



Texas Secretary of State
ELECTIONS DIVISION



Mastering Hash Validation

44th Annual
Election Law Seminar
for County Election Officials

August 10–12, 2026



Session Agenda

Background

- Defining hash validation
- Foundational understanding
- Legal context
- Federal, state, and local roles

Performing Hash Validation

- ES&S
 - 6.1.1.0
 - 6.3.0.0
- Hart
 - Verity Systems

Examining Outputs

- Defining a successful hash validation
- What to do if hash validation fails

Table Talk

- Hash validation requirements



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Hash Validation: Background



Defining Hash Validation Generally

What is a Hash Value?

- A string of characters or “digital fingerprint” associated with a particular file or software
- Created using a cryptographic algorithm
- The same file or software will always produce the same hash value if the file has not been altered

What is Hash Validation?

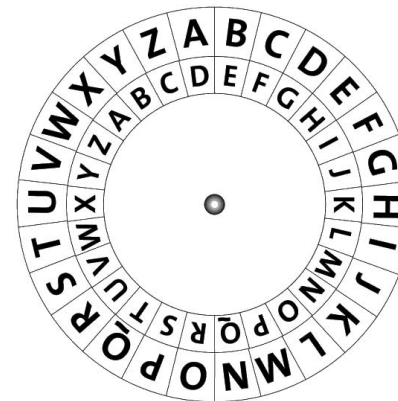
- Process to verify a particular file or software has not been altered
- Achieved by producing a hash value from a file or software and comparing it with the known, trusted hash or “Golden hash” from the original source file or software
- Validation is successful if both hashes are identical



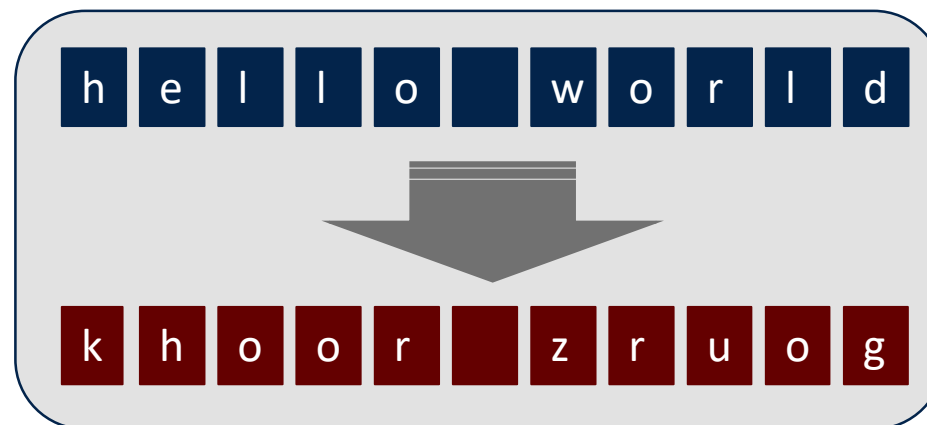
Cryptographic Algorithm

- A cipher is a cryptographic algorithm used for encrypting and decrypting data.
- It converts a readable message (**plaintext**) into an unreadable format (**ciphertext**) using a specific set of rules or a **key**, ensuring that only authorized parties can reveal the original information.
- There are 3 categories of cryptographic algorithms
 1. Symmetric Key
 2. Asymmetric Key
 3. **Hash Functions**

We use
this one!



*simple shift
cypher key*



plaintext

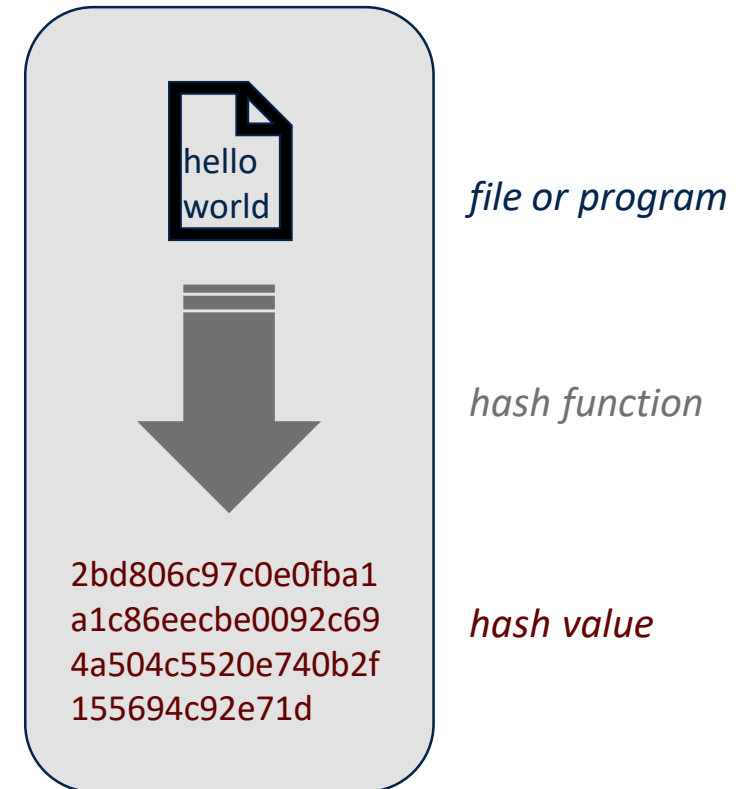
encryption

ciphertext



Hashing Functions

- Hash Functions
 - Convert an input of any size into a fixed length string of characters
 - One-way
 - Designed so that the process cannot be reversed
- Current cryptographic standard: **SHA-256**
 - For us, this just means we'll see 32 characters in the hash values every time

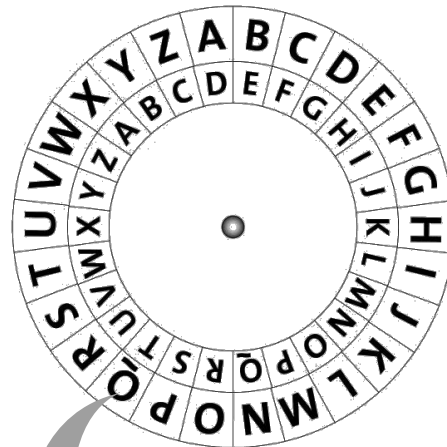




Brain Game

Prompt:

Use the simple shift cypher or “decoder ring” below to decrypt the secret message on the right.



A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
D E F G H I J K L M N O P Q R S T U V W X Y Z A B C

“HOHFWLRQ RIILFLDOV
DUH WKH EHVW!”



Work on your own or with
the people next to you.

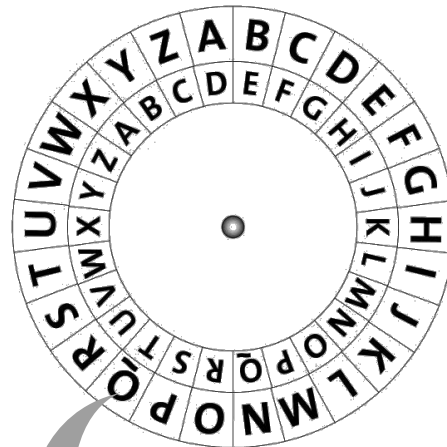
You will have
5 minutes
to decode.



Brain Game

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“HOHFWLRQ RIILFLDOV
DUH WKH EHVW!”

“ELECTION OFFICIALS
ARE THE BEST!”



Work on your own or with
the people next to you.

You will have
5 minutes
to decode.



How to Hash a File

- Any file can generate a hash value
- **Numerous online tools:** Including md5file.com and hash-file.online
- **PowerShell or Terminal:** command prompts
- **Built-in utilities:** 7-Zip now comes native in Windows 11 PCs

While there are countless methods, the steps for generating a hash file from your voting equipment and software will be specifically provided by the voting system vendor



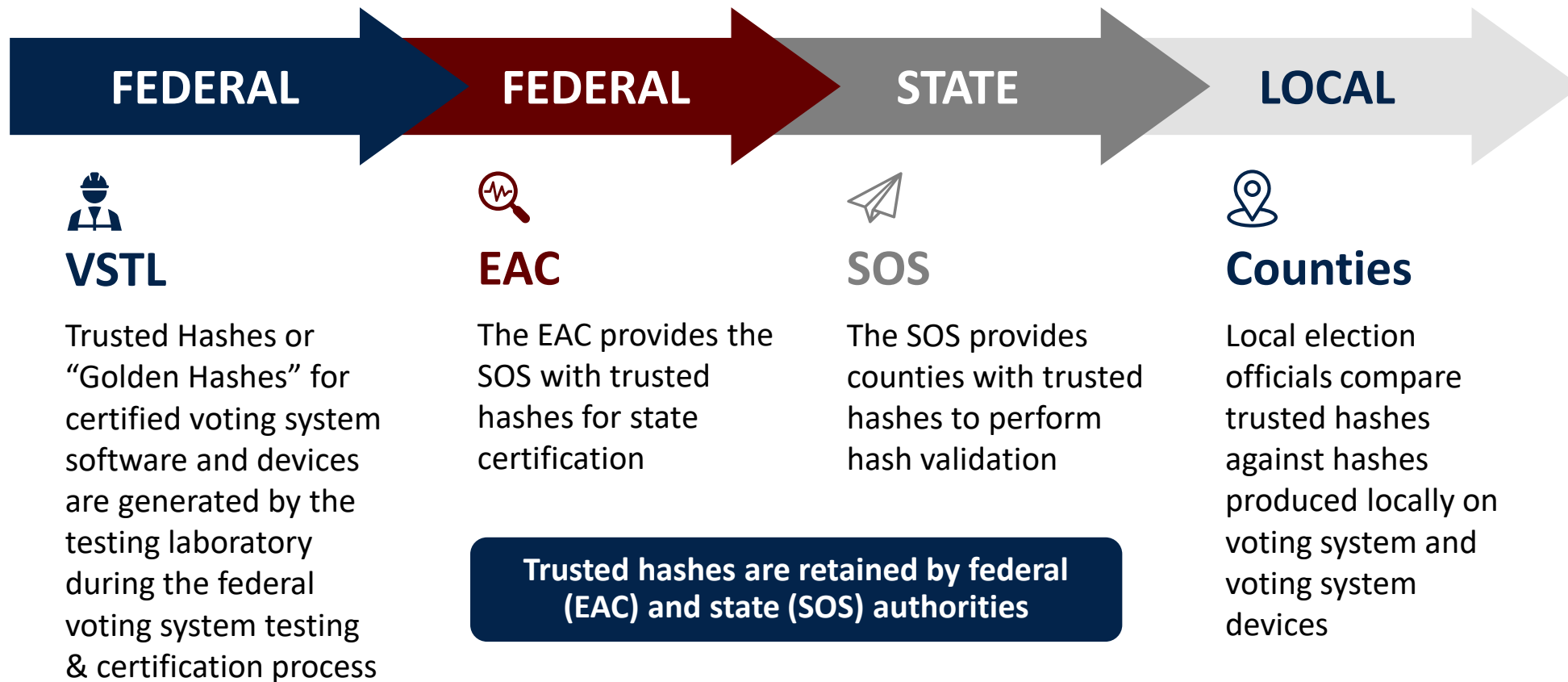
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Hash Validation in Elections



Hash Validation in Elections





Intergovernmental Roles

Federal (EAC)

- Conducts federal certification of voting system
- Generates and retains trusted hashes

State (SOS)

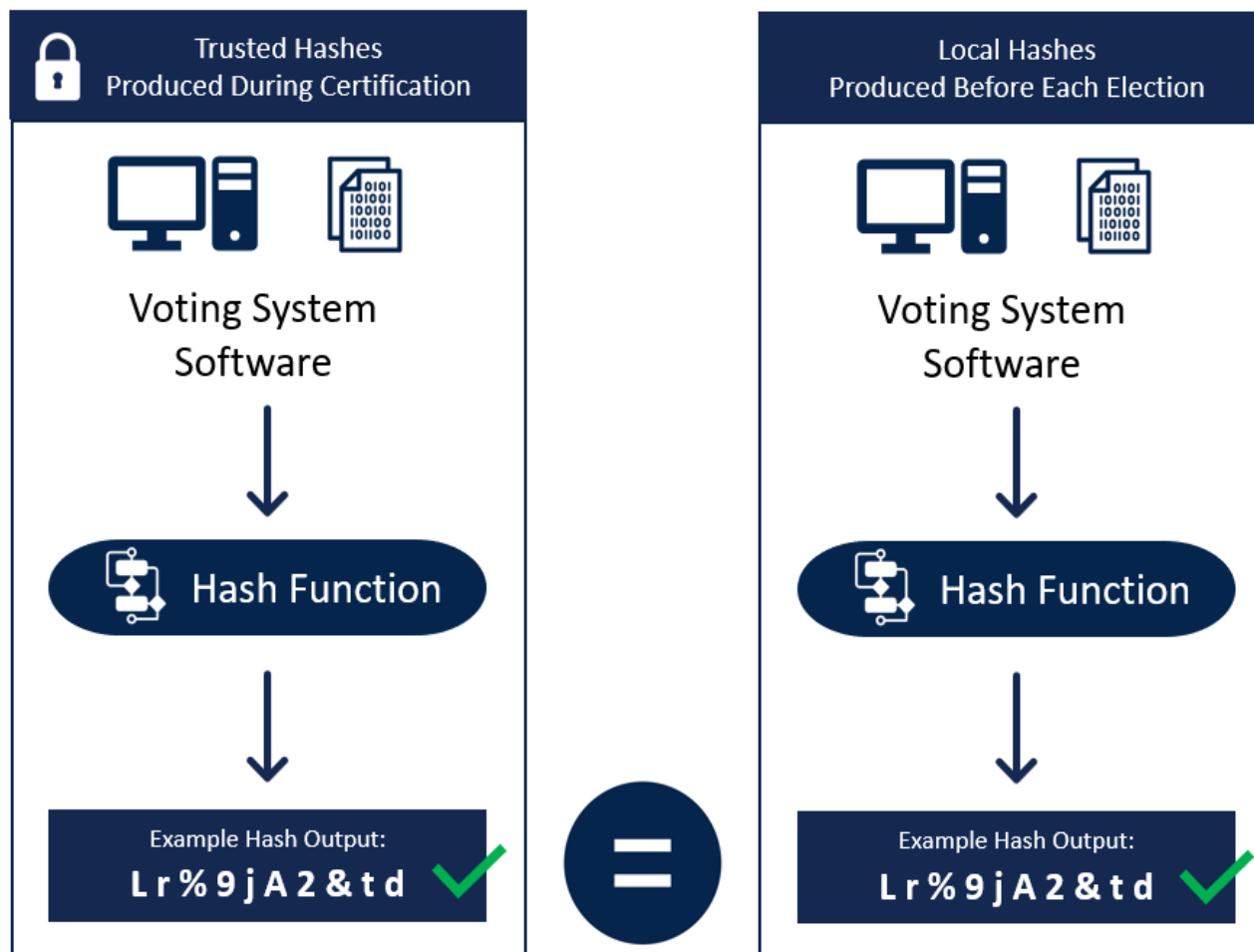
- Conducts state certification of federally certified voting system
- Requests and retains trusted hashes from EAC

Local Election Officials

- Performs hash validation upon initial receipt of voting system and before Logic and Accuracy
- Obtains trusted hashes from SOS



Hash Validation in Elections





Legal Context

Acceptance Testing

- Mandates that, immediately upon receiving a voting system from a vendor, the general custodian of election records perform a hash validation on each of the following:
- Ballot Marking Device (BMD)
- Tabulating Equipment (Precinct Scanner, Central Scanner)
- Tabulation Computer (EMS)

Hash validation must be completed on supplemental voting system devices purchased after acquisition of a new voting system



Legal Context

Logic and Accuracy Testing

- Mandates the general custodian of election records to perform a hash validation on a “representative sample” of each type of voting system equipment used in the election
- A representative sample is defined as:
 - Ten (10) of each type of voting device **OR** 5% of each type of voting device (whichever number is fewer)

Hash validation may be performed on a sample larger than the representative sample required by the Texas Election Code

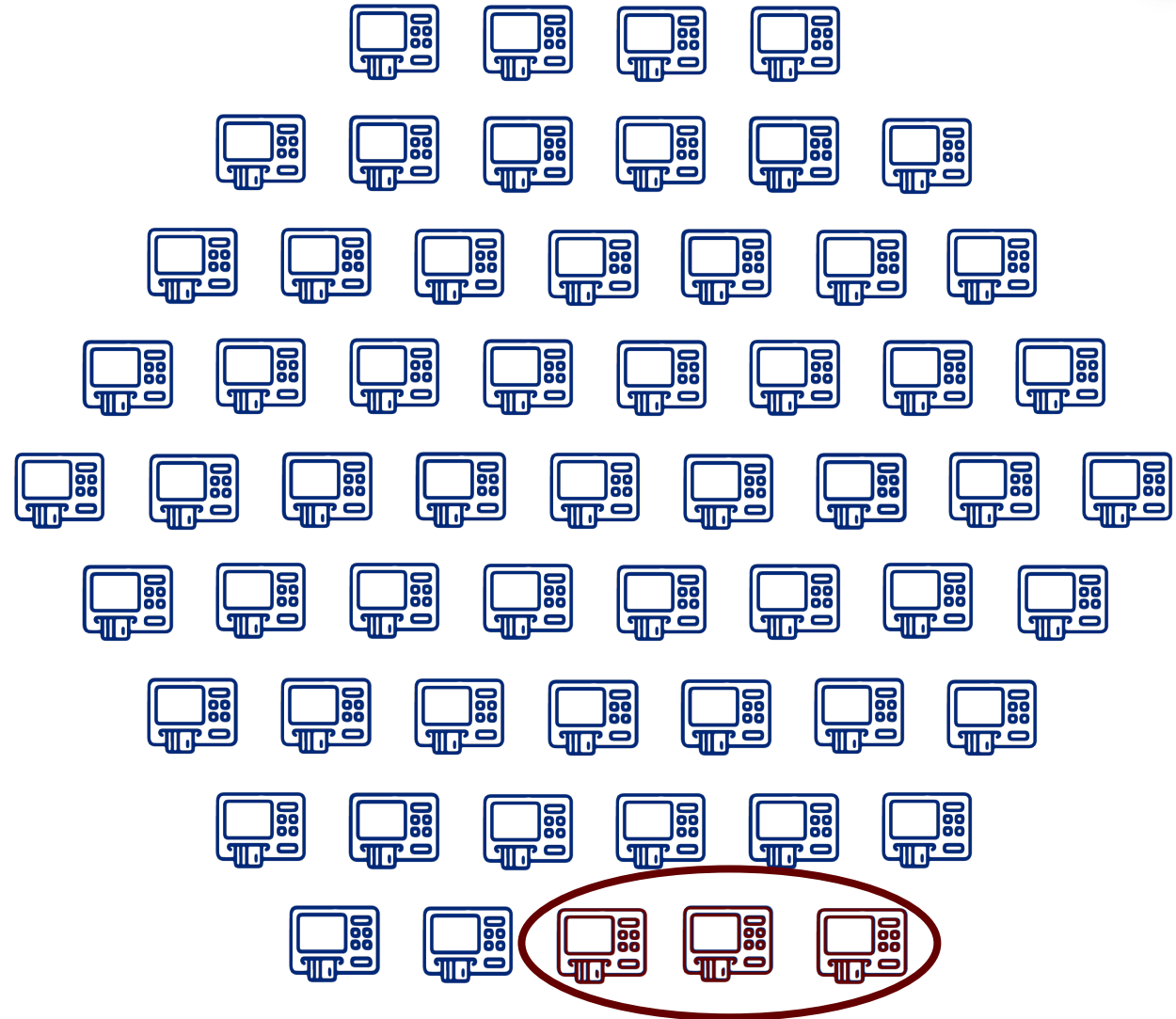


Legal Context

For example, a county has 60 BMDs.

$$60 \times 5\% = 3$$

Since 3 is fewer than 10,
the representative sample size
to hash validate is **3 devices**.





Records Retention

Retention and Security of Test Materials

- Mandates testing material to be placed in a sealed container that prevents opening without breaking the seal for the period of preserving the precinct election records (22 months)
- May only be unsealed for specific reasons:
 - Criminal investigation, or another official proceeding under the Election Code
 - Election contest
 - Perform another voting system test
 - Respond to a public information request or another official proceeding

Test materials are now available for public inspection beginning on the first day after the final canvass of the election



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Performing Hash Validation



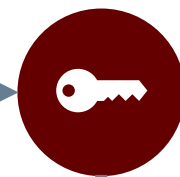
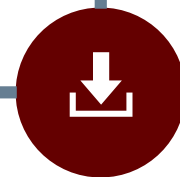
Requesting the Trusted Hash

Email electionsecurity@sos.texas.gov with the following information:

- County/Municipality Name
- Voting System Vendor
- Voting System Software Version

The SOS Election Security Team will locate and encrypt the trusted hash files for your voting system version

Download and save the encrypted trusted hash files locally on your computer



*Your local email security settings may require an alternative method of hash file delivery

Depending on your voting system version, you'll receive 2-3 emails*

1-2 with encrypted versions of your voting system version's trusted hash files

1 with the decrypting passcode

Enter the decrypting passcode for the first file you open. You should not have to enter it again after that.



ES&S 6.1.1.0 & 6.3.0.0 – Workstations

- What you'll need:



Business PC
Non-voting system computer
with Windows 10 OS



Ubuntu OS CD
**6.1.1.0 only*



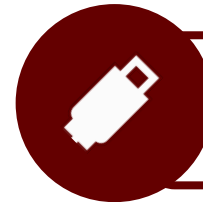
Unit Under Test
EMS Standalone, Client, or
Server



Trusted Hash File
Provided by the SOS



Scripting USB
A blank flash drive



Verification Trusted Pack
Hash generation flash drive



ES&S 6.1.1.0 & 6.3.0.0 – Workstations

*Must be logged in as
“sysadmin” (Standalone/Client)
“Administrator” (Server)

Step 1



Use the **Business PC** to update the **Verification Pack** with the **Trusted Hash** from SOS. Prepare the **Scripts USB**.

Step 2



Boot the **Workstation** with the existing OS (6.3.0.0) or Ubuntu OS (61.1.10) and follow provided instructions.

Step 3



Follow vendor instructions to execute the scripts from the **Scripts USB** and generate the **Workstation's** hash files. 6.1.1.0 has significantly more steps.

Step 4



The **Workstation's** hash validation **Resulting Output** will save to the **Scripts USB**

Step 5



Use the **Business PC** to examine the **Resulting Output** folder on the **Scripts USB** for errors.

Step 6



Archive the **Scripts USB** with the **Verification Package** and **Resulting Outputs** for record retention



ES&S 6.1.1.0 & 6.3.0.0 – Devices

- What you'll need:

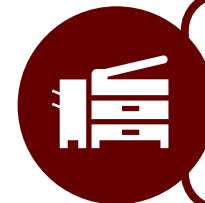


Business PC

Non-voting system computer with
Windows 10 OS **6.3.0.0 only*



Scripting USB
Blank flash drive



Unit Under Test

Ballot Marking Devices
and Scanners



Verification PC

Non-voting system
computer with Ubuntu OS



Trusted Hash File
Provided by SOS



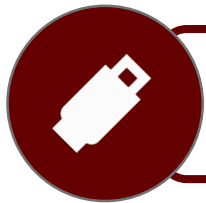
Verification Trusted Pack

Hash generation
flash drive

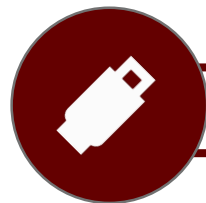
Device-Specific Requirements



Firmware
USB



Election
Definition



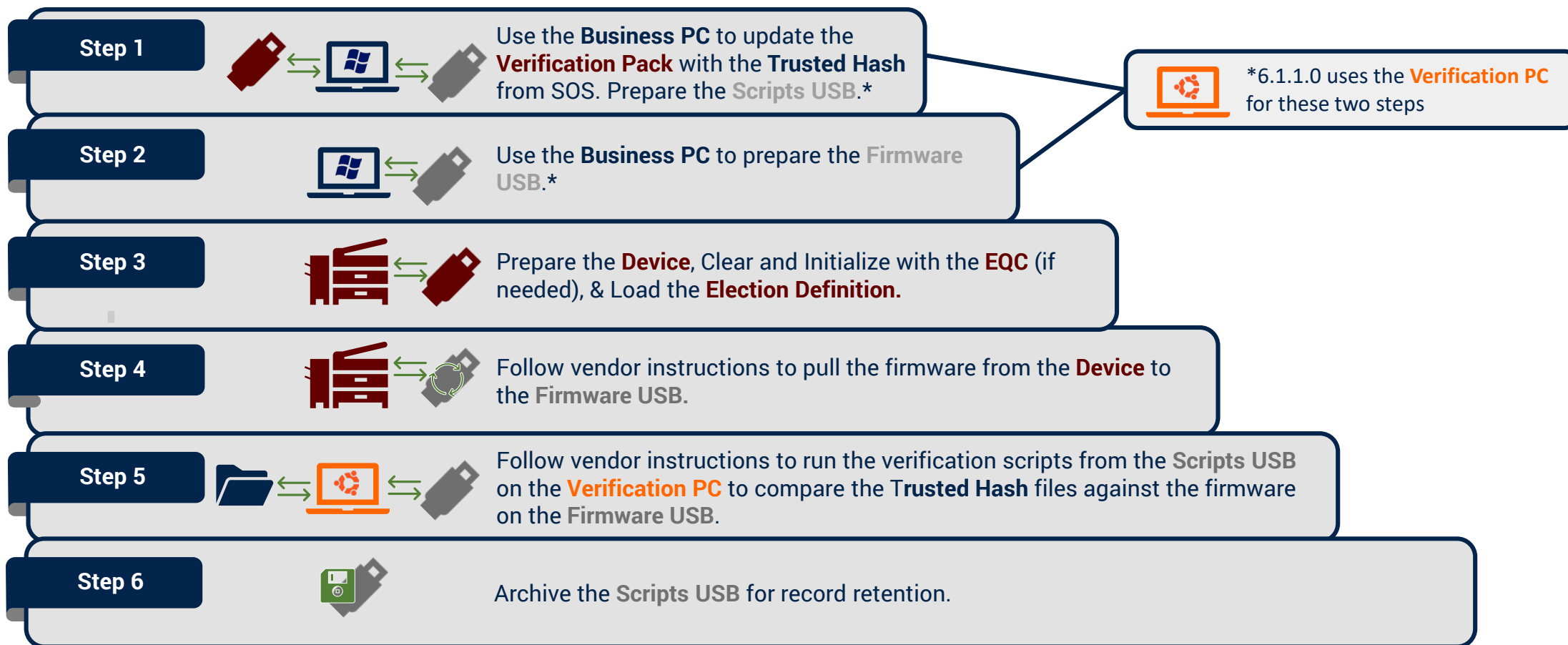
EQC



Key Sets



ES&S 6.1.1.0 & 6.3.0.0 – Devices





HART – Workstations

Administrator-level users

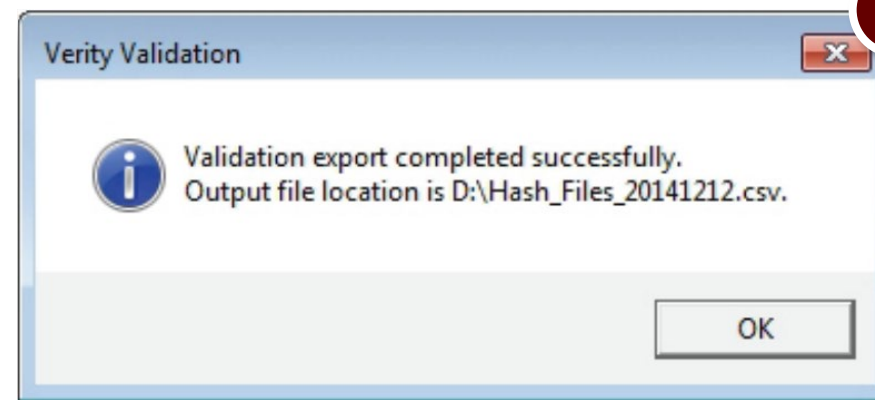
1. Insert a removable USB drive into the Verity workstation.
2. Under Export file hashes to a removable drive, click **Export (1)**.
 - 2.4 & 2.5 must Browse to the location where you would like to save the files, and then click **OK**.
3. You will see the message “Validation export completed successfully...”; click **OK (2)**.
 - The exported files are saved to a folder on the inserted USB drive named with the workstation serial number and date/time of export.

1

Export system files and hashes to a removable drive for validation:

Export

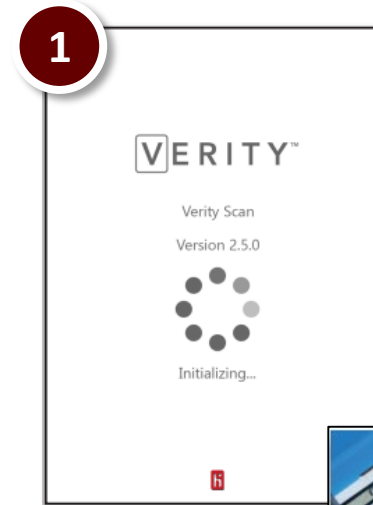
2





HART – Devices

1. Use a standard USB drive (**do not** use a vDrive).
 - 2.4 and 2.5 must create a folder named “HartValidation” (no spaces).
2. Set up the Verity device and connect it to AC power. Open the vDrive compartment. The device should not have a vDrive or Key inserted.
3. Insert the USB drive into one of the two USB ports inside the vDrive compartment on the device.
4. Press the red power button on the back of the device to power it on. Look for the Verity Initialization screen.
5. When you see the Verity Initialization screen (1), immediately press and hold the blue Validation button (2) inside the vDrive compartment.
6. Hold the button down until the device displays the **Additional Functions** screen (3).
7. Select **Validate** (4).
8. When you see the message “Hash values have been calculated and saved”





Comparing the Hashes

- Hash Comparison Tools

- Online tools
- System Utilities, built-in self-validations, native programs (such as 7-Zip)
- Ubuntu Terminal: FSFS provides pre-written commands for this method for
- Windows PowerShell: ES&S provides pre-written commands for this method for workstations
- Microsoft Excel functions:

	A	B	C
1	Trusted Hash Value	Generated Hash Value	Check Function
2	2bd806c97c0e0fba1a1c86eecbe0092c6 94a504c5520e740b2f155694c92e71d	2bd806c97c0e0fba1a1c86eecbe0092c6 94a504c5520e740b2f155694c92e71d	=If(A2=B2,"Match","No Match")

This output
would be a
“Match”!



Comparing the Hashes

Hash Values Match (SUCCESSFUL)

- If validating during Acceptance Testing, continue with any remaining acceptance testing requirements
- If validating during Logic & Accuracy Testing, continue with the rest of the test
- Hash Validation Test Results are subject to records retention

Hash Values Don't Match (FAILED)

- Verify the correct corresponding trusted hash file is being used
- Re-request the trusted hash file if you believe the copy you are using has been corrupted in any way
- Verify the correct steps have been taken to:
 - Generate hash files from the equipment
 - Compare the generated hash files against the trusted hash files
- Reach out to your vendor or our office for additional assistance



Best Practices and Recommendations

- **Removable Media Policy**
 - New COTS media
 - Reformatted before use
 - If chain of custody cannot be confirmed, removable media should not be used
- **File Storage & Naming Convention**
 - Use consistent practices for where to save files & how they are named
- **Standard Operating Procedures**
 - Have clear, documented procedures for conducting Hash Validation Testing
 - Ensure more than one person is familiar with the procedures for redundancy
- **Designated Point(s) of Contact**
 - Know how to contact your vendor, IT team, or our office



Resources and More Information

- **Educational Material**
 - [EAC Article](#) | [EAC Learning Lab](#)
 - [Microsoft Windows Article](#)
- **Resources**
 - [SOS Election Advisory No. 2022-30](#)
- **Further Consideration**
 - [Introductory Computer Science-Based Puzzle Game \(ae27ff\)](#)
 - Self-validation: systems testing themselves



Table Share

Prompt:

Share best practices you have learned from performing your own hash validation tests.

Consider:

- Do's & do not's
- Lessons learned
- Things you wish you knew before your first test



Work together with people at your table and the table directly behind you.

Ensure that everyone has a turn to share their thoughts, ideas, or perspective.

You will have
5 minutes
to discuss.



Available Support



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elections@sos.texas.gov

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