



**DIGITALISERINGSSTYRELSEN**

# OIO JWT Token Profile Version 0.3

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|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>INTRODUCTION</b> .....                         | <b>3</b>  |
| 1.1      | PREFACE .....                                     | 3         |
| 1.2      | USAGE SCENARIOS .....                             | 3         |
| <b>2</b> | <b>NOTATION AND TERMINOLOGY</b> .....             | <b>5</b>  |
| 2.1      | TERMINOLOGY .....                                 | 5         |
| <b>3</b> | <b>JWT TOKEN REQUIREMENTS</b> .....               | <b>6</b>  |
| 3.1      | GENERAL REQUIREMENTS .....                        | 6         |
| 3.2      | REQUIRED CLAIMS FOR ALL TOKEN TYPES .....         | 6         |
| 3.3      | OPTIONAL CLAIMS FOR PERSONS.....                  | 7         |
| 3.4      | MANDATORY CLAIMS FOR PROFESSIONALS .....          | 7         |
| 3.5      | OPTIONAL CLAIMS FOR PROFESSIONALS .....           | 9         |
| 3.6      | SIGNATURE AND VALIDATION REQUIREMENTS .....       | 9         |
| <b>4</b> | <b>PRIVILEGES IN JSON ENCODING</b> .....          | <b>11</b> |
| <b>5</b> | <b>EXAMPLE (NOT NORMATIVE)</b> .....              | <b>12</b> |
| <b>6</b> | <b>OTHER CONSIDERATIONS (NOT NORMATIVE)</b> ..... | <b>13</b> |
| 6.1      | ENCRYPTION.....                                   | 13        |
| 6.2      | BEARER TOKENS.....                                | 13        |
| 6.3      | VALIDITY PERIOD .....                             | 13        |
| 6.4      | DIFFERENCES BETWEEN ID- AND ACCESS TOKENS .....   | 13        |
| <b>7</b> | <b>REFERENCES</b> .....                           | <b>15</b> |



# 1 Introduction

## 1.1 Preface

This profile is part of a larger set of specifications aimed at supporting mobile applications (apps) based on OpenID Connect, JWT and related technologies. The specifications are written with NemLog-in3 in mind but can freely be used elsewhere, and they are exclusively focused on app-scenarios.

NemLog-in3 will establish infrastructure components based in OpenID Connect to support native apps and their access to REST APIs offered by public and private service providers. The future NemLog-in3 components will include an authorization server, a token service and web portals for registration and management of apps and APIs. The infrastructure will ensure user authentication based on [NSIS] and subsequent authorization of apps with user consent by issuing and managing security tokens - in parallel with the current infrastructure for web applications and SOAP-services based on SAML and WS-Trust.

For a quick overview of the planned architecture, components and flows, we refer to the scenario document [ @todo ].

This profile has a close relationship with the OIOSAML 3.0 and OIO WS-Trust 1.1 profiles, and several elements from these specifications are re-used<sup>1</sup>:

- Several attributes (claims) defined in OIOSAML 3.0 are used.
- Identifiers for users (UUID) and service providers (Entity IDs) are reused.
- The model for access rights and delegations as specified in OIO Basic Privilege Profile are re-used – but expressed using JSON syntax.

The goal is to ensure the same user experience in apps and web, and that back-end infrastructure can easily be re-used for the two scenarios.

Note: readers of this document are expected to be familiar with OAuth, JWT and OpenID Connect.

## 1.2 Usage Scenarios

This profile is intended for use within Danish public sector federations where information about authenticated identities is federated across service providers. The goal is to achieve standardization, interoperability, security and privacy, while enabling re-use of common implementations.

The profile is targeted for use with the OpenID Connect protocol (also currently being profiled) for use with native apps.

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<sup>1</sup> A merge of specifications can be considered at a later stage, but for now they are kept separate as they have different status (early draft vs final specification).



## DIGITALISERINGSSTYRELSEN

The profile specifies requirements for two types JWT tokens issued by NemLog-in infrastructure in app scenarios:

- ID tokens describing an authenticated end-user (OIDC).
- Access tokens providing an app to access a REST API on behalf of an end-user.

The NemLog-in OIDC flow uses two other tokens:

- Access tokens for the NemLog-in OIDC UserInfo endpoint
- Refresh tokens for the above access tokens

Both of these are opaque and thus not meaningful outside NemLog-in and not detailed in this specification. They should however comply with [RFC6819] and thus contain entropy  $\geq 128$  bits and be constructed from a cryptographically strong random or pseudo-random number sequence.



## 2 Notation and terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119][RFC8174] when, and only when, they appear in all capitals, as shown here.

This specification uses the following typographical conventions in text: `<ns:Element>`, `Attribute`, **Datatype**, `OtherCode`. The normative requirements of this specification are individually labeled with a unique identifier in the following form: **[OIO-EXAMPLE-01]**. All information within these requirements should be considered normative unless it is set in *italic* type. Italicized text is non-normative and is intended to provide additional information that may be helpful in implementing the normative requirements.

### 2.1 Terminology

to do...



## 3 JWT token requirements

This chapter contains requirements for ID tokens. Two variants of claims sets are defined:

- Tokens issued to natural persons (e.g. citizens)
- Tokens issued to professionals (acting on behalf of an organization)

Later other variant may be added, including claim sets for non-person entities (e.g. software robots) and for EU-citizens logging in via the Danish eID-gateway.

### 3.1 General requirements

#### [JTP-01]

All tokens **MUST** comply with the [JWT] specification.

### 3.2 Required claims for all token types

#### [JTP-02]

Tokens issued for persons and professionals **MUST** include all the claims listed below with values as specified:

| Claim     | Value  |
|-----------|--|
| iss       | Identifier for the issuer as an URL using https scheme.<br>Example: 'https://nemlog-in.dk'   |
| jti       | A unique identifier for the token, which can be used to prevent reuse of the token.  |
| sub       | Subject identifier containing a persistent and service-provider specific UUID in the format specified in OIOSAML 3.0 requirement [OIO-IDP-15].<br>Example: 'https://data.gov.dk/model/core/eid/person/uuid/123e4567-e89b-12d3-a456-426655440000'<br><br>Note that the subject will indicate the type of identity (person or professional). |
| aud       | Audience for the token as an EntityID following OIOSAML 3.0 [OIO-IDP-18].<br>Example: 'https://digitalpost.dk'.  |
| exp       | Expiration time. JSON number with the same clock skew tolerance as defined in OIOSAML 3.0 [OIO-GE-01].   |
| iat       | Time at which the token was issued as a JSON number.   |
| auth_time | Time when the end-user authentication occurred as a JSON number.   |



## DIGITALISERINGSSTYRELSEN

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| nonce    | Client session ID received in the request which is relayed back to prevent man-in-the-middle attacks. Note that requirements for entropy is defined in the OIO OIDC Profile.   |
| amr      | Authentication methods reference using the NSIS assurance level achieved during authentication. MUST be one of the following:<br><a href="https://data.gov.dk/concept/core/nsis/loa/Low">https://data.gov.dk/concept/core/nsis/loa/Low</a><br><a href="https://data.gov.dk/concept/core/nsis/loa/Substantial">https://data.gov.dk/concept/core/nsis/loa/Substantial</a><br><a href="https://data.gov.dk/concept/core/nsis/loa/High">https://data.gov.dk/concept/core/nsis/loa/High</a> |
| spec_ver | Version of this token specification, currently '1.0'.  |

### 3.3 Optional claims for persons

#### [JTP-03]

Tokens issued for persons MAY include the claims specified below with values as specified. The desired claims set SHOULD be agreed in advance via out-of-band mechanisms.

| Claim       | Value  |
|-------------|--|
| priv        | Privileges according to OIO Basic Privilege Profile 1.1 encoded as JSON (see chapter 4 for details). |
| ial         | Identity Assurance Level as specified on OIOSAML 3.0 section 6.2.5                                   |
| aal         | Authenticator Assurance Level as specified on OIOSAML 3.0 section 6.2.6                              |
| name        | Full name as specified in OIOSAML 3.0 section 6.2.7  |
| given_name  | First name as specified in OIOSAML 3.0 section 6.2.8   |
| family_name | Last name as specified in OIOSAML 3.0 section 6.2.9  |
| email       | Email as specified in OIOSAML 3.0 section 6.2.11   |
| cpr         | CPR number as specified in OIOSAML 3.0 section 6.2.12  |
| cpr_uuid    | CPR UUID as specified in OIOSAML 3.0 section 6.2.11  |

### 3.4 Mandatory claims for professionals

#### [JTP-04]

Tokens issued for professionals MUST (in addition to claims specified in [JTP-02]) include the claims specified below with values as specified.

| Claim | Value |
|-------|-------|
|-------|-------|



## DIGITALISERINGSSTYRELSEN

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| cvr      | CVR number as specified in OIOSAML 3.0 section 6.4.3           |
| org_name | Name of organization as specified in OIOSAML 3.0 section 6.4.4 |





### 3.5 Optional claims for professionals

#### [JTP-05]

Tokens issued for professionals MAY include the claims specified below with values as specified. The desired claims set SHOULD be agreed in advance via out-of-band mechanisms.

| Claim         | Value   |
|---------------|---|
| priv          | Privileges according to OIO Basic Privilege Profile 1.1 encoded as JSON (see chapter 4 for details).      |
| ial           | Identity Assurance Level as specified on OIOSAML 3.0 section 6.2.5  |
| aal           | Authenticator Assurance Level as specified on OIOSAML 3.0 section 6.2.6                                   |
| name          | Full name as specified in OIOSAML 3.0 section 6.2.7   |
| given_name    | First name as specified in OIOSAML 3.0 section 6.2.8  |
| family_name   | Last name as specified in OIOSAML 3.0 section 6.2.9   |
| email         | Email as specified in OIOSAML 3.0 section 6.2.11  |
| cpr           | CPR number as specified in OIOSAML 3.0 section 6.2.12   |
| cpr_uuid      | CPR UUID as specified in OIOSAML 3.0 section 6.2.11   |
| auth_to_repr  | Set when the person is authorized to represent the organization as specified in OIOSAML 3.0 section 6.4.7 |
| p_number      | Production number as specified in OIOSAML 3.0 section 6.4.5   |
| se_number     | SE number as specified in OIOSAML 3.0 section 6.4.6   |
| persistent_id | Persistent identifier across service providers as specified in OIOSAML 3.0 section 6.4.1                  |

### 3.6 Signature and validation requirements

#### [JTP-06]

Tokens MUST be signed using [JWS] using one of the following algorithms from [JWA]:

- PS256, PS384, PS512 (RSA)
- ES256, ES384, ES512 (ECDSA)

#### [JTP-07]

Token signatures MUST be verified against a pinned certificate provided as part of the secure configuration (e.g. NemLog-in token signing certificate).



## DIGITALISERINGSSTYRELSEN

Tokens with invalid signatures or algorithms **MUST** be rejected. Revocation checks of pinned token signing certificates is not required.

### **[JTP-08]**

A key ID (kid) header **MAY** be used to indicate the version of signing key in order to support key-rollover schemes.

### **[JTP-09]**

The following JWS header fields **MUST** not be used: x5u, x5c, jku, or jwk.



## 4 Privileges in JSON encoding

This section describes how to encode a set of assigned of privileges defined in OIO Basic Privilege Profile [OIO-BPP] as a JSON structure with exactly the same semantics. Thus, all names of privileges, scopes and constraints are URIs and values of these are simple text strings.<sup>2</sup>

The intermediate version of [OIO-BPP] uses a structure like the one below:

```
<?xml version="1.0" encoding="UTF-8"?>
<bpp:PrivilegeList
  xmlns:bpp="http://digst.dk/oiosaml/basic_privilege_profile"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
  <PrivilegeGroup Scope="urn:dk:gov:saml:cvrNumberIdentifier:12345678">
    <Constraint Name="urn:dk:kombit:KLE">25.*</Constraint>
    <Constraint Name="urn:dk:kombit:sensitivity">3</Constraint>
    <Privilege>urn:dk:kombit:system_xyz:view_case</Privilege>
  </PrivilegeGroup>
</bpp:PrivilegeList>
```

The corresponding JSON structure for the `priv` claim is formatted as shown below:

```
{
  "privilegegroups" : [
    {
      "privilege" : "urn:dk:kombit:system_xyz:view_case",
      "scope" : "urn:dk:gov:saml:cvrNumberIdentifier:12345678",
      "constraints" : [
        {
          "name" : "urn:dk:kombit:KLE",
          "value" : "25.*"
        },
        {
          "name" : "urn:dk:kombit:sensitivity",
          "value" : "3"
        }
      ]
    }
  ]
}
```

---

<sup>2</sup> A more formal syntax definition will be given at a later stage.



## 5 Example (not normative)

Below is show an example of claims sections for a person JWT:

```
{
  "iss" : "https://nemlog-in.dk",
  "sub" : "https://data.gov.dk/model/core/eid/person/uuid/123e4567-e89b-12d3-66554400...",
  "aud" : "https://digitalpost.dk/postapi",
  "exp" : 1317281970,
  "iat" : 1311280970,
  "auth_time" : 1311280969,
  "nonce" : "n-0S6_wzA2Mj",
  "amr" : "https://data.gov.dk/concept/core/nsis/loa/Substantial",
  "specver" : "1.0",
  "cpr" : "2611771023"
}
```



## 6 Other considerations (not normative)

### 6.1 Encryption

Since tokens are not transported via the user agent and are always sent over TLS 1.2<sup>3</sup> (or higher) with pinned server certificates, encryption of tokens is not deemed necessary.

### 6.2 Bearer tokens

All JWT tokens specified are bearer tokens<sup>4</sup>.

### 6.3 Validity period

The validity period of tokens (including refresh tokens) is left as an implementation policy decision. Thus, it can be based on a risk assessment that takes multiple factors into account including sensitivity of the app and API, the NSIS assurance level, and other relevant parameters.

### 6.4 Differences between ID- and access tokens

As mentioned in the introduction, this profile will be used with two types of tokens:

- ID tokens describing an authenticated end-user.
- Access tokens providing access to a REST API on behalf of an end-user.

Even though the claims are the same, a few differences will exist in claim values:

| Claim     | ID tokens   | Access Tokens   |
|-----------|---|---|
| aud       | The app will be the audience. The structure of entityID for apps will be defined in the NemLog-in registration model (separate document.) | The entityID of the API will be the audience.   |
| priv      | Contains user's rights in the app.  | Contains the access rights granted by the user to the app with the API.   |
| exp       | ID tokens are typically short-lived (minutes). Token lifetime is defined according to implementation policy and not defined here.         | Access tokens are typically longer-lived in order to last a typical user session (hours).   |
| auth_time | User authentication typically takes place just before ID tokens are issued.   | User authentication can be much longer back in time especially if the access token is refreshed multiple times using a refresh token. By including the original time of |

<sup>3</sup> Requirements for transport protocols are defined in the OIO OIDC profile to be used with this token profile.

<sup>4</sup> Holder-of-key tokens can be considered at NSIS level High, but since tokens are only exchanged via TLS 1.2 or higher and not exposed in the user agent, bearer tokens are probably sufficient.



## DIGITALISERINGSSTYRELSEN

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|--|--|--|
|  |  | user authentication, the API can enforce its own policies. |
|--|--|--|



## 7 References

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