***Disclaimer***

The present document has been produced and approved by the Permissioned Distributed Ledger (PDL) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG.  
It does not necessarily represent the views of the entire ETSI membership.

ETSI DGS ISG-PDL 029 V0.0.2 (2024-04)

**Group Specification**

Digital Autonomous Organization (DAO);

Permissioned Distributed Ledger;

Group Specification PDL029

Release 1

<

Reference

GS/PDL-0029\_Digital\_Autonomous\_Organization

Keywords

Data Interoperability, Data Models, PDL

***ETSI***

650 Route des Lucioles

F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B

Association à but non lucratif enregistrée à la

Sous-préfecture de Grasse (06) N° w061004871

***Important notice***

The present document can be downloaded from:  
<https://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at [www.etsi.org/deliver](http://www.etsi.org/deliver).

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at <https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:  
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our

Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

***Notice of disclaimer & limitation of liability***

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or

other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

***Copyright Notification***

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.  
The content of the PDF version shall not be modified without the written authorization of ETSI.  
The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024.

All rights reserved.

Contents

Intellectual Property Rights 5

Foreword 5

Modal verbs terminology 5

Executive summary 5

Introduction 5

1 Scope 6

2 References 6

2.1 Normative references 6

2.2 Informative references 6

3 Definition of terms, symbols and abbreviations 6

3.1 Terms 6

3.2 Symbols 6

3.3 Abbreviations 6

4 Definition of a DAO 7

4.1 Foreword 7

4.2 Current definition 7

4.3 Current Implementations 7

4.4 Differences between a DAO and traditional organizations 8

5 Minimum requirements to operate a DAO 9

5.1 Foreword 9

5.2 Minimum Requirements 9

5.2.1 Code Base 9

5.2.1.1 Open Source 9

5.2.1.2 Proprietary code 9

5.2.2 Chain type 9

5.2.3 Validating nodes 9

5.2.4 Neutral nodes 9

6 Operating a DAO 10

6.1 Foreword 10

6.2 Single Chain environment 10

6.2.1 Single Chain considerations 10

6.2.1.1 Codebase 10

6.2.1.2 Nodes 10

6.2.1.3 Governance 10

6.3 Hybrid environment 10

6.3.1 Types of Hybrid environments 10

6.3.1.1 Multi Chain 10

6.3.1.2 Multi Vendor/Code base 10

6.3.2 Multi-chain 10

6.3.2.1 Interoperability 10

6.3.2.1.1 Data Interoperability 10

6.3.2.2.1 Consensus interoperability 10

6.3.2.3.1 Smart-Contract interoperability 10

6.3.3 Multi Vendor/Codebase 10

6.3.3.1 Data Model alignment 10

6.3.3.2 Architectural alignment 10

6.3.3.2.1 Interface Reference Points 10

6.3.3.2.2 Functional blocks 10

6.3.3.3 Process alignment 10

6.4 Tokens 10

7 Governance 11

7.1 Definition of governance 11

7.1.1 Functionality 11

7.1.2 Architectural elements 11

7.1.2.1 Implementation agreements 11

7.1.2.2 Governing Entity 11

7.2 Governance in a Single chain environment 11

7.3 Governance in a Hybrid environment 11

7.4 Governance through consensus 11

7.4.1 on-chain consensus 11

7.4.2 off-chain consensus 11

7.4.3 multi-chain consensus 11

7.4.3.1 Voting and majority in a multi chain environment 11

7.5 Governance without consensus 11

7.5.1 Delegated governance 11

7.5.1.1 Human delegates 11

7.5.1.2 Machines as delegates 11

7.6 Automated governance 11

7.6.1 Minimum requirements 11

7.6.1.1 Unified data models 11

7.6.1.2 Unified processes 11

7.6.1.3 Unified IRPs 11

7.6.2 Code-base alignment 11

7.7 Hybrid governance 11

7.7.1 Evolution of hybrid governance 11

7.7.2 Initiation 11

7.7.3 Scale 11

7.7.4 Self sustained 11

7.7.5 Change management 12

7.8 Tokens in a Hybrid environment 12

Annex A (normative or informative): Title of annex 13

Annex B (normative or informative): Title of annex 14

B.1 First clause of the annex 14

B.1.1 First subdivided clause of the annex 14

Annex (informative): Bibliography 15

Annex (informative): Change history 16

History 17

# Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server ([https://ipr.etsi.org](https://ipr.etsi.org/)).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™**and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

# Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group Permissioned Distributed Ledger (ISG-PDL).

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Executive summary

# Introduction

# 1 Scope

The present document …

# 2 References

## 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non‑specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at [https://docbox.etsi.org/Reference](https://docbox.etsi.org/Reference/).

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] <Standard Organization acronym> <document number>: "<Title>".

[2] <Standard Organization acronym> <document number>: "<Title>".

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non‑specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] <Standard Organization acronym> <document number><version number/date of publication>: "<Title>".

[i.2] etc.

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the [following] terms [given in ... and the following] apply:

## 3.2 Symbols

For the purposes of the present document, the [following] symbols [given in ... and the following] apply:

## 3.3 Abbreviations

For the purposes of the present document, the [following] abbreviations [given in ... and the following] apply:

# 4 Definition of a DAO

## 4.1 Foreword

The acronym DAO stands for Decentralized Autonomous Organization:

**Decentralized** – in a manner that it is managed through decentralized governance using tools that allow it to function without a centralized authority. Blockchain, DLT and PDL (which by themselves are common derivatives of blockchain) are often used as the tool enabling such decentralized governance.

**Autonomous** – in a manner that a DAO operates by itself and independent of involvement of external entities or powers. That does not mean that a DAO is disconnected from its surroundings and does not require certain resources from external sources (e.g., power supply, communication facilities) but it is able to perform its tasks in an autonomous manner without being influenced by external events or forces.

**Organization** – in a manner that corroborates to achieve goals defined by a multitude of entities (individuals, groups, companies or institutional bodies).

There are additional aspects to a DAO:

1. It is **collectively owned** by multiple entities. Some DAOs are owned by an equal split of ownership. Others allow differential split based on criteria such as amount of investment, amount of use, amount of assets/tokens etc.
2. It operates towards a **shared mission** defined collectively by the shared owners.

Operation using Blockchain allows:

1. **Automated functionality** using smart contracts.
2. Data is **immutable** (or resistant to change) and **non-repudiable**.
3. **Trust** between otherwise non-trusting entities.

It is often claimed that Bitcoin [i.x] was the first DAO, because it arguably meets the above criteria. While this may indeed be the case, there are additional uses for a DAO other than cryptocurrency and the current view of a DAO has taken a slightly different shape as described in section 4.2 herewith.

## 4.2 Current definition

The abstract definition of a DAO is a system that enables distributed decision making, management and ownership of assets.

The current implementations of DAOs are based on an operational model that requires:

A single ledger technology. Any type of ledger can be used (distributed or not) as long as it supports smart contracts (code executed automatically when certain conditions are met).

Non-proprietary codebase. The code may be open sourced (open and available to the public through a git) or partially open (open and available only to members in a consortium operating the DAO). One way or the other – there should not be elements of the codebase that are proprietary (meaning: can be executed by everyone but visible only to certain entities).

## 4.3 Current Implementations

DAOs are currently used for a multitude of purposes such as. While it is beyond the scope of the current document to discuss each implementation, the following list provides a glimpse to the variety of use-cases where a DAO can be used to offer a democratised solution to a service that would otherwise be operated centrally.

* Legal services (LexDAO)
* Venture capital (“The DAO”, BitDAO)
* Crowdfunding (UkraineDAO, ConstitutionDAO, MakerDAO)
* Shared interests and collaboration (Decentraland, “Friends with Benefits”, Aragon, PleasrDAO)
* CryptoCurrency trade (Uniswap, “Curve DAO”, DASH)
* Investment (Aave, Compound, HeadDAO, GnosisDAO)
* Governance (Aragon)
* Entertainment and Media (Flufworld)
* Social Networking (Blockster)
* DAO as a service (DAOstack, Aragon)

## 4.4 Differences between a DAO and traditional organizations

While traditional organizations operate in more than one manner table [x] herewith describes the main differences between a DAO and a traditional organization:

Table 1

|  |  |  |
| --- | --- | --- |
| Title | DAO | Traditional Organization |
| Hierarchy and structure | Flat, controlled through democratic vote of all participants | Centralized hierarchy controlled by a select entities. |
| Speed of decision | Fast. Flat hierarchy: everyone can decide (by vote) in parallel | Slow, Sequential approvals following hierarchy. |
| Voting | Any change has to be agreed through a democratic vote | A single or a subset of all entities may make decisions and changes without need for consent by entities affected by such change |
| Governance | The entire community governs the behaviour of the DAO | Select entities govern the behaviour of the organization |
| Transparency | All actions and decisions are transparent and visible to all participants (in public DAOs: visible to everyone). | Restricted visibility and transparency. Decisions may be kept confidential. |
| Operation and handling of events | Automated using smart contracts | Often requires manual processes |

# 5 Minimum requirements to operate a DAO

## 5.1 Foreword

This section will…

## 5.2 Minimum Requirements

### 5.2.1 Code Base

#### 5.2.1.1 Open Source

#### 5.2.1.2 Proprietary code

### 5.2.2 Chain type

### 5.2.3 Validating nodes

### 5.2.4 Neutral nodes

# 6 Operating a DAO

## 6.1 Foreword

## 6.2 Single Chain environment

### 6.2.1 Single Chain considerations

#### 6.2.1.1 Codebase

#### 6.2.1.2 Nodes

#### 6.2.1.3 Governance

## 6.3 Hybrid environment

### 6.3.1 Types of Hybrid environments

#### 6.3.1.1 Multi Chain

#### 6.3.1.2 Multi Vendor/Code base

### 6.3.2 Multi-chain

#### 6.3.2.1 Interoperability

##### 6.3.2.1.1 Data Interoperability

##### 6.3.2.2.1 Consensus interoperability

##### 6.3.2.3.1 Smart-Contract interoperability

### 6.3.3 Multi Vendor/Codebase

#### 6.3.3.1 Data Model alignment

#### 6.3.3.2 Architectural alignment

##### 6.3.3.2.1 Interface Reference Points

##### 6.3.3.2.2 Functional blocks

#### 6.3.3.3 Process alignment

## 6.4 Tokens

# 7 Governance

## 7.1 Definition of governance

### 7.1.1 Functionality

### 7.1.2 Architectural elements

#### 7.1.2.1 Implementation agreements

#### 7.1.2.2 Governing Entity

## 7.2 Governance in a Single chain environment

## 7.3 Governance in a Hybrid environment

## 7.4 Governance through consensus

### 7.4.1 on-chain consensus

### 7.4.2 off-chain consensus

### 7.4.3 multi-chain consensus

#### 7.4.3.1 Voting and majority in a multi chain environment

## 7.5 Governance without consensus

### 7.5.1 Delegated governance

#### 7.5.1.1 Human delegates

#### 7.5.1.2 Machines as delegates

## 7.6 Automated governance

### 7.6.1 Minimum requirements

#### 7.6.1.1 Unified data models

#### 7.6.1.2 Unified processes

#### 7.6.1.3 Unified IRPs

### 7.6.2 Code-base alignment

## 7.7 Hybrid governance

### 7.7.1 Evolution of hybrid governance

### 7.7.2 Initiation

### 7.7.3 Scale

### 7.7.4 Self sustained

### 7.7.5 Change management

## 7.8 Tokens in a Hybrid environment

Annex A (normative or informative):  
Title of annex

Annex B (normative or informative):  
Title of annex

# B.1 First clause of the annex

## B.1.1 First subdivided clause of the annex

Annex (informative):  
Bibliography

Annex (informative):  
Change history

| Date | Version | Information about changes |
| --- | --- | --- |
| <Month year> | <#> | <Changes made are listed in this cell> |
|  |  |  |
|  |  |  |
|  |  |  |

# History

|  |  |  |
| --- | --- | --- |
| **Document history** | | |
| <Version> | <Date> | <Milestone> |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

*Latest changes made on 2022-03-14*