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Five Solutions for Remote Identity Proofing

Presentation at IIW 23

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In-Person vs. Remote Identity Proofing

- Typically in-person identity proofing relies on
  - Primary evidence: picture ID
    - Driver's license, passport
  - Secondary evidence from other identity sources:
    - Ownership of utility, financial, mobile, or social network accounts
    - Address verification
- No problem with remote presentation of secondary evidence
- **Goal: replace picture ID with primary evidence that can be presented remotely**
- **We can do that with higher identity assurance than provided by a picture ID**

Multifactor Identity Verification without Prior Relationship

- Identity proofing is harder than authentication
  - No prior relationship between subject and verifier
- Authentication gold standard: provide three verification factors
  - Something you have: device containing private key
  - Something you know: password
  - Something you are: one or more biometric features
- But in identity proofing, without prior relationship:
  - The subject cannot have previously registered a password, nor enrolled a biometric sample with the verifier

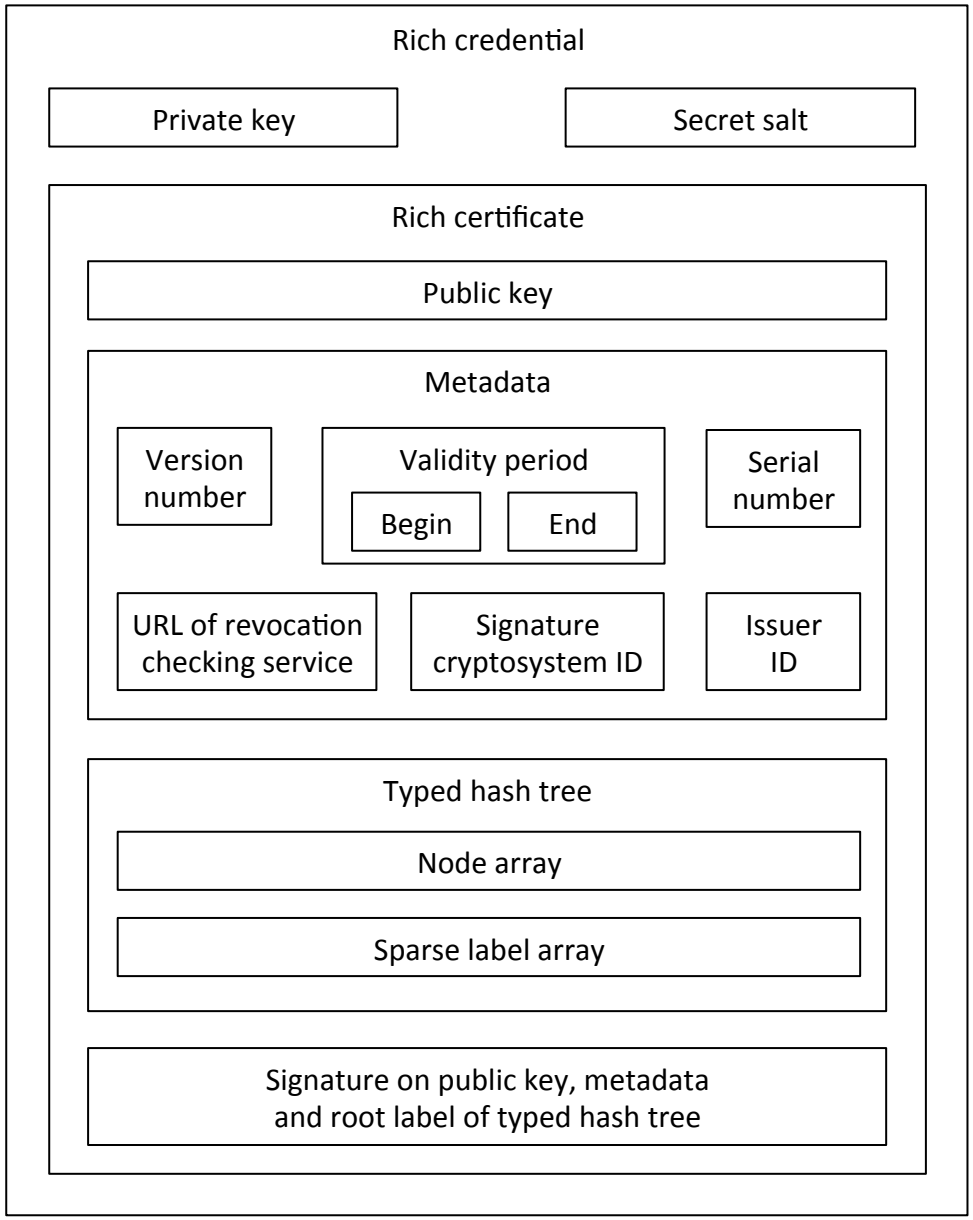
3F Verification w/o Prior Relationship Using a Rich Credential

1. Possession of private key
2. Knowledge of password
   - Not registered with verifier
   - Salted hash built into credential by issuer, then forgotten
   - Salted hash submitted to verifier
3. One or more biometric features
   - Biometric verification data built into the credential by the issuer
   - Remote biometric presentation to verifier, rather than to a device owned by the subject that may be compromised
   - Spoofing detection by the verifier

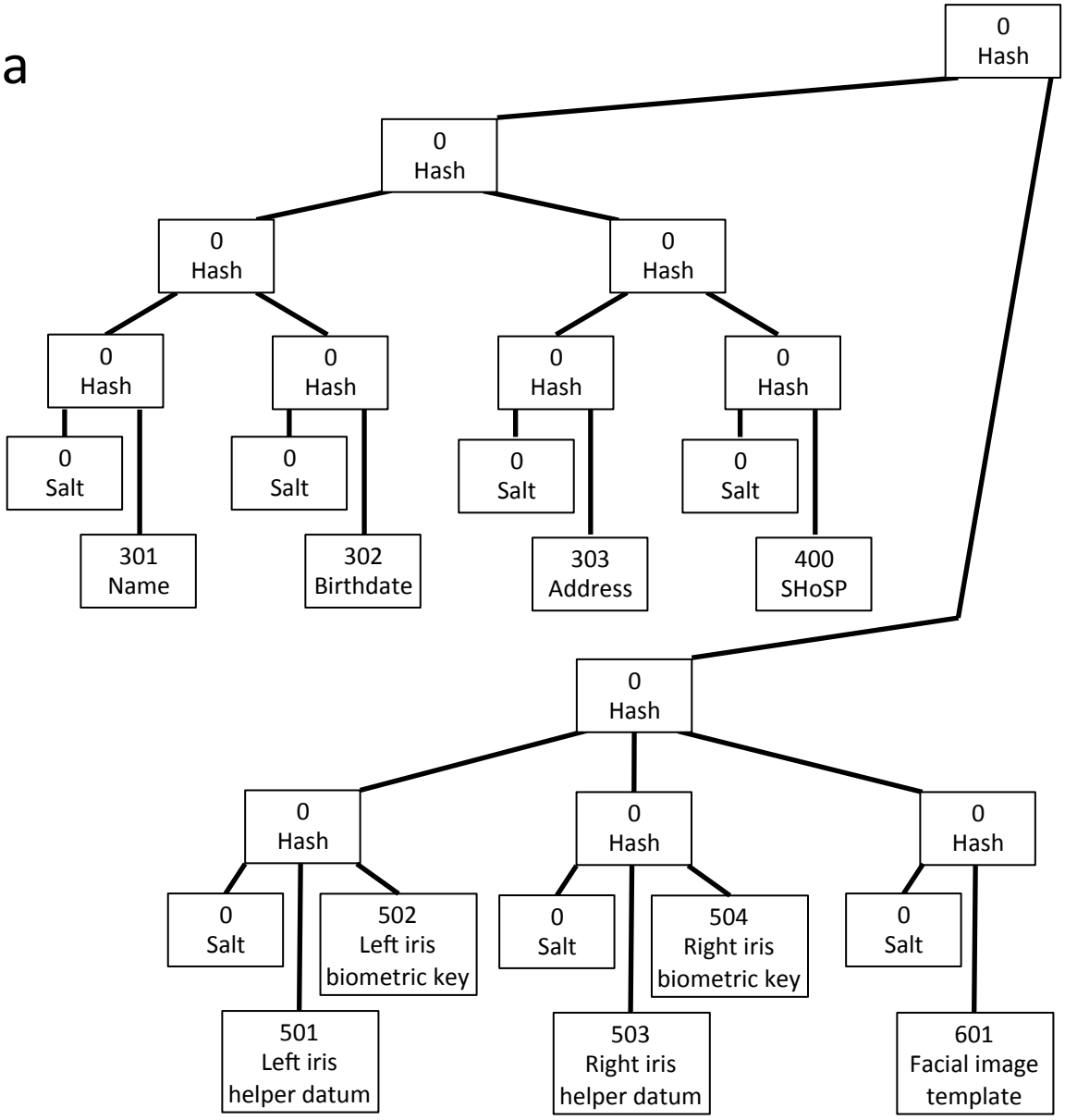
Privacy Features of a Rich Credential

- Selective disclosure of attributes
  - As provided by an anonymous credential, but without unlinkability
- Selective presentation of verification factors
  - May omit submission of (salted hash of) password
  - May omit biometric verification
  - May choose which biometric modalities to use, if multiple ones are built into the credential

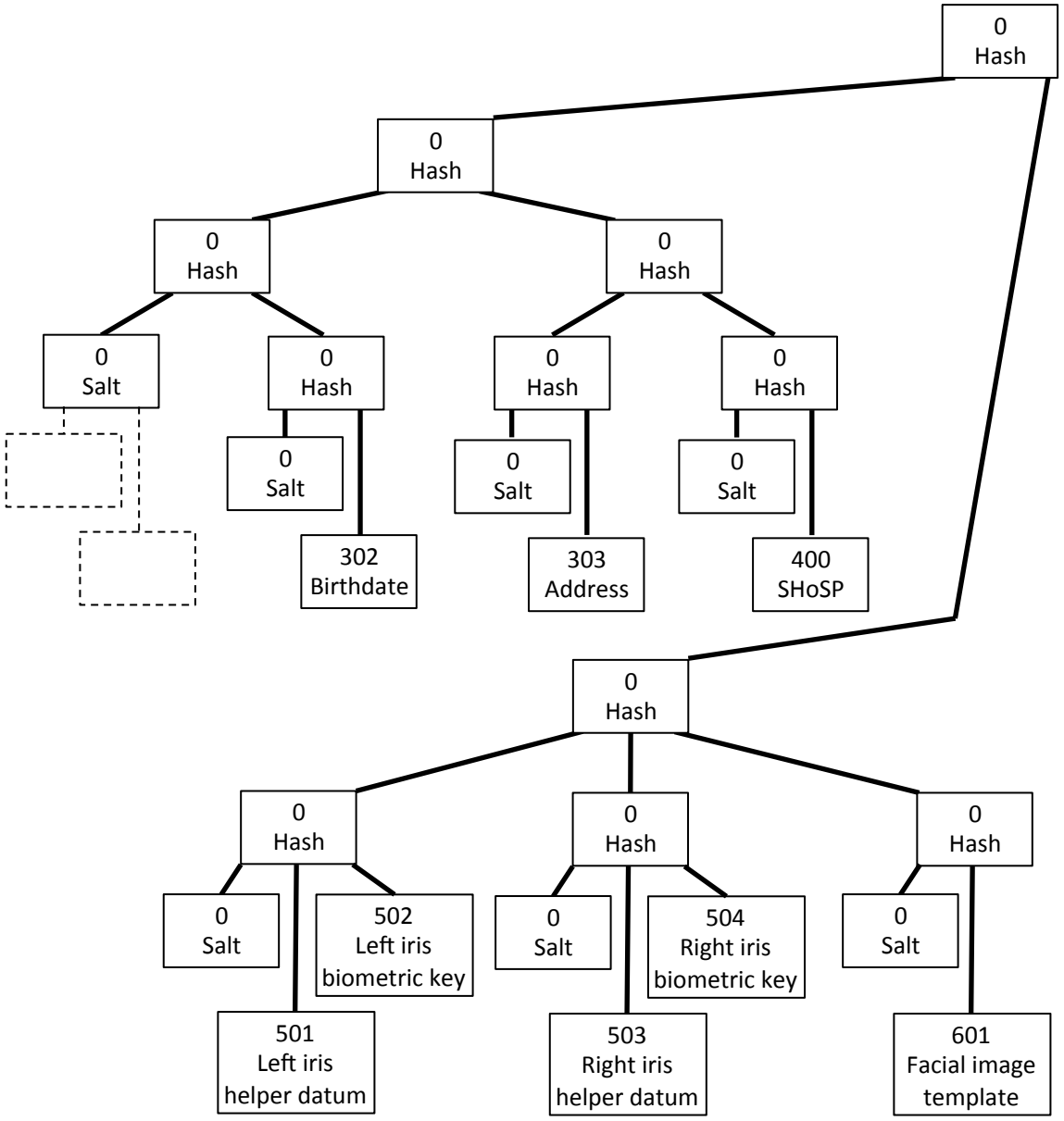
Components of a rich credential



Example of a typed hash tree

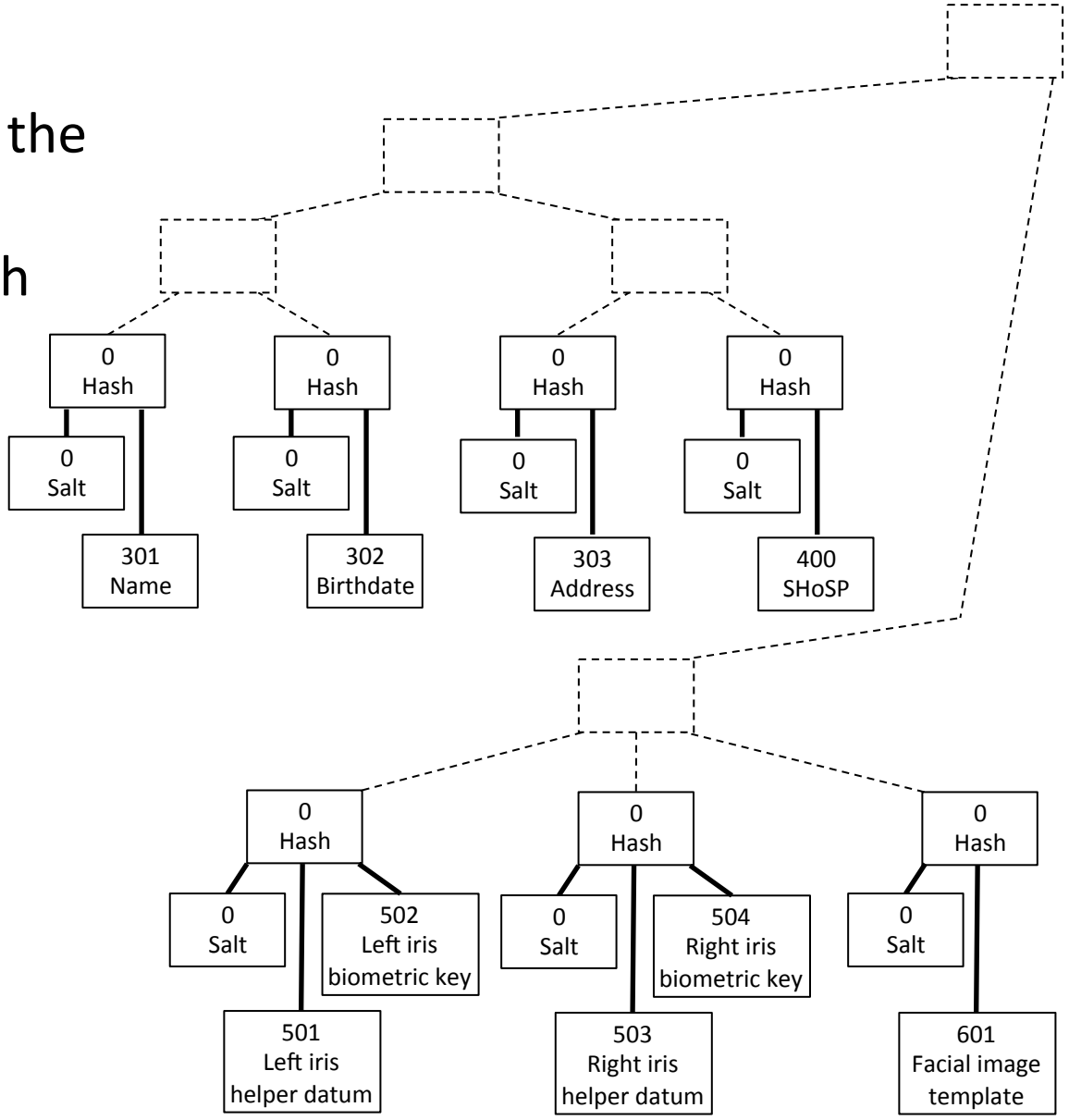


Subtree pruning

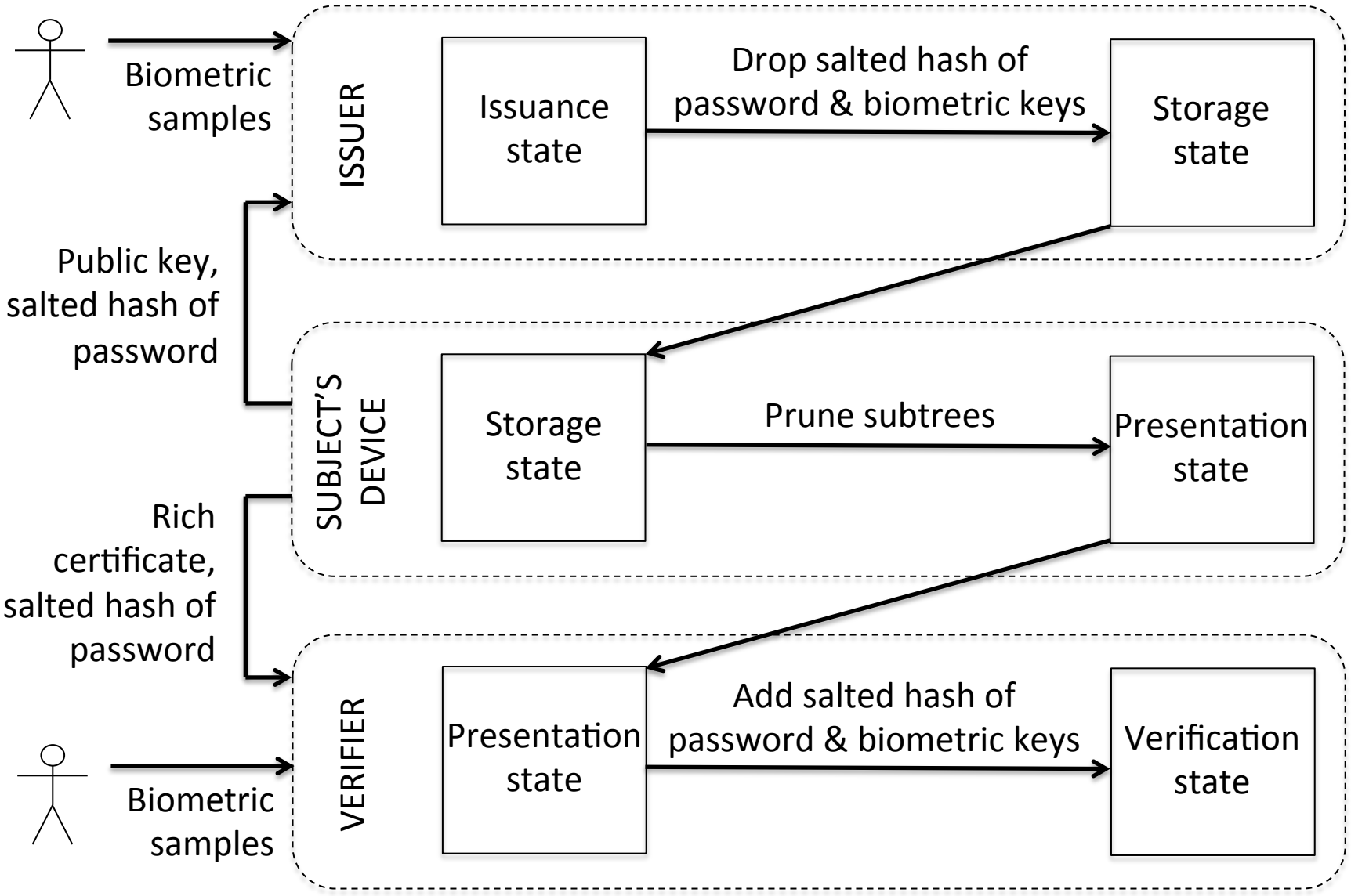


Root label is omission-tolerant cryptogaphic checksum

Peripheral subtrees of the typed hash tree of a rich credential



State transitions of a rich certificate



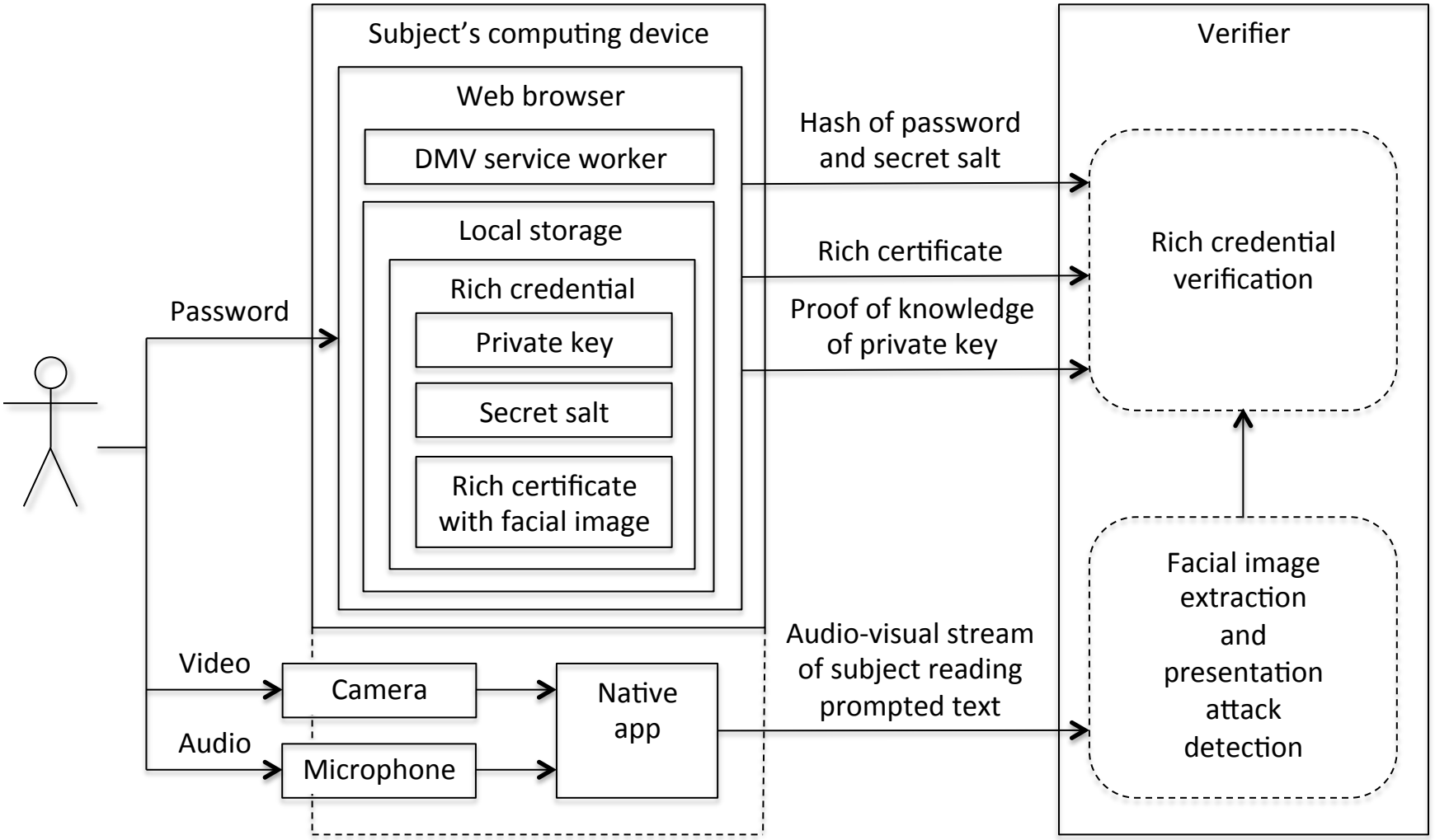
Remote spoofing detection with a rich credential

- Verifier receives an **audio-visual stream** of the subject reading prompted text selected at random with high entropy
- **Uses face recognition** to match a face in the stream to a facial image in the rich credential
- **Uses speech recognition** to verify that the subject is reading the prompted text
- **Verifies audio-visual synchrony** by tracking lip movement and matching distinguishable visemes to phonemes
- **Optionally uses speaker recognition** against a voiceprint in the rich credential
  - Possible because a rich credential supports multiple biometric modalities

Overview of the Five Solutions

	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
Identity Source	DMV	Bank	Credit card issuer	Medicare or medical insurance provider	State Department
Credential	Rich credential with facial image	Rich certificate asserted on a blockchain	Contactless EMV chip card	Medical ID smart card with signed facial image	Passport with signed facial image in RFID chip

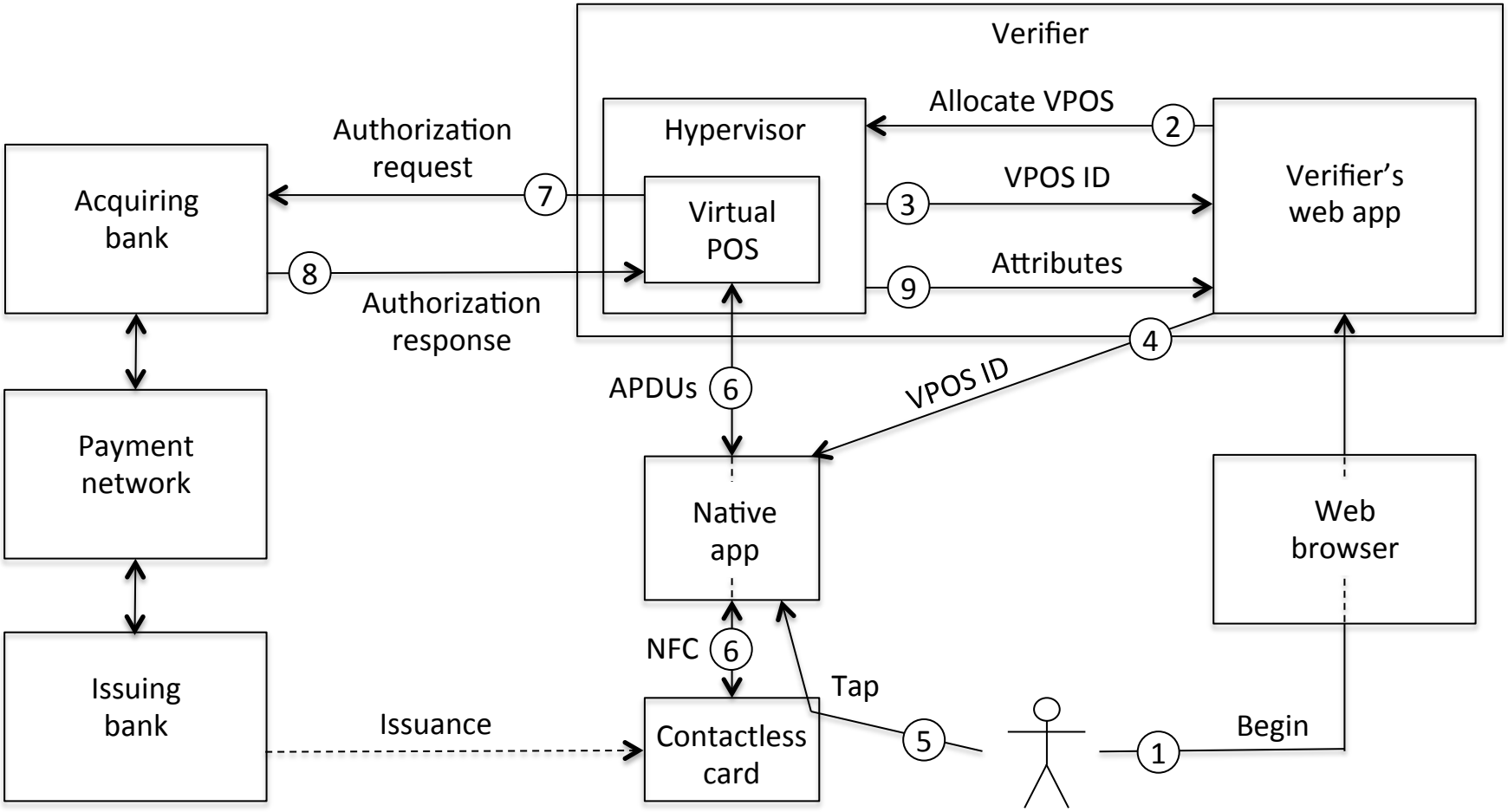
Solution 1: Rich Credential Issued by a DMV



Solution 2: Unsigned Rich Certificate Asserted by a Bank on a Blockchain

- Bank asserts certificate by placing hash of certificate in a storage location that it controls within the blockchain
- Bank revokes certificate by placing hash in another storage location
  - **Big improvement over CRLs and OCSP**
- Three-factor verification as in Solution 1
- Biometrics:
  - Speaker recognition, leveraging voiceprint used for customer authentication
  - Optional: face recognition as in Solution 1, to defeat voice morphing

Solution 3: Remote Proof of Possession of a Contactless EMV Chip Card



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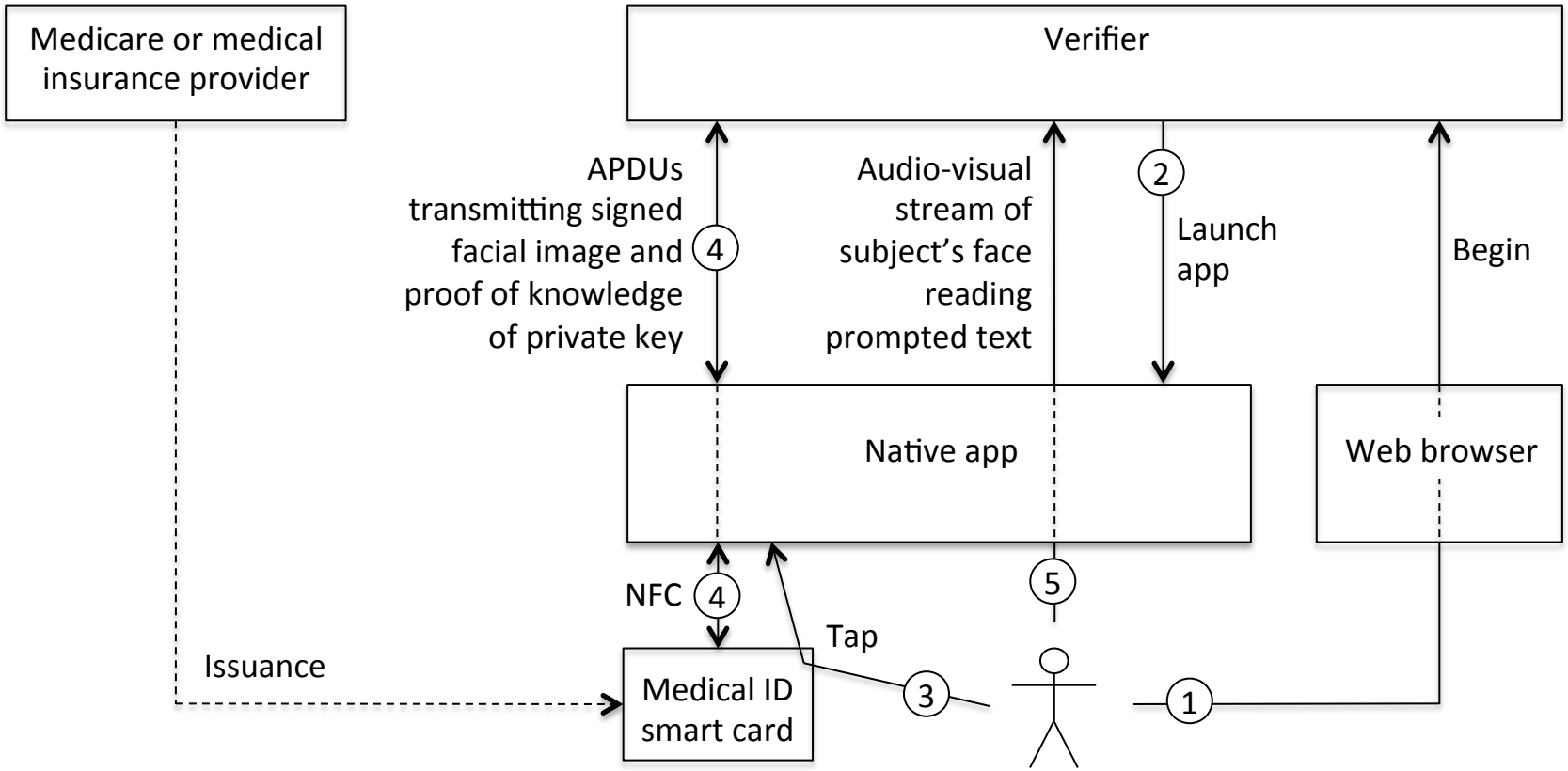
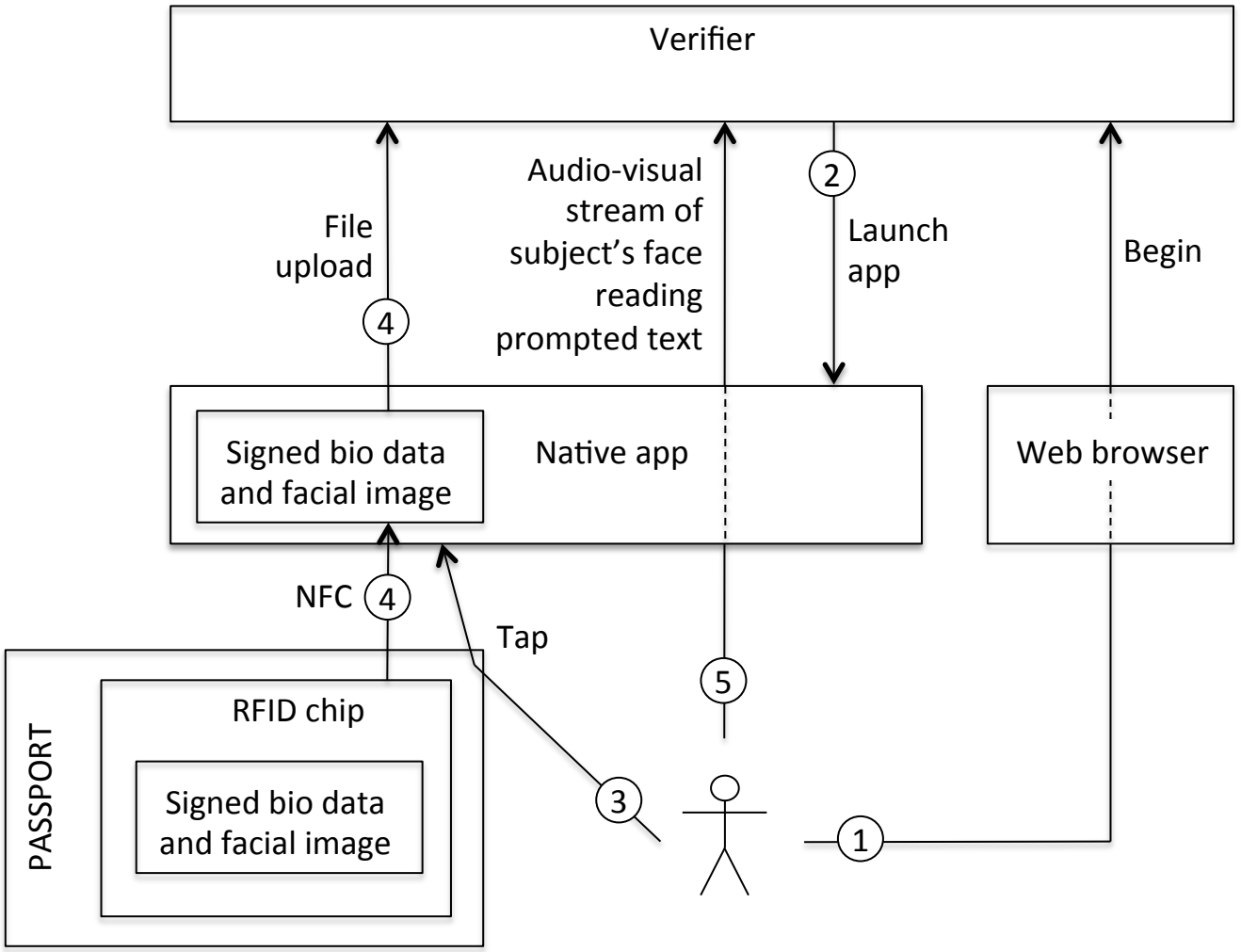
Solution 3 Enhancements

- As described above, Solution 3 provides only one verification factor:
  - Possession of contactless EMV card
- An "indirect" factor can be added
  - By asking the subject to demonstrate ownership of the account by reporting the amounts of the transactions
- The issuing bank could add a face recognition factor by placing a signed facial image in the card

Solution 4: Medical ID Smart Card with Signed Facial Image



Solution 5: Passport with Signed Facial Image in RFID chip



Solution 5 Enhancements

- As described above, Solution 5 provides only one verification factor:
  - Face recognition
- A strong proof of possession could be added by storing a key pair in the RFID
  - As specified by ICAO Doc 9303 Part 11, but not implemented in US passports
- A weaker proof of possession can be added by asking subject to show passport data page in audio-visual stream
  - Next generation passports will add more physical security features (but no private key?!)

Recap of Verification Factors Provided by the Five Solutions

	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
Identity source	DMV	Bank	Credit card issuer	Medicare or medical insurance provider	State Department
Credential	Rich credential with facial image	Rich certificate asserted on a blockchain	Contactless EMV chip card	Medical ID smart card with signed facial image	Passport with signed facial image in RFID chip
Verification factors	3 strong	3 strong	1 strong + 1 indirect	2 strong	1 strong + 1 weak

Thank you for your attention!

For more information:
pomcor.com
pomcor.com/blog/
https://pomcor.com/techreports/RichCredentials.pdf
https://pomcor.com/techreports/BlockchainPKI.pdf

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Any questions?