
- StartTabulator
- StartUploader
- UpdateScanner

4. When the build completes, shut down the VM for the Windows build.

## Chapter 6. Downloading the third-party libraries for the CountServer

This chapter describes how to download the third-party libraries for the CountServer application. These downloads include the third-party libraries for Ubuntu and Python.

### 6.1 Creating the download VM for the CountServer

To create the download VM, use the Windows 10 host computer that you set up in Chapter 2 to run VirtualBox. Follow these steps:

1. Start VirtualBox.
2. Right-click the machine name **Ubuntu 18.04.5** and select **Clone**.
  - a. Set the name to **CountServer Download**.
  - b. Leave the default values in all other fields and click **Next**.
  - c. Leave as **Full Clone** and click **Clone**.

### 6.2 Downloading the files for the CountServer

To download the files, do the following:

1. Insert the USB drive created in Chapter 3 into a port on the Windows host computer.
2. Start the CountServer Download VM created in the previous section by double-clicking it in the VirtualBox application.
3. Attach the USB drive to the CountServer Download VM by selecting the **Devices** menu item and then **USB**.
4. From the list of USB devices, select the USB drive to attach.
5. Log in to the Count Server Download VM by entering the username and password that you set up in Chapter 2.

6. From the Ubuntu command prompt to the following:

a. Mount the USB drive by entering:

```
sudo mkdir -p /media/usb  
sudo mount /dev/sdb1 /media/usb
```

b. Change to the CBGBuild directory on the mount USB drive by entering:

```
cd /media/usb/CBGBuild
```

c. Download the files by entering:

```
sudo src/setup/build-server-setup/download.sh
```

d. When the download has finished, unmount the USB drive by entering:

```
cd ~  
sudo umount /dev/sdb1
```

e. To shut down the machine and close the window, enter:

```
shutdown now
```

## Chapter 7. Building the CountServer

This chapter describes how to create and set up the VM for building the CountServer and how to build the CountServer.

### 7.1 Creating the VM for building the CountServer

To create the VM for building the CountServer, use the Windows 10 host computer that you set up in Chapter 2 to run VirtualBox. Follow these steps:

1. Start VirtualBox.
2. Right-click the machine name **Ubuntu 18.04.5** and select **Clone**.
  - a. Set the name to **CountServer Build**.
  - b. Leave the default values in all other fields and click **Next**.
  - c. Leave as **Full Clone** and click **Clone**.
  - d. When the new VM has been created, right-click it and select **Settings**.
  - e. Select **Network** from the list on the left side.
  - f. Change the **Attached to** value to Host-only Adapter.

### 7.2 Setting up the VM for building the CountServer

To setup the build machine, do the following:

1. Insert the USB drive created in Chapter 3 into a port on the Windows host computer.
2. Start the VM for building the CountServer that you created in the previous section by double clicking it in the VirtualBox application.
3. Attach the USB drive to the VM for building the CountServer by selecting the **Devices** menu item and then **USB**.
4. From the list of USB devices, select the USB drive to attach.
5. Log in to the VM for building the CountServer by entering the username and password that you set up in Chapter 2.

6. From the Ubuntu command prompt, enter the following:

- a. Mount the USB drive:

```
sudo mkdir -p /media/usb
sudo mount /dev/sdb1 /media/usb
```

- b. Change to the CBGBuild directory on the mounted USB drive:

```
cd /media/usb/CBGBuild
```

- c. Setup the VM:

```
sudo src/setup/build-server-setup/setup.sh
```

## 7.3 Building the CountServer

To build the CountServer, do the following:

1. If you are not already logged in to the CountServer Build VM, follow steps 1 through 5b in the previous section.

2. Build the CountServer by entering:

```
sudo src/setup/build-server-setup/build.sh
```

3. Verify that the following files are in the CBGBuild directory:

- clearcount-x.x.x-*date*.iso
- clearcount-x.x.x-*date*.deb

where:

x.x.x is the version number.

*date* is the date of the build.

The installation process uses these files.

4. When the build has finished, unmount the USB drive:

```
cd ~
sudo umount /dev/sdb1
```

5. Shut down the VM and close the Window:

```
shutdown now
```