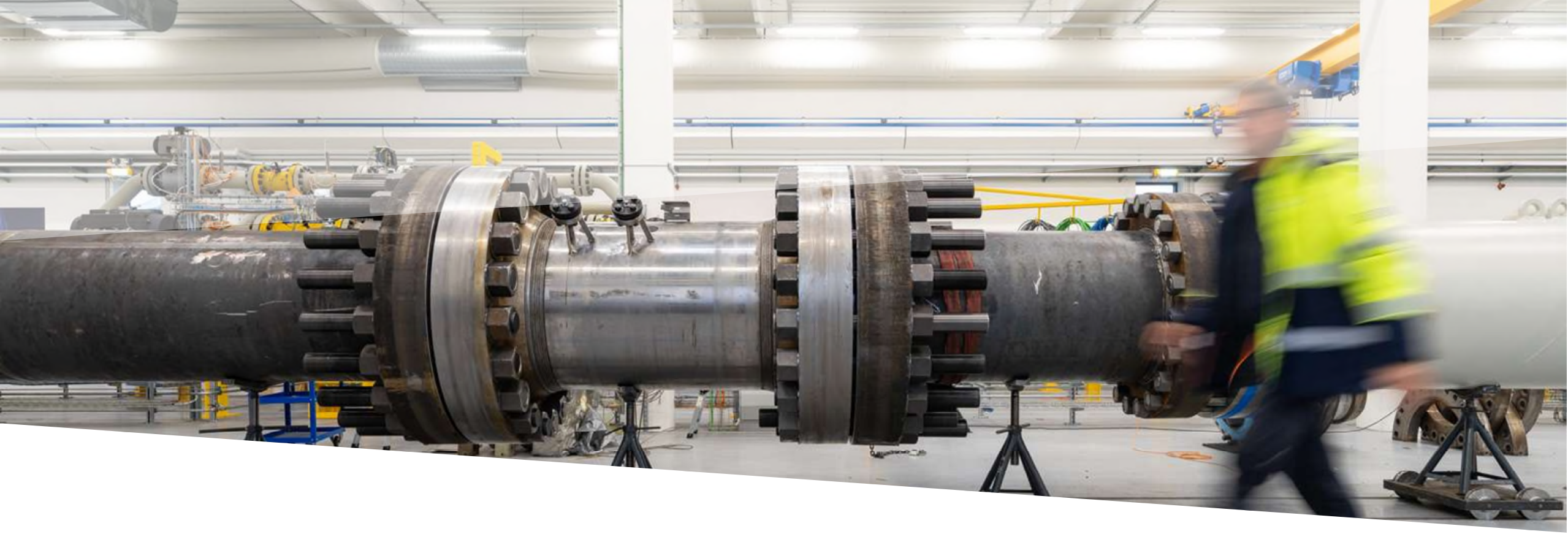

DCC Hub for Digital Calibration Certificates

Ensuring Security, Trust, Transparency and Traceability (3Ts) in the DCC world

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Outline

- Background:
  - Introduction to DCC
  - Need, Advantages and challenges
- Security
  - DCC Transfer and Security
  - Algorithms and methods
- Bringing **T**rust, **T**ransparency and **T**raceability to the DCCs
  - Need for 3Ts
  - FORCE Technology's Vision to ensure 3Ts
- Implementation and Development of DCC Hub
  - Status
  - Future ambitions

Digital Calibration Certificate (DCC)

Digital Calibration Certificate (DCC)

- A DCC is a machine-readable piece of data that provides equipment calibration information in a standardized XML format.
- Machine readability ensures that DCCs can be accessed and used without human intervention, reducing data transfer errors.
- Machine readable, DCCs (XML) will eventually replace PDF and paper-based calibration certificates.

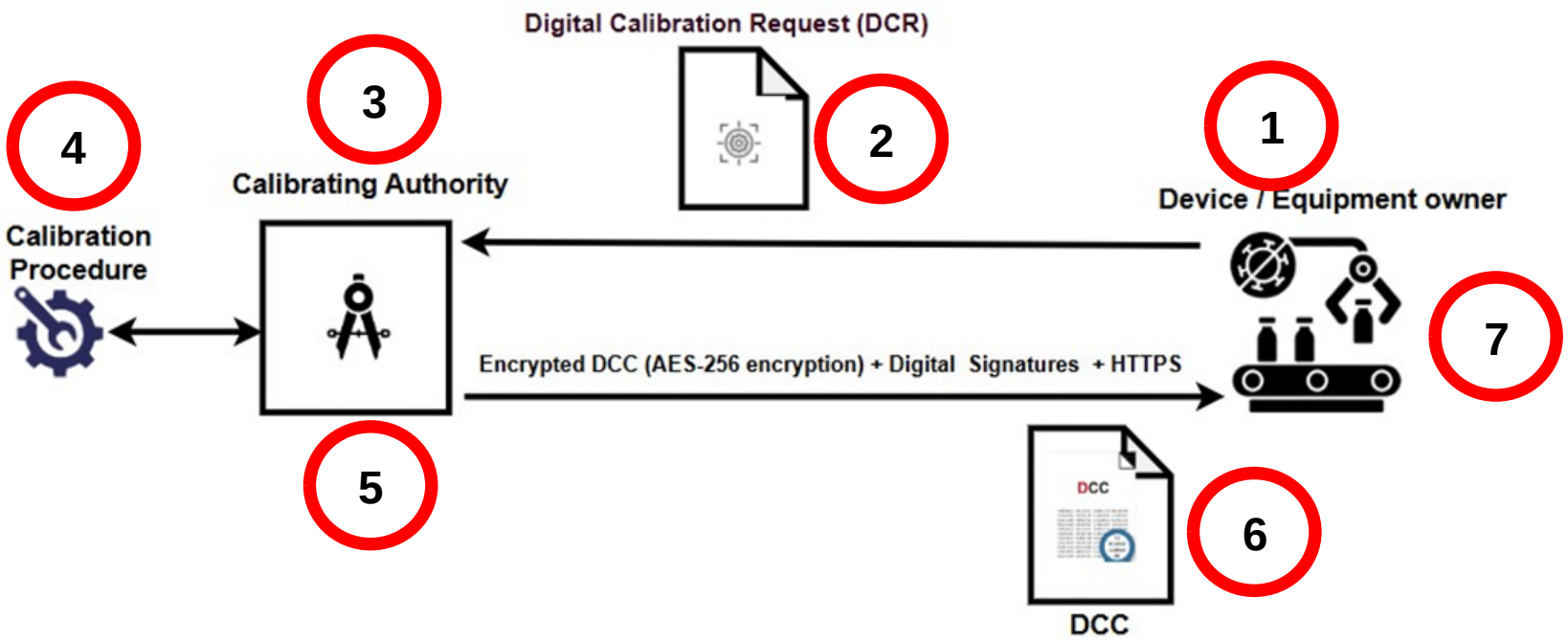
```xml
<xs:complexType name="digitalCalibrationCertificateType">
    <xs:annotation>
        <xs:documentation>
            The root element that contains the four rings of the DCC.
        </xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element name="administrativeData" type="dcc:administrativeDataType"/>
        <xs:element name="measurementResults" type="dcc:measurementResultListType"/>
        <xs:element name="comment" minOccurs="0">
            <xs:complexType>
                <xs:sequence>
                    <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
                </xs:sequence>
            </xs:complexType>
        </xs:element>
        <xs:element name="document" type="dcc:byteDataType" minOccurs="0"/>
        <xs:element ref="ds:Signature" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="schemaVersion" use="required">
        <xs:simpleType>
            <xs:restriction base="xs:string">
                <xs:pattern value="3\.3\.0"/>
            </xs:restriction>
        </xs:simpleType>
    </xs:attribute>
</xs:complexType>
```

Ref: Standardization effort on DCCs is done within the framework of working group under EURAMET and project TC-IM1448

DCC Transfer and Security

Ensuring DCC security is easier

- DCC= data + format (xml)
- DCC (secure)= AES-256 + Digital signature + https



Ensuring trust is always difficult

Ensuring Trust, Transparency and Traceability in The Calibration Process and DCC

Ensuring Trust between stakeholders

Billions of devices (A near future scenario)

1

Device / Equipment owner

2

Calibration labs

3

Standardization bodies

4

Compliance authorities

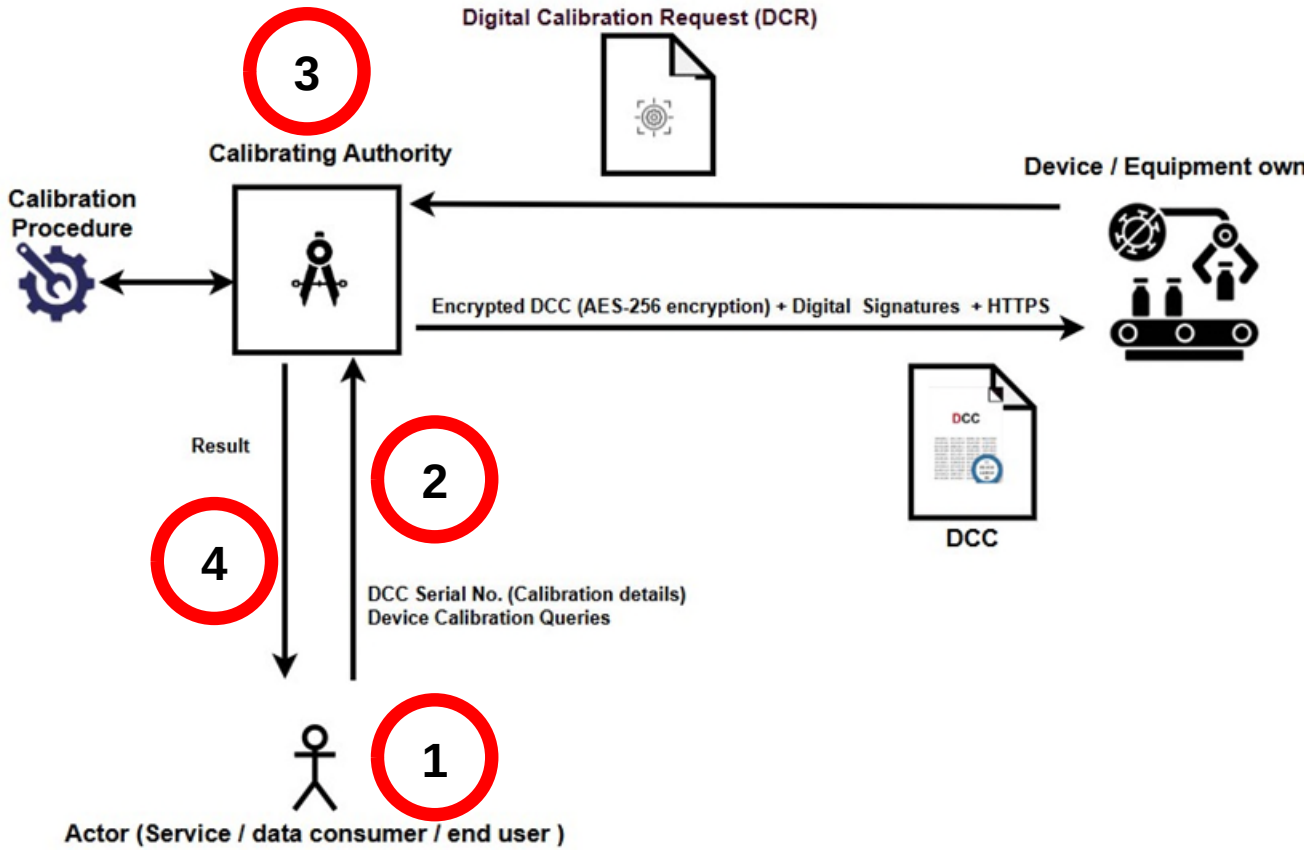
5

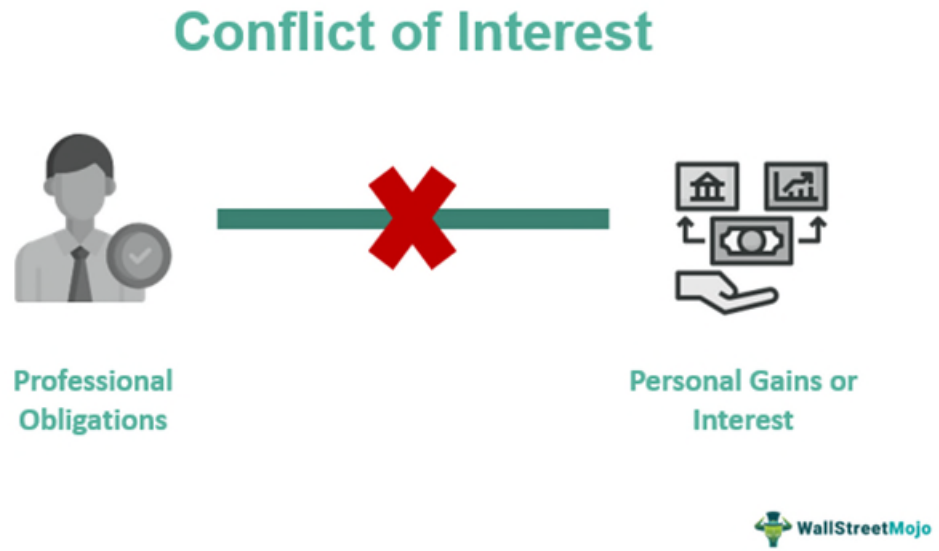
Industry

6

Accreditation Institutions

Ensuring Trust between stakeholders





Ensuring Traceability, Trust, and Transparency

- There’s no digital and automated service that can ensure:
  - Standards across industry
  - Quality of calibration
  - Compatibility
  - Tracking calibration process
  - Calibration service providers
  - Devices calibrated
  - Calibration history
  - DCCs issued etc

- A real-time online platform or a DCC Hub can solve many of the listed problems

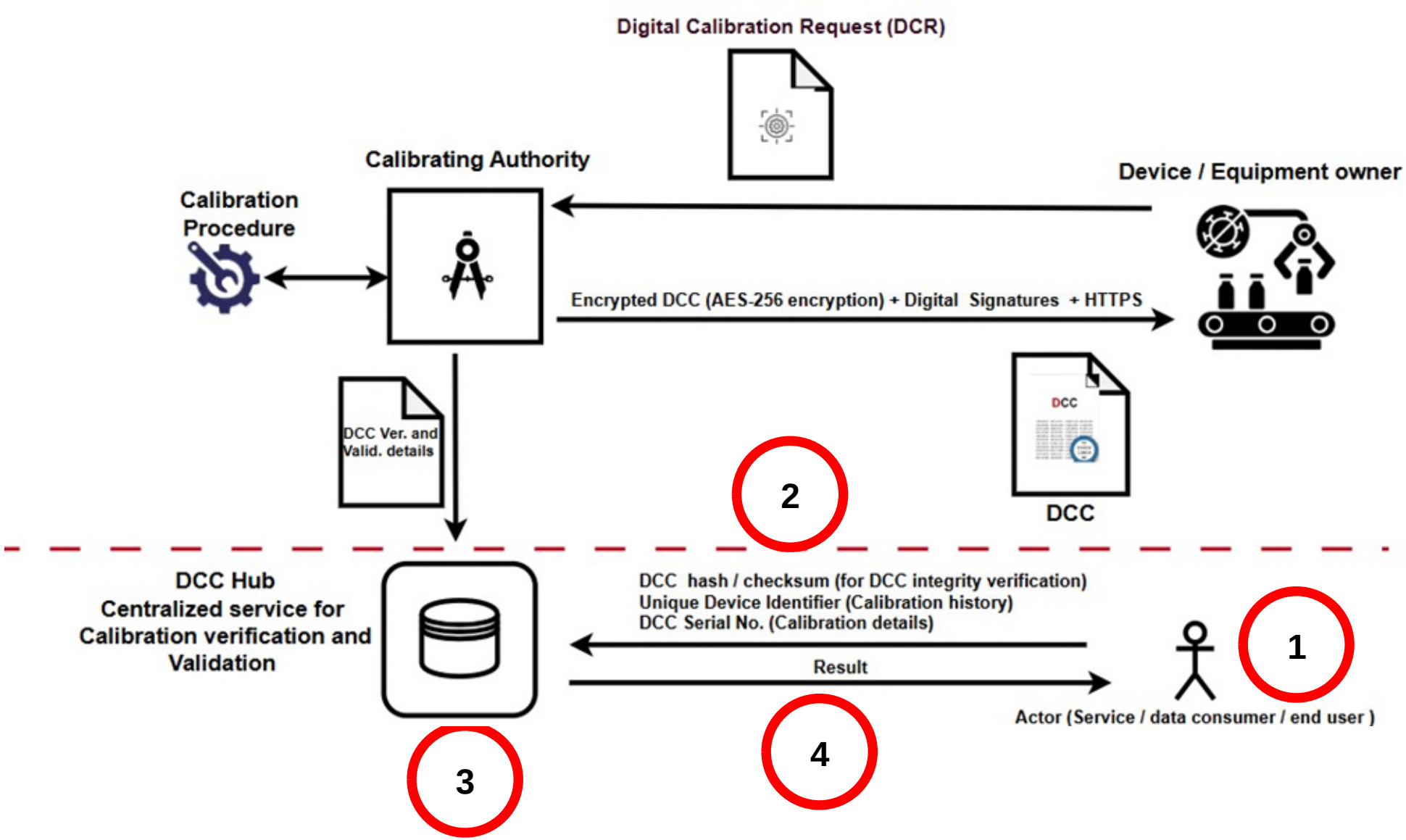
DCC Hub supporting calibration processes

A centralized and real-time **online service (DCC Hub)** will provide the following services.

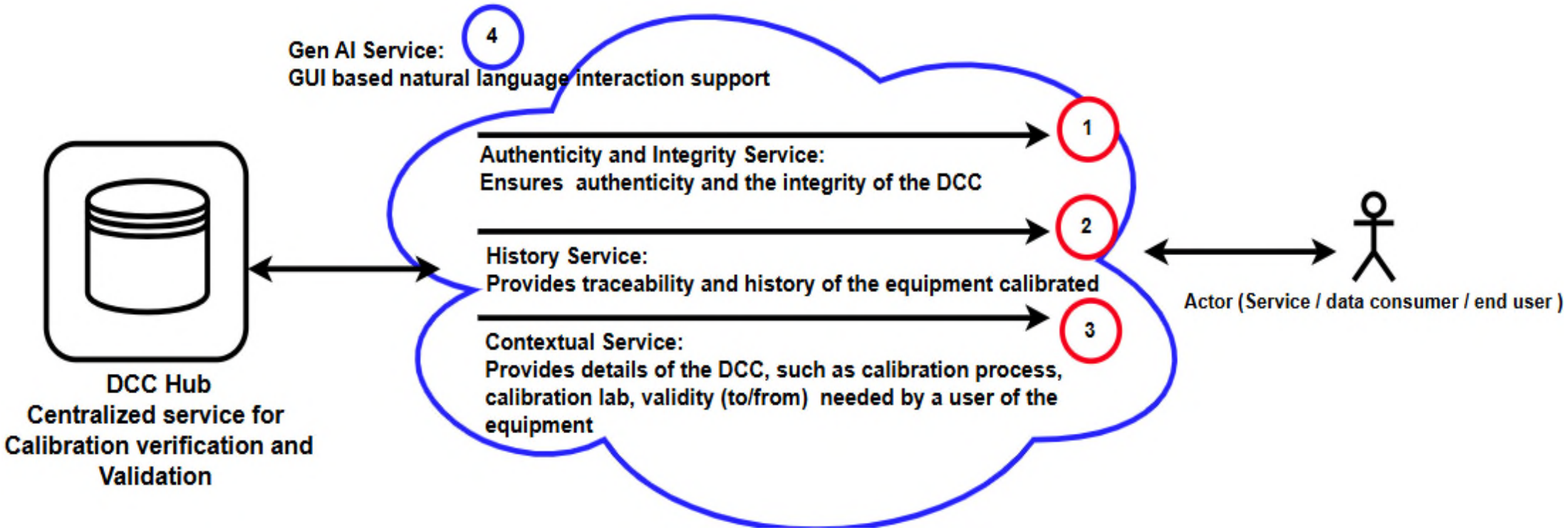
- Increased Trust and Credibility
- Authenticity of Digital Certificates
- Standardization and Compliance
- Easy and Reliable Verification
- Time & Cost Efficiency
- Interoperability Across Systems
- Traceability and Lifecycle Management
- Supports Regulatory and Legal Requirements

Future calibration services and offerings without a real-time **online service (DCC Hub) ??**

DCC Hub functions and information flow

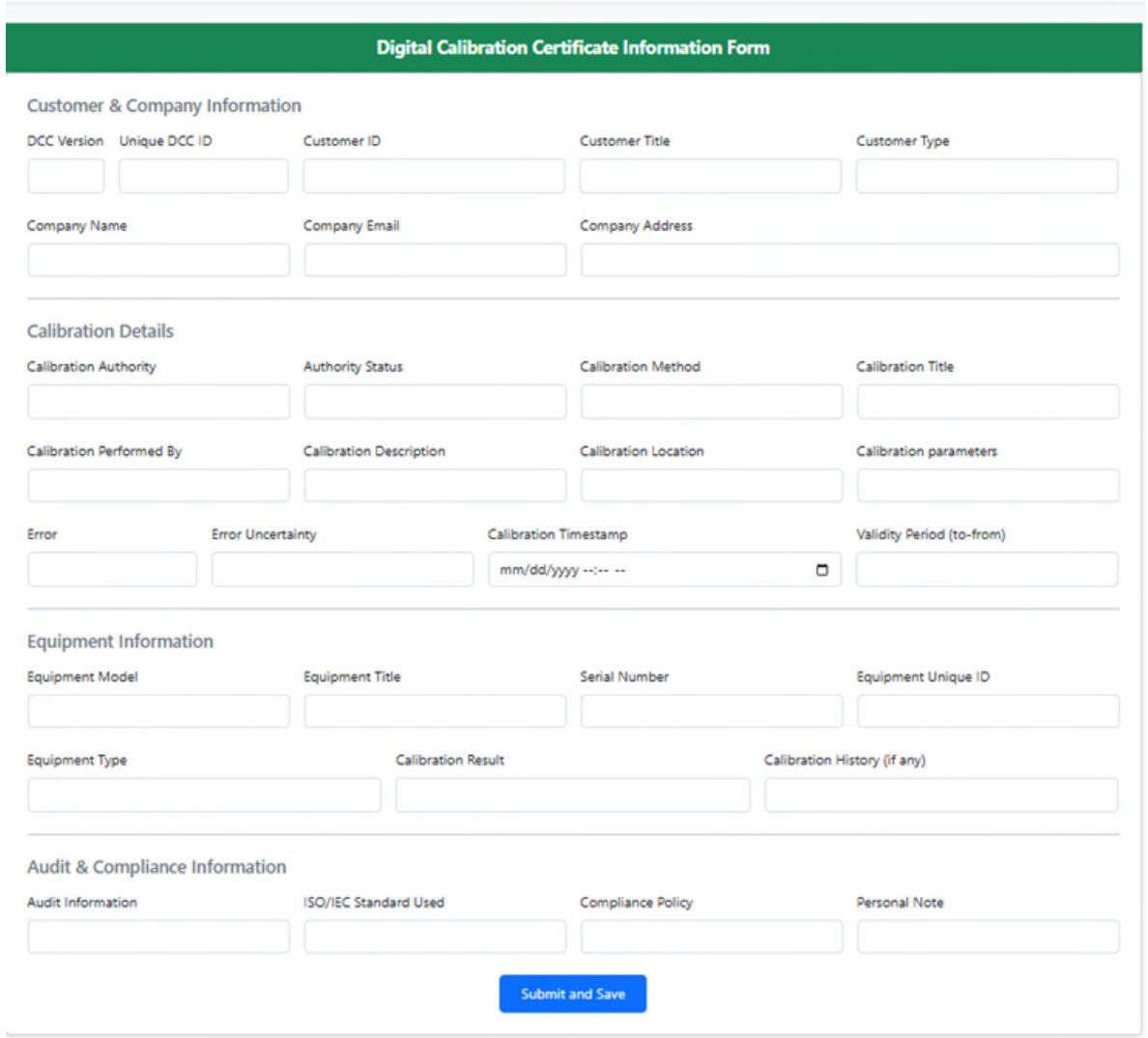


DCC Hub Core Services



Implementation Status

DCC Information Dashboard



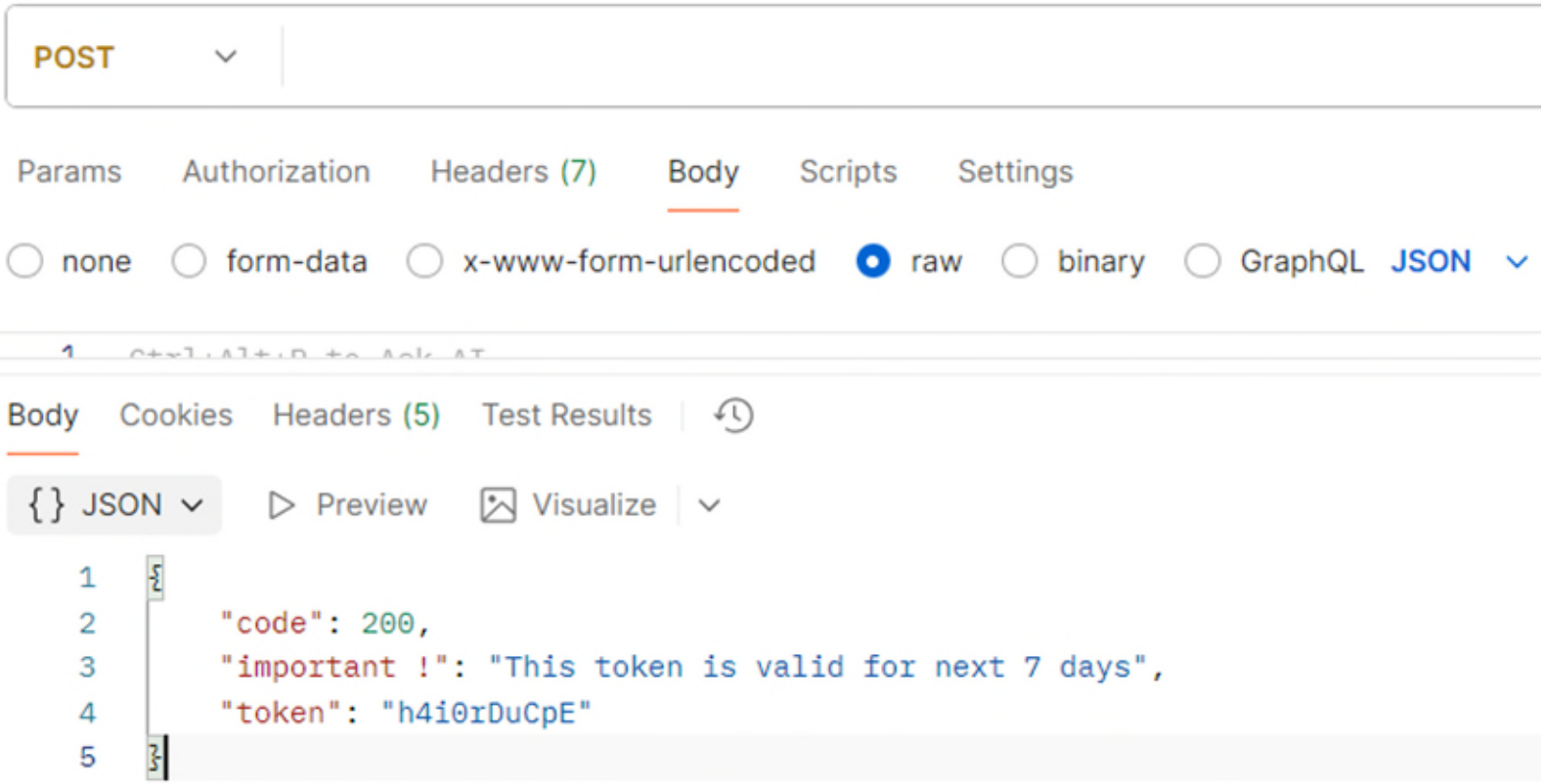
A working demo, version 0.1 is ready.

curl://

httpie

Verification and Validation

Token generation



Verification and Validation

XML submission

POST

Params Authorization Headers (8) Body Scripts Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
{
  "xml": "<Calibration><Verification>Requested</Verification></Calibration>",
  "token":"h4i0rDuCpE",
  "permission": true

}
```

Body Cookies Headers (5) Test Results 200 OK 73 ms 571 B

{ } JSON Preview Visualize

```
{
    "Important !": "Secret-Key and digest are confedential and together they can be used to verify the integrity of a DCC;",
    "digest": "c3bf2f920ba57f58342c43c57410b4d48c67ce34aa4ed8d78da9a6a7c2f0804b",
    "Secret-Key": "8fb32ac5-0411-43bc-8644-323c8baa3e99",
    "permission": true,
    "barcode": "/api/generate/qr?code=8fb32ac5-0411-43bc-8644-323c8baa3e99&
       hash=c3bf2f920ba57f58342c43c57410b4d48c67ce34aa4ed8d78da9a6a7c2f0804b"
}
```

Verification and Validation

Integrity and Authenticity Verification via an API Call

POST

Params Authorization Headers (8) Body Scripts Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
{
"hash": "c3bf2f920ba57f58342c43c57410b4d48c67ce34aa4ed8d78da9a6a7c2f0804b",
"code": "11c5f2b3-4f21-4545-b39d-c8e570c342ac"

}
```

Body Cookies Headers (5) Test Results 200 OK

{} JSON Preview Visualize

```
{
    "Result": "The DCC record found in the DCC Hub, it implies that the DCC is not tampered "
}
```

Verification and Validation

Integrity and Authenticity Verification via QR code

POST

Params Authorization Headers (8) Body Scripts Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
{
  "xml": "<Calibration><Verification>Requested</Verification></Calibration>",
  "token":"h4i0rDuCpE",
  "permission": true

}
```

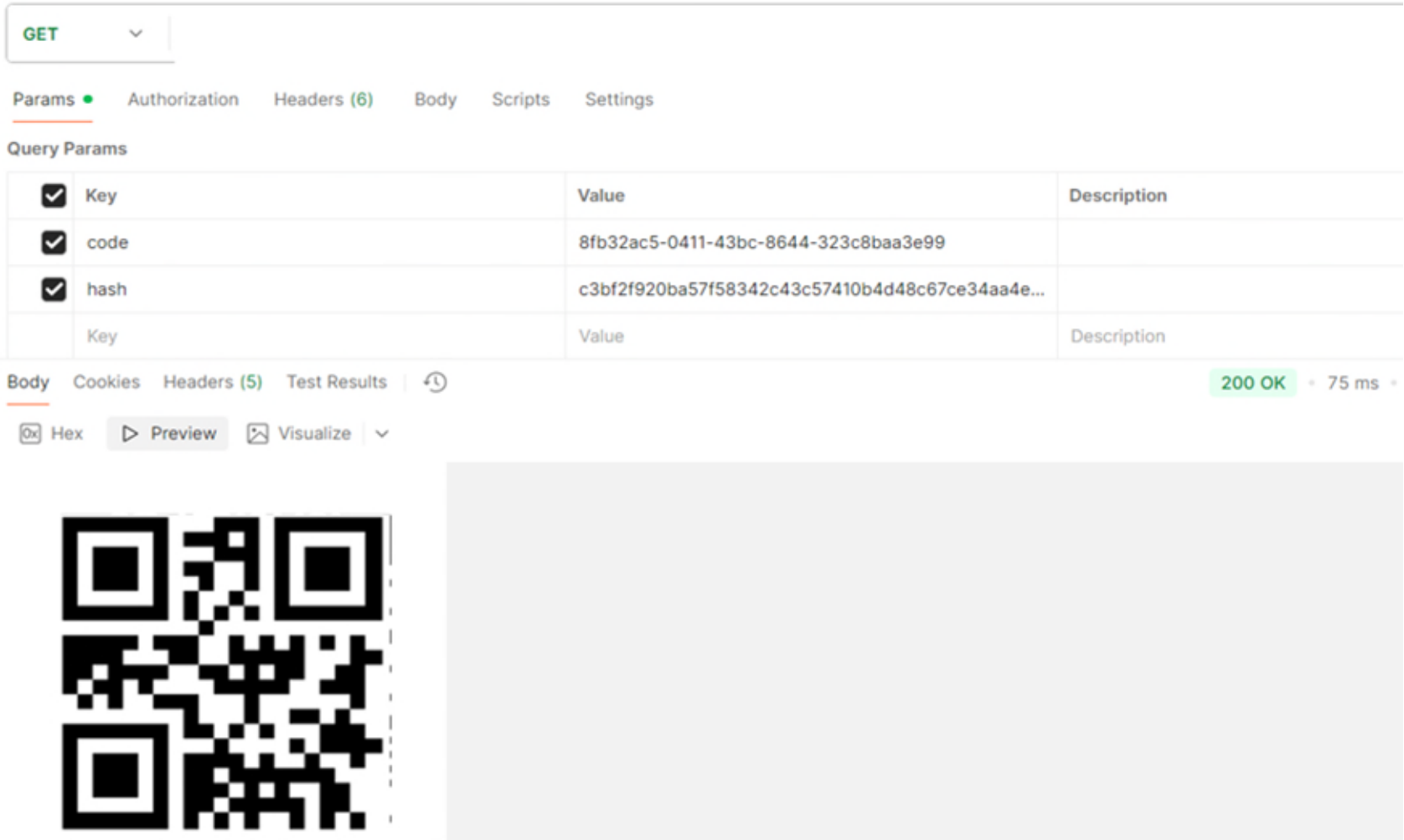
Body Cookies Headers (5) Test Results 200 OK 73 ms 571 B

{ } JSON Preview Visualize

```
{
    "Important !": "Secret-Key and digest are confedential and together they can be used to verify the integrity of a DCC;",
    "digest": "c3bf2f920ba57f58342c43c57410b4d48c67ce34aa4ed8d78da9a6a7c2f0804b",
    "Secret-Key": "8fb32ac5-0411-43bc-8644-323c8baa3e99",
    "permission": true,
    "barcode": "/api/generate/qr?code=8fb32ac5-0411-43bc-8644-323c8baa3e99&
       hash=c3bf2f920ba57f58342c43c57410b4d48c67ce34aa4ed8d78da9a6a7c2f0804b"
}
```

Verification and Validation

Integrity and Authenticity Verification via QR code



DCC History

History verification

POST

Params Authorization Headers (8) Body Scripts Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
{
  "equipmentUniqueId": "EQP-9001",
   "token": "h4i0rDuCpE"

```

Body Cookies Headers (5) Test Results 200 OK

{} JSON Preview Visualize


```
{
    "Result": [
        {
            "id": 2,
            "dccVersion": "1.0",
            "uniqueDccId": "FT2025=L439tXPbQA",
            "customerId": "CUST-1001",
            "customerTitle": "Mr.",
            "customerType": "Corporate",
            "companyName": "FutureTech Innovations",
            "companyAddress": "456 Innovation Drive, Silicon City, USA",
            "companyEmail": "contact@futuretech.com",
            "dccIssuerName": "Precision Labs Inc.",
            "calibrationAuthorityName": "National Metrology Institute",
            "calibrationAuthorityStatus": "Accredited",
            "calibrationPerformedBy": "Jane Smith",
            "dccIssuerEmail": "support@precisionlabs.com",
            "dccIssuerPhone": "+1-555-987654",
            "calibrationLocation": "Lab Facility B",
```


POST

Params Authorization Headers (8) Body Scripts Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
{
  "equipmentSerialNumber": "SN-5566778899",
   "token": "h4i0rDuCpE"

```

Body Cookies Headers (5) Test Results

{} JSON Preview Visualize


```
{
    "Result": [
        {
            "id": 2,
            "dccVersion": "1.0",
            "uniqueDccId": "FT2025=L439tXPbQA",
            "customerId": "CUST-1001",
            "customerTitle": "Mr.",
            "customerType": "Corporate",
            "companyName": "FutureTech Innovations",
            "companyAddress": "456 Innovation Drive, Silicon City, USA",
            "companyEmail": "contact@futuretech.com",
            "dccIssuerName": "Precision Labs Inc.",
            "calibrationAuthorityName": "National Metrology Institute",
            "calibrationAuthorityStatus": "Accredited",
            "calibrationPerformedBy": "Jane Smith",
            "dccIssuerEmail": "support@precisionlabs.com",
            "dccIssuerPhone": "+1-555-987654",
            "calibrationLocation": "Lab Facility B",
```

Upcoming features

Upcoming features

- Gen AI Service: Naturel language interaction support for end users
- Local deployment: On prem deployment
- Customization: Based on feedback received
- Finetuning and release: Updating and polishing exsiting features and making an official release

Feedback from industry or individuals is welcome

Contact for a live demo, free test setup for your organization, or to hear more about the DCC Hub.

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Questions