Roles, Principles, and Ecosystem
Version 1.0
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- Public Query Interface Version 1.0. Edited by David Snelling. Latest version:
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Abstract:
This document defines and describes roles of the various actors and principles of a COEL ecosystem, within the framework of the COEL Model.

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1 Introduction

This document describes in detail the comprehensive set of ACTORS that take part in a COEL compliant ecosystem. For each of the ACTORS a description of their possible activities is given, all referenced to a set of seven normative principles. A number of specific, but jurisdiction agnostic, definitions are given to support the role descriptions and principles.

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_COEL-1.0] Classification of Everyday Living Version 1.0. Latest version: http://docs.oasis-open.org/coel/COEL/v1.0/COEL-v1.0.docx

1.3 Non-Normative References

2 Roles

2.1 Summary of Roles

The **Identity Authority** (IDA) oversees the effective, open running of the eco-system and administers the operation of the IDA service. The IDA service issues and checks unique Pseudonymous Keys that provide security and ensure the interoperability and universality of the ecosystem.

**Data Engines** receive, store and process Behavioural Atoms. Data Engines provide business-to-business services to Service Providers and other organisations in the form of queries that create Report Data.

**Service Providers** are the primary link between a Consumer and a Data Engine. They are able to query the atoms held by a Data Engine to develop personalised services for Consumers based on their everyday behaviours. Service Providers will often be consumer facing brands.

An **Associated Service Provider** is a Service Provider that gains access to data collected by another service provider to provide a service to a Consumer. To do so, the Consumer MUST give consent to the Associated Service Provider to access the data collected by the original Service Provider. An Associated Service Provider has no right to grant a third-party any access to the data held by the original Service Provider. All of the technical requirements on a Service Provider that are defined in section 2.4 of this specification apply equally to an Associated Service Provider.

**Operators** administer contact with the Consumer and hold the directly-identifying personal information (DIPI) needed to engage with the Consumer. An Operator might be an independent app, exist within a Service Provider or be an independent organisation. Operators only receive information from their Consumers and their Service Provider.

The **Consumer** is the generic reference to any individual registered with the eco-system. They might be patients in a healthcare setting, subjects in a trial as well as consumers of a commercial digital service. A Consumer’s primary relationship might be with a Service Provider via a near-invisible Operator or with clearly recognisable Operator that is supported by a Service Provider in the background.

**Hardware Developers** are developers of hardware (such as Internet of Things devices) which are compliant with COEL protocols for use by Service Providers and Operators.
### 2.2 Identity Authority

<table>
<thead>
<tr>
<th>Technical requirement</th>
<th>Guiding principles &amp; notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHALL</strong></td>
<td>Maintain an always-on IDA service that will generate or validate unique Pseudonymous Keys for Data Engine, Service Provider &amp; Operator</td>
</tr>
<tr>
<td></td>
<td>Be a non-profit legal entity</td>
</tr>
<tr>
<td></td>
<td>Provide its services on a fair, reasonable and non-discriminatory basis</td>
</tr>
<tr>
<td></td>
<td>Provide Consumers with information about the operation of the eco-system free of charge</td>
</tr>
<tr>
<td><strong>SHALL NOT</strong></td>
<td>Act as a Data Engine or Service Provider (other than for the purposes of providing a limited 'sandbox' test environment)</td>
</tr>
<tr>
<td></td>
<td>Store Behavioural Atoms</td>
</tr>
<tr>
<td></td>
<td>Hold any Consumer’s directly identifying personal information (DIPI)</td>
</tr>
<tr>
<td><strong>MAY</strong></td>
<td>Request Data Engine support to deliver population-level insights for public information and the purposes of marketing the specification</td>
</tr>
<tr>
<td></td>
<td>Make a query on Data Engines to ensure a specific ConsumerID has been forgotten</td>
</tr>
<tr>
<td></td>
<td>Provide Consumers with information about their status within the eco-system, i.e. ‘known’ or ‘forgotten’ and only by ConsumerID and not DIPI.</td>
</tr>
<tr>
<td></td>
<td>Provide audit services to Data Engine, Service Provider, Operator and regulators</td>
</tr>
</tbody>
</table>
## 2.3 Data Engine

<table>
<thead>
<tr>
<th>Technical requirement</th>
<th>Guiding principles &amp; notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHALL</strong></td>
<td>Provide secure storage of Behavioural Atoms for a period to be agreed with the Service Provider in line with the Consumer consent</td>
</tr>
<tr>
<td></td>
<td>Provide minimal interface services for Service Providers to process joiners, movers, and leavers (e.g. Operator &amp; Consumer trees, registration, ID re-allocation, forgetting)</td>
</tr>
<tr>
<td></td>
<td>Provide minimal interface services for querying Behavioural Atoms by registered Service Providers</td>
</tr>
<tr>
<td></td>
<td>Maintain an always-on, single entry point for uploading Behavioural Atoms to the Data Engine</td>
</tr>
<tr>
<td></td>
<td>Receive Behavioural Atoms from Consumers or Devices registered with their Operators that conform to the specification free of charge</td>
</tr>
<tr>
<td></td>
<td>Provide information to the Service Provider about the location and security of the infrastructure used in the delivery of services</td>
</tr>
<tr>
<td><strong>SHALL NOT</strong></td>
<td>Link Behavioural Atom data to directly-identifying personal information (DIPI) from external sources</td>
</tr>
<tr>
<td></td>
<td>Link Behavioural Atom data directly to external data storage if such link might directly identify Consumers</td>
</tr>
<tr>
<td></td>
<td>Hold any Consumer’s directly identifying personal information (DIPI)</td>
</tr>
<tr>
<td></td>
<td>Act as a Service Provider or Operator itself</td>
</tr>
<tr>
<td></td>
<td>Request more than the Segment Data as defined in the specification (gender, year of birth, time zone &amp; latitude to 0 decimal points) on registration of a Consumer</td>
</tr>
<tr>
<td></td>
<td>Knowingly receive DIPI</td>
</tr>
<tr>
<td></td>
<td>Levy unreasonably punitive charges for the complete download of stored Behavioural Atoms</td>
</tr>
<tr>
<td></td>
<td>Utilise IDA unique Pseudonymous Keys outside of the ecosystem</td>
</tr>
<tr>
<td><strong>MAY</strong></td>
<td>Add non-personal data to the atom store to deliver enhanced services (e.g. local weather data)</td>
</tr>
<tr>
<td></td>
<td>While Behavioural Atoms cannot be linked out, additional information can</td>
</tr>
<tr>
<td>Use suitable aggregation techniques rendering the data non-personal to provide indirect services to parties other than contracted Service Providers</td>
<td>P1 &amp; P6</td>
</tr>
<tr>
<td>Host multiple Service Providers</td>
<td></td>
</tr>
</tbody>
</table>
## 2.4 Service Provider

<table>
<thead>
<tr>
<th>Technical requirement</th>
<th>Guiding principles &amp; notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHALL</strong></td>
<td></td>
</tr>
<tr>
<td>Ensure that their Operators have the minimum standard consent from Consumers</td>
<td>P3</td>
</tr>
<tr>
<td>Secure additional consent from Consumers when sending personal information outside the eco-system</td>
<td>P3 &amp; P6</td>
</tr>
</tbody>
</table>
| When sending Behavioural Atom information outside the eco-system, remove the ConsumerID and replace with DIPI | P6  
  This ensures that information that has left the eco-system can be clearly identified. |
| Ensure that their Operators follow the specification                                   | P6                                                                                       |
| For any one purpose and at any one time, have only one Data Engine                    | Avoids potential data loss for the consumer and ensures the complete audit map of the eco-system. |
| On a request from a Consumer, supply (or require associated Operator to do so) all DIPI, Segment Data, Behavioural Atoms and any stored Report Data | P2  
  Basic tenet of EU data protection.                                                                 |
<p>| On a request from a Consumer to be forgotten, remove or render DIPI to be non-personal | Basic tenet of EU data protection.                                                        |
| On a request from a Consumer to be forgotten, instruct their Data Engine to remove or render data to be non-personal | P2 &amp; P3                                                                                  |
| On a request from an Operator or Consumer, provide the identity of the Data Engine    | P7                                                                                       |
| Notify Consumers (via Operators) of any mergers and acquisitions or other changes that would result in a change of control over the Consumers’ data | P7                                                                                       |
| Check the credentials of an Operator every time a request is made to release data for a ConsumerID | Security.                                                                              |
| Ensure that all Operators within a specific embodiment are working under equivalent terms (e.g. consent, purpose, retention periods etc.). | P7                                                                                       |
| Use different passwords to interact with different actors in the ecosystem (within the same service embodiment). | Security.                                                                              |</p>
<table>
<thead>
<tr>
<th>SHALL NOT</th>
<th>Receive Behavioural Atoms directly</th>
<th>P1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Send DIPI to a Data Engine</td>
<td>P1</td>
</tr>
<tr>
<td></td>
<td>Share DIPI with another Service Provider without additional consent from the Consumer</td>
<td>P3</td>
</tr>
<tr>
<td>MAY</td>
<td>Transfer its operations between Data Engines</td>
<td>Supports open, competitive ecosystem.</td>
</tr>
<tr>
<td></td>
<td>Host multiple Operators</td>
<td></td>
</tr>
</tbody>
</table>
## 2.5 Operator

<table>
<thead>
<tr>
<th>Technical requirement</th>
<th>Guiding principles &amp; notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHALL</strong> Provide a mechanism for the consumer to access their ConsumerID</td>
<td>P7 This allows the Identity Authority to audit the ‘forgetting’ process.</td>
</tr>
<tr>
<td>Ensure that the minimum standard consent is given by Consumers - freely, specific &amp; informed</td>
<td>P3</td>
</tr>
<tr>
<td>For any one purpose and at any one time, have only one Service Provider</td>
<td>Avoids potential data loss for the consumer and ensure the complete audit map of the eco-system.</td>
</tr>
<tr>
<td>Clearly identify the Service Provider to the Consumer</td>
<td>P7</td>
</tr>
<tr>
<td>Notify Consumers of any mergers and acquisitions or other changes that would result in a change of control over the Consumers’ data</td>
<td>P7</td>
</tr>
<tr>
<td>Hold ConsumerID Pseudonymous Keys with the same security level as DIPI</td>
<td>Security</td>
</tr>
<tr>
<td>Use different passwords to interact with different actors in the ecosystem (within the same service embodiment).</td>
<td>Security</td>
</tr>
<tr>
<td>Use a different OperatorID for every instance of a service embodiment in which they are an actor</td>
<td>Security</td>
</tr>
<tr>
<td><strong>SHALL NOT</strong> Store Behavioural Atoms other than for the purposes of transmission to the Data Engine.</td>
<td>P1</td>
</tr>
<tr>
<td>Send DIPI to a Data Engine</td>
<td>P1</td>
</tr>
<tr>
<td>Share DIPI with another Operator or Service Provider without additional consent from the Consumer</td>
<td>P3</td>
</tr>
<tr>
<td>Utilise IDA unique Pseudonymous Keys outside of the ecosystem</td>
<td>P1</td>
</tr>
<tr>
<td><strong>MAY</strong> Host multiple Consumers</td>
<td></td>
</tr>
</tbody>
</table>
## 2.6 Consumer

<table>
<thead>
<tr>
<th>Technical requirement</th>
<th>Guiding principles &amp; notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAY Request to be ‘forgotten’ in the eco-system</td>
<td>Basic tenet of EU data protection.</td>
</tr>
<tr>
<td>Request the Identity Authority to audit their status in the eco-system</td>
<td>P5 &amp; P7</td>
</tr>
<tr>
<td>Request the Service Provider to supply their DIPI, demographic information</td>
<td>Basic tenet of EU data protection.</td>
</tr>
<tr>
<td>and all Behavioural Atoms</td>
<td></td>
</tr>
</tbody>
</table>
3 Normative principles of the Operation of COEL ecosystem

3.1 Data Separation Principle (P1)

The specification implements a separation of data types: Data Engines keep data on *what* Consumers do (Behavioural Atoms) and the Service Provider/Operator keeps data on *who* Consumers are (DIPI). No single organisation holds both sets of data together. This means that it would need a double accidental or malicious disclosure for connected information to be released.

3.2 Data Atomisation Principle (P2)

Data is deliberately broken down into small chunks of information by the Operator and coded with the Consumer's ConsumerID (which implies their atomised consent), thus each separate Behavioural Atom has a very low privacy risk. Neither the Operator/Service Provider sees these atoms as raw atoms and can only see composite data from Data Engine under the terms of the specification.

3.3 Atomised Consent Principle (P3)

Consumer gives informed consent to the Operator under guideline terms set by the specification. Consent allows the Operator to sign up the consumer with a ConsumerID. This ConsumerID is the indicator to Identity Authority and other eco-system actors that the consumer has given appropriate consent. Because each and every Behavioural Atom has the ConsumerID, each atom has that consumer's consent written into the structure of the data. Removing the ConsumerID from a Behavioural Atom is removing the consent of that individual so the data can no longer be used by either the Operator or Service Provider who signed them up. The time stamp uniquely associated with each Behavioural Atom allows full auditing of this principle.

3.4 Separation of Competence Principle (P4)

Data Engines are expert data handlers. They know how to run robust, secure and always on cloud based data services; they handle Behavioural Atoms NOT Consumers. Service Providers / Operators are experts at Consumer facing / relevant services and handling DIPI; they handle Consumers NOT Behavioural Atoms. The Identity Authority is expert at overseeing the ecosystem.

3.5 No Conflict of Interest Principle (P5)

Consumers need to see that there are no conflicts around their data. To ensure this, the Identity Authority acts on behalf of the Consumer in partnership with Operator/Service Provider, Data Engine and regulators.

3.6 Active Support Principle (P6)

All actors will actively promote the principles of the specification, safeguard the structure of the eco-system and support good data practice for both consumers and enterprise.

3.7 Transparency Principle (P7)

The roles and identities of all the actors in the eco-system who are working together on behalf of a Consumer will be clear and visible to that Consumer.
4 Ecosystem

4.1 General diagram of key relationships between actors
4.2 Data Flows

The IDA issues a unique Pseudonymous Key to the Operator when the Consumer joins the ecosystem. Once this has been registered with the Data Engine it becomes the ConsumerID and replaces the DIPI in all transactions other than those between the Operator and Consumer.

In normal operation the Behavioural Data will stay with the Data Engine unless the Service Provider needs to provide non-standard services or the Consumer makes a specific data request.

The illustration shows the Segment Data delivered through the Service Provider, this is accurate when the data is recalled but the Operator sends this directly to the Data Engine when the Consumer is first registered.
4.3 Security Considerations

4.3.1 General technical principles:

4.3.1.1 Internet

SSL/TLS [RFC5246] SHALL be used for all internet communications within the ecosystem. This creates an encrypted channel for the data (Behavioural Atoms, Report data and Pseudonymous Keys – no DIPI) and prevents a third party from reading it in transit. It means that servers like the IDA, Data Engine and any Service Provider/ or Operator systems MUST have SSL/TLS certificates.

4.3.1.2 Authentication

Single factor authentication (userid and password) SHALL be used for all Data Engine and IDA calls with the exception of: [a] submitting atoms which can be done anonymously [b] an Operator registering consumers with the DE.

4.3.1.3 Pseudonymous Keys

IDA generated Pseudonymous Keys SHALL be used as the userids for actors in the ecosystem. These are devoid of DIPI and unique across the ecosystem.

4.3.1.4 Userids and passwords

Different userids and different passwords MAY be used for each embodiment (e.g. for Operator with IDA, Operator with Data Engine, Service Provider with different Data Engines). These SHALL be stored in an encrypted format.
4.3.2 Ecosystem security diagram and analysis

With reference to above diagram, the following is a summary of the specific requirements for the use or otherwise of secure communication:

1. Operator / IDA: The IDA SHALL require single factor authentication with userid and password for an Operator to access the IDA API.

2. Service Provider / IDA: The Service Provider does not have a role in the IDA API. The IDA MAY provide a mechanism to allow a Service Provider to register new Operators and this mechanism MUST be protected through single factor authentication, at least, with userid and password. The IDA SHALL NOT keep any DIPI for Operators.

3. Operator / Data Engine: The Data Engine SHALL NOT require a password from an Operator when registering a new Consumer or when registering a new Device for a Consumer. The Data Engine SHALL require a password from an Operator when removing a Device from a Consumer.

4. Service Provider / Data Engine:
   a. The Data Engine SHALL require single factor authentication with userid and password for a Service Provider to access the Management Interface (MI) and Query Interface (QI)
   b. Separate credentials SHOULD be used to access the Management Interface (MI) and Query Interface (QI), reducing the likelihood of getting access to both and retrieving Atoms for all of the Service Provider’s Consumers.
c. The data engine MUST use a secondary method to assert the identity of the Service Provider prior to processing a 'forget' request for a Consumer since these requests are not reversible.

5. Operator / Service Provider: Where the Operator is a separate entity, it will request reports on Consumers from the Service Provider, but these reports are pseudonymised and contain no DIPI. Where the Operator is a separate entity their communication MUST use single factor authentication with userid and password.

6. Data Engine / IDA: The IDA SHALL require single factor authentication with userid and password for a Data Engine to access the IDA API.
5 Glossary and Nomenclature

For the purposes of this specification and the COEL ecosystem the following are defined.

5.1 Behavioural Atom

The fundamental data type defined and used extensively throughout the COEL ecosystem is Behavioural Atom (Atom). An Atom is a digital representation of an observable event in an individual’s life. It is a small block of self-describing, micro-structured data. Any type of life event can be coded into a Behavioural Atom using the Classification of Everyday Living, a hierarchical taxonomy of decreasing granularity. The individual’s identity is pseudonymised with the directly identifying personal information (DIPI) segregated from the Behavioural Atoms in both storage and transmission. The Behavioural Atoms also code the time and duration of events, how they were observed and where they occurred. The Atom types are described by the Classification of Everyday Living Version 1.0, one of this collection’s specifications.

5.2 Ecosystem

The Ecosystem is defined as ‘the extended set of corporate and individual actors who interact for their mutual benefit via the medium of the specification and under appropriate voluntarily entered into legal agreements’.

5.3 Pseudonymous Key

The unique Pseudonymous Keys are generated by the IDA for use with the ecosystem to provide unique codes for the data and transaction of Consumers, Devices, Operators and Service Providers.

5.4 Directly Identifying Personal Information (DIPI)

Static or slow-changing data needed to provide services to a Consumer including, for example: name, date of birth, contact information, medical/insurance numbers, payment details, etc. DIPI specifically excludes all event-based information (Behavioural Data / Atoms). DIPI is information that would be generally known as PII in a USA context.

5.5 Segment Data

Year of birth, gender, home time zone (GMT+/x) and home latitude to single degree resolution.

5.6 Behavioural Data

Data that is coded according to the COEL TC protocols with, as a minimum, a Classification of Everyday Living code, a unique ConsumerID and a timestamp. A single instance is known as a Behavioural Atom or Atom.

5.7 Report Data

Data developed from the analysis of Behavioural Data (Atoms) for the purposes of developing insight and information for the provision of value-add services.
5.8 Aggregated and anonymised summary data
Data developed from the analysis of Behavioural Data (Atoms) for the purposes of comparison with Report Data and to deliver business to business services outside a COEL ecosystem.

5.9 ConsumerID
An IDA unique Pseudonymous Key for a particular Consumer.

5.10 ServiceProviderID
An IDA unique Pseudonymous Key for a particular Service Provider.

5.11 OperatorID
An IDA unique Pseudonymous Key for a particular Operator.

5.12 DeviceID
An IDA unique Pseudonymous Key for a particular consumer device.
6 Conformance

An **Identity Authority** (IDA) conforms if it meets the technical requirements set out in Section 2.2 and the security requirements of Section 4.3.

A **Data Engine** conforms if it meets the technical requirements set out in Section 2.3 and the security requirements of Section 4.3.

A **Service Provider** conforms if it meets the technical requirements set out in Section 2.4 and the security requirements of Section 4.3.

An **Operator** conforms if it meets the technical requirements set out in Section 2.5 and the security requirements of Section 4.3.

A **Consumer** of a COEL compliant service conforms if they meet the conditions set out in Section 2.6.
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>
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<tbody>
<tr>
<td>1</td>
<td>22/9/2015</td>
<td>Matthew Reed</td>
<td>First full version</td>
</tr>
<tr>
<td>2</td>
<td>26/9/2015</td>
<td>Joss Langford</td>
<td>Updated with all latest definitions.</td>
</tr>
<tr>
<td>3</td>
<td>05/10/2015</td>
<td>Paul Bruton</td>
<td>Minor corrections and review comments.</td>
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<tr>
<td>4</td>
<td>13/10/2015</td>
<td>Matthew Reed</td>
<td>Added definition of Associated Service Provider in Section 2.1.</td>
</tr>
<tr>
<td>5</td>
<td>19/10/2015</td>
<td>David Snelling</td>
<td>Major review from DE perspective.</td>
</tr>
<tr>
<td>6</td>
<td>20/10/2015</td>
<td>Joss Langford</td>
<td>COEL – 24, 35, 36, 37, 38 all fixed. Some defined terms updated.</td>
</tr>
<tr>
<td>7</td>
<td>23/10/2015</td>
<td>Paul Bruton</td>
<td>Minor style updates, placeholder for definition of Hardware Developer, Rephrased security requirements.</td>
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<tr>
<td>8</td>
<td>27/10/2015</td>
<td>Joss Langford</td>
<td>Hardware Developer defined, changes agreed and conformance modified to include all security requirements.</td>
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<tr>
<td>9</td>
<td>31/10/2015</td>
<td>Joss Langford</td>
<td>Accept all changes, track changes off, check references and style consistency.</td>
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<tr>
<td>10</td>
<td>02/11/2015</td>
<td>David Snelling</td>
<td>Final date change</td>
</tr>
<tr>
<td>11</td>
<td>25/11/2015</td>
<td>Joss Langford</td>
<td>Fix issue COEL-46, first 'SHALL' in 4.3.1.4 changed to 'MAY'.</td>
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<tr>
<td>12</td>
<td>25/11/2015</td>
<td>David Snelling</td>
<td>Set date for CD publication.</td>
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