Assertions and Tokens
+
Path tracing

SPIFFE/SPIRE

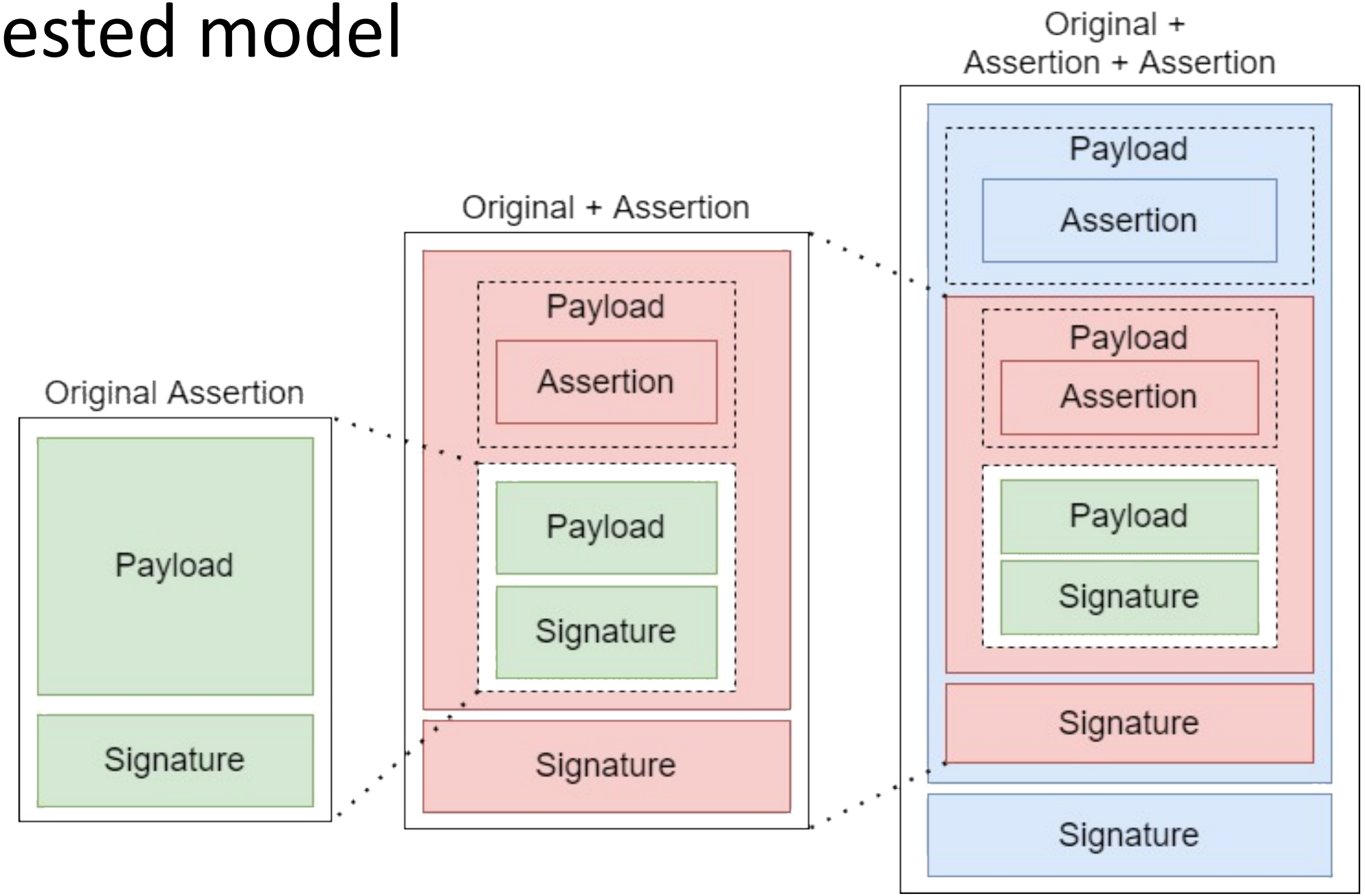
Nov/2022

Introduction

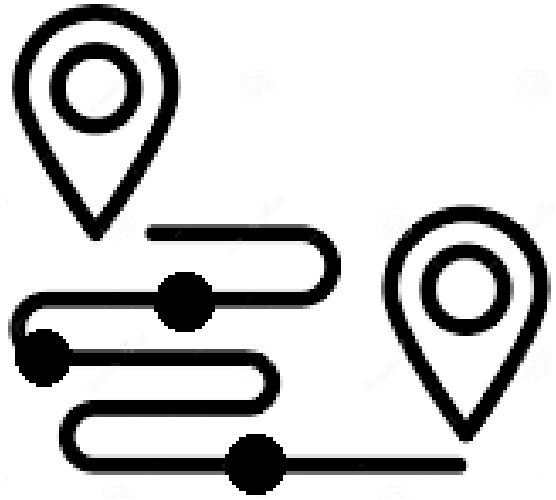
Main needs:

- A system that allow a subject to make arbitrary authenticated statements
- A token scheme that supports distributed signing, aggregate/concatenate signatures, and/or attenuations

Nested model



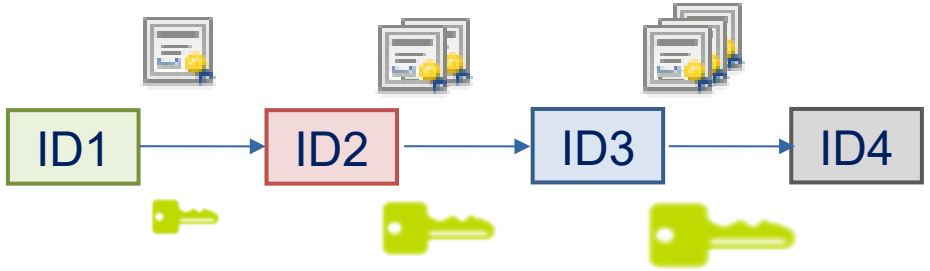
Token path tracing



Provide the path of workloads that a request has passed

- **ID mode**:
  - Uses SVID private key to sign, sending necessary certificates to identify the workload and validate the signature and iss/aud link
- **Anonymous mode**:
  - No ID associated to keys
  - Uses concatenated Schnorr signatures that results in smaller tokens and faster validation

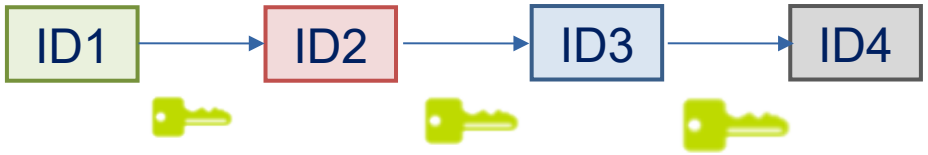
ECDSA – SVID
(ID mode)



Sign with SVID private key. Send SVID certificates with token

- Pros:
  - Certificates allow off-line validation and identification
  - Anonymous mode also available
- Cons:
  - ID mode requires more bandwidth
- Possibilities:
  - Use lightweight SVID

EdDSA – Schnorr Concatenated

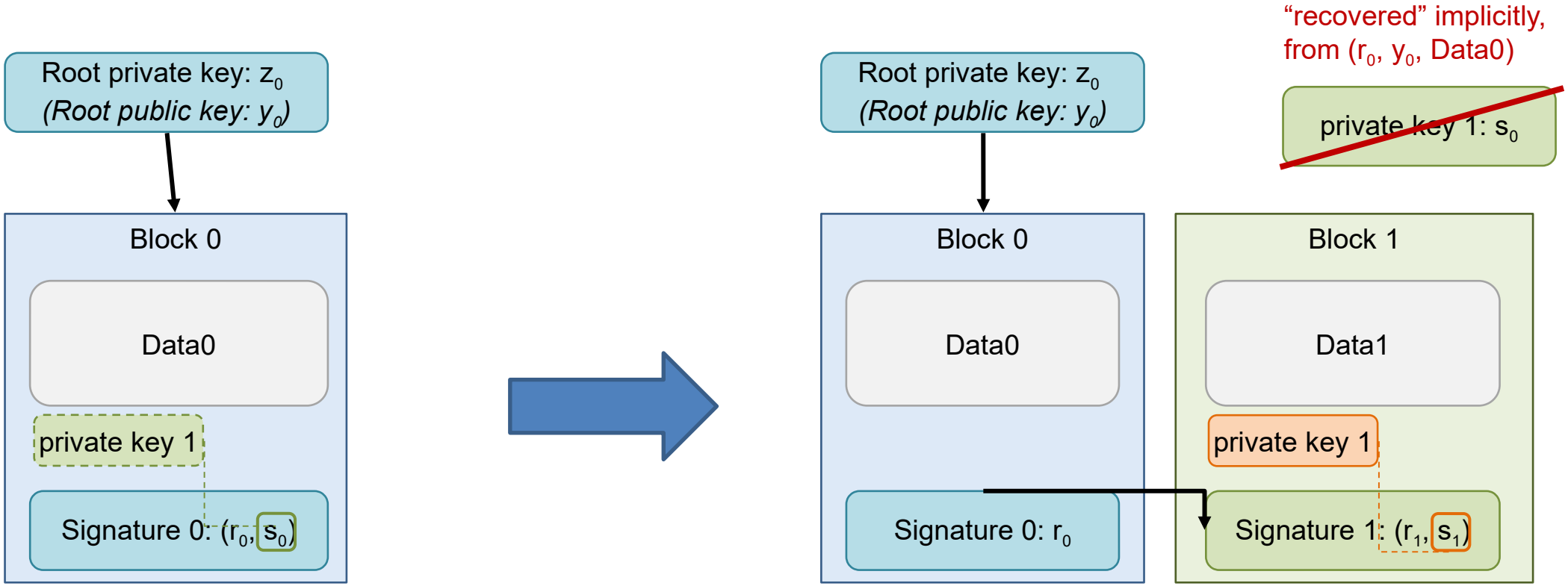


Biscuits-based solution. Each hop uses part of previous signature as private key

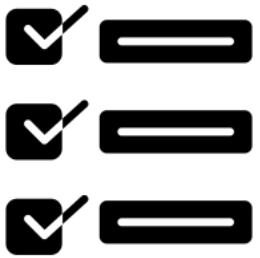
- Pros:
  - Smaller token size (compared to standard model and ECDSA)
  - Faster validation (using Galindo-Garcia) than sequencial model
  - Cryptographic-linked signatures
- Cons:
  - Only anonymous mode available
- Possibilities:
  - Study aggregated signatures state-of-art and ECDSA-Schnorr

SchCo-Biscuits

(using concatenated Schnorr-based signatures: Galindo-Garcia-style)



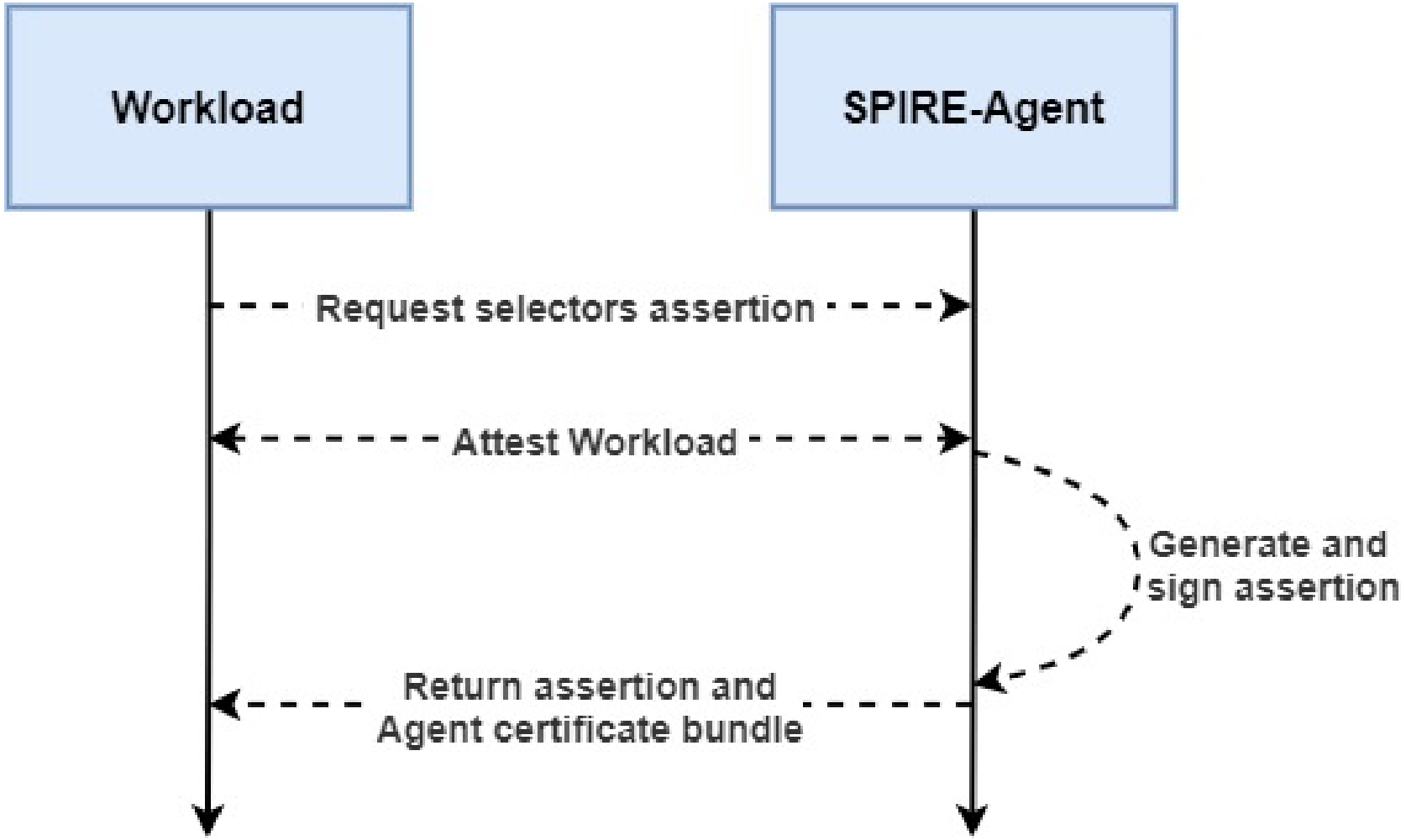
Selector-based Assertion



Contain selectors used by SPIRE-Agent during workload attestation process

- Generated and signed by SPIRE-Agent using its SVID
- Return the assertion and SPIRE-Agent certificate bundle

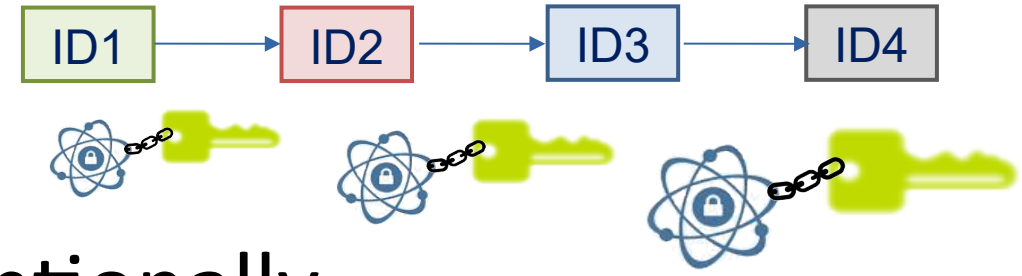
Selectors-based Assertion



Selector-based Assertion


```
{
  "iat": 1670470473,
  "sel": [
    { "type": "unix", "value": "uid:1000" },
    { "type": "unix", "value": "user:spire" },
    { "type": "unix", "value": "gid:1000" },
    { "type": "unix", "value": "group:spire" },
    { "type": "unix", "value": "supplementary_group:spire" },
    { "type": "unix", "value": "path:/opt/spire/bin/spire-agent" },
    {
      "type": "unix",
      "value": "sha256:ff9270b6c985fa1ad3476e5f1cf83648033cd1ec02b"
    }
  ]
}
```

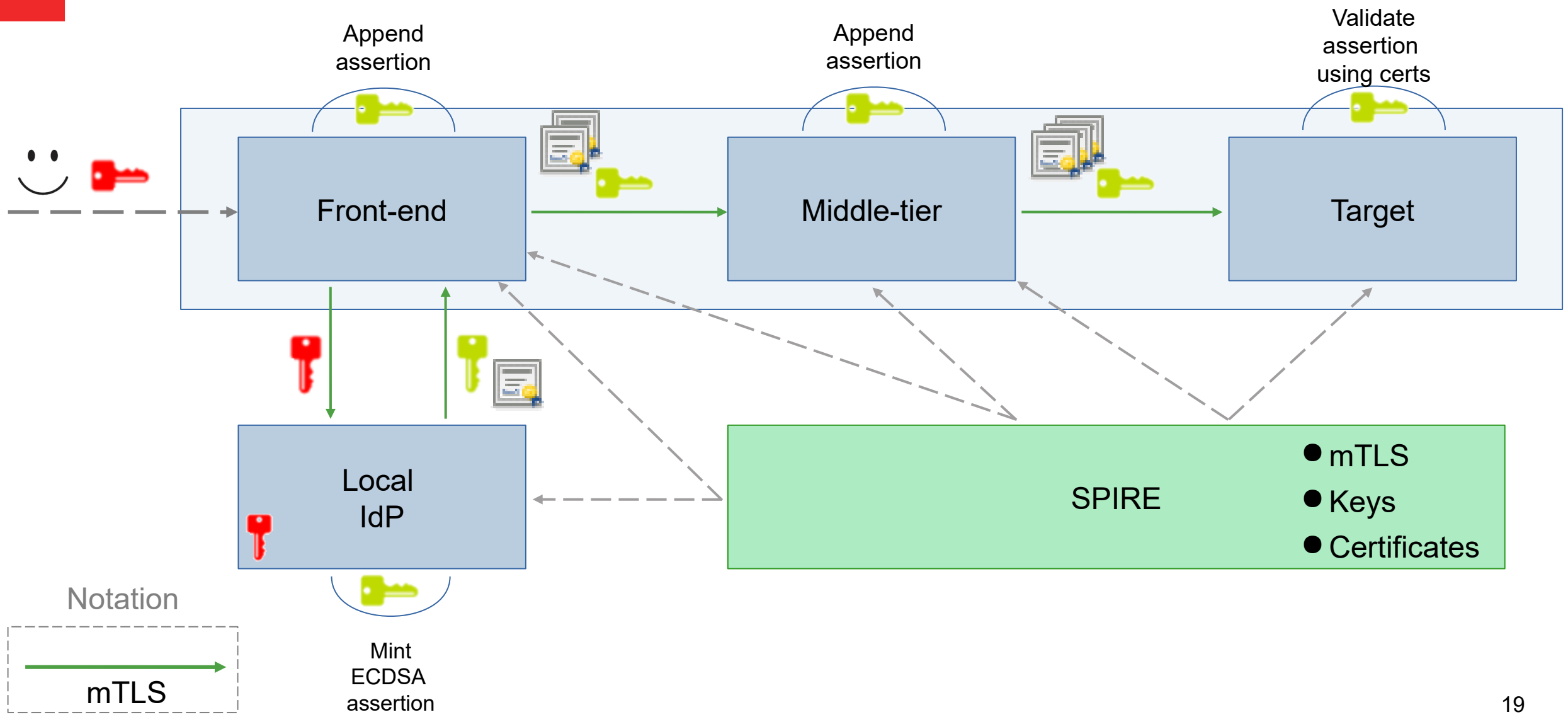
ECDSA – Dillithium



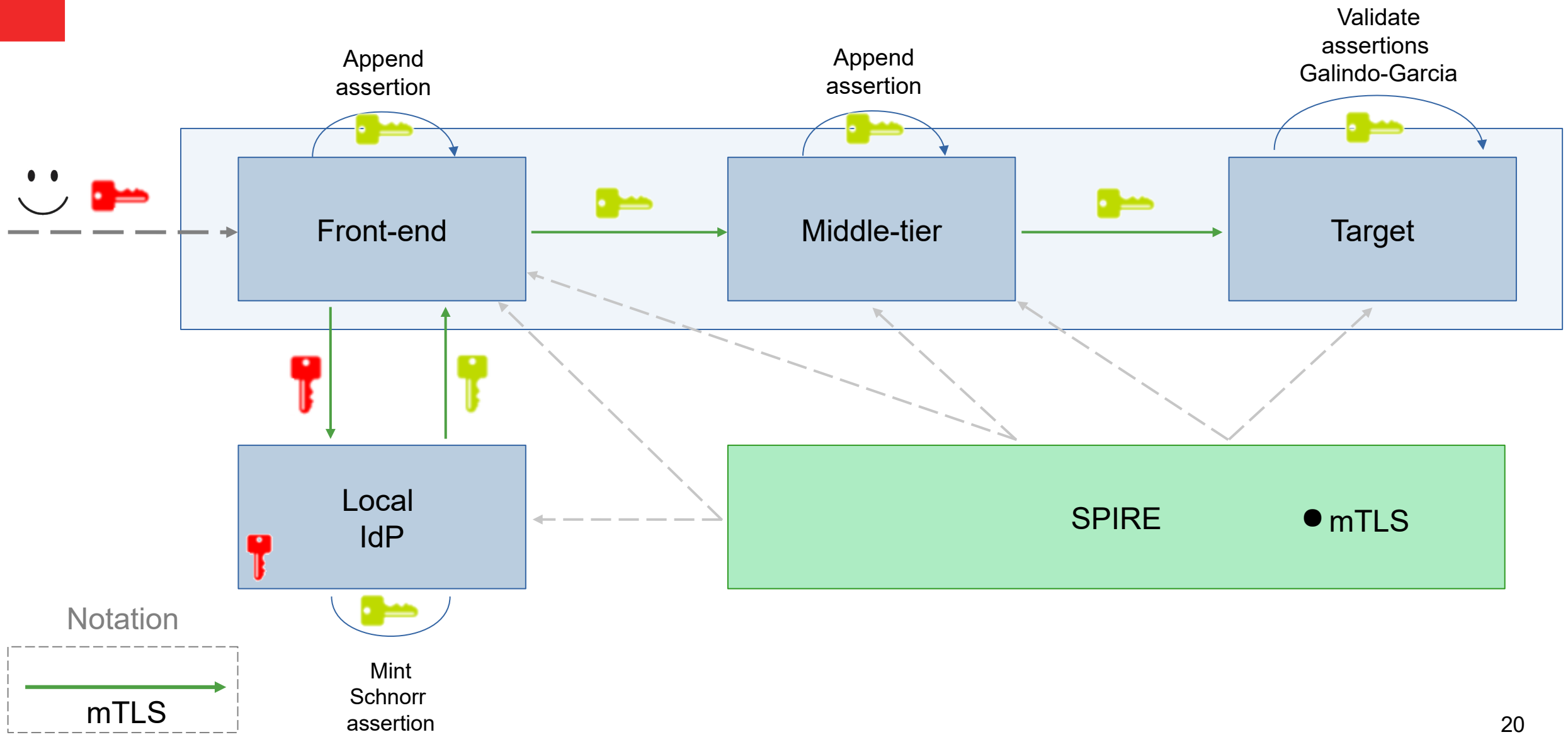
Sign with SVID private key adding, optionally, a post-quantum signature algorithm.

- Pros:
  - Improved security using post-quantum algorithm (ECDSA+Crystals)
- Cons:
  - Bigger keys/signatures
- Possibilities:
  - Optional to specific use cases
  - Follow-up state-of-art

Demo 1: ECDSA – SVID (ID mode)

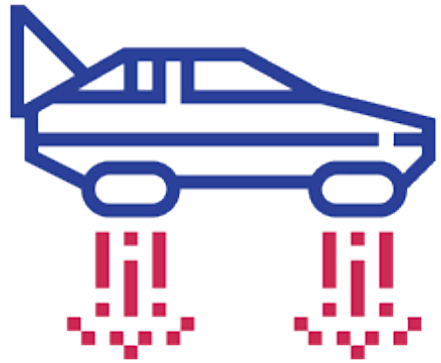


Demo 2: EdDSA – Schnorr (Anonymous mode)



Future Work

- Specify and implement lightweight SVID
- Identity-based SVID: lightweight SVID with Galindo-Garcia
- Use SchCo biscuits model in selectors assertion
- Post-Quantum algorithms (e.g. Crystals) analysis
- Protobuf / JSON analysis

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