www.pdfa.org

Blockchain, Threat or Opportunity?

Joris Schellekens
Software Engineer - iText

Joris Schellekens
Software Engineer
iText

The iText R&D team

Why?

- **Integrity**
  "The document has this exact content."

- **Authentication**
  "I created this document. And I can prove it."

- **Non-repudiation**
  "He created this document. And I can prove it."

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Software Engineer
iText

Why?

- *"Hey, I've created this hash on 10 Oct 2016: here is the transaction in the blockchain which contains the hash. I've created it according to this formula from this file."*

- Integrity
- Authentication
- Non-repudiation
- Timestamp

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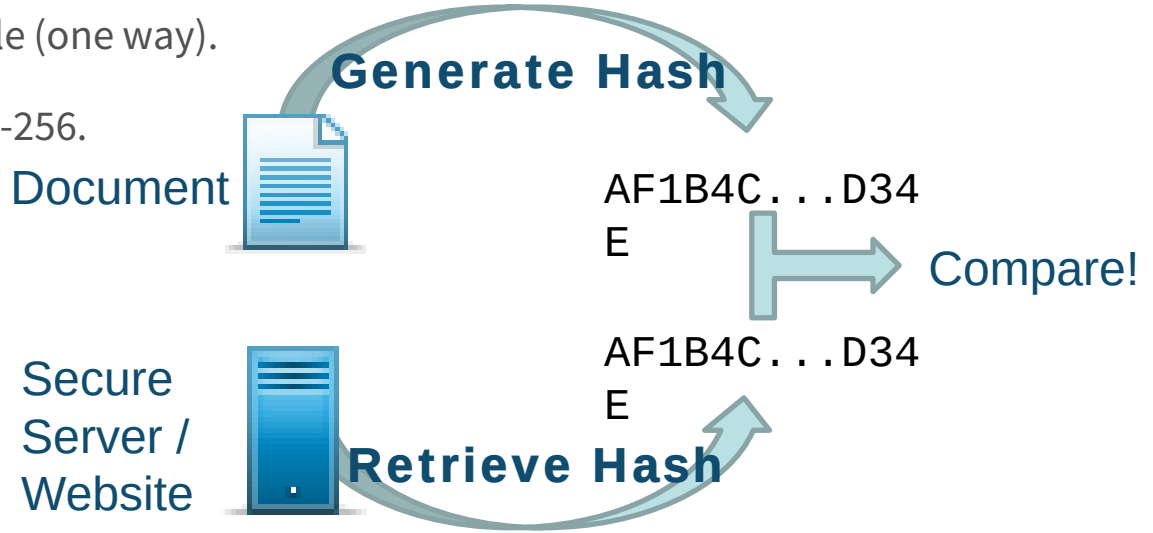
Software Engineer
iText

Hashing

- Turns an arbitrary block of data into a fixed-size bit string.
- Used for verification of data integrity.
  - Any small change to input has huge effect on hash value.
- Non-reversible (one way).
- SHA-1 vs SHA-256.



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Encryption

- Using two separate but compatible keys to encrypt information.
  - Encrypt data

  - Sign data

- Can be decrypted => two-way.

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Software Engineer
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Relation to pdf

- Pdf documents can be digitally signed.
  - Requires Certificate Authority (centralized).
  - Requires timeserver (centralized).
  - Can not be signed in parallel.
  - Signatures live in the document.

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Software Engineer
iText

Opportunities

- Data in a blockchain
  - Can be signed using known PKI – infrastructure.
  - Is automatically validated and timestamped.
  - Can be viewed by everyone.
  - Can live separately from the physical (real world) data it references.

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Software Engineer
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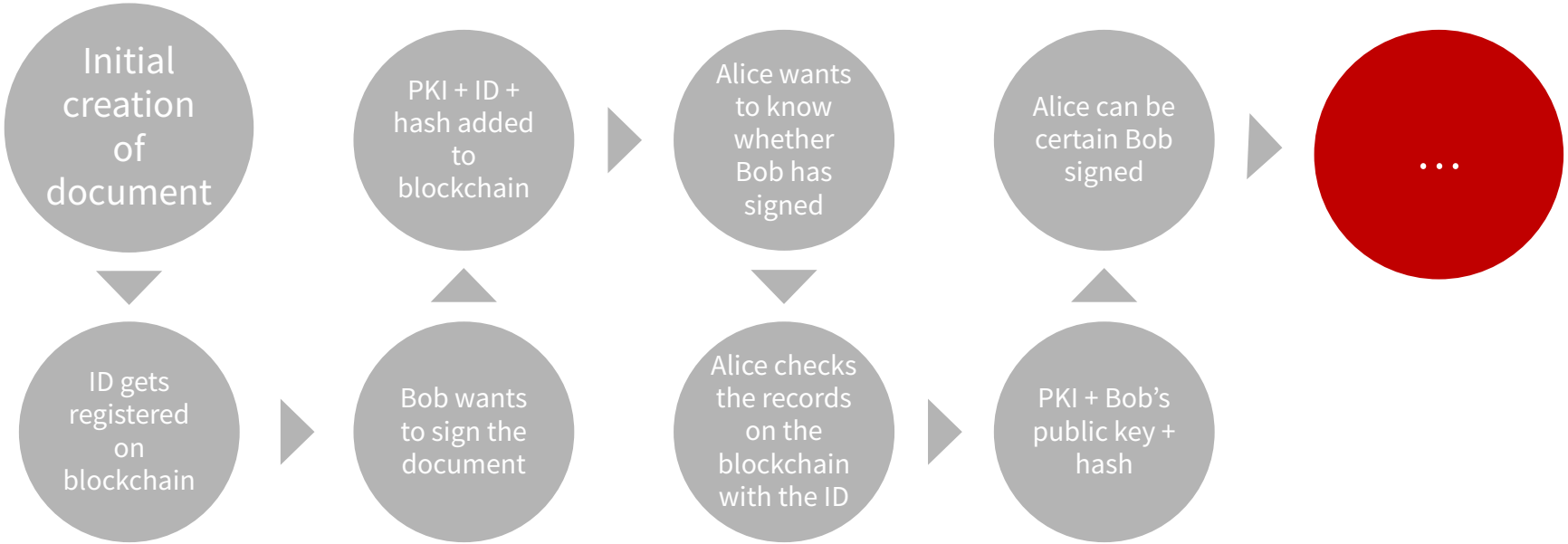
Our idea - high level



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Software Engineer
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Our idea - detail level

- Store meta-information of the pdf document on a blockchain:
  - ID,
  - hash (+ algorithm),
  - signature (+ algorithm),
  - fields that can be chosen by the end-user.
    - E.g. “currently awaiting feedback”, “asset has been checked by customs USA”, etc.

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Software Engineer
iText

Web of trust

Web of trust

- In cryptography, a web of trust is a concept to establish the authenticity of the binding between a public key and its owner.

  Source: Wikipedia

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Software Engineer
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Web of trust

- Bob can look up the public key of Alice
  - assuming public keys are truly publicly available,
  - or Alice can simply give Bob her public key.

- Bob signs the public key of Alice with his private key.

- Other users can see all these records.
  - They can verify (using Bob's public key) that Bob has signed Alice's key.
  - This is considered as "Bob trusts Alice".

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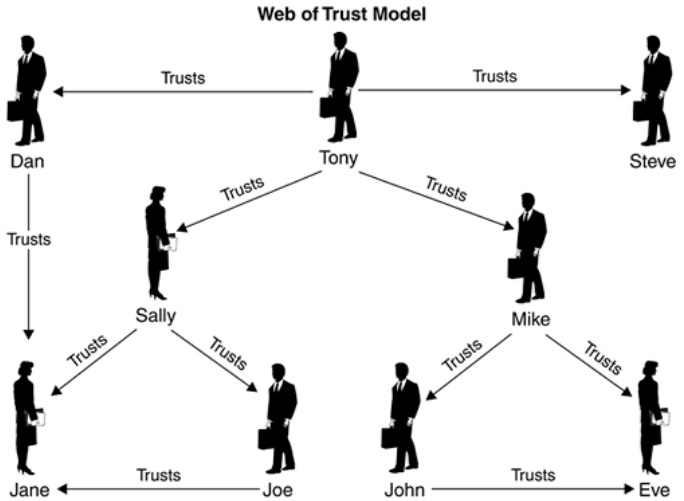
Web of trust

- This builds a graph where some nodes are connected by a “X trusts Y” relationship.
- The application built on top of this framework can then decide how to handle trusted vs. untrusted users.



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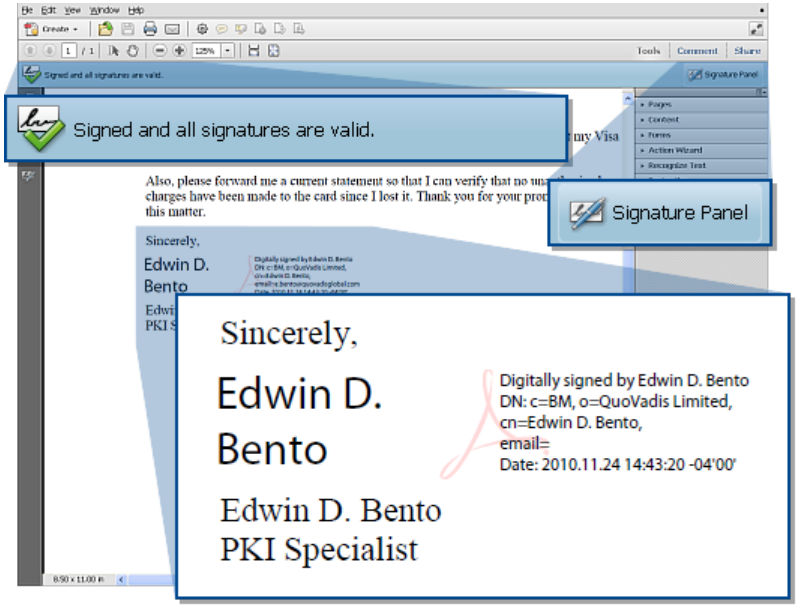
Software Engineer
iText

Web of trust

- Example



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Web **of trust**

- Extensions are possible.
- Add a status field “ACK” or “NACK”.
  - Now Bob can revoke his trust in Alice.
  - Only the most recent record is taken into account.
- Allows temporary trust (interim workers).

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Software Engineer
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Use case

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Software Engineer
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Roadmap

PDF community

A typical PDF company:

- Proven PDF experts.
- 20 years of experience with PDF (and related software)
- Members of ISO committee that sets PDF standards.
- highly trained (in a niche market).

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Software Engineer
iText

Blockchain community

- Substantial amount of investigation to be done.
- Patents with regards to blockchain-PDF interaction.
  - Everyone wants to be ‘the first’
- Loads of startups.
- Mutually beneficial cooperation:
  - They learn about the possibilities of PDF documents.
  - We learn about how blockchain can be used.

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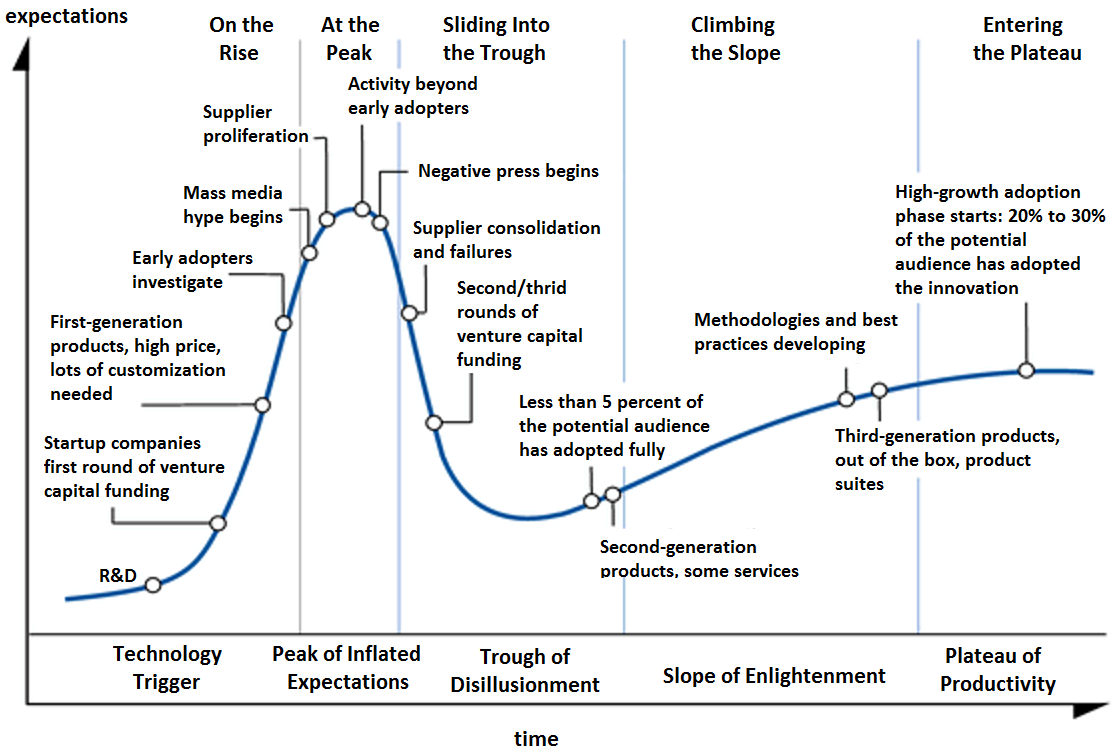
Software Engineer
iText



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Software Engineer
iText

Community outreach

How can you help?

- **Gathering use-cases**
- **Working group within PDF association**
- **Specification (drafts)**

- **Pull request always welcome**
- **https://github.com/itext/i7j-pdfchain**

Joris Schellekens
Software Engineer
iText

Thank you! Any questions?

Joris Schellekens
Software Engineer
iText

Get in touch: joris.schellekens@itextpdf.com
Web site: www.itextpdf.com
Twitter: @itext