The State of US Voting System Security

DEFCON Voting Machine Hacking Village
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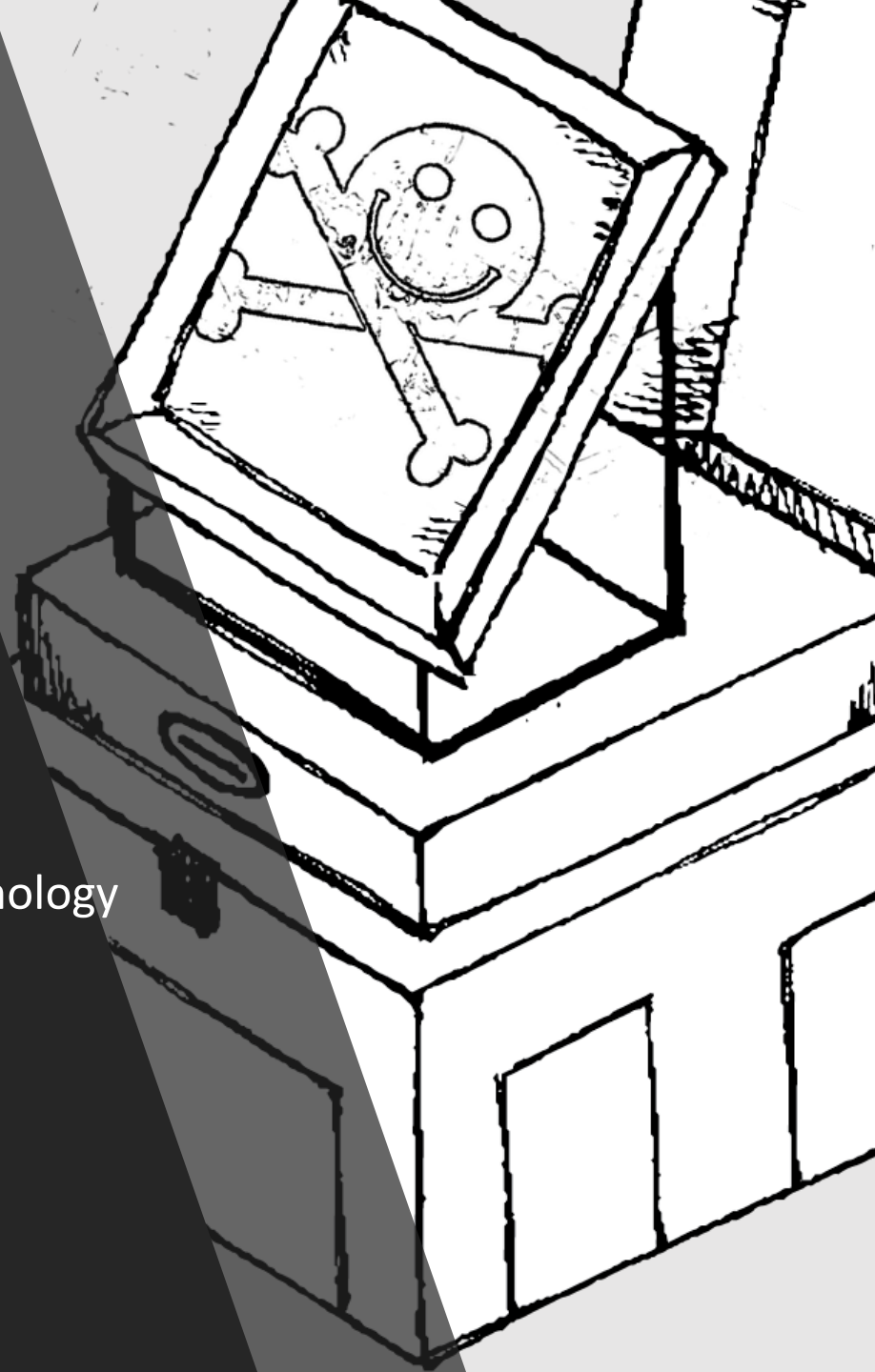

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Election Fraud Types - 1934

- Registration fraud
- Repeating
- Ballot box stuffing
- Assistance to voters
- Intimidation & violence
- Altering ballots
- Ballot substitution
- False counts and returns
- Altering returns

[1] Joseph Harris, 1934

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Bio

- IT Security Engineer, NIST
- Enterprise mobility, telecommunications, evoting
- 10+ years in the elections community
- Co-chair the Election Cybersecurity Working Group
- Masters in Information Security from George Mason

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Get to Know an Agency

- Federal:
  - Election Assistance Commission (EAC)
  - NIST, DHS, and FBI
- State: Secretary of State's office
- Local: counties, cities, townships, parishes, hamlets

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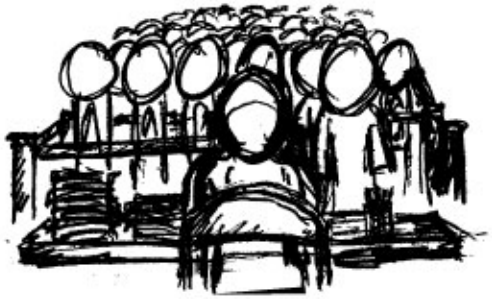


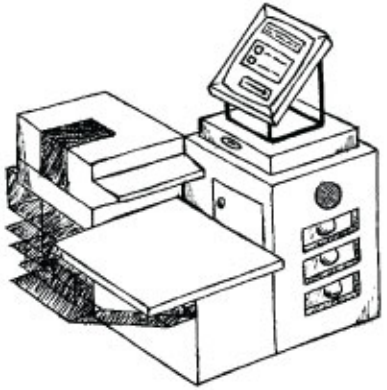
Local and Online Voter Registration

Electronic Pollbooks

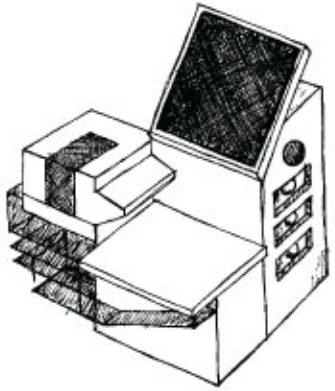
Candidate Filing Systems

Campaign Voter Info Databases

Direct Record Electronic



Optical Scan



Ballot Marking Device

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Types of Voting Systems

- Vote capture & tabulation
  - DREs, central & precinct optical scan, ballot marking device
  - Software associated with election administration
- Supporting election systems
  - Voter registration, epollbooks, election night reporting
  - Candidate filing, poll worker tracking, ballot tracking …

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A Changing Threat Model

Old & Busted

- Physically proximate attackers
- Accidental events
- Natural disasters
- Events affecting public confidence and trust

New Hotness

- Nation state attackers
- Phishing
- Supporting election systems
- Everything in the old threat model, plus CYBER

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Security Architecture

- Embedded legacy system
  - Typically running *nix variant
- Older or proprietary physical media
- Working TCP/IP stack is common
- Wireless is possible
- Required to stand the test of time (10 - 15 years)
- Jurisdiction that can pay MAY receive 1 - 5 updates

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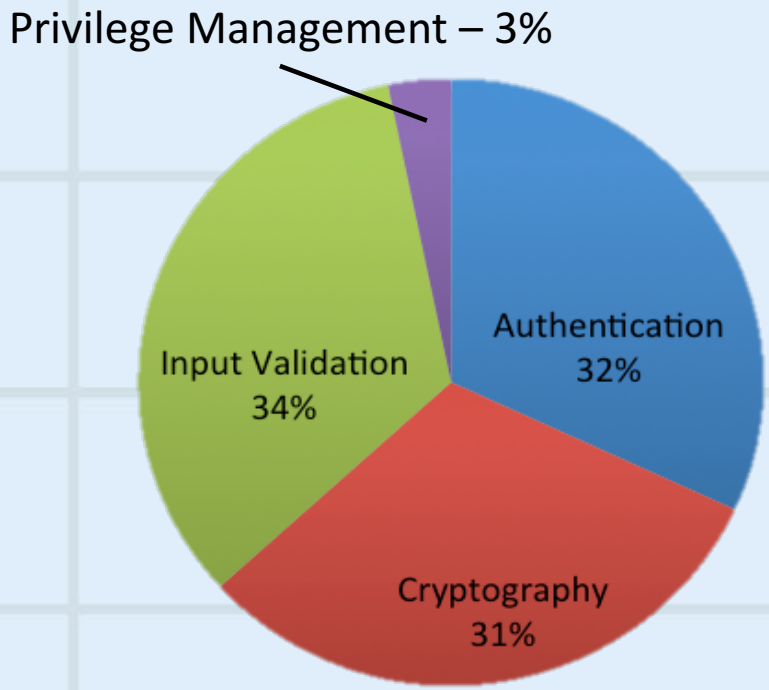
Independent Reviews



Common CWEs

- CWE-306: Missing Authentication for Critical Function
- CWE-120: Classic buffer overflow
- CWE-522: Insufficiently Protected Credentials
- CWE-345: Insufficient Verification of Data Authenticity
- CWE-311: Missing encryption of sensitive data

[10] – [27]

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Innovations in Voting Security

- Risk Limiting Audits [8]
- Software Independence [6]
- E2E verifiable cryptographic protocols [9]
- Recognition of usability as a security issue

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Paper is not a Panacea

- Paper ballots provide tamper detection and enable auditability
- Paper can be modified
- Seals and chain of custody need verification
- Routine audits need to be performed
- Cyberhygiene

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Testing & Certification

- EAC runs a testing and certification program
  - Most states do as well
- Voting system test labs (VSTLs) perform testing
- States are not required to use certified systems
- Testing validates voting machines *submitted for certification* meet the VVSG
- Freely available test reports!
  www.eac.gov

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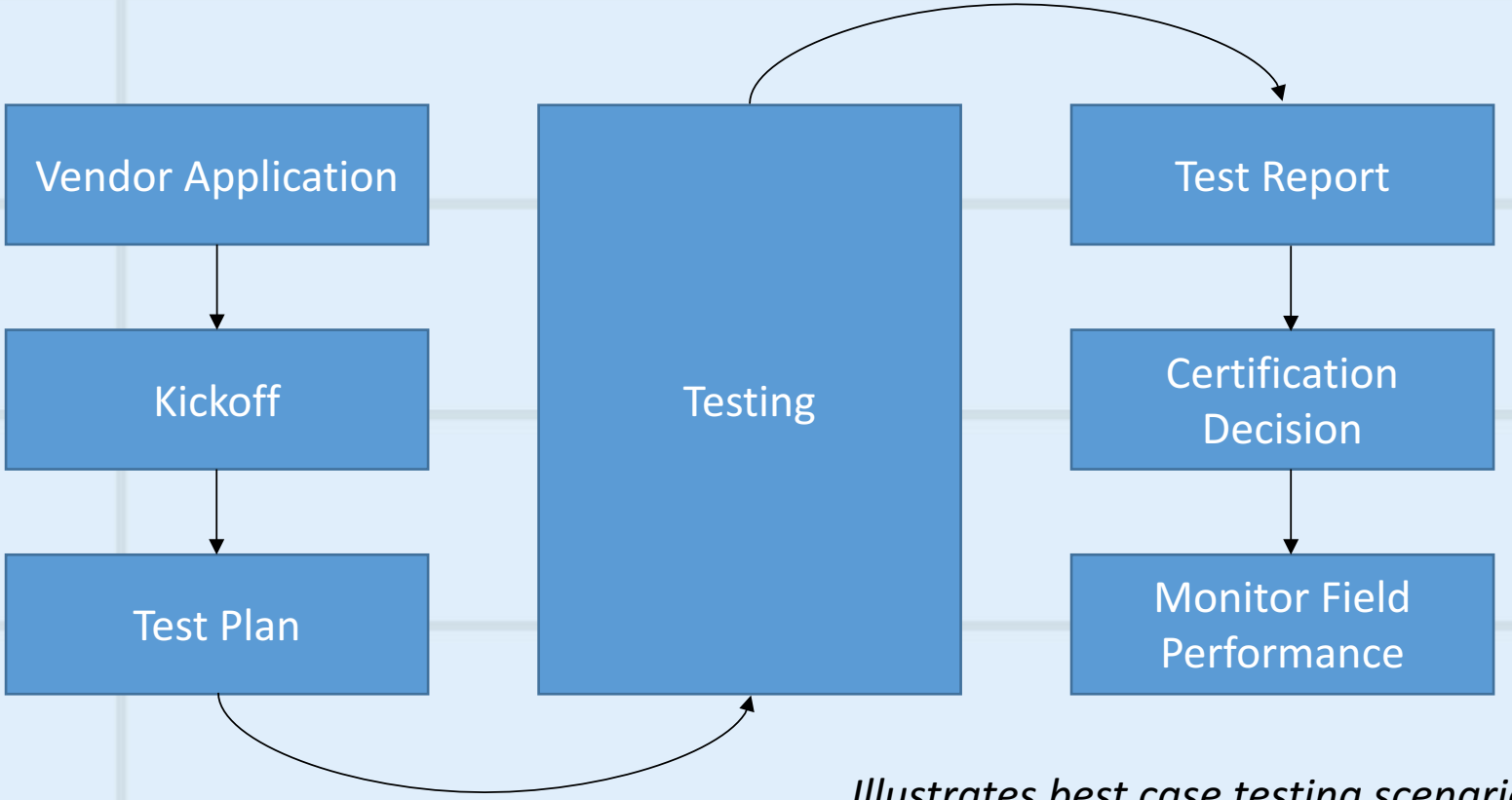
Certification Process



Illustrates best case testing scenario

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Voting Standards

- Voluntary Voting System Guidelines = VVSG [2]
- Scoped to vote capture and tabulation
- Not mandated for use
- Little security focus in initial drafts
  - Large overhaul in security requirements since 2005

VVSG Updates

1. 1990 VSS
2. 2002 VSS
3. 2005 VVSG
4. 2007 Recommendations
5. 2015 VVSG
6. Principles & Guidelines under development

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New Proposed Structure

- Principles
  - High level system design goals
- Guidelines
  - Broad system design details for election officials
- Requirements
  - Technical details for design and development by vendors
- Test Assertions
  - Technical specification for testing by labs

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Security Principles & Guidelines

- Auditability
- Ballot Secrecy
- Access Control
- Detection and Monitoring
- Data Protection
- Software Integrity
- Physical Security

[3] NIST & EAC Voting Twiki

apt-get upgrade

- Routine meaningful audits
- Responsible vulnerability disclosure
- Augment how we manage election security
  - Risk assessment, threat modeling, and contingency planning
- Regular, external scrutiny of systems is essential
- Voting systems need software updates
- Election officials need actionable guidance

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Help Make a Difference

- Register to vote
- Be a pollworker
- Work with your election official – not against
- Join the public working groups

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