NIST VOTING

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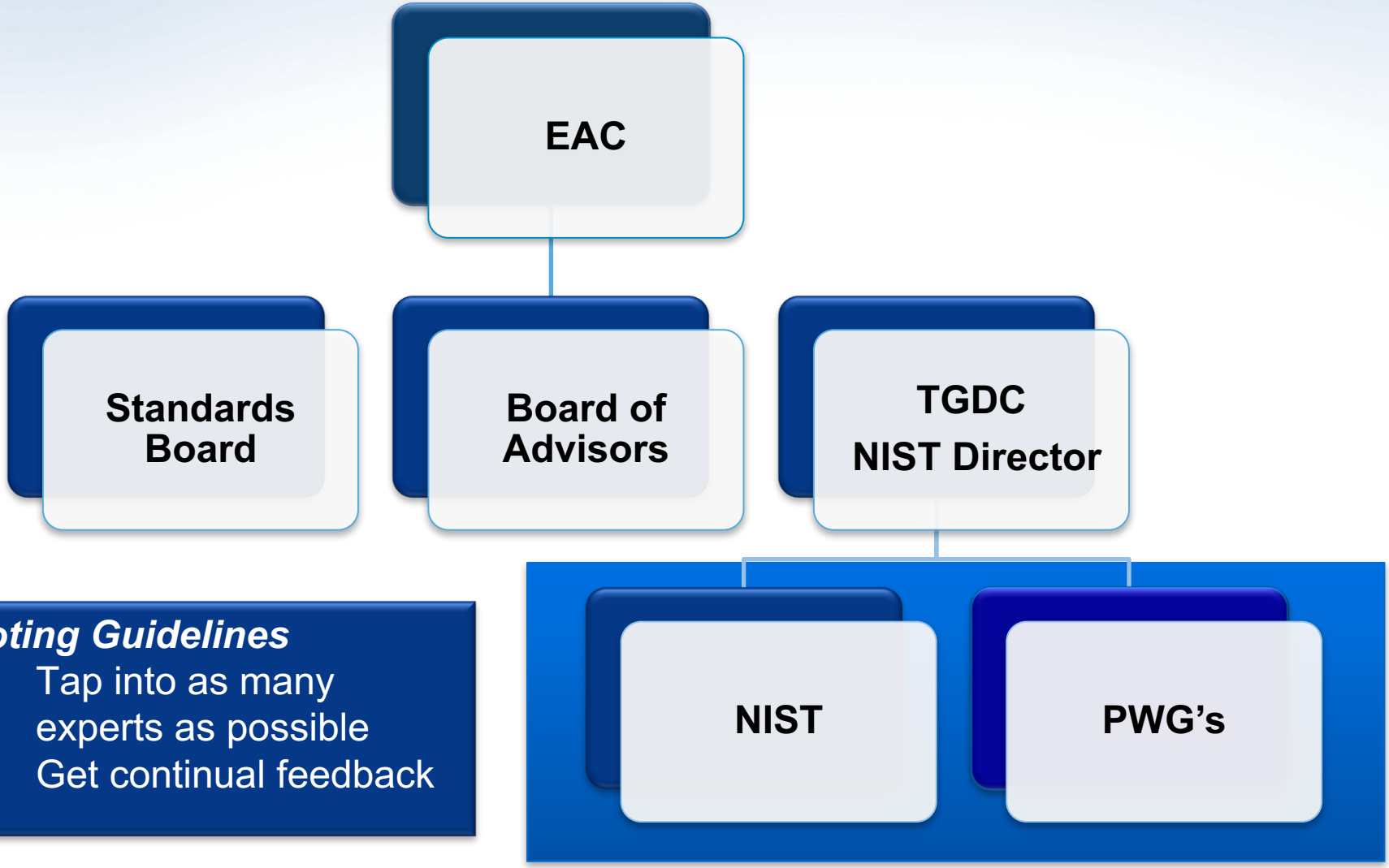
Topics

- VVSG 2.0 Development
- VVSG Scope
- VVSG Structure
- VVSG: Principles and Guidelines
- Requirements & Test Assertions
- Cybersecurity and Elections

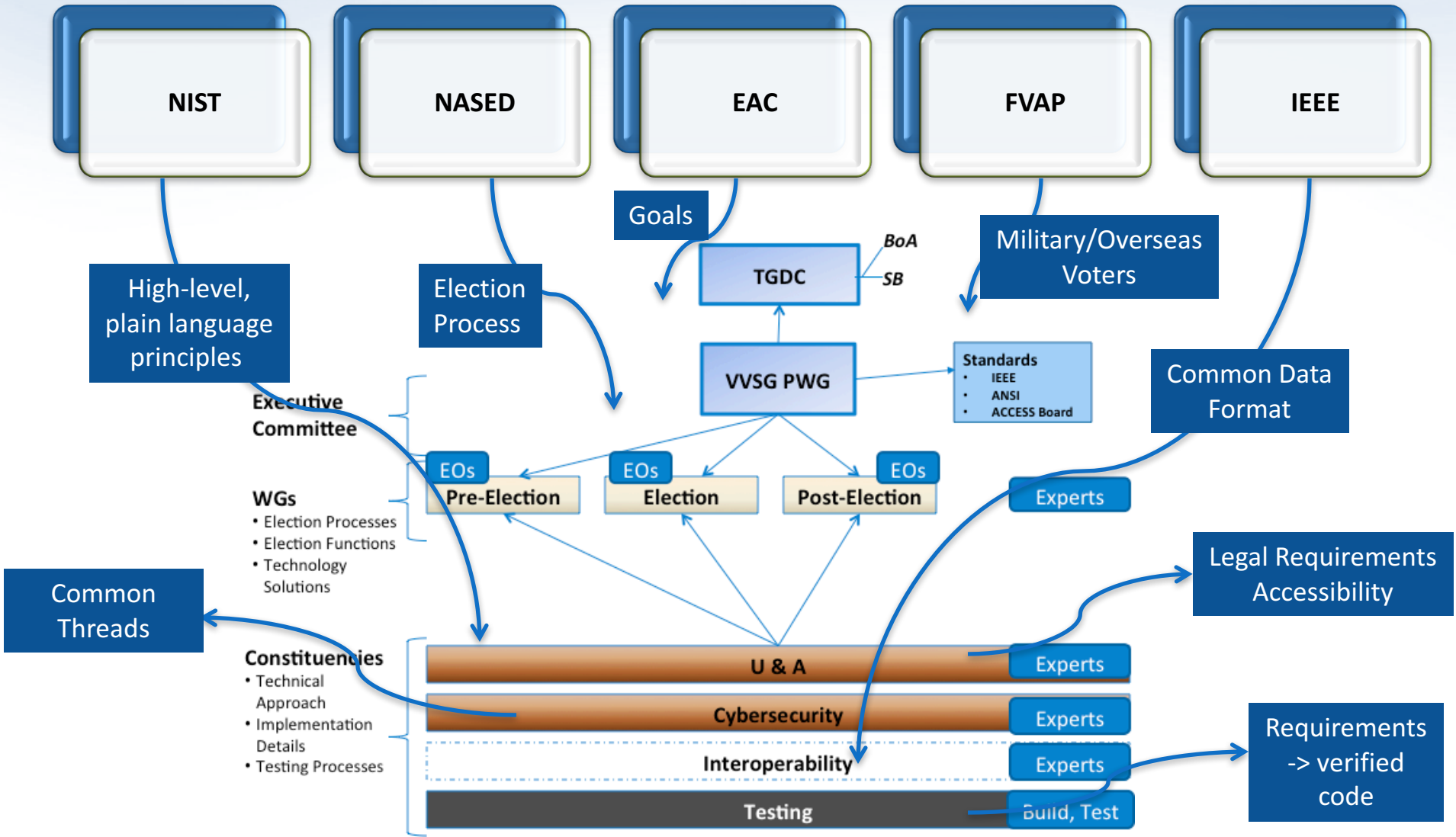
VVSG 2.0 Development



Voting Guidelines

- Tap into as many experts as possible
- Get continual feedback

Together…Making It Happen



NIST-EAC Public Working Groups

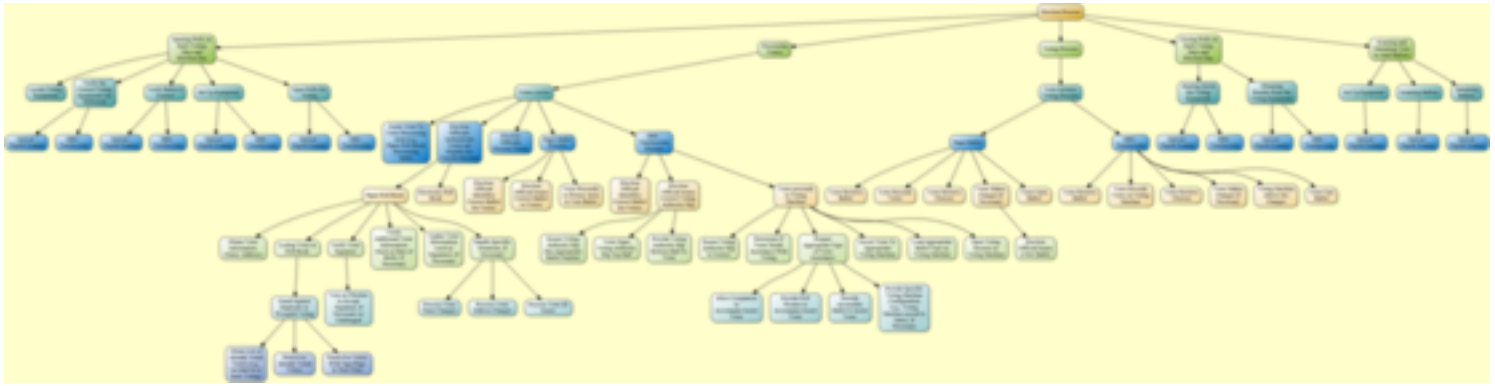
Election Groups

- Developed election process models that served as the basis for use cases and the core functions
  - Pre-Election (103 members)
  - Election: (107 members)
  - Post-Election: (96 members)

Constituency Groups

- Conducted gap analyses and developed draft VVSG 2.0 Principles and Guidelines
  - U&A (105 members)
  - Cybersecurity (121 members)
  - Interoperability (158 members)
  - Testing (84 members)

Election Models



Reaching Consensus on VVSG Scope

Election WGs

Pre, Election, and Post

Election Process Models

- TGDC
- EAC/NIST
- PWG Chairs

Use Case Scenarios

Core Functions

- Standards Board
- Board of Advisors
- NASED

A New VVSG Structure

Guidelines **Requirements**

HIGH LEVEL
Principles

LOW LEVEL
Test Assertions

- NASED Subgroup / NIST
- EAC VVSG Futures Group
- NASED Input to EAC / NIST
- EAC Roundtable / Public Meetings
- TGDC, SB, BoA Adoption

VVSG 2.0: Principles and Guidelines

	Principles	Guidelines
General	15	52
Interoperability	3	10
Human Factors	5	12
Security	7	21
	18	**53**

- ***Feedback from NASED, SB, BoA***
- ***Discussed within/between PWGs***
- ***Simplified text, removed duplicates, merged categories***

15 Principles, 52 Guidelines

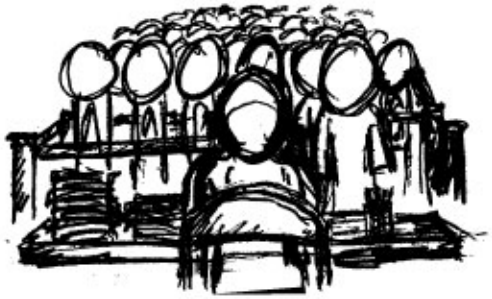
- *Principles*: High-level design goals
- *Guidelines*: Broad system design details for election officials
- Written in plain English
- Greatly reduced size: ~~**221,38, 20, 10**~~**,5 pages!**
- *Requirements*: Low-level guidance for manufacturers/laboratories
- *Test Methods*: Guidance to ensure necessary breadth/depth when testing voting systems

- Engaged NASED, SB, BoA members in discussions and garnered feedback
- Presented at TGDC September 2017 meeting for discussion/adoption

Cybersecurity and Elections

Election Fraud Types - 1934[1]

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



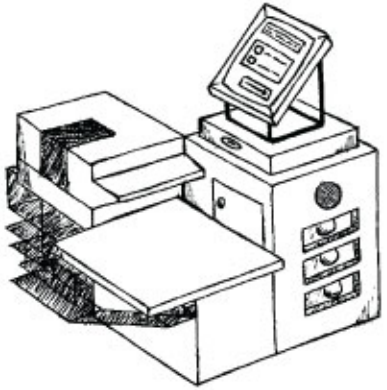
Local and Online Voter Registration

Electronic Pollbooks

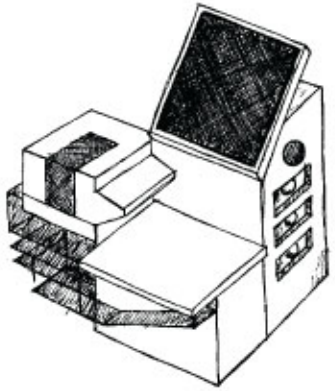
Candidate Filing Systems

Campaign Voter Info Databases

Direct Record Electronic



Optical Scan



Ballot Marking Device

2016 General Election Attacks

- Data exfiltration from voter registration systems [3] [4]
- Phishing election officials & voting system vendors [2]
- Doxing of political campaigns [2]
- Attacks on backend, non-tabulation systems [2]

"We assess Moscow will apply lessons learned from its Putin-ordered campaign aimed at the US presidential election to future influence efforts worldwide, including against US allies and their election processes." – *Office of the Director of National Intelligence* [2]

An Expanding Threat Model

Traditional Attacks

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

Recent Attacks

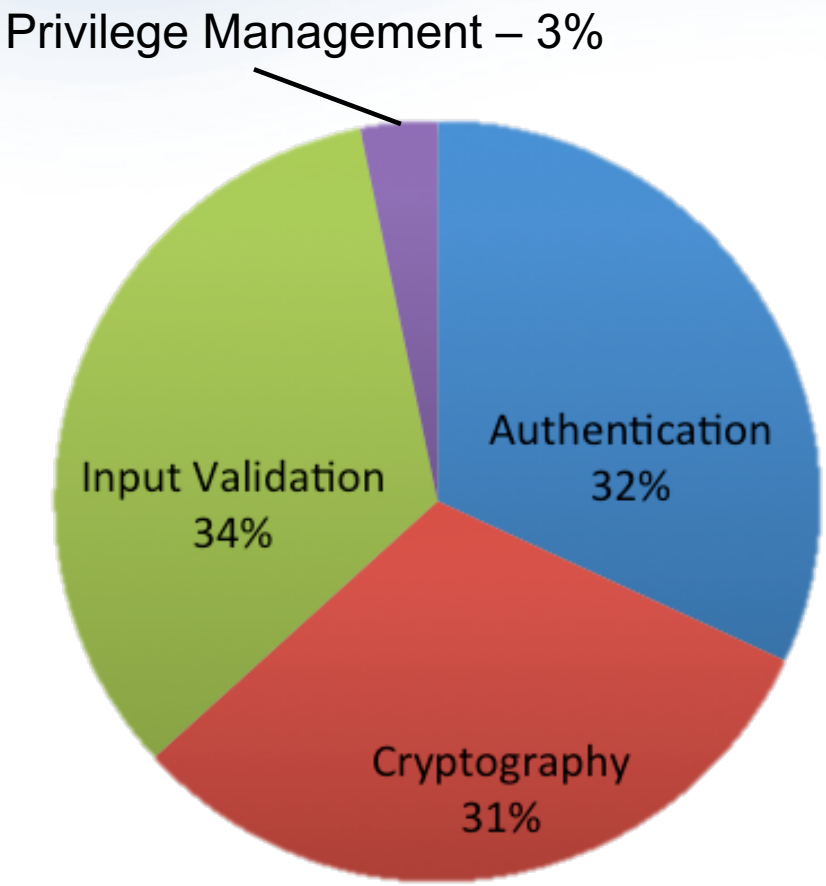
- Nation-state
- Phishing of work and personal accounts
- Supporting election systems

Voting System Security

- Embedded legacy Linux OS distro
- Older or proprietary physical media
- Working TCP/IP stack
- Wireless and public telecommunications
- Required to stand the test of time (10 - 15 years)
- Jurisdiction that can pay MAY receive 1 - 5 update

This is slowly changing as modern systems are introduced.

Independent Reviews



CWEs [8]-[25]

- 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

Security Innovations Since 2007

Industry

- Secure boot and strong process isolation
- Exploit mitigation technologies (e.g., ASLR, DEP)
- Stronger network protocols
- Security frameworks

Voting Systems

- Software Independence [5]
- Risk Limiting Audits [6]
- E2E verifiable cryptographic protocols [7]
- Recognition of usability as a security issue

Paper is not a Panacea

- Paper ballots provide tamper detection and enable auditability
- Paper can be modified or swapped
- Seals and chain of custody need verification
- Routine audits need to be performed
- Administrative controls are **very** important
- Cyber-hygiene

Standards vs. Best Practices

- Standards and best practices are different beasts
  - Standards are requirements, best practices often context dependent
- The VVSG is a voluntary voting system standard
- Examples of US election best practices:
  - EAC ENR Checklist
  - DHS VR guidance & EAC VR Checklist
  - EAC Incident Response Guidance
  - EAC EMGs
  - EVN's Top 10
  - NIST UOCAVA series

Voluntary Security Standards

Have

- DREs
- Optical scan
- Ballot marking devices
- Election management systems

Don't Have

- Electronic pollbooks
- Voting registration
- Campaign voter info systems
- Election night reporting
- Back-end office systems
- Supporting UOCAVA systems

Security Best Practices

Have

- Voter registration
- Election night reporting
- Supporting UOCAVA systems
- DREs
- Optical scan
- Ballot marking devices

Don't Have

- Electronic pollbooks
- Campaign voter info systems
- Back-end office systems
- Election management systems

Important Election Security Issues

- Technology
  - Need for accessible and auditable voting systems
  - External scrutiny of voting systems
  - Software updates for voting systems
  - Security posture of supporting infrastructure is an unknown
- Election Management
  - Meaningful post-election audits
  - Augment how we manage election security

Solving These Issues

- Threat modeling and risk assessments for the entire elections infrastructure
- Best practices for procedural election security and audits
- Ensuring usable security controls for voting systems
- Changes to allow for regular, secure patching
- Information sharing between all levels of government, industry, and security community

Cybersecurity Awareness

- In most industries and sectors there is a need for enhanced cybersecurity awareness
  - Elections is no different
- Need to understand how modern computers are attacked
- DHS is already helping with online educational materials
- Election officials need information in their language
- Topics we may need election specific guidance for:
  - Incident response
  - Authentication issues and password management
  - Physical and operational security
  - Decommissioning of old systems and media sanitization

Some Coordination Required

- Many of these security issues are broader than our scope of voting system technology
  - Policy, procedures, and law
- Local and state officials can't defend themselves against state actors alone
- Coordination is needed between all levels of government, industry, academia, and the broader elections community

Summary

- VVSG 2.0
  - Principles and Guidelines: Draft ready for TGDC review
  - Developed through open and transparent WG process
- PWGs are busy and have already started on requirements
- Requirements, test methods will be developed using an open and transparent process
- Many challenges remain for addressing cybersecurity for election infrastructure

Thank You!

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