Post-Quantum

Cryptography Conference

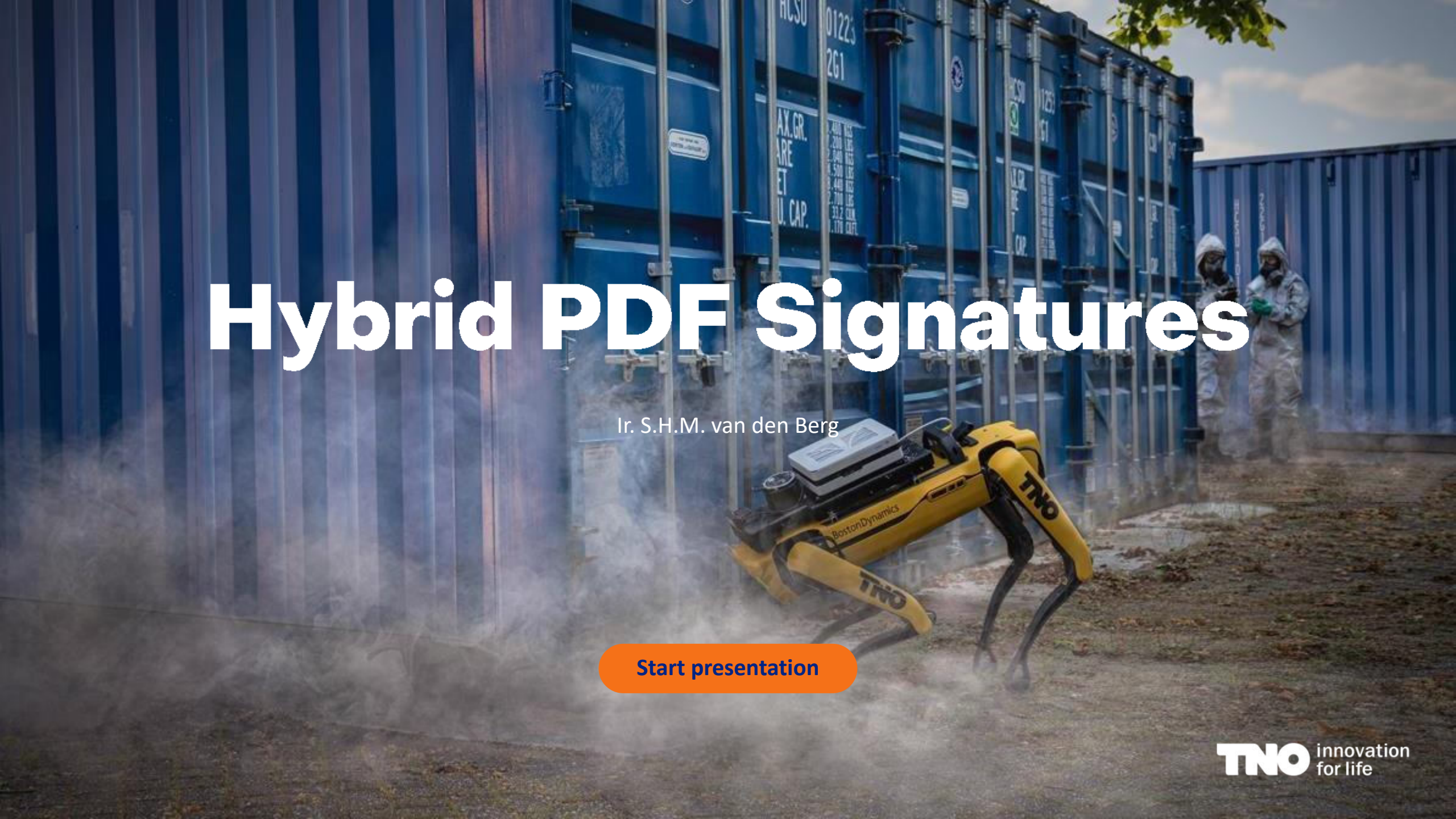
Using quantum-safe hybrid certificates for signing documents

Stefan van den Berg
Cryptographer at TNO

ENTRUST HID PKI Consortium

Hybrid PDF Signatures

Ir. S.H.M. van den Berg



Start presentation

TNO innovation for life

Hybrid PDF Signatures

HAPKIDO

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TNO innovation for life

1. Contracts

- Basis for legal agreements
  - Valid for long periods

- Many are digitalized
  - My contract with TNO is digitally signed

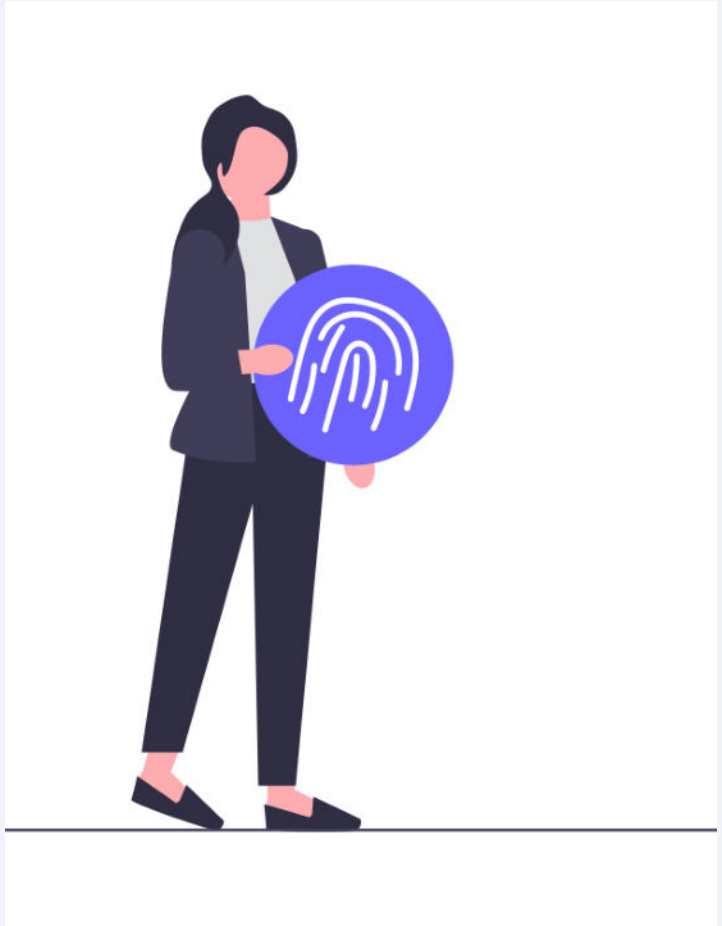
2. Quantum computer

- Allows for many amazing things:
  - Optimizations
  - Simulations
  - Factorization of numbers

- Impact on cyber security
  - Threatens classical cryptography

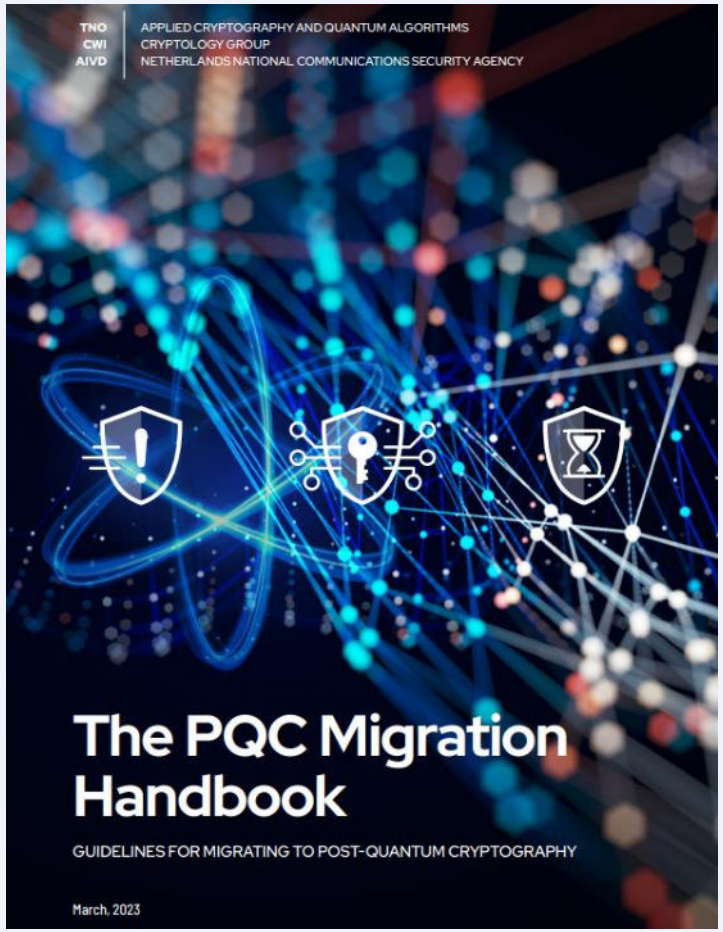
Impact

- Forge contracts
  - Recalculating signature
- Loss of trust in classical signatures
- Solutions:
  - Reissue all contracts
    - Impractical due to number of documents
  - Transition a.s.a.p. to Post-Quantum Cryptography



Transition to Post-Quantum Cryptography

- PQC migration handbook
  - AIVD, CWI and TNO
  - Help companies transition to PQC
- Crypto-agility
  - Minimal effort to change cryptographic algorithms
- Asymmetric Cryptography strategy
  - Hybrid solutions

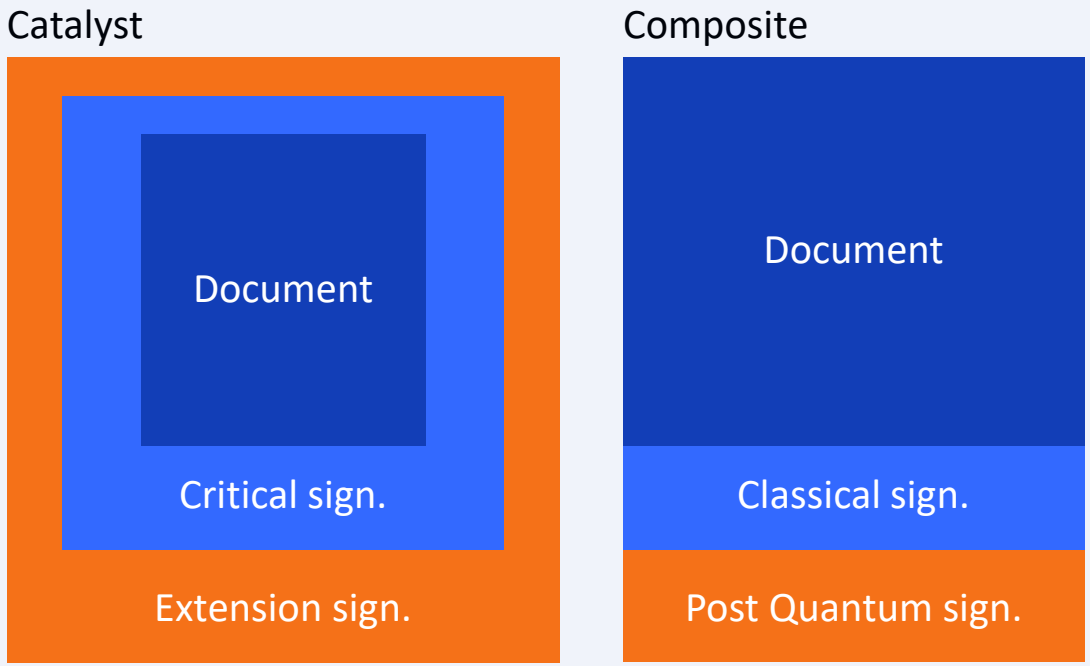


Hybrid solutions

- Combination between classical and quantum cryptography

- Catalyst (X.509 ITU-T)
  - Critical algorithm
  - Extension algorithm

- Composite (IETF Draft)
  - Multiple keys in certificate
  - Standardization under development
  - No adoption yet…



Applying signatures to PDF's

- Most digital contracts PDF format

- Legally compliant across borders
  - eIDAS Regulation (Europe)

- PAdES standard
  - Information inside of pdf
    - Visible signature
    - Invisible signature
  - Different profiles for different use-cases

What is inside the PDF

- Add byte range used for message digest
  - Should be entire document excluding signature dictionary
- Message digest
- Certificate used

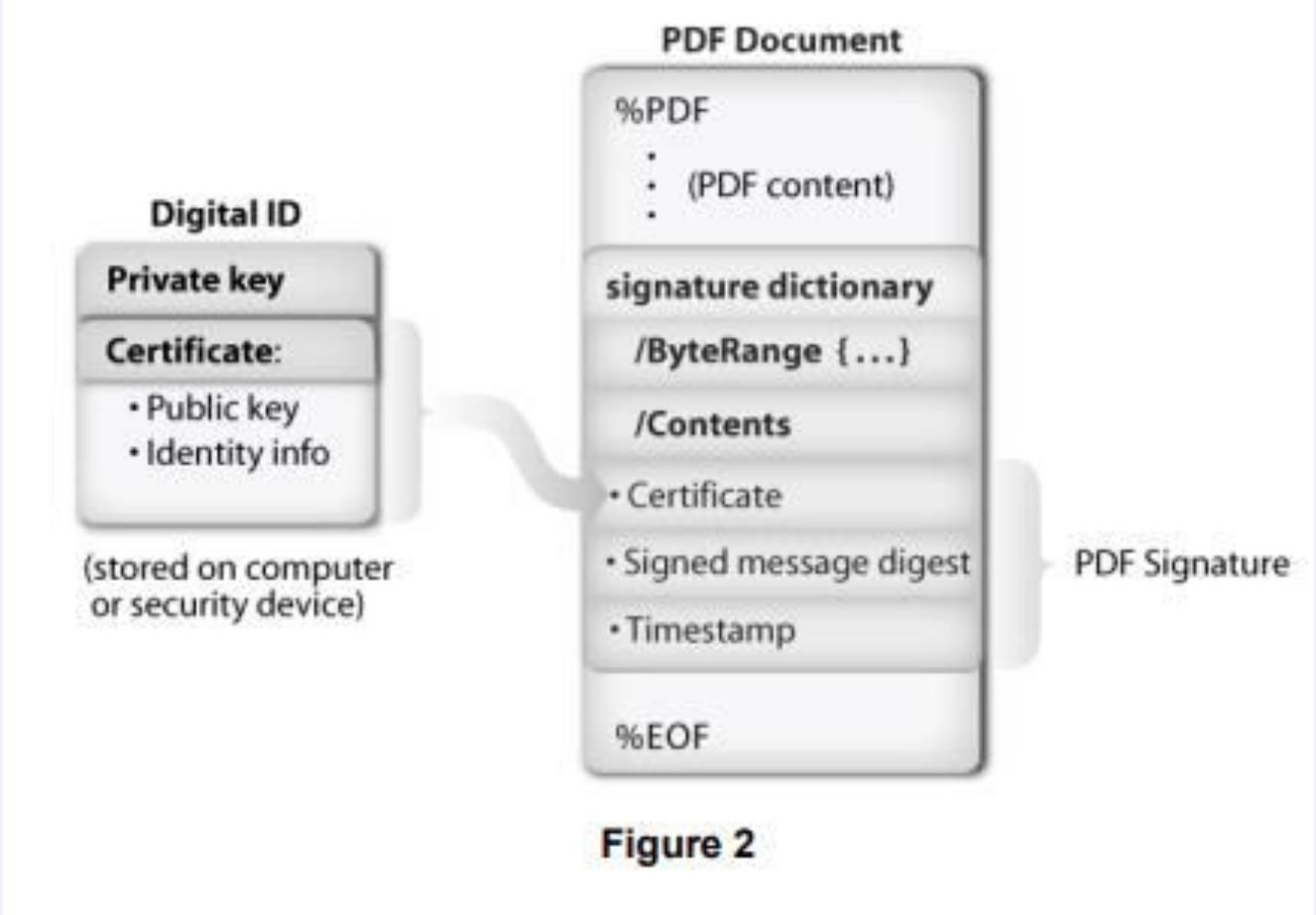
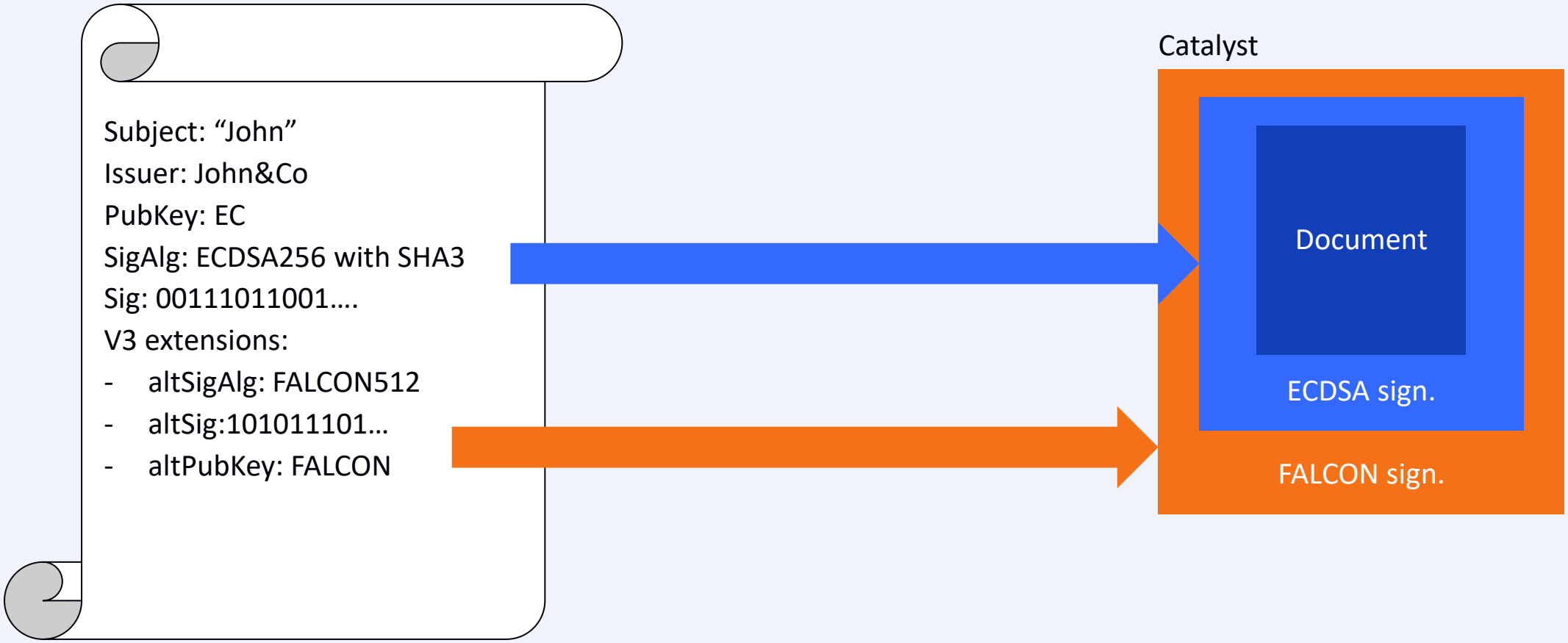


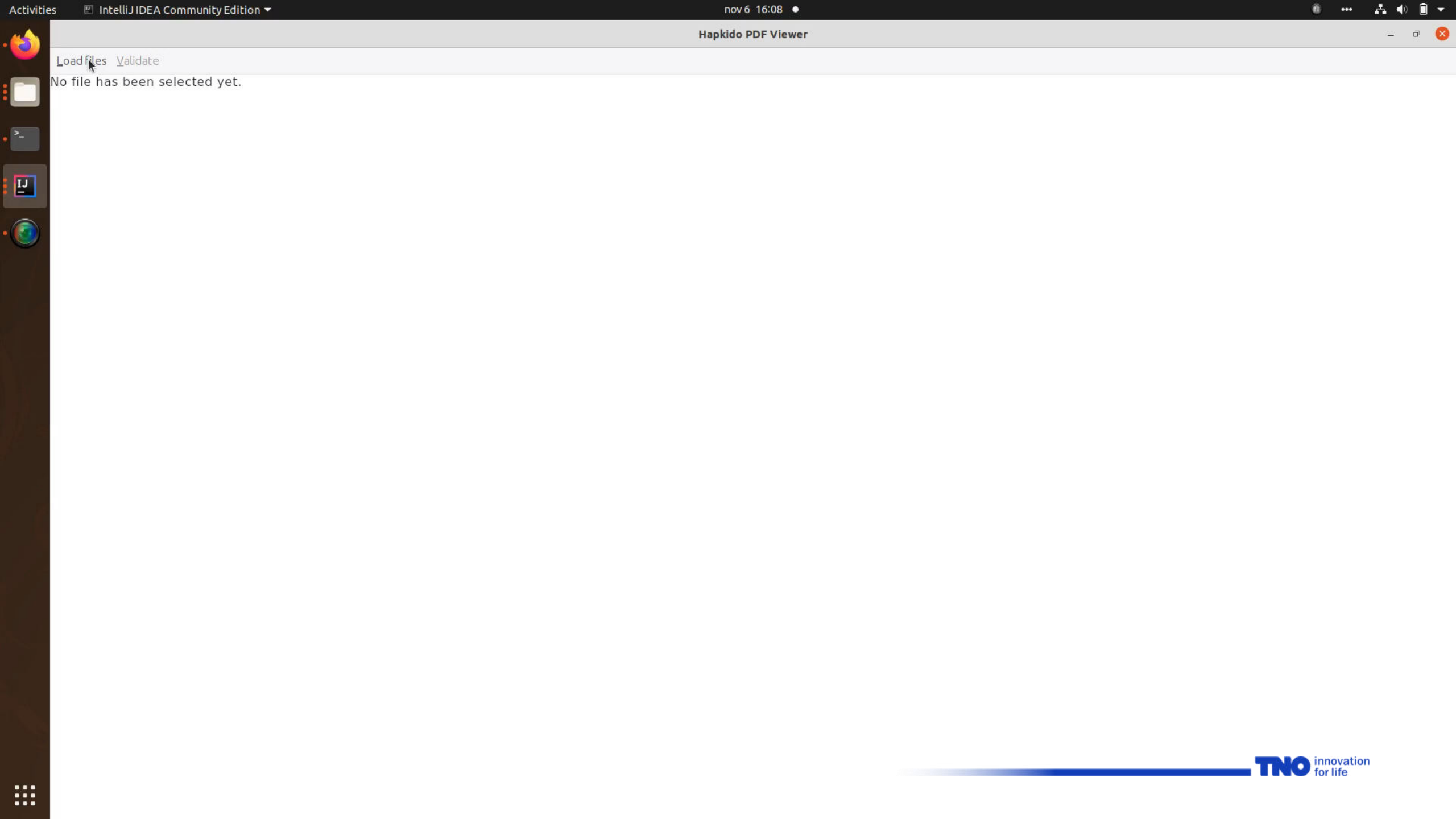
Figure 2

DSS PAdES

- ‘Implementation from the EU
- Digital Signature Service
- Our contribution:
  - Extended with Catalyst hybrid solution
  - Both for signing as for validation

Demo explanation

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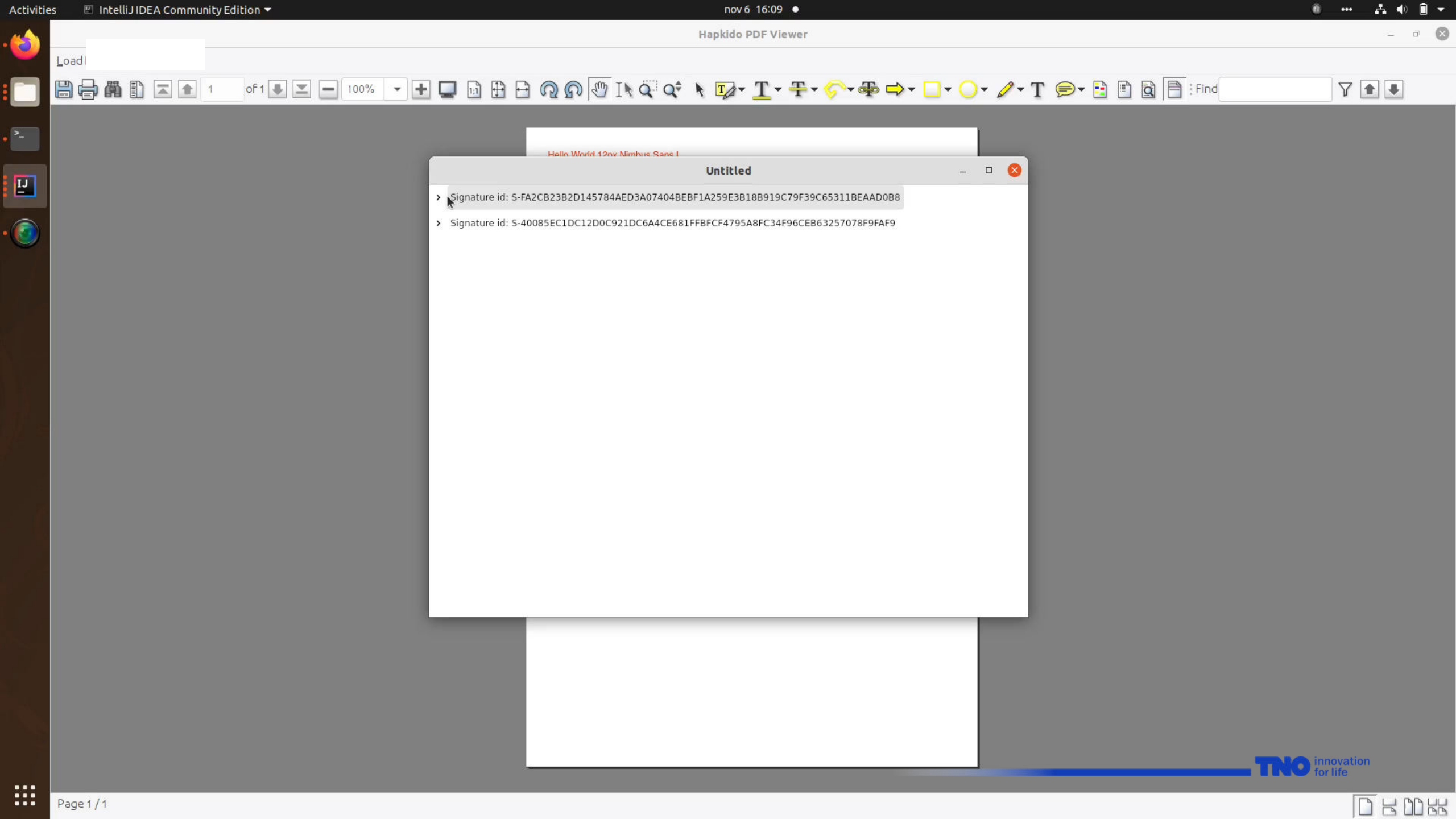
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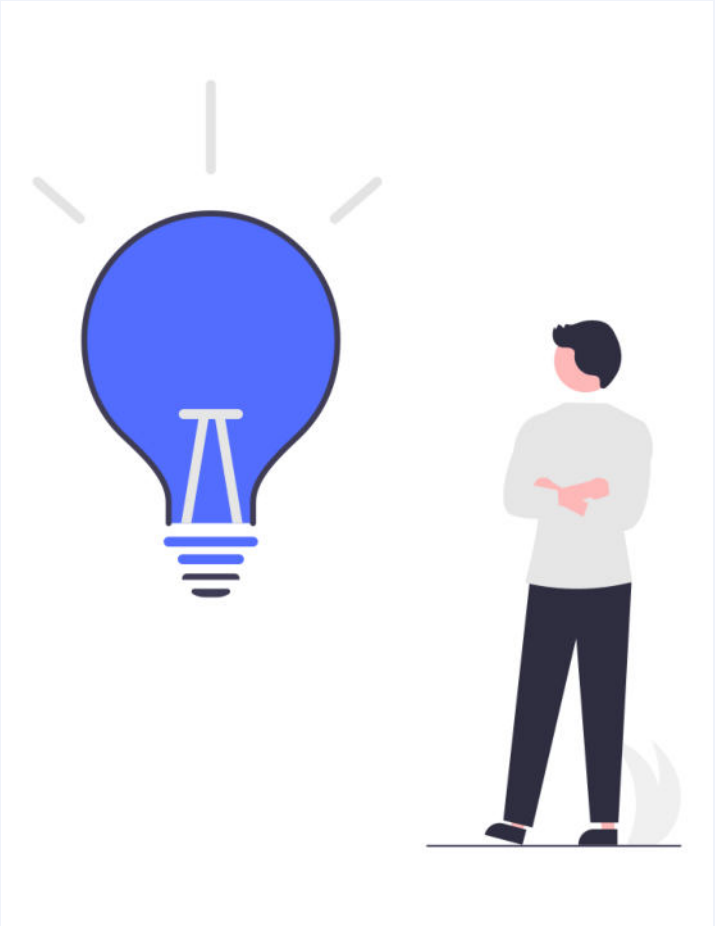
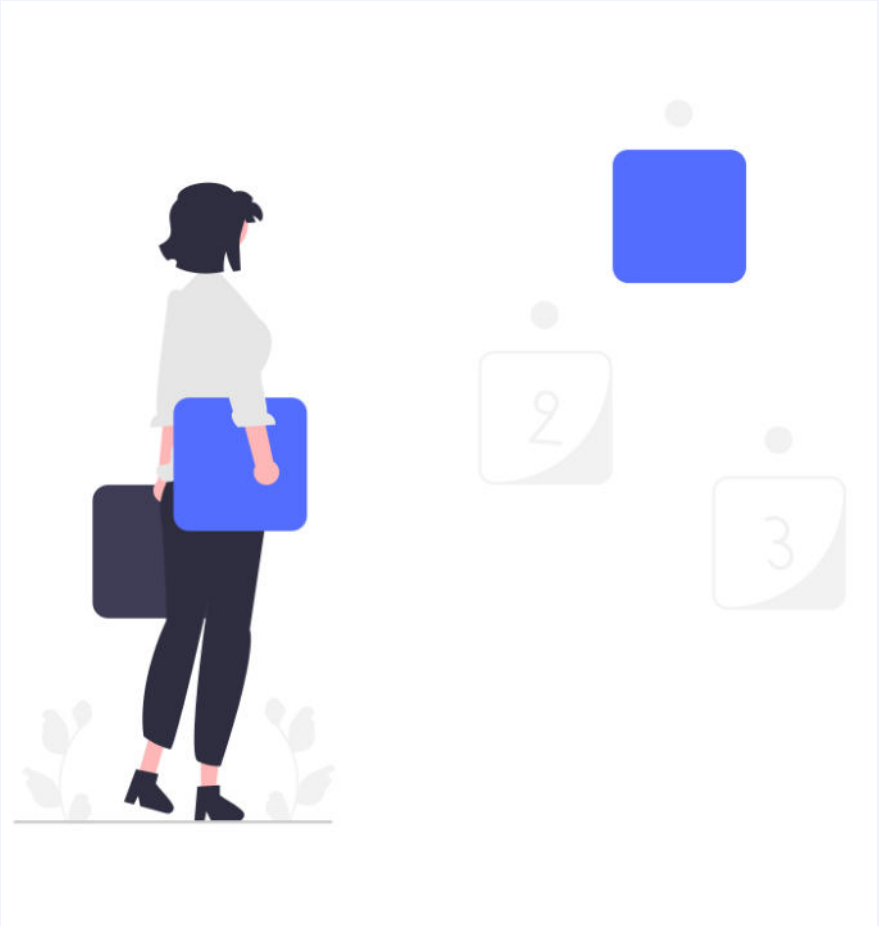
Lessons learned

- Hybrid difficult to integrate
  - not replacing one but replacing by two algorithms
- Lot of focus on TLS
  - AdES/ non-internet proctocols
  - eIDAS very little attention
- Patching your libraries not enough
  - Ecosystem needs to change
  - Plan carefully ahead



Possible future steps

- PoC improve robustness
  - Integrate with other PDF readers
- Extend to other AdES services
- Open sourcing DSS-fork



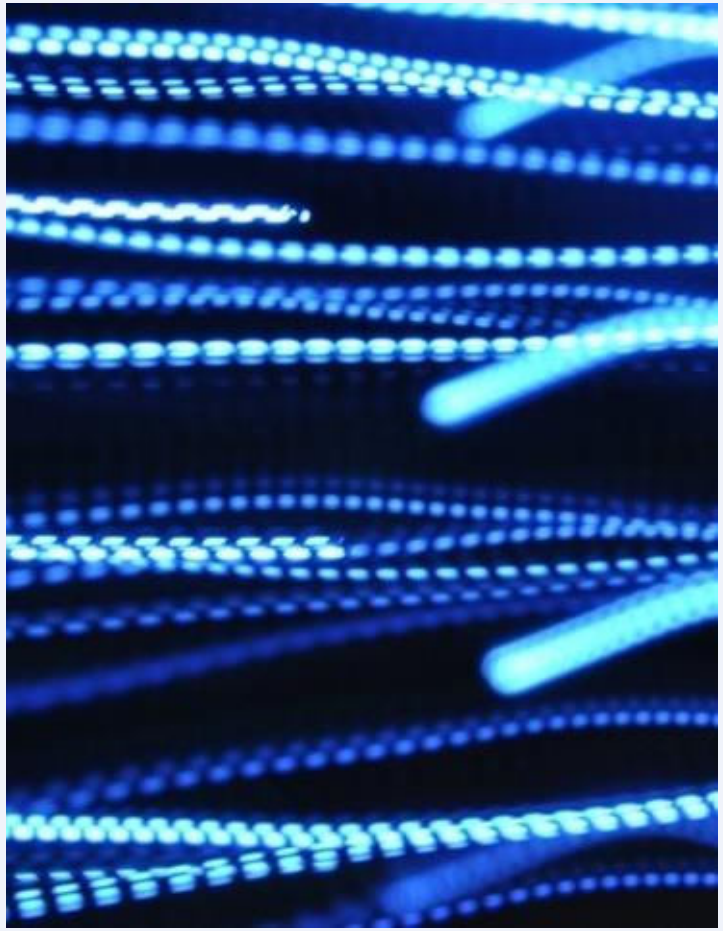
PKIC

HAPKIDO

- HAPKIDO: for quantum-safe Public Key Infrastructures (tno.nl)

- More information can be found on:
  - hapkido.tno.nl
  - Work package 4

- If you have any questions reach out to me at:
  - stefan.vandenberg@tno.nl



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PKI Consortium

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