Electronic Health Certificate

– Proposal for encoding and signing

Prerequisits

- Several initiatives for an electronic health certificate (EHC) have been launched, but none so far seem to have addressed the large-scale requirements of such an electronic document.
- An EHC should be machine readable for automatic validation (offline), and it should be possible to apply a set of rules/conditions for the check to be positive.
- It must not be possible for forge or tamper with an EHC.
- In order for it to work reliably with all types of information-carrying media (including paper), the information of the EHC needs to be encoded very compactly.

Control of one's personal information

- An EHC may contain sensitive personal information, and should be carried by the holder and presented as needed, not dispersing any information without the holder/subject informed consent, nor outside of what is strictly necessary.
- The contents of an EHC may be filtered by an Issuer to include only what is relevant for a specific purpose.
- Any verifier should not need access to any central registers containing sensitive information, mitigating risks for intractable data breaches.

Identity information

- It is assumed the EHC contains a reference to an identity document.
- Hence, the EHC is intended to be used in tandem with such an identity document. The EHC itself does not need to be an identity document or contain biometrical information.
- Hence, the EHC may exist in multiple identical copies. There are no risks associated with multiplying the EHC.

Security

- The EHC must be cryptographically sealed with a key that only the issuer of the cerificate is in control of.
- Traditional (X.509) PKI should not be used due to its complexity and heavy weight. A more light-weight route should be chosen, without relaxing the security requirements. A flat issuer structure is feasible.
- A Coordinator is required to collect and publish a set of signed metadata containing the public keys of the Issuers, and distribute this in a secure manner to all stakeholders.
- A key is easily revoked by withdrawing it from the metadata, and a new one can be quickly added in its place.

Encoding and signing

- Given choice to build on open standards, where software libraries already exists and are readily available to implementors. Modern and proven technology should be used:
  - CBOR (Concise Binary Object Representation) according to RFC 7049
  - COSE (CBOR Object Signing and Encryption) according to RFC 8152
  - ECDSA (Elliptic Curve Digital Signature Algorithm) according to ISO/IEC 14888-3:2006 with the parameters for P-256
  - Packaged in a CWT (CBOR Web Token) according to RFC 8392

Representation format

- Compression according to RFC 1950 (zlib)
- Optical encoding according to ISO/IEC 24778:2008 (Aztec)
  - Aztec-code can accommodate up to about 1500 bytes
  - More robust reading than its sibling ISO/IEC 18004:2015 (QR)
  - Robustness important in these diverse environments for handling challenging lighting conditions, cracked mobile screens and folded paper
- Raw data format for contactless transfer (NFC/RFID)

Proven technology

- Similar technology already used in public transport environments in Sweden.
- Proven on a large scale for a few years.
- Most public transport companies in Sweden have already implemented this type of technology, the rest are in the implementation stages.

Data structure

- Basic Interoperability Elements according to a specification drafted within the EU eHealth Network.
- Expressed as a JSON Schema for automatic validation.
- Defines the data structure of the EHC.

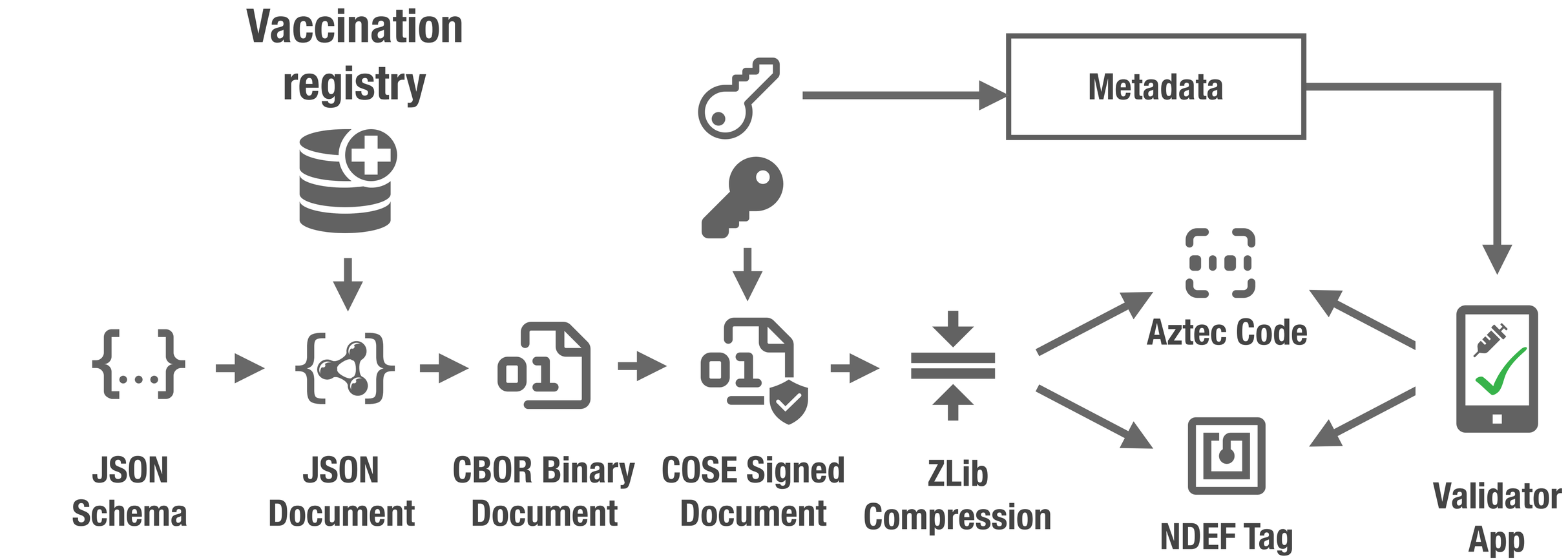
```
$schema: http://json-schema.org/schema#

type: object
required:
  - sub
  - vac
properties:
  sub:
    description: Subject
    type: object
    required:
      - n
    properties:
      n:
        title: Person name
        description: The legal name of the vaccinated person
        type: string
        example: Tolvan Tolvansson
      id:
        title: Person identifiers
        description: Identifiers of the vaccinated person, according to
          the policies applicable in each country.
        type: array
        items:
          type: object
          required:
            - t
            - i
          properties:
            t:
              title: Identifier type
              description: The type of identifier
                pin = personal identity number
                pas = passport number
                nid = national identity card number
              example: pin
              enum:
                - pin
                - pas
                - nid
              type: string
            i:
              title: Identfier number or string
              type: string
              example: 121212-1212
      dob:
        title: Date of birth
        description: Mandatory if no Person identifier is provided.
        format: date
  vac:
    description: Vaccination/prophylaxis information
    type: array
    items:
      type: object
      required:
        - des
        - nam
        - aut
        - seq
        - tot
        - dat
        - adm
      properties:
        tar:
          title: Disease target
          description: Disease or agent that the vaccination provides protection.
            against.
          type: string
          example: SARS-CoV-2
        des:
          title: Vaccine/prophylaxis
          description: Generic description of the vaccine/prophylaxis or its
            component(s).
          type: string
          example: J07BX03
        nam:
          title: Medicinal product name
          description: Name of the medicinal product as registered in the country.
```

Evaluation of conditions

- Exampel of conditions:
  - At least one vaccination against a specific decease within the last month, or
  - Full vaccination against the decease within the last two years.

- Conditions can automatically be evaluated and the result presented to the Verifier (including any failing factor).

```
vac:
  description: Vaccination/prophylaxis information
  type: array
  items:
    type: object
    required:
      - des
      - nam
      - aut
      - seq
      - tot
      - dat
      - adm
    properties:
      tar:
        title: Disease target
        description: Disease or agent that the vaccination provides protection
          against.
        type: string
        example: SARS-CoV-2
      des:
        title: Vaccine/prophylaxis
        description: Generic description of the vaccine/prophylaxis or its
          component(s).
        type: string
        example: J07BX03
      nam:
        title: Medicinal product name
        description: Name of the medicinal product as registered in the countr
        type: string
        example: COMIRNATY
      aut:
        title: Marketing Authorisation Holder
        description: EMA's Organisations System data (SPOR).
        type: string
        example: Pfizer BioNTech
      seq:
        title: Dose sequence number
        description: The sequence number of this dose in the series of
          vaccinations.
        example: 1
      tot:
```



Example proof:

12 vaccinations
6 different substances

(2717 bytes)

(1276 bytes)

(1349 bytes)

(455 bytes)