USENIX Security 2024

Election Eligibility with OpenID: Turning Authentication into Transferable Proof of Eligibility

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Université de Lorraine, CNRS, Inria, LORIA, France

Context: online voting systems

Desired properties:

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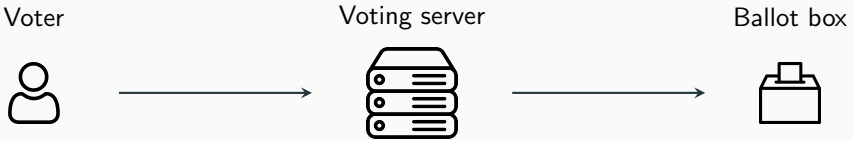
- result integrity: result is the combination of cast ballots



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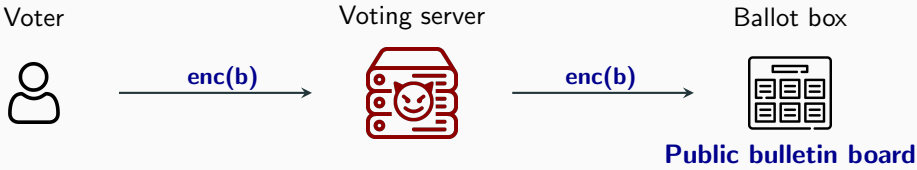

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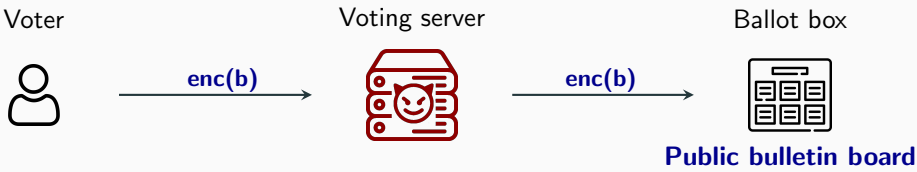

Studied in academic research and used in real elections:

- Helios, Select, Belenios, ...
- Estonia, Australia, Switzerland, ...

Attack: ballot stuffing

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Current problem: no existing *privacy-preserving* and *practical* solution

OpenID for e-voting

OpenID Connect:

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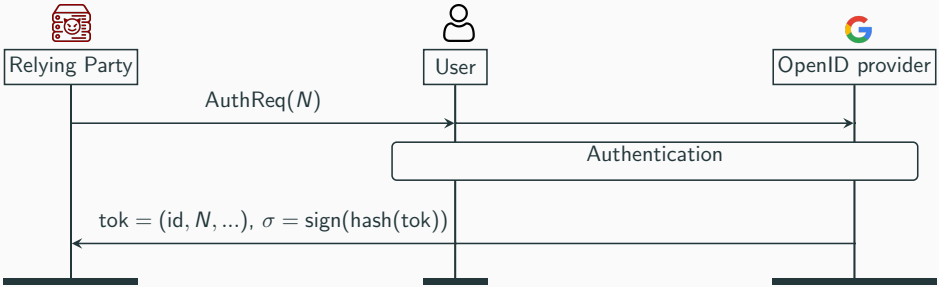

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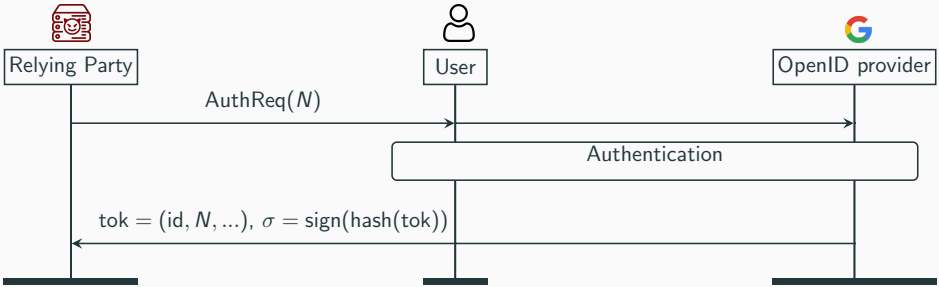


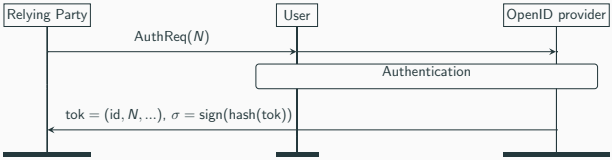
Problem for e-voting: non-transitive authentication

⇒ **not suitable for e-voting out-of-the-box**

Sign ballots with OpenID

Idea:

- set N = ballot
  $\Rightarrow$ **σ is linked to ballot**
- publish σ along ballot



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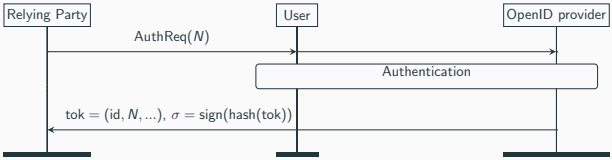

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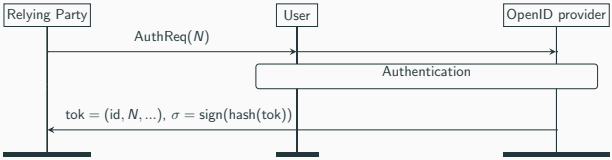

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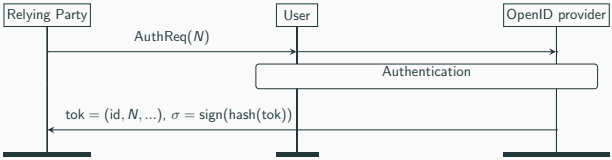

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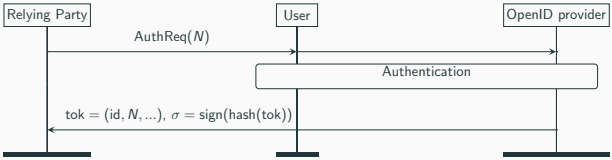

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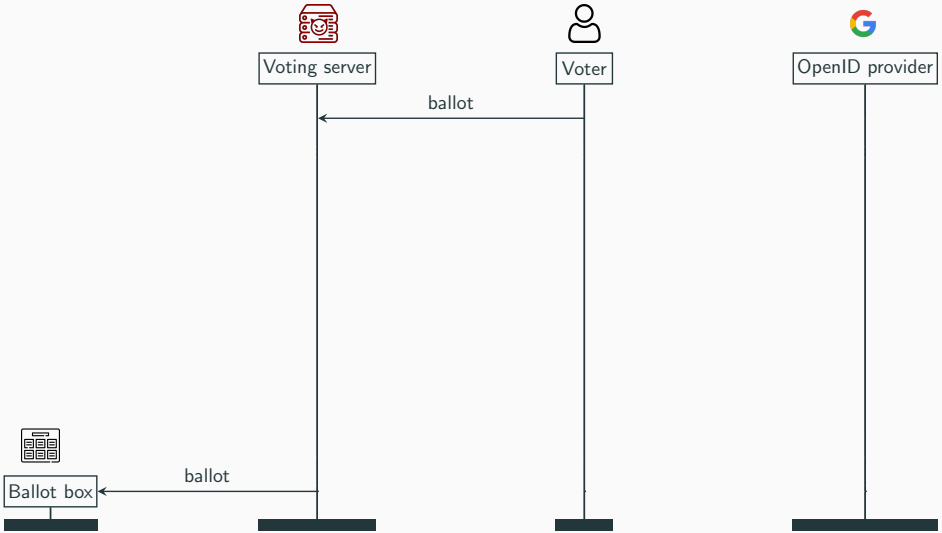

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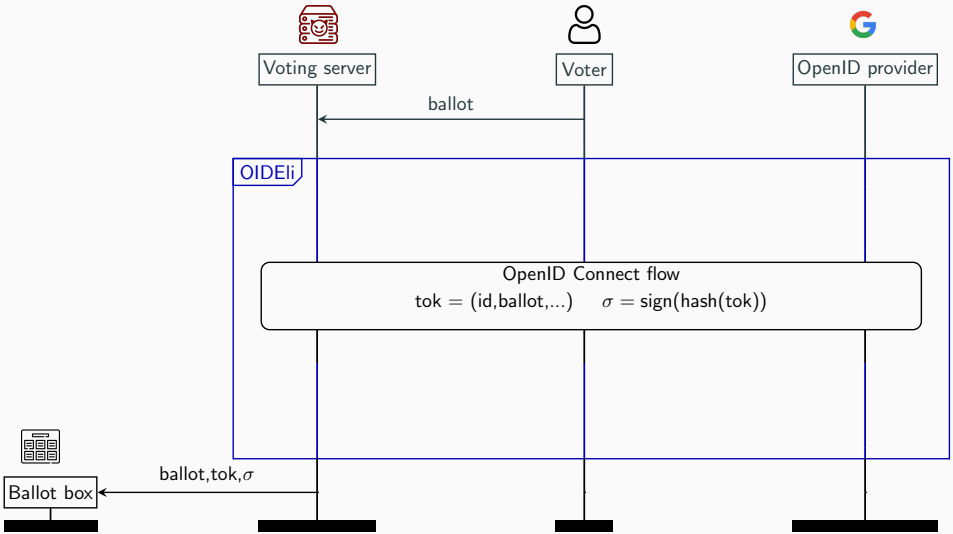

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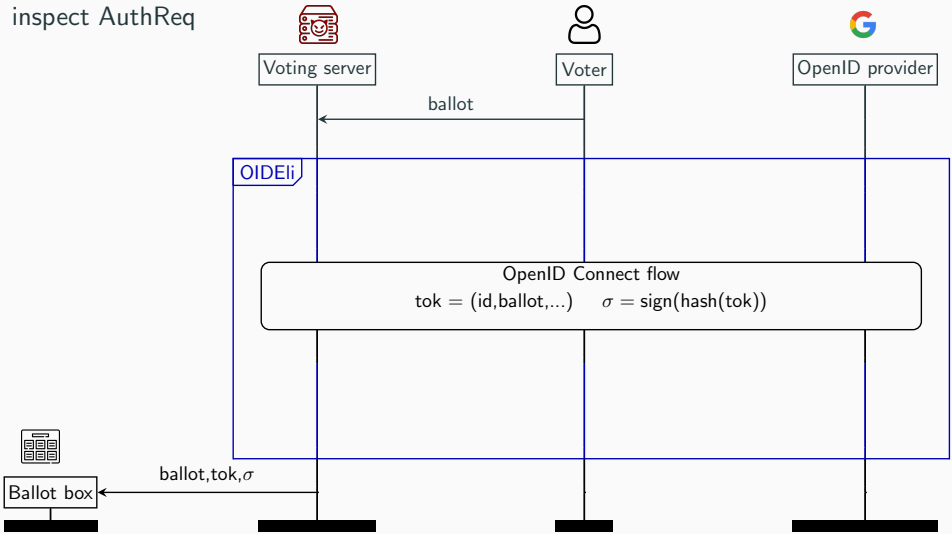

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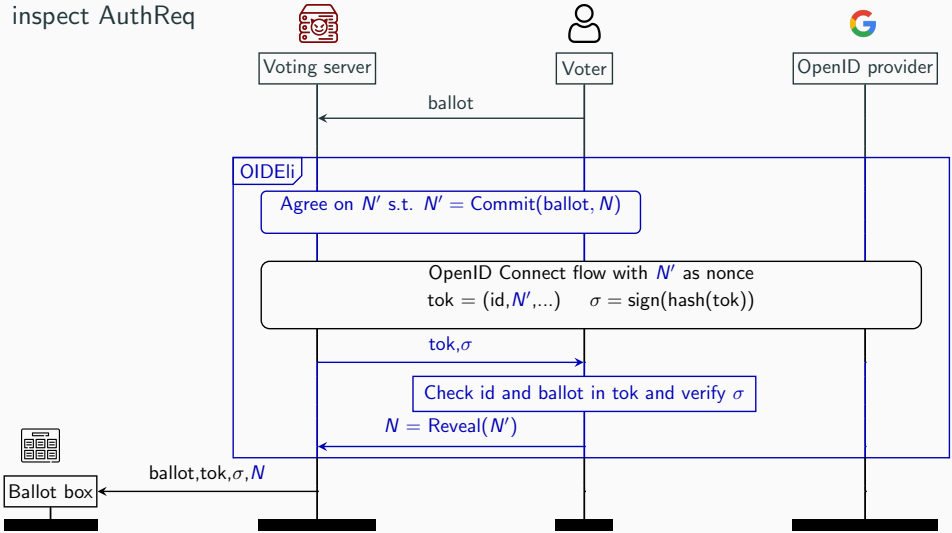

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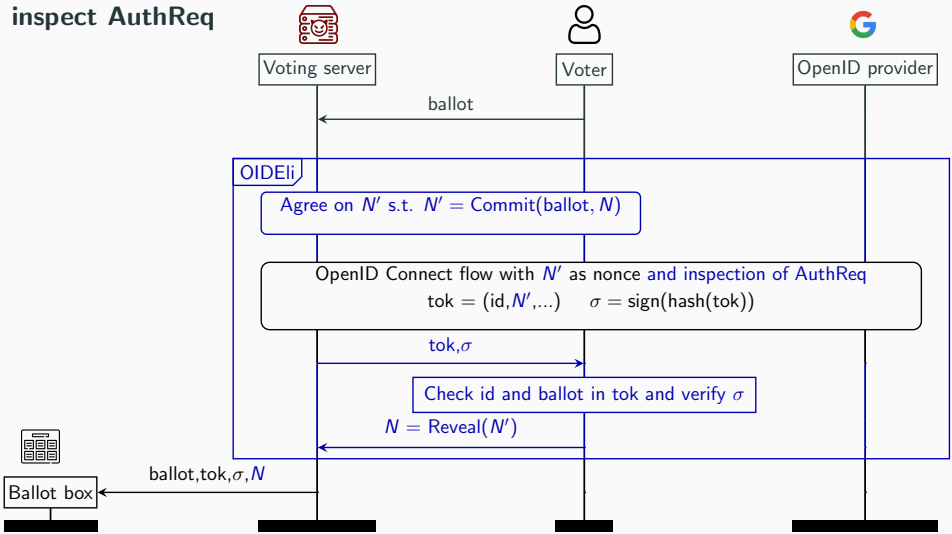

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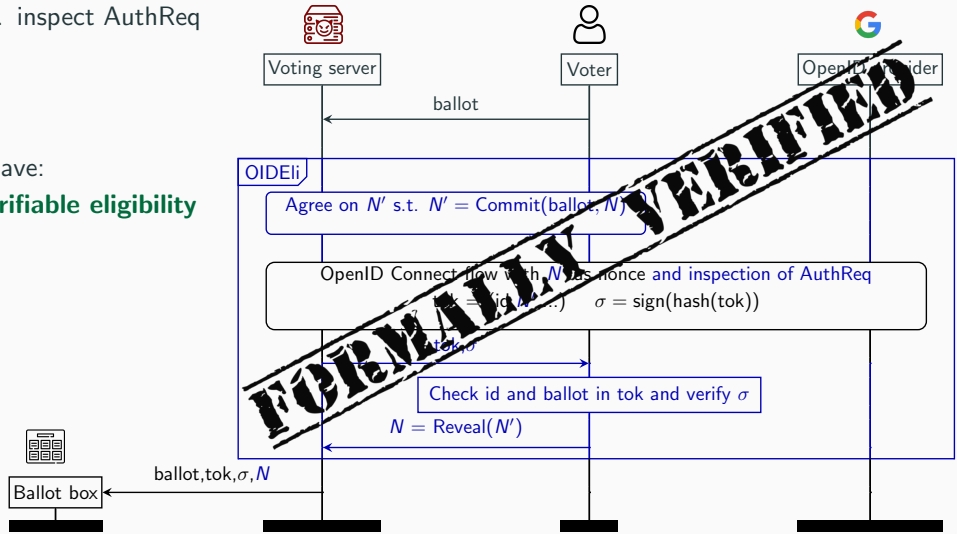

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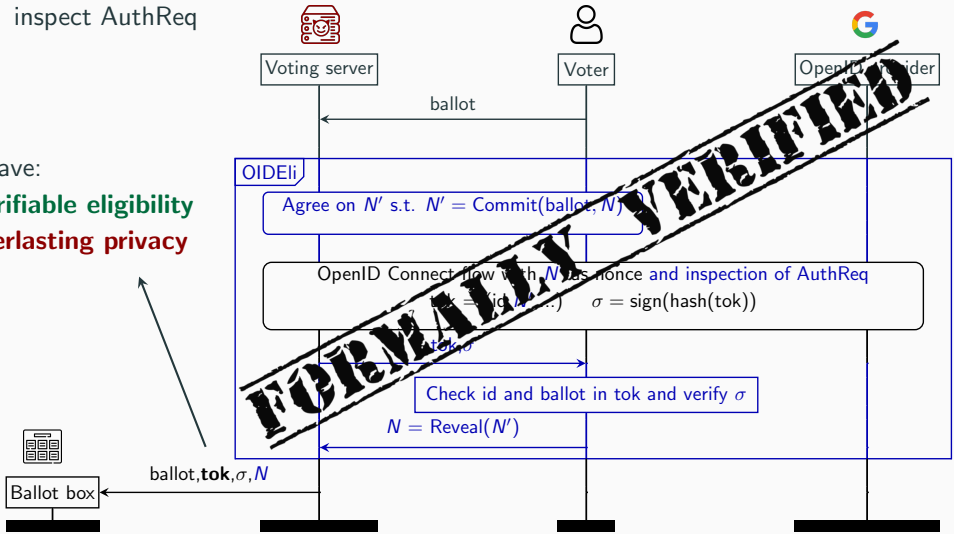

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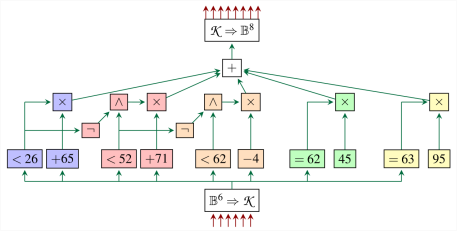

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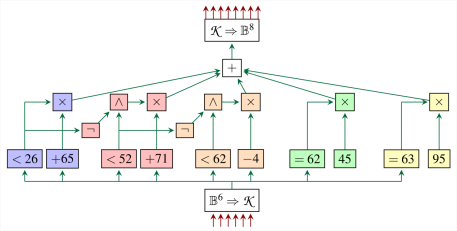
Performance:

- ✗ naive circuit: < 0.75 proof per hour
- ✓ our circuit: $\sim$1.3K proofs per hour
- ✓ highly parallelizable
- ✓ computation on server



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