# New technologies for democratic elections

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# A bit of history


- First reports on Estonian i-voting in 2001
- Following principles were developed in 2003 to suit the legal framework:
  - Principles of paper-voting are followed
  - i-voting during the advance voting period
  - The voter uses ID-card
    - System authenticates the voter
    - Voter confirms his/her choice with digital signature

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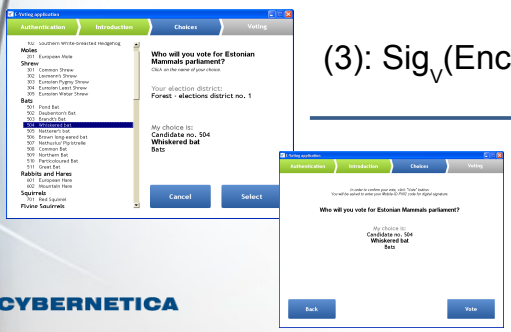
# I-voting protocol since 2005

(1): ID-card authentication

(2): List of candidates

(3): $Sig_V(Enc_S(Rnd,Vote))$

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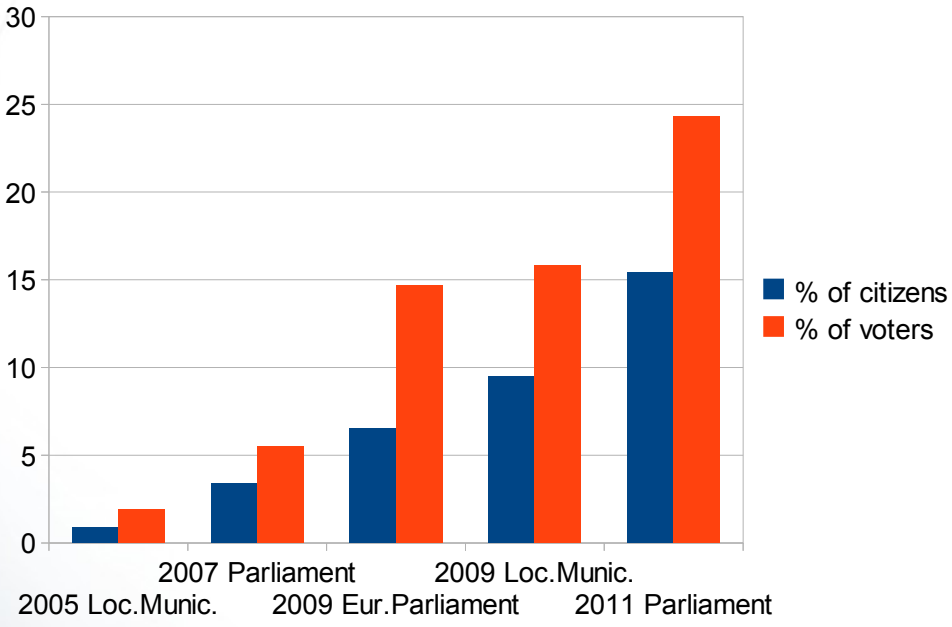
# I-voting in Estonia

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# I-voting is possible!

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# Threats to election

- The purpose of the elections is delegating the power (formally vested into people) to a small set of representatives
- Increase influence in the society
  - Bribery
  - Coercion
  - Fraud
  - Disenfranchisement
  - ...

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# How to counter those threats?

- Have to maintain ballot secrecy
- Paper voting in polling stations
  - Privacy of polling-booth
  - Observation of the procedures
- Voter can i-vote from anywhere
  - Have to trust computer
  - Electronic process are not observable
  - Attacks scale

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# Verifiability

- Verifiability reduces trust to voting system and voting environment
- Individual verifiability – voter has means to verify some of following properties about the ballot:
  - Cast as intended
  - Accepted as cast
  - Tallied as recorded
- Universal verifiability – public means to observe correctness of tally

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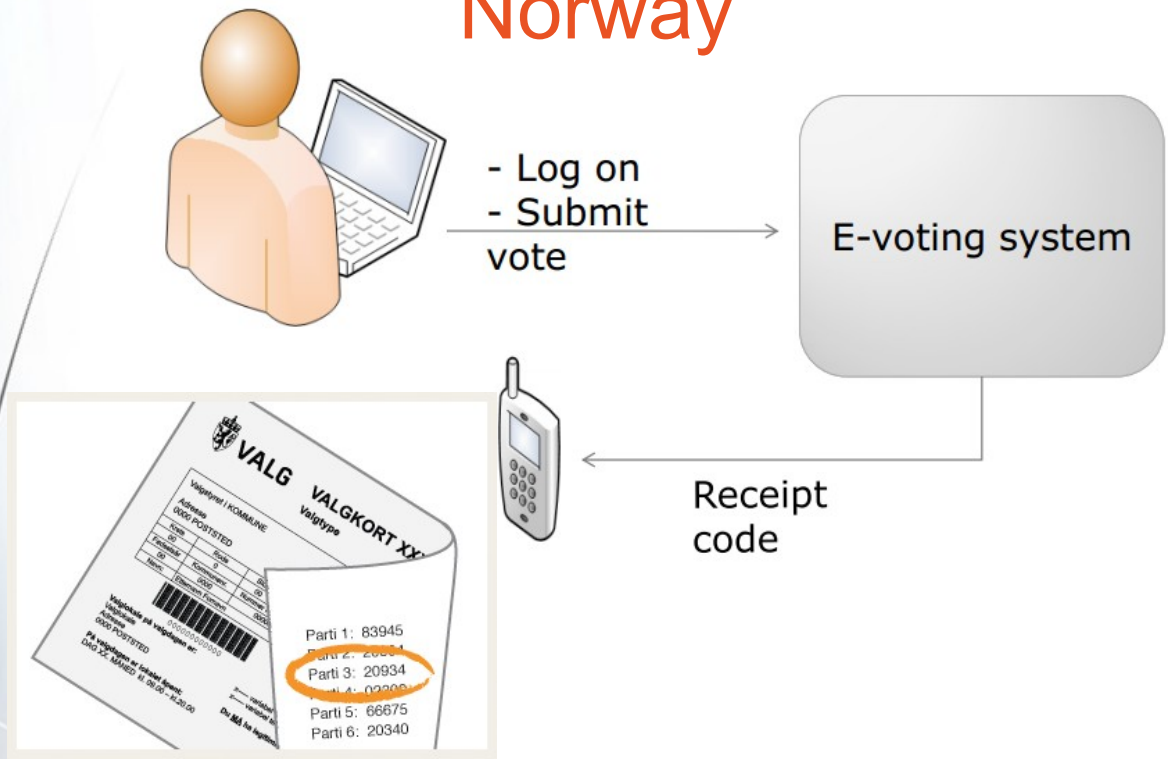
# Individual verifiability: Norway

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http://www.regjeringen.no



# We do not want verifiability!

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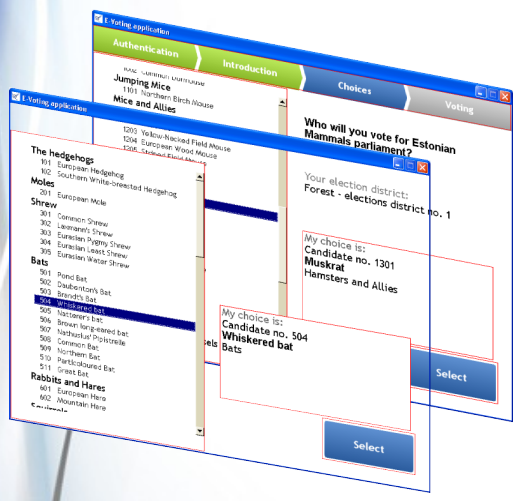
# Parliamentary election 2011




- Election rigging malware developed by a student
  - Wanted public attention, attempted revocation
- Voting application defect used in political battle
- I-voting has become so significant that it makes sense to attack it



# Risk-analysis

- Attack strategies
- Three main attack classes
- Violating the requirements
- Specific techniques
- Generic techniques

# Main attack classes

- Manipulation attacks
  - „Classical“ attacks against uniformity, correctness, freedom, etc.
- Revocation attacks
  - Referring to a real attack, try to achieve cancelling all the i-votes, hoping to change the outcome of the tally
- Reputation attacks
  - Try to discredit i-voting and hope that people who choose not to i-vote will not vote at all

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# We need verifiability!

- Fight against real manipulation attacks
- Discourage potential real attackers
- Prevent revocation and reputation attacks
  - This item is actually the most important one, since reputation attacks are cheap, risk-free and can be expected to have huge impact

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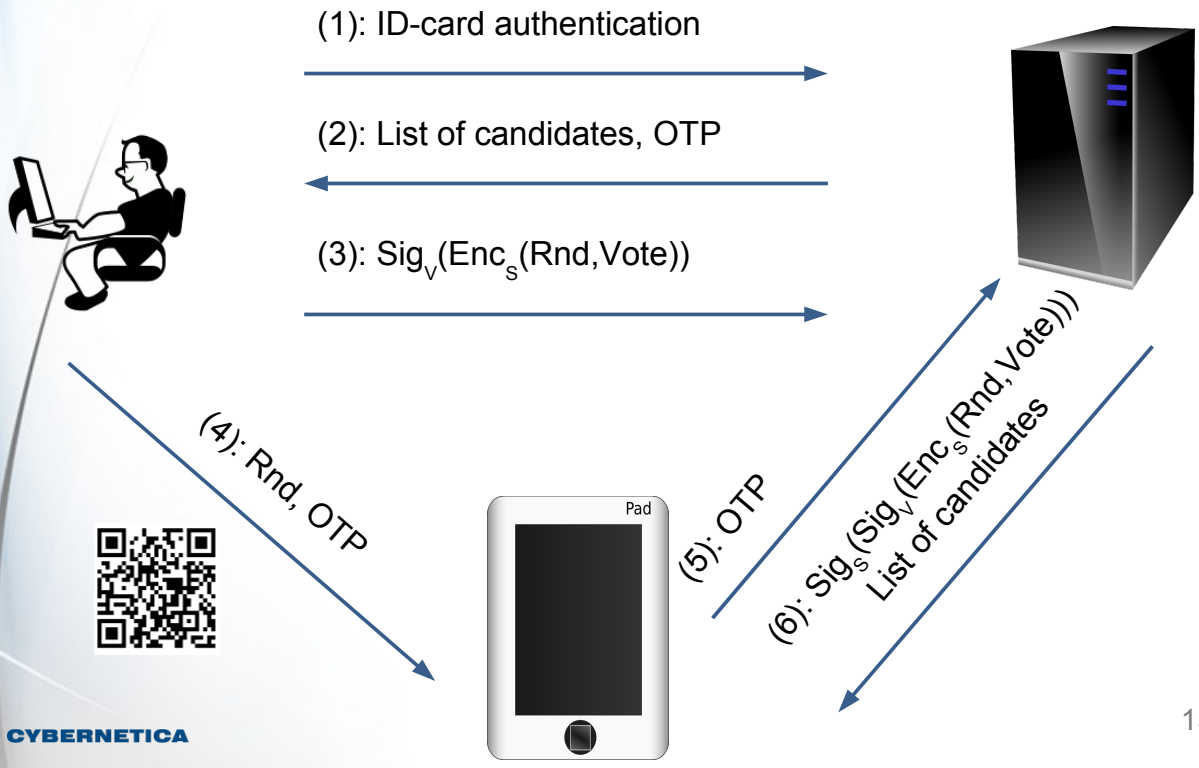
# I-voting with vote auditing

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# Draft of the new Election Law

- §48. Verification of the i-vote
  - (1) The voter can verify whether the vote given by internet voting has been sent to i-voting system according to the voter's intention.
  - (2) Verification procedures are established by Electoral Commission.

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# Last but not least...

- Verifiability has to be supported by incident handling
- Verifiability changes the way voters perceive elections
  - Is ballot secrecy under doubt?
  - Does verifiability ease coercion?
  - Can verifiability be misused?
  - Do we need universal verifiability?
  - Do we need verifiability for paper voting?

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# Questions?

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