

ClearAccess 1.0 System Overview



Clear Ballot

Abstract: This document provides information about the functional and physical components of the ClearAccess system, including how components are structured and interfaced.

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Clear Ballot Group
71 Summer Street, Suite 3
Boston, MA 02110
(857) 250-4957
<http://www.clearballot.com>

Document history

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1 Abstract

This section defines the purpose of this document. It contains the following sections:

- About this document
- Scope of this document
- Intended audience

1.1 About this document

This *System Overview* document provides information about the functional and physical components of the ClearAccess system, how the components are structured, and the interfaces between them. It also reviews system performance characteristics.

It corresponds to the VVSG 1.0 Volume 2 Section 2.2 requirement for the Technical Data Package (TDP).

1.2 Scope of this document

This section provides summary information about the following aspects of the ClearAccess system:

- High level system description
- Functional components and subsystems
- Operational environment of the system
- System performance
- Quality attributes

1.3 Intended audience

This document is intended for state election officials and their delegated Voting Systems Test Laboratory, as part of the TDP required to certify the ClearAccess in-person, accessible ballot marking system for use in their state.

2 System description

ClearAccess is an in-person, accessible ballot marking system created by the Clear Ballot Group (Clear Ballot).

The ClearAccess software runs on unmodified COTS laptop computers / tablets running the Windows 8.1 Pro operating system and supports specific models of accessible input devices.

The ClearAccess ballot marking system consists of one or more Ballot Marking Stations (BMS) having the following physical components (all of which consist of standalone, unconnected, unmodified COTS hardware):

Ballot Marking Device (BMD): a computer running the ClearAccess software as a browser application. On the BMS is web server which serves up HTML pages for both voting and administration. The BMD runs the Windows 8.1 Pro operating system. The BMD may be optionally enclosed in a protective bezel which does not affect its operation.

Privacy Screen: A folding screen to ensure privacy for the voter during ballot marking.

Personal Assistive Technology Devices (PAT): For each Ballot Marking Station, the following assistive input devices are provided:

- Headphones
- Sip-n-Puff
- Lap Paddles

Ballot Style Transfer Stick: A COTS USB 2.0/3.0 memory stick having at least 1GB of memory that is used to transfer the ballot styles from ClearDesign to the BMD. The ballot styles are HTML files that are encapsulated in a ZIP file.

Laser Printer: A COTS laser printer attached to the BMD with a USB 2.0/3.0 cable that is capable of printing 8.5" x 11" 2-sided ballots (i.e., duplex printing) on 57# vellum or 65# index paper. [Source: Brother HLL-2320D Mono Laser Printer]

The ClearAccess software consists of the following components that are presented as HTML pages in a browser interface:

Ballot Marking Device Configuration: This software allows a credentialed user to configure the BMS. Configuration includes:

- Selecting eligible ballot styles to be displayed at this polling location, or all ballot styles in the event the BMS resides in a vote center.
- Performing diagnostics
- Opening the polls
- Assisting the voter in their choice of languages, whether or not to enable audio, and selecting the ballot style appropriate to the active voter.
- Closing the polls.
- Printing report(s) (e.g. Time of poll opening; number of ballots printed by style, time of poll closing.)(Note: as this device is a ballot marking device which produces a marked paper ballot, there is no tabulation and no ballots are stored in BMD.)

Ballot Marking: For each ballot style in the election, ClearDesign produces an HTML file – a program – that contains all the information and software needed to produce a marked ballot:

- Select a language,
- Select whether or not to invoke audio
- Display the instructions to the voter,
- Display a contest,
- Allow the voter to select his/her choice(s) and, if necessary, scroll to see all choices,
- Allow the voter to enter write-in choices,
- Prevent over votes,
- Allow the voter to correct mistakes,
- Navigate to the next or previous contest and to skip a contest if requested,
- Review all votes and return to a particular contest,
- Print a machine readable ballot that can be immediately tabulated by ClearCount.

(**Note:** ClearDesign can produce card sets formatted so that a ballot that would normally be printed on a single page 8.5" x 18" ballot can be printed on two (or more) pages of 8.5" x 11" ballot stock. This feature enables low-cost printers to be utilized in place of expensive ballot-on-demand printers capable of duplex printing of long ballots.)

All files that make up the ClearAccess software reside on the memory stick that is produced by ClearDesign and which are copied onto the ClearAccess BMD prior to the opening of polls.

All connections between devices in the ClearAccess system are private and wired. ClearAccess does not utilize wireless connectivity. Wireless capabilities present on any hardware used with the ClearAccess system must be disabled.

3 Operational environment of the system

This section introduces the pre-election, election, and post-election operational environment of the ClearAccess system. Figure 3-1 illustrates the relationships between the components that are used in each of the election phases – ballot design, voting, tabulation and reporting and post-election audits.

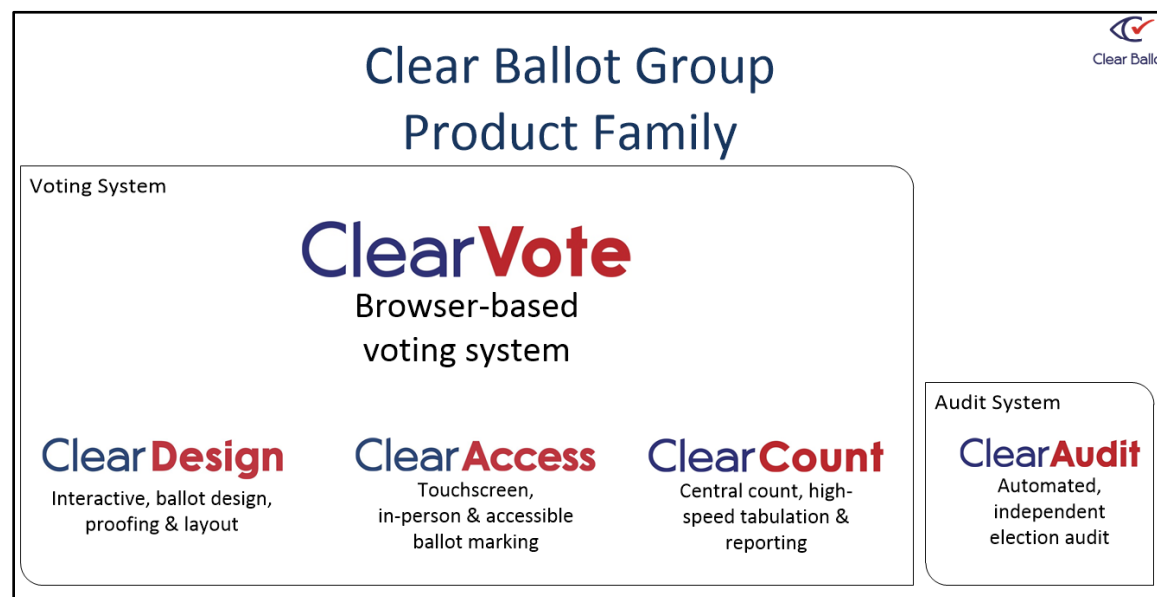


Figure 3-1 ClearVote Architecture

Figure 3-2 shows how the components of ClearVote exchange data between themselves.

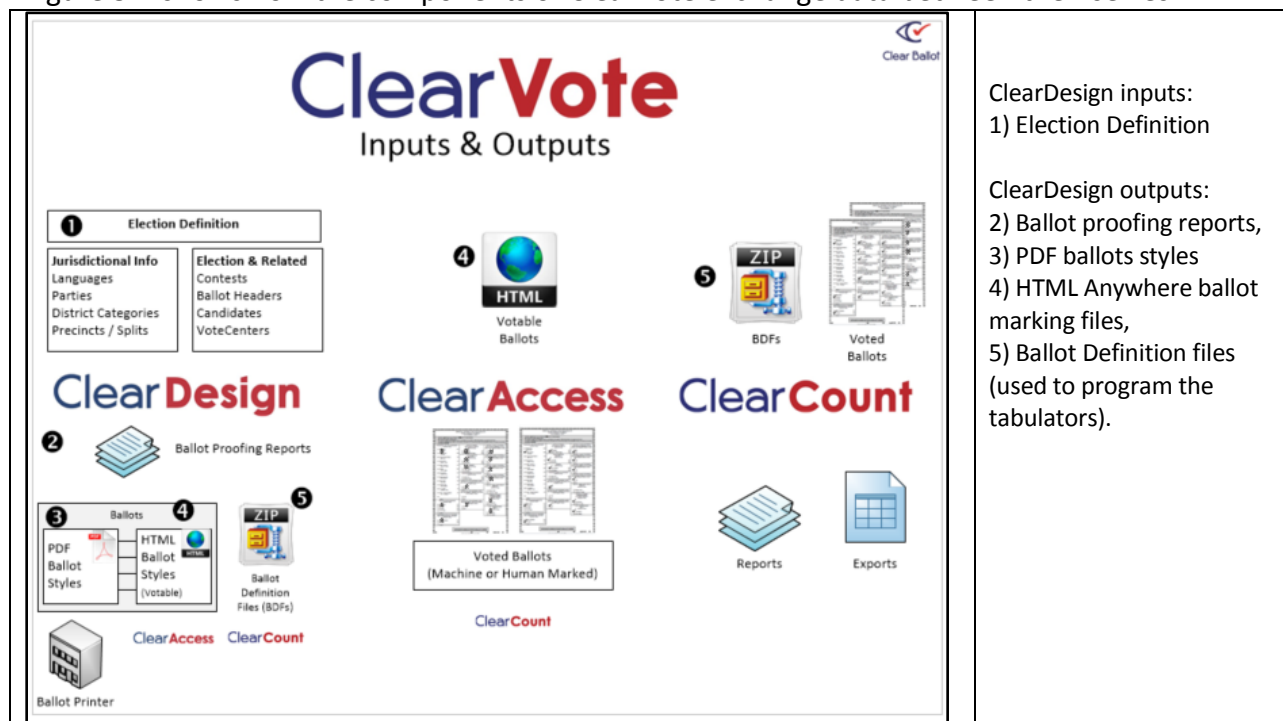


Figure 3-2 ClearVote Data Flows

The following sections describe the activities associated with the phases of an election.

3.1 Pre-election phase

ClearDesign, the EMS component of ClearVote, is used to create ballot styles. The HTML Anywhere Ballot style files are exported to a memory stick for importing into ClearAccess. Ballot styles will be rendered as votable ballots using an HTML interface. Figure 3-3 details this flow.

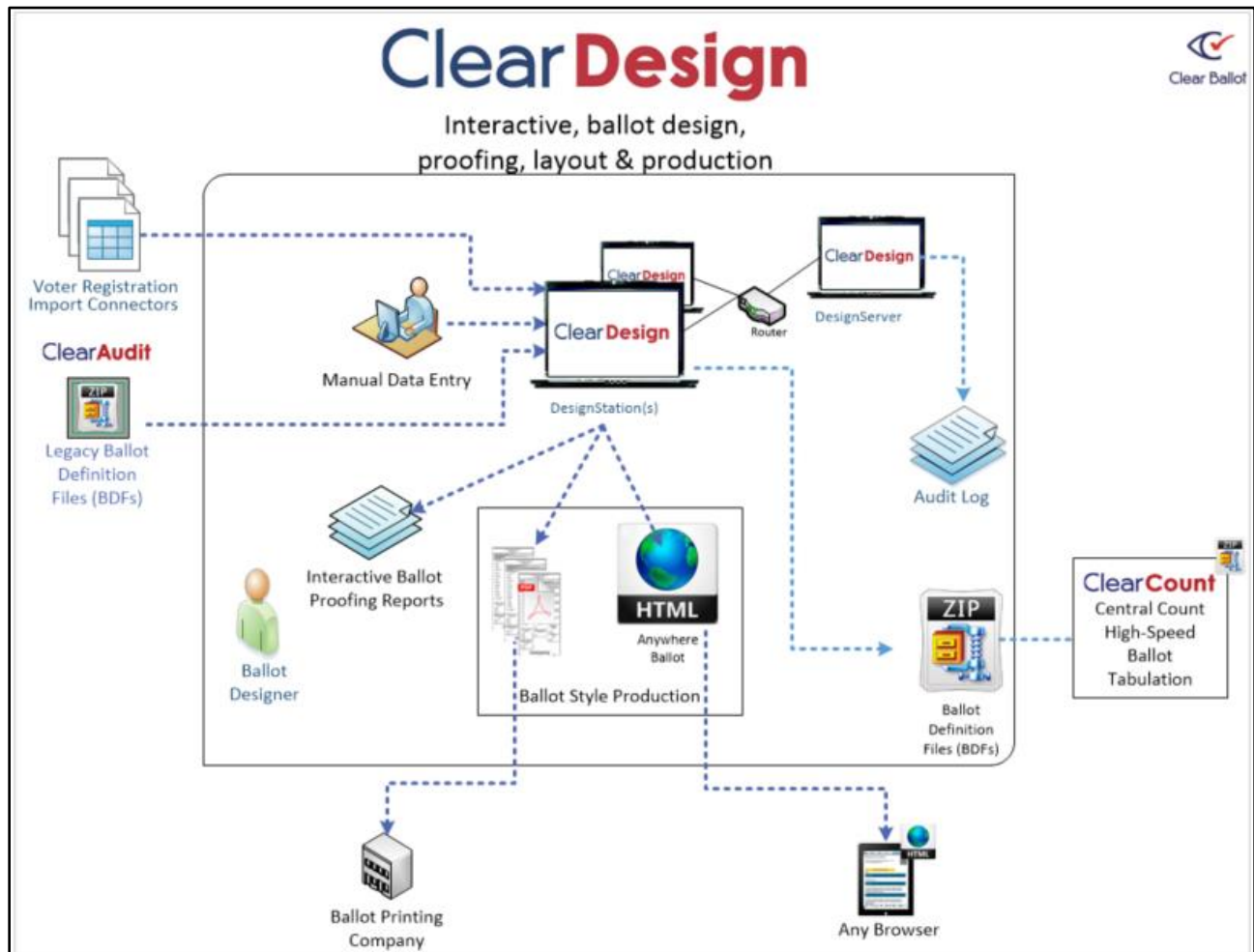


Figure 3-3 ClearDesign Process Flow

3.2 Election processing phase – Early and Election Day Voting

The ballot marking phase shown in Figure 3-4 is described here.

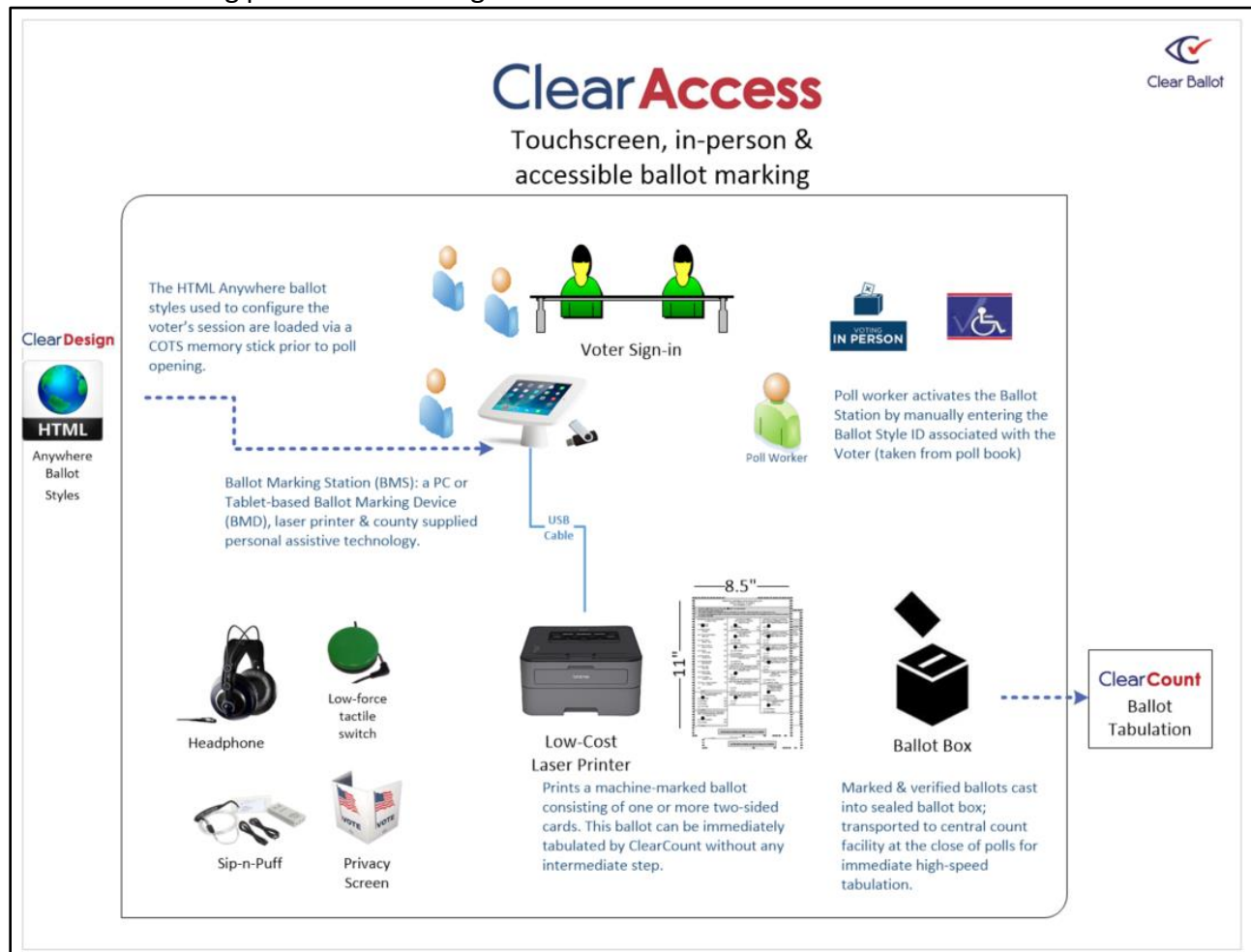


Figure 3-4 ClearAccess in-Person Process Flow

3.2.1 The Anywhere Ballot – A brief history

For its accessible, in-person voting experience, Clear Ballot has chosen to emulate the Anywhere Ballot.

The Anywhere Ballot was developed in 2013 under a sub-grant from an Election Assistance Commission grant to the ITIF for a project called the "Accessible Voting Technology Initiative." The goal: "a digital ballot front end that anyone can use in their voting system. It's a ballot served through a browser, built in CSS3 and HTML5 so it's fully standards compliant. It's also 95% accessible out of the box. [The focus was] on voters with low literacy or mild cognitive disabilities (like short term memory loss) and making sure that the design didn't distract or confuse them."¹

The creators of the Anywhere Ballot were Drew Davies (Oxide Design), Kathryn Summers (Univ. of Baltimore), Dana Chisneld (Center for Civic Design) and Whitney Quesenbery. The initial prototype of their design can be found at <http://anywhereballot.com/>.

¹ <http://civicdesigning.org/wp-content/uploads/2014/01/CCD-Year-in-review-2013.pdf>

In 2014, the Clear Ballot Group contracted with Oxide Design to incorporate the Anywhere Ballot into the company's in-person, accessible ballot marking system called ClearAccess. Not wanting to re-invent the wheel; our goal to leverage the Anywhere Ballot's elegant design and extensive field testing.

3.2.2 A Comparison: Vote-by-Mail vs the Anywhere Ballot

Clear Ballot has developed an accessible, in-person voting solution that responds to the budgetary needs of election jurisdictions that, in turn, must accommodate an aging voting population that will develop age-related disabilities.

The figure below compares two methods of creating ballots for different voters.

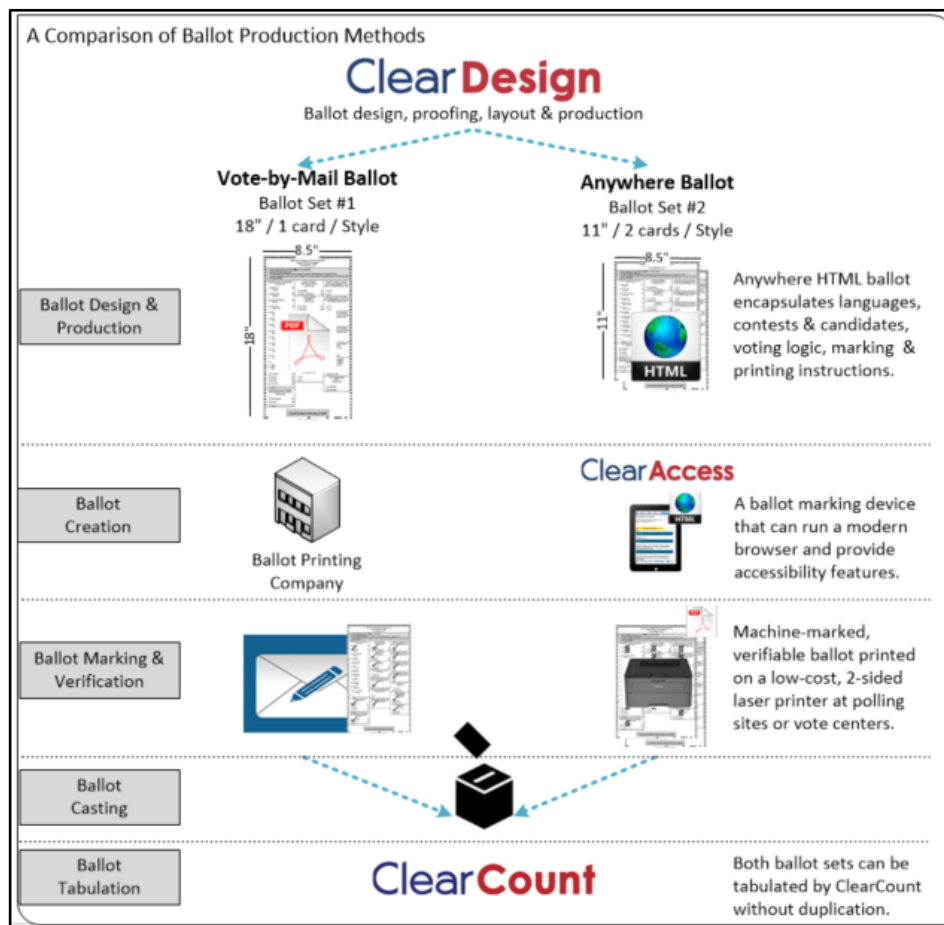


Figure 3-5 A Comparison of Ballot Production Methods

Current solutions are expensive to purchase, expensive to deploy and expensive to maintain. Furthermore, they lock a jurisdiction into a long-term commitment to proprietary systems at a time when the industry is beginning to see rapid innovation and cost savings which are substantial in both capital, operational costs and time:

- Capital Cost Savings: COTS computers vs proprietary accessible voting systems; low-cost vs high-cost laser printers;
- Operational Cost Savings: Storage & transportation of small, lightweight printers (<16 lbs.) and computers vs heavy printers (> 160 lbs.) and proprietary systems. Toner cartridges \$70 (2600 pages) vs \$150 (2000 pages).

- Time Savings: No ballot duplication required.

3.2.3 Bibliography on the Anywhere Ballot and Accessible Voting

1. "Rapid, responsive, radical: The Anywhere Ballot is born"
<http://civicdesigning.org/featured-story/rapid-responsive-radical-the-anywhere-ballot-is-born/>
2. "Making Voting Accessible: Designing Digital Ballot Marking" http://civicdesigning.org/wp-content/uploads/2014/08/jets_0202-summers.pdf
3. "Deep background: reviewing research on ballot design, low literacy, and mobile"
<http://civicdesigning.org/featured-story/deep-background-reviewing-research-on-ballot-design-low-literacy-and-mobile/>
4. A Comprehensive Bibliography on Accessible Voting (over 60 articles)
<http://civicdesigning.org/wp-content/uploads/2013/05/Anywhere-Ballot-bibliography1.pdf>

3.3 Post-election phase

Once the polls close, the poll workers perform whatever ballot reconciliation procedures are required by their jurisdiction. The expected number of cards in the sealed ballot box is displayed on the BMD and is printed. The ballots are transported back to the central site for tabulation by ClearCount. The process flow for ClearCount is shown in Figure 3-5.

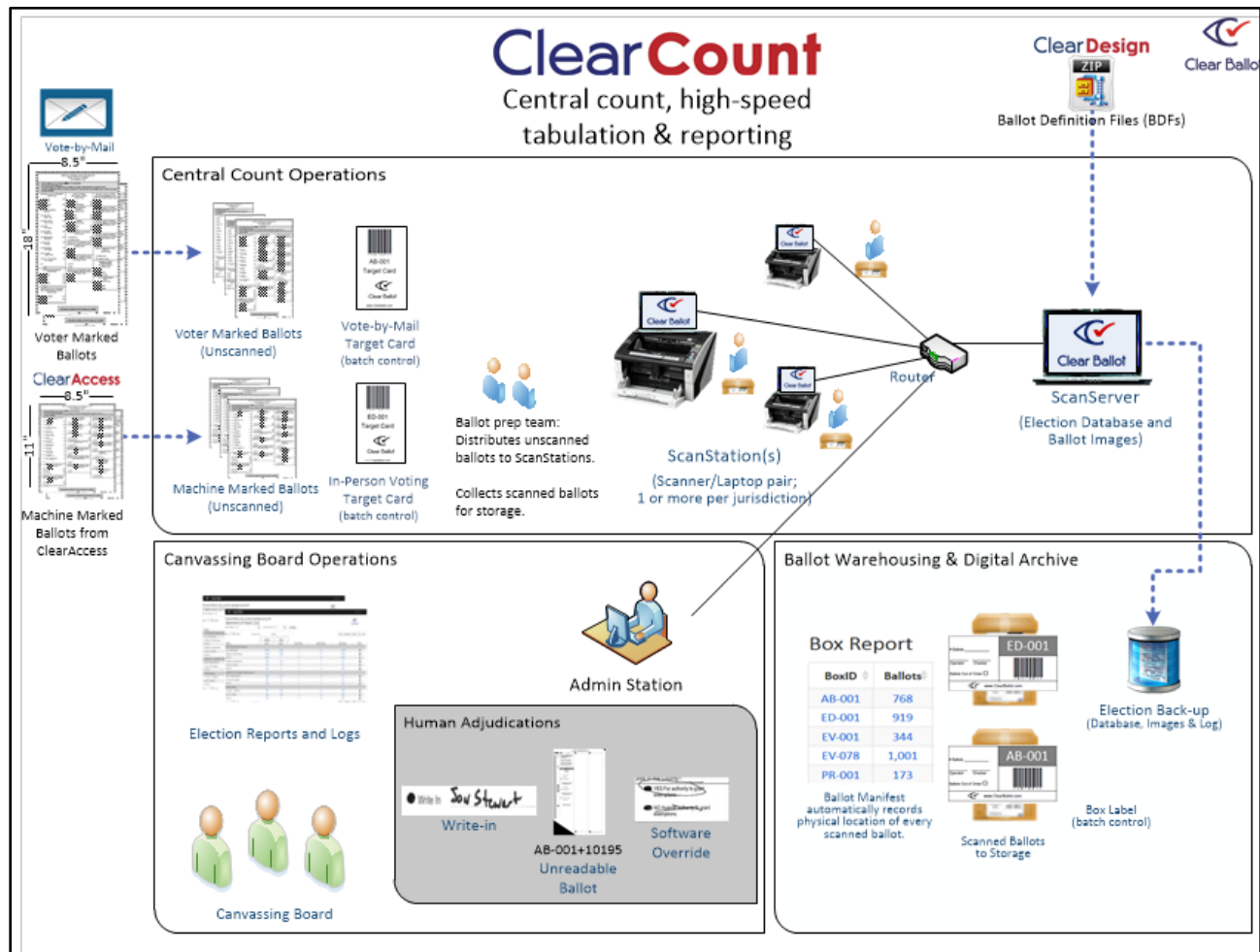


Figure 3-5 ClearCount Process Flow

The ClearCount process flow is described in the *Clear Count Software Overview*

Note: The ballots marked by voters casting their ballot into a USPS mailbox are treated identically to ballots marked by machine and cast into a sealed ballot box at the polling site or vote center.

3.4 Audit logging and reporting

Audit logging takes place during configuration of the Ballot Marking Device as well as at the beginning of each ballot marking session. Care is taken not to collect any information that might compromise voter privacy.

For additional information about logging in ClearAccess, see *ClearAccess Election Administrator's Guide* and *ClearAccess Installation and Preparation Guide*.

4 COTS components in the ClearAccess system

This section introduces the COTS hardware, software, and communications services utilized in ClearAccess.

For details on the COTS components used in the ClearAccess System, see *ClearAccess Approved Parts List* and *ClearAccess Hardware Specification*.

4.1 COTS hardware

All of the hardware used by the ClearAccess system is unmodified COTS.

4.2 COTS software

All third-party software included in ClearAccess is unmodified.

All software (ClearAccess and third-party) is stored in the CBG source control management system, as described in the *Configuration control procedures* chapter of *ClearAccess Configuration Management Plan*.

4.3 COTS communications services

All hardware in a ClearAccess system is connected using a private wired Ethernet. Wireless connections are not supported. In order to distribute election reports, election officials may either attach a temporary drive in order to burn a CD or DVD on an Election Administration computer, or transfer the results to a flash memory drive. It is not necessary to connect a printer to the Election Administration Station computer.

5 Interfaces among internal components

This section describes interfaces between the components in the ClearAccess system.

5.1 Physical interfaces among system components

ClearAccess utilizes the following physical interfaces between components:

- Between the Ballot Marking Device and the Anywhere ballot style HTML files: a USB 2.0/3.0 memory stick.
- Between the Anywhere Ballot Marking Device and the Laser Printer: a USB 2.0 cable.

For details on hardware components, see *ClearAccess Hardware Specification*.

5.2 Functional interfaces between components

For details of the functional interfaces between components, see the *Software overview* and *Interfaces* sections of *ClearAccess Software and Design Specification*.

5.3 Benchmark directory structure

For the ClearAccess benchmark directory structure, see the Software Item Identification section of ClearAccess Software Design and Specification.

This section contains performance information about the ClearAccess system.

5.4 Performance characteristics of each component

ClearAccess performance can be broken into three sections:

- Download time to install HTML files onto the BMD: USB 3.0 speed
- Transition time between contests: sub second
- Printing time

Time to print (sec) (assumes printer ready)	1-sided ballot		2-sided ballot	
	8.5"x 11"	8.5" x 14"	8.5"x 11"	8.5" x 14"
First Page	5	10	5	15
Additional pages	3	3	10	11

Performance is the same in Test and Election modes.

6 Quality attributes

ClearAccess ensures product quality in the following areas:

- Safety
- Security
- Privacy
- Continuity of operation
- Design constraints
- Applicable standards

6.1 Safety

The ClearAccess system and recommended methodology do provide safety risks to operators, as confirmed by the *ClearAccess Quality Assurance Program*.

All of the COTS hardware used in the system has been tested by a Nationally Recognized Testing Laboratory (NTSL) and is marked with a UL or other safety mark.

ClearAccess addresses physical safety in its product documentation concerning setup, maintenance, and scanning. For details, see:

- *ClearAccess Election Preparation and Installation Guide*
- *ClearAccess System Maintenance Manual*

6.2 Security

The ClearAccess system and recommended methodology ensure security through the following mechanisms:

- Access control
- Use of a closed network
- Security-minded administrative practices

For full details on ClearAccess security, see *ClearAccess Security Specification*.

6.3 Privacy

Because ClearAccess is a ballot marking system, it is important to preserve privacy while the user is selecting his/her choices. For this purpose a privacy screen is placed on three sides of the Ballot Marking tablet/PC. No personally identifying information is collected. The voter is responsible for depositing his/her ballot into the sealed ballot box.

6.4 Continuity of operation

ClearAccess runs on COTS tablets or laptops. To ensure continuity of operation, jurisdictions should ensure that the batteries in these devices are fully charged prior to the opening of polls and remain plugged in during operation to ensure the battery is not prematurely drained.

6.5 Design constraints

See the ClearAccess Software Specification.

6.6 Applicable standards

The ClearAccess software is run on unmodified COTS computers and tablets. Each piece of COTS hardware used in the ClearAccess system has an FCC Class B declaration of conformity and a CE Mark affixed to it.

- The FCC Class B Mark certifies that an electronic product's electromagnetic interference falls under the limits set by the Federal Communications Commission of the United States in its Declaration of Conformity and Certification procedures of 1998.
- The CE Mark (1993) indicates a product's conformance to relevant European Union regulations.

CBG recommends that COTS equipment also bear a safety testing mark by an OSHA Nationally Recognized Testing Laboratory (NRTL), such as the Underwriters Laboratory UL mark.