Abstract:
This document defines the interface protocol for an Identity Authority (IDA). The IDA is a central web-based service, needed in any ecosystem that conforms to the ecosystem architecture, that statelessly provides unique, signed Pseudonymous Keys. These Pseudonymous Keys are used to register actors within the ecosystem and are then requested by an actor wishing to register an
individual person within the ecosystem (and thus enter into data exchanges about that person's Behavioural Atoms).

**Status:**

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**Citation format:**

When referencing this specification the following citation format should be used:

[COEL-IDA-v1.0]

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1 Introduction

[All text is normative unless otherwise labelled]

1.1 Terminology

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

1.2 Normative References


[COEL_RPE-1.0] Roles, Principles, and Ecosystem Version 1.0. Latest version: http://docs.oasis-open.org/coel/RPE/v1.0/RPE-v1.0.docx

1.3 Non-Normative References

2 The Identity Authority

An Identity Authority (IDA) provides an Identity Authority Interface (the API) that generates and subsequently validates a digitally signed unique Pseudonymous Key to be used in signup to Data Engine services. The IDA does not require any input to generate the Pseudonymous Key.

Section 3 of this document describes how the API is used by Operators, Service Providers, and Data Engines to register Consumers or Devices. Section 4 gives details on the API itself.

The terms Pseudonymous Key, Data Engine, Operator, Hardware Developer and Service Provider are as defined in [COEL-RPE-1.0].
3 Protocol Overview

Figure 1: IDA/Data Engine signup sequence

Figure 1 shows the sequence an Operator MUST follow in signing up a new consumer: obtain a Pseudonymous Key from IDA and then use it to signup with the Data Engine. The Pseudonymous Key is used in all subsequent communications with the Data Engine such as sending data, requesting reports. For each new consumer, the Operator and Data Engine use a separate Pseudonymous Key. Applications that generate input (Behavioural Atoms) for the Data Engine also use the Pseudonymous Key.

The signature is used so that the Data Engine can be assured that the Pseudonymous Key is genuine. Rather than using asymmetric key-pairs and distributing a public key and signing algorithm, the IDA provides the means for a receiver of a signed Pseudonymous Key to validate its signature. The Data Engine MUST use this validation mechanism.

It is assumed that this transaction is short – Operators only request Pseudonymous Keys when they need them and register them shortly afterwards (probably within minutes). The Identity Authority needs to be free to alter the means of signature (if for example it believes the mechanism used internally has been revealed). If this change happens during a transaction then validation will fail. This is an unlikely event, but parties in the transaction need to be able to manage it:

- Data Engines receiving a failed validation code MUST pass the failure back to the Operator.
- Operators receiving a failed validation code from the Data Engine MUST discard the Pseudonymous Key and request a new one from the IDA.
- If the second attempt also fails, the Operator SHOULD try once more after a short delay (1-2 seconds) before aborting the attempt to register.
The IDA also provides a means to generate a batch of up to 1000 Pseudonymous Keys in one request. The batch contains a single signature and the same protocol MUST be followed for validation: The Service Provider passes the batch to the Data Engine which MUST validate the batch with the IDA. It is expected that the Service Provider will then provide this batch of IDs to a Hardware Developer to be used in devices.

Pseudonymous Keys are primarily intended to represent a consumer in the ecosystem. However, Operators and Service Providers also require keys to identify themselves in their machine to machine interactions. IDA generated Pseudonymous Keys MAY be used for this purpose since they are devoid of DIPI and unique across the ecosystem.
4 API Overview

4.1 Introduction

The Identity Authority (IDA) API provides a means for Operators and/or Service Providers to generate unique Pseudonymous Keys for Consumers or Devices. A Pseudonymous Key is REQUIRED when an Operator or Service Provider registers a consumer or device with a Data Engine. Pseudonymous Keys are digitally signed so that Data Engines can validate them to ensure they were generated by the IDA and have not been altered.

4.2 Authentication and Authorisation

To access the IDA API, callers need API Credentials with two components:

- A userid to identify the caller.
- A password to authenticate the caller.

A userid MUST be assigned to one of the following two roles in the IDA:

- **Generator**: Allowing the userid to generate Pseudonymous Keys
- **Validator**: Allowing the userid to validate Pseudonymous Keys

HTTP basic authentication SHALL be used to authenticate calls to the API. Passwords SHOULD be 64 bytes in length and MUST be supplied as an ASCII string. This MUST be prefixed with the userid followed by a colon to form the token passed in the HTTP Authorisation Header.

Example:

```
"9abf5386-2ac6-4e61-abc4-6b809a85d6cb:JhmiDAlnpolSBrlrN6H09RqOerdlCyeprXgE70050SzXzMeUsGCEaVNAMrKv8D"
```

If the userid is unrecognized, or the wrong password is supplied a HTTP status code 401 *Invalid username or password* SHALL be returned.

If a request is made with a userid that is assigned a role that is not authorized to perform that action then the HTTP status code 403 *Unauthorised* SHALL be returned.

4.3 Identity Authority Information Request

Every Identity Authority SHALL publish its Home URI. Performing a GET on this URI SHALL return general information about the Identity Authority as JSON object.

<table>
<thead>
<tr>
<th>Method</th>
<th>Request</th>
<th>Response Status</th>
<th>Response Content-Type</th>
<th>Response Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>GET</td>
<td>None</td>
<td>200 (OK)</td>
<td>application/json</td>
<td>JSON object</td>
</tr>
<tr>
<td>POST</td>
<td>Any</td>
<td>405 (Method Not Allowed)</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Format for the returned JSON Object:

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Description</th>
<th>REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>IdentityAuthorityURI</td>
<td>String</td>
<td>The URI of the Identity Authority service encoded as a string.</td>
<td>Yes</td>
</tr>
<tr>
<td>ServerTime</td>
<td>Integer</td>
<td>Current server time in UTC as a Unix timestamp.</td>
<td>Yes</td>
</tr>
</tbody>
</table>
IdentityAuthorityStatus | String | The current status of the Identity Authority service encoded as a string. It MUST be one of "Up", "Down", or "Unknown". | Yes

The JSON object of the response MAY contain additional fields with information about the Identity Authority.

Example request message:

```
GET /home
```

Example response message:

```
HTTP/1.1 200 OK

{"IdentityAuthorityURI": "https://www.ida.com/api",
 "IdentityAuthorityStatus": "Up",
 "ServerTime": 1470822001}
```

### 4.4 PseudonymousKey endpoint

The IDA SHALL provide a PseudonymousKey end-point which provides the means to generate Pseudonymous Keys for users whose API Credentials have the Generator role.

#### 4.4.1 Response

The response SHALL contain three parameters: The Pseudonymous Key; the timestamp at which the response was generated; and a signature that can be used for validation.
<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PseudonymousKey</td>
<td>Unique key to be used to represent a consumer, Service Provider, Operator or</td>
<td>String: Formatted as a UUID as defined in</td>
</tr>
<tr>
<td></td>
<td>device in the ecosystem.</td>
<td>[RFC_4122, Section 3]</td>
</tr>
<tr>
<td>TimeStamp</td>
<td>Date and time at which the PseudonymousKey was generated.</td>
<td>String: Formatted as a date-time according to [RFC_3339].</td>
</tr>
<tr>
<td>Signature</td>
<td>ASCII encoded signature which the IDA will use for validation.</td>
<td>String</td>
</tr>
</tbody>
</table>

**Media type:**

application/json, text/json

**Sample:**

```json
{
  "PseudonymousKey": "00000000-0000-0000-0000-000000000000",
  "TimeStamp": "2011-02-14T00:00:00",
  "Signature": "SGFDXCTVIVVIFUJUVUYBKJHBK=="
}
```

**Status:**

- 200: The operation was successful
- 401/403: The operation failed due to authentication or authorization failure. The caller should confirm its credentials and retry.
- 500: Internal error, the caller should retry

### 4.5 PseudonymousKeyBatch endpoint

The IDA SHALL provide a PseudonymousKeyBatch end-point which provides the means to generate a batch of Pseudonymous Keys in one response packet for users whose API Credentials have the Generator role.
4.5.1 Request
The request body SHALL contain one parameter: Size.

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>The number of PseudonymousKeys to return in the batch.</td>
<td>Integer: 1 &lt;= n &lt;= 1000</td>
</tr>
</tbody>
</table>

Media type:
application/json, text/json

Sample:
```json
{“Size”: 1000}
```

4.5.2 Response
The response SHALL contain three parameters: An array of Pseudonymous Keys; the timestamp at which the response was generated; and a signature that can be used for validation.

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PseudonymousKeys</td>
<td>Array of unique keys to be used to represent a devices in the ecosystem.</td>
<td>Array of String: Each string formatted as a UUID as defined in [RFC_4122, Section 3]</td>
</tr>
<tr>
<td>TimeStamp</td>
<td>Date and time at which the PseudonymousKey was generated.</td>
<td>String: Formatted as a date-time according to [RFC_3339].</td>
</tr>
<tr>
<td>Signature</td>
<td>ASCII encoded signature which the IDA will use for validation.</td>
<td>String</td>
</tr>
</tbody>
</table>
Media type:
application/json, text/json

Sample:

```
{
    "PseudonymousKeys": [
        "00000000-0000-0000-0000-000000000000",
        "00000000-0000-0000-0000-000000000001",
        "00000000-0000-0000-0000-000000000002"],
    "TimeStamp": "2011-02-14T00:00:00",
    "Signature": "SGFDXCTIVVIFUUVYBKYKJHBK=="
}
```

Status:

- 200: The operation was successful
- 400: The operation failed due to the request body being malformed or the size being out of range [1..1000]
- 401/403: The operation failed due to authentication or authorization failure. The caller should confirm its credentials and retry.
- 500: Internal error, the caller should retry

The IDA SHALL be capable of generating a batch of up to 1000 PseudonymousKeys.

### 4.6 Validation endpoint

The IDA SHALL provide a Validation end-point which provides the means to validate a signed PseudonymousKey or a signed batch of PseudonymousKeys for users whose API Credentials have the Validator role.

<table>
<thead>
<tr>
<th>API</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST /Validation</td>
<td>Validates a single signed Pseudonymous Key or a signed batch of Pseudonymous Keys to ensure that they were generated by IDA. The mechanism used for signing is periodically changed. If validation fails, the caller MUST request that the Operator requests a new Pseudonymous Key.</td>
</tr>
</tbody>
</table>

#### 4.6.1 Request

The request body format SHALL conform to the specification of EITHER the /PseudonymousKey response packet OR the /PseudonymousKeyBatch response packet.

**Media type:**
application/json, text/json

**Sample 1 (Single input):**

```
{
    "PseudonymousKey": "00000000-0000-0000-0000-000000000000",
    "TimeStamp": "2011-02-14T00:00:00",
```
"Signature": "SGFDXCTVIVVIFUJUVUYBKJHJBK=="
}

Sample 2 (Batch input):
{
  "PseudonymousKeys": [
    "00000000-0000-0000-0000-000000000000",
    "00000000-0000-0000-0000-000000000001",
    "00000000-0000-0000-0000-000000000002"
  ]
  "TimeStamp": "2011-02-14T00:00:00",
  "Signature": "SGFDXCTVIVVIFUJUVUYBKJHJBK=="
}

4.6.2 Response

If successful, an HTTP status code of 200 OK MUST be returned. If unsuccessful, an HTTP error code SHOULD be returned and a JSON object MAY be returned providing some explanation of the failure.

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason</td>
<td>An optional description of why the operation failed.</td>
<td>String:</td>
</tr>
</tbody>
</table>

Media type:
application/json, text/json

Sample:
{"Reason": "The input was missing mandatory elements"}

Status:
200: The operation was successful. The Pseudonymous Key or batch of Pseudonymous Keys is valid.
410: The operation was successful (the request was properly formed and authorized) but the Pseudonymous Key or batch of Pseudonymous Keys is no longer valid.
400: The operation failed due to the request body being malformed.
401/403: The operation failed due to authentication or authorization failure. The caller should confirm its credentials and retry.
500: Internal error, the caller should retry
5 Conformance

An implementation is a conforming Identity Authority Interface if the implementation meets the conditions in Section 4 of this document AND the conformance criteria in [COEL_RPE-1.0]
Appendix A. Acknowledgments

The following individuals have participated in the creation of this specification and are gratefully acknowledged:

Participants:
  Paul Bruton, Individual Member
  Joss Langford, Activinsights
  Matthew Reed, Coelition
  David Snelling, Fujitsu
## Appendix B. Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Editor</th>
<th>Changes Made</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27/07/2015</td>
<td>Paul Bruton</td>
<td>Initial version for OASIS submission</td>
</tr>
<tr>
<td>2</td>
<td>15/09/2015</td>
<td>Paul Bruton</td>
<td>Header page, references, acknowledgements, conformance sections finalized. Body text still needs a review so that it clearly uses normative language in section 4, with sections 2 and 3 being descriptive text only.</td>
</tr>
<tr>
<td>3</td>
<td>21/09/2015</td>
<td>Paul Bruton</td>
<td>Clarification of terms by replacing ‘access credentials’ with ‘API Credentials’ to signify that the userid/password combination is used only for API access.</td>
</tr>
<tr>
<td>4</td>
<td>22/09/2015</td>
<td>Paul Bruton</td>
<td>Action #0016: Removed ‘api/’ prefix from methods in API.</td>
</tr>
<tr>
<td>5</td>
<td>23/09/2015</td>
<td>Paul Bruton</td>
<td>Added normative references for UUID and TimeStamp formats. Corrected sequence diagrams following removal of api/. Section 4 altered to use appropriate normative terms. Added definitions of request and response (action #0014). Added references to related works</td>
</tr>
<tr>
<td>6</td>
<td>25/09/2015</td>
<td>Joss Langford</td>
<td>Review with minor changes to clarify meanings and correct spelling.</td>
</tr>
<tr>
<td>7</td>
<td>05/10/2015</td>
<td>Paul Bruton</td>
<td>Previous changes accepted. Added reference to conformance criteria in RPE and clarified the name of the conformance target: Identity Authority Interface, referred to as the API.</td>
</tr>
<tr>
<td>8</td>
<td>19/10/2015</td>
<td>David Snelling</td>
<td>A few tweaks and fixed the COEL link.</td>
</tr>
<tr>
<td>9</td>
<td>20/10/2015</td>
<td>Paul Bruton</td>
<td>Accepted changes. Resolved COEL-39 (data engine must validate) and COEL-40 (removed unnecessary text about combining data engine data)</td>
</tr>
<tr>
<td>10</td>
<td>21/10/2015</td>
<td>Paul Bruton</td>
<td>Minor changes for consistent style</td>
</tr>
<tr>
<td>11</td>
<td>31/10/2015</td>
<td>Joss Langford</td>
<td>Accept all changes, track changes off, check references and style consistency.</td>
</tr>
<tr>
<td>12</td>
<td>02/11/2015</td>
<td>David Snelling</td>
<td>Final data change.</td>
</tr>
<tr>
<td>13</td>
<td>03/11/2015</td>
<td>Paul Bruton</td>
<td>Spelling correction following review.</td>
</tr>
<tr>
<td>14</td>
<td>25/11/2015</td>
<td>David Snelling</td>
<td>Set date for final CD publication.</td>
</tr>
<tr>
<td>15</td>
<td>07/01/2016</td>
<td>Paul Bruton</td>
<td>COEL-42 clarification of response codes and updated to WD02</td>
</tr>
<tr>
<td></td>
<td>Date</td>
<td>Author</td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>------------</td>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>16</td>
<td>20/01/2016</td>
<td>Paul Bruton</td>
<td>COEL-42 implementation of 410 status code in event of validation failure. Also fixed broken hyperlinks and removed hidden hyperlinks.</td>
</tr>
<tr>
<td>17</td>
<td>10/08/2016</td>
<td>David Snelling</td>
<td>Added status field to IDA information request, COEL-68.</td>
</tr>
<tr>
<td>18</td>
<td>14/08/2016</td>
<td>Joss Langford</td>
<td>Checked and changes accepted.</td>
</tr>
<tr>
<td>19</td>
<td>23/09/2016</td>
<td>Paul Bruton</td>
<td>Corrected role of Hardware Developer (COEL-83)</td>
</tr>
<tr>
<td>20</td>
<td>27/09/2016</td>
<td>David Snelling</td>
<td>Final review: Rebuild the ToC, corrected spelling of artefact, labelled, added Service Providers to list of IDA users in section 2 &amp; 4.1, and accepted all changes.</td>
</tr>
</tbody>
</table>