A secure electronic voting primer

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S/n	Constitutional requirements	E-voting systems Design Principles
1	General	1.1 Institutionally equivalent to traditional 1.2 Eligibility (registration and identification)
2	Free	2.1 Uncoercibility 2.2 No propaganda in the e-voting site 2.3 Non-valid voting capability
3	Equal	3.1 Equality of candidates 3.2 Equality of voters 3.3 One voter – one vote
4	Secret	4.1 Secrecy 4.2 Balance security vs. transparency
5	Direct	5.1 Not monitored ballot recording and counting
6	Democratic	6.1 Trust and transparency 6.2 Verifiability and accountability 6.3 Reliability and security 6.4 Simplicity

Figure 1: Constitutional requirements and design principles for e-voting systems

Security Requirements

- Accuracy
- Democracy
- Privacy
- Robustness
- Verifiability
- Uncoercibility
- Fairness

Figure 2: Security requirements for e-voting systems

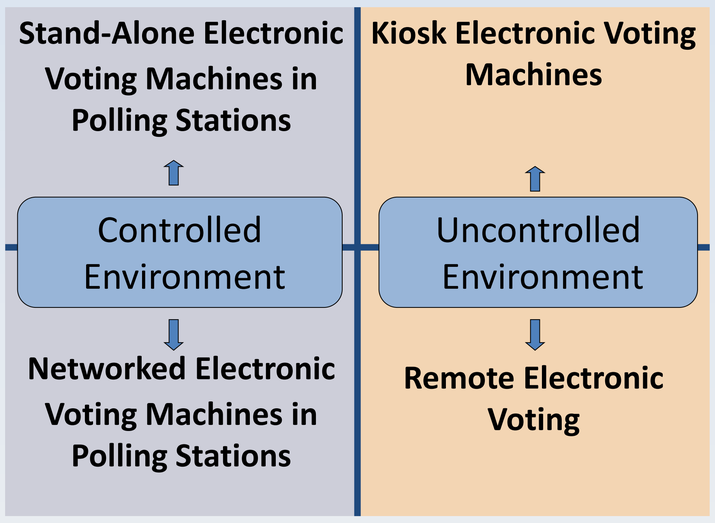
Contradicting Requirements

- **Privacy** (Unlinkability) vs **Verifiability** (Linkability)
- **Individual Verifiability** vs **Uncoercibility**

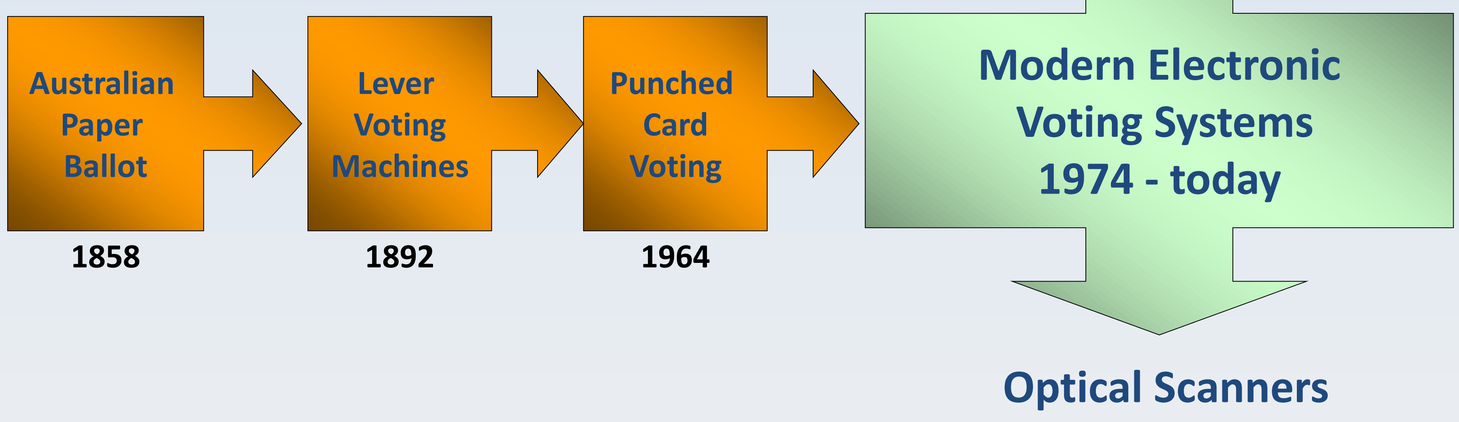
The 4 stages of elections

- Registration
- Validation
- Vote casting
- Vote tallying

Classification of Electronic Voting Systems



History of Voting Technologies



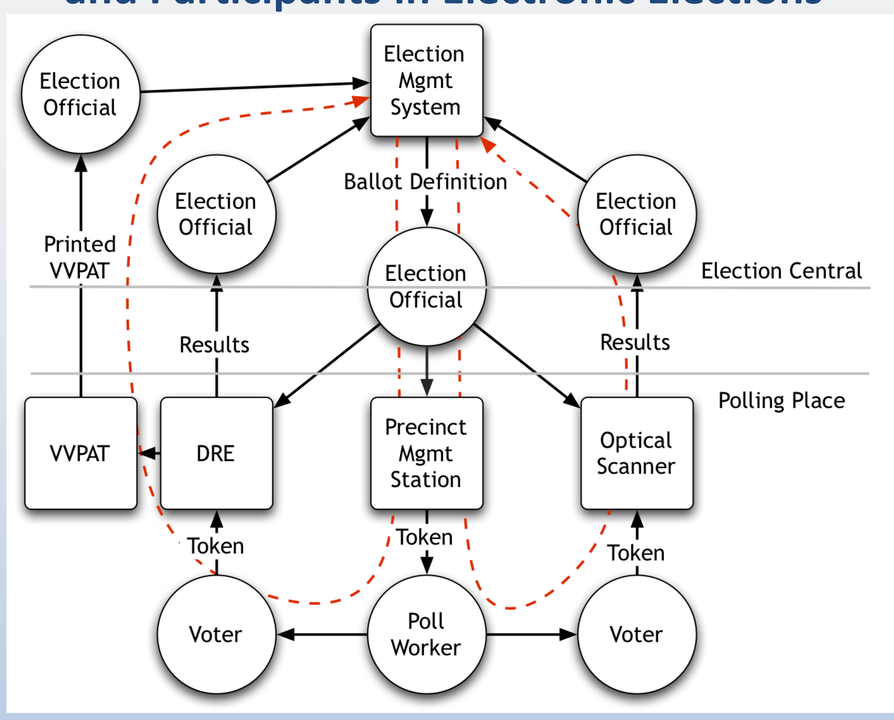
Cryptographic Models for e-voting

- Mix-nets
- Homomorphic Encryption
- Verifiable Secret Sharing
- Blind Signatures
- Zero Knowledge Proofs

Components of E-voting Systems

- **Election Management System** (central voting software)
- **DREs with Voter Verifiable Paper Audit Trails** (VVPAT)
- **Paper ballot optical scanners** (in the polling place)
- **High-speed paper ballot optical scanners** (at Election Central)
- **Removable media**
  - Smart cards
  - Memory packs
  - Result cartridges

Flow of Information Among the Components and Participants in Electronic Elections



Types of Attackers

- **Outsiders**
- **Voters**
- **Insiders**
  - Poll workers
  - Election Officials
  - Vendor employees

Security weaknesses found in real e-voting systems

- Ineffective mechanisms for assuring data integrity
- Misuse of cryptography
- Ineffective access control
- Dangerous development practices in software engineering

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