Update on BRSKI-CLE:
A Certificateless Enrollment Framework in BRSKI

draft-yan-anima-brski-cle-01

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Issues received in the last meeting

- Issue 1 (from Steffen Fries): The cryptographic approach should be discussed with CFRG.
- Issue 2 (from Michael Richardson): COSE objects and ACE-EST should be compared with.

Issue 1： The cryptographic approach should be discussed with CFRG.

- All the **mathematical** algorithm is **deleted** from the draft.
- The draft is changed to an enrollment **framework** based on Key Encapsulation Mechanism (**KEM**).
  - Considering the evolution towards quantum-safe algorithms
  - KEM-based authentication is **lightweight** than signature-based authentication
    - KEM-based authentication resulted in a speed increase of 25 ms, a saving of 71% compared with signature-based authentication [1].

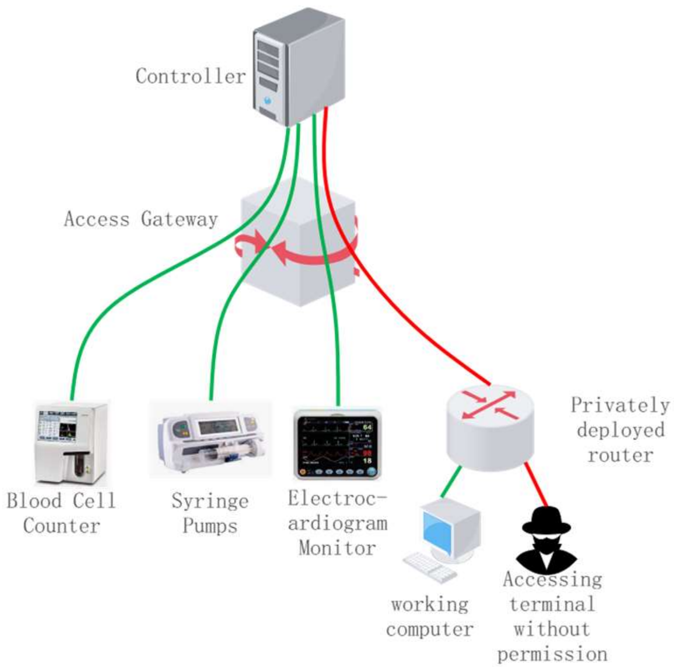
[1] Samandari, J.; Gritti, C. Post-Quantum Authentication in the MQTT Protocol. J. Cybersecur. Priv. 2023, 3, 416–434. https://doi.org/ 10.3390/jcp3030021

Issue 2: COSE objects and ACE-EST should be compared.

- The draft does not specify any **local credentials** any more.
  - This framework can issue:
    - Any **lightweight credentials**, such as CBOR Web Tokens (CWTs)
    - Any **credential references**
- The **use case** is clarified and detailed.
  - The CBOR encoded certificate chain is still heavy for the Class 1 constrained IoT devices (defined in RFC7228).
- All existing **authentication protocols** supporting the **KEM** mechanism are compared with.
  - EDHOC (used by ACE-EST)
  - IPsec
  - TLS

Use case

- The access gateway is required to **authenticate** every connected IoT device in the hospital.
  - Preventing **medical data theft**



Medical Data Theft Security Incident in hospital

- Medical Constrained IoT devices:
  - RAM for authentication < **10 KB**
  - Total RAM = **8 KB** in extreme condition
- This kind of constrained IoT devices are also common in scenarios other than in the hospital.
  - **Class 1** constrained devices: ~ **10 KB** RAM (RFC7228)

Examples of medical constrained IoT devices

Motivation

- The limited RAM resources make the Class 1 constrained IoT devices **hard** to use **certificates**.
- The **CBOR** encoded **certificate chain** is still **heavy** for the Class 1 constrained IoT devices.
  - The CBOR encoded certificate chain[1]:
    - 4 length: ~ 4 KB
    - 2 length: ~ 1.5 KB.
- All existing enrollment protocols of BRSKI are based on **certificates**.
- This draft propose a **certificateless** enrollment **framework** for constrained IoT devices.

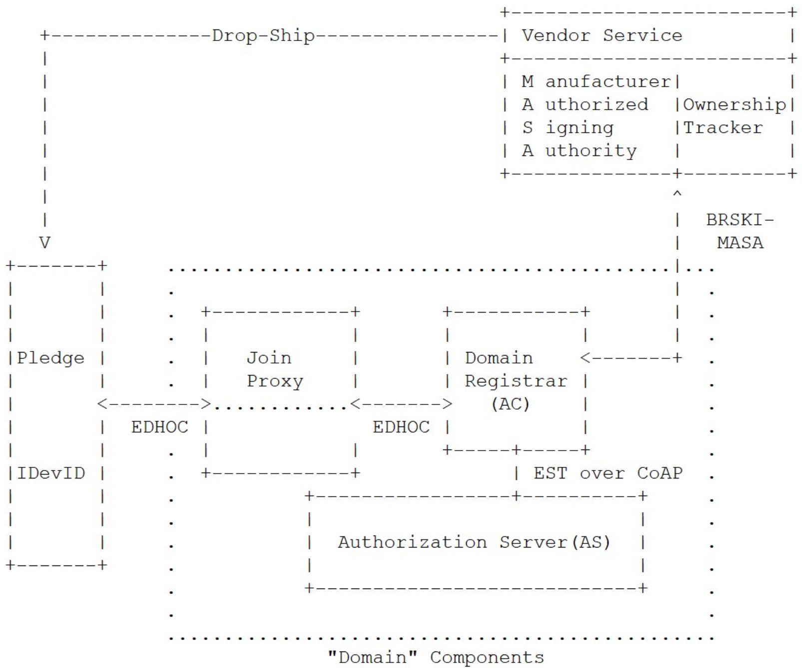
[1] I-D.ietf-cose-cbor-encoded-cert: "CBOR Encoded X.509 Certificates (C509 Certificates)"

Whose public key is used for Encapsulating in KEM: **client** end VS **server** end

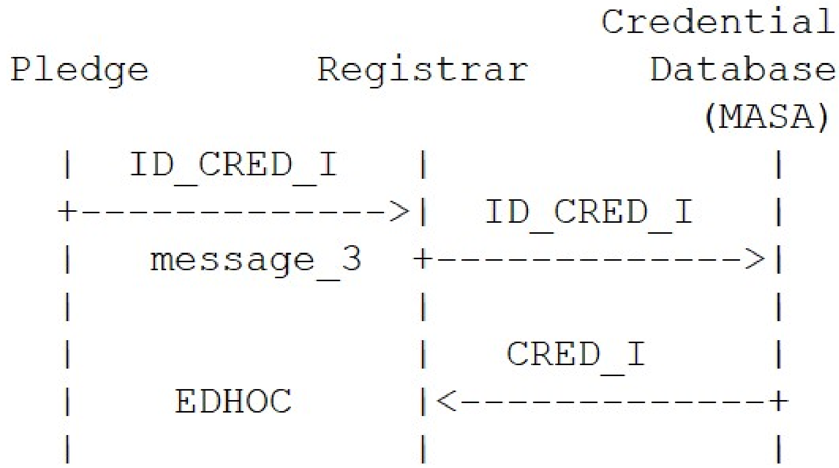
- Client end:
  - **A unique public key** is required to be configured on **every IoT device**.
  - Less efficient in deployment when the amount of IoT devices is huge.
  - **EDHOC** (I-D.ietf-lake-edhoc) and **IPsec** (RFC 9370)
- Server end:
  - Only **one public key** needs to be configured on the server end for dealing with an **enormous amount of** client ends (the IoT devices).
  - More efficient in deployment
  - **This draft** and **TLS** (I-D.wiggers-tls-authkem-psk and I-D.celi-wiggers-tls-authkem)
    - The client end is assumed to have previously known the server end's public key in [I-D.wiggers-tls-authkem-psk].
      - In the BRSKI scenario, a pledge cannot previously know a domain server's public key.
    - The client uses the certificate chain to authencate the server in [I-D.celi-wiggers-tls-authkem].
      - As BRSKI has already built trust between the pledge and the domain before enrollment, using public key is enough.

Another change

- EDHOC is used for the mutual authentication between the pledge and the registrar in BRSKI, as shown in [I-D.ietf-lake-authz].
  - The pledge's credential is supported transporting by **reference** rather than by value.
- A constrained IoT device does **not need to** configure a **public key to identify itself** for the whole bootstrapping process.



Architecture Overview



Transporting Credential by reference

Basic protocol flow

```
+----------+           +-----------+              +--------+
|          |           |           |              |        |
|  Pledge  |           | Registrar |              |   AC   |
|          |           |           |              |        |
+-----+----+           +-----+-----+              +---+----+
      |                      |                        |
      |    [imprint finished]  | (A) Pledge's ID Register |
      |                      +------------------------>|
      |                      |                        |
      |  (B) Public Key Request |                        |
      +------------------------>|  (B) Public Key Request  |
      |                      +------------------------>|
      |                      |                        |
      |                      |       (C) Public Key     |
      |      (C) Public Key      |<------------------------+
      |<------------------------+                        |
      |                      |                        |
      | (D) [Credential Request] |                        |
      +------------------------>| (D) [Credential Request] |
      |                      +------------------------>|
      |                      |                        |
      |                      |     (E) <Credential>     |
      |     (E) <Credential>     |<------------------------+
      |<------------------------+                        |
      |                      |                        |

      [] Indicates messages protected using AC's public key.
      <> Indicates messages protected using a symmetric key.
```

Thank you!
Looking for co-authors!

Questions?

It is welcome to make comments in the email list.