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ETSI GR ISG-PDL 001 v0.0.5(2019-07)

**Group REPORT**

Title; PDL Landscape of Standards and Technologies

Release #

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<

Reference

DGR/PDL-001\_Landscape

Keywords

blockchain, gap analysis, state of the art survey

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To update the Table of Contents: F9.  
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List of figures and/or tables

*A list of figures and/or a list of tables may be included in ETSI deliverables. If included, the respective titles shall be "List of figures" and/or "List of tables", shall be unnumbered, shall appear after the table of contents and shall be generated automatically.*

* Use **TT** style for the title.
* Use the field {TOC \t "TF" \c} for the list of figures and the field {TOC \t "TH" \c} for the list of tables.

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# Intellectual Property Rights *(style H1)*

This clause is always the first unnumbered clause.

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is 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/)).

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# Foreword *(style H1)*

*~~The "Foreword" clause is the second unnumbered clause and on the same page as the IPR clause.~~*

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~~Replace all <parameters> with the appropriate text.~~

This Group Report (GR) has been produced by ETSI Industry Specification Group <long ISGname> (<short ISGname>).

~~Multi-part documents~~

~~The following block is required in the case of multi-part deliverables.~~

* ~~the <common element of the title> is the same for all parts;~~
* ~~the <part element of the title> differs from part to part; and if appropriate;~~
* ~~the <sub-part element of the title> differs from sub-part to sub-part.~~

~~For more details see clause 2.5 of the ETSI Drafting Rules (~~[*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~).~~

~~The best solution for maintaining the structure of series is to have a detailed list of all parts and subparts mentioned in one of the parts (usually it is part 1).~~

~~If you choose this solution, the following text has to be mentioned in all of the other parts and sub-parts:~~

The present document is part <i> of a multi-part deliverable. Full details of the entire series can be found in part [x] [Bookmark reference].

# Modal verbs terminology *(style H1)*

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx), clause 2.6.*

In the present document "**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 *(style H1)*

~~This clause,~~ ~~is an optional informative element.~~

~~The "Executive summary" is used~~ ~~to summarize the ETSI deliverable. It should contain enough information for the readers to become acquainted with the full document without reading it. It is usually one page or shorter.~~

[*~~ETSI Drafting Rules~~* ~~(~~*~~EDRs)~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~,~~* ~~clause~~ *~~2.7.~~*

# Introduction *(style H1)*

~~The "Introduction" clause may be used to give specific information or commentary about the technical content of the ETSI deliverable, and about the reasons prompting its preparation.~~

*~~[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~* ~~[(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~*~~[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),~~* ~~clause 2.8.~~

~~Clause numbering starts hereafter.~~

~~Automatic numbering~~ **~~may be used~~** ~~in ETSI deliverables,~~ *~~if used, shall be applied anywhere in an ETSI deliverable including annexes using the appropriate ETSI styles, otherwise it may corrupt the deliverable.~~*

~~See clause 2.12.1.1 and 6.9.2 of the ETSI Drafting Rules (~~[*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~).~~

~~<PAGE BREAK>~~

Standards are everywhere and are playing a key role to protect consumers, workers and environment. Blockchain and Distributed Ledger Technologies represent a key performance indicator for the Standardization Bodies and Organizations worldwide. First initiative was launched by ISO in 2016, as an initiative from Australian mirror Committee which conformed the [Committee ISO TC307](https://www.iso.org/committee/6266604.html) with the Scope “Standardisation of Blockchain technologies and distributed ledger technologies.

Following the aim of standardization at the European level, CEN-CENELEC conformed a [Focus Group](https://www.cencenelec.eu/news/brief_news/pages/tn-2018-085.aspx) for Blockchain and Distributed ledger technologies in 2017 which is under liaison with ISO TC307 and a [White Paper “Recommendations for Successful Adoption in Europe of Emerging Technical Standards on Distributed Ledger/Blockchain Technologies”](ftp://ftp.cencenelec.eu/EN/EuropeanStandardization/Sectors/ICT/Blockchain%20+%20DLT/FG-BDLT-White%20paper-Version1.2.pdf) was approved and published by CEN-CENELEC in 2018.

At United Nations level, the International Telecommunication Union is working very efficient with various Study Groups and related materias and it is relevant the [Focus Group](https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx) on Application of Distributed Ledger Technology in May 2017.

There are also initiatives and programs which are focus on standardization like the Joint Initiative on Standardization under the [Single Market Strategy](https://ec.europa.eu/growth/single-market/strategy_en) which is a voluntary collaborative effort and does not establish any new legal commitments whereby Standards are key for innovation and progress within the European competitiveness. Basically this Joint Initiative on Standardization sets out a shared vision for European standards in order to take steps to better prioritise and to modernise the current European Standardization system, as well as to strive for the timely delivery of standardization deliverables. It supports the relevant aspects of the ten European Commission’s Priorities and other policy objectives, while clearly respecting the distribution of different competences between the EU and the Member States.

The [European Blockchain Observatory and Forum](https://www.eublockchainforum.eu/) is an open project to create most comprehensive map of the European Blockchain ecosystem and as European Commission Initiative to accelerate blockchain innovation and the development of blockchain ecosystem within the EU and so help cement Europe´s position as a global leader in this transformative new technology.

There are also other alternative efforts related to the standardization of some properties that DLTs can provide which are considered within this GR like [W3C](https://www.w3.org/) or <https://opentimestamps.org/> .

# 1 Scope *(style H1)*

The present document will identify current activities in standardisation and in research which are particularly relevant to PDL, with the goal of identifying applicable solutions, required enhancements and recommendations for further collaboration. As appropriate, activities of professional or non-profit initiatives will also be considered.

# 2 References *(style H1)*

*~~The "References" clause shall list all the documents cited anywhere in an ETSI deliverable including annexes. It shall consist of clause 2.1 "Normative references" and clause 2.2 "Informative references".~~*

~~More details can be found in~~ [*~~ETSI Drafting Rules~~* ~~(~~*~~EDRs)~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~,~~* ~~clause 2.10.~~

~~The following text block applies.~~

## 2.1 Normative references *(style H2)*

~~As the ETSI Group Report (GR) is entirely informative it shall not list any normative references.~~

Normative references are not applicable in the present document.

## 2.2 Informative references *(style H2)*

~~Clause 2.2~~ *~~shall provide a numbered list of all informative references in an ETSI deliverable.~~*~~It is preferable that informative references are publicly available. Current practice is that the Secretariat need not check the public availability of 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.

* Use the **EX** style, add the letter "i" (for informative) before the number (which shall be in square brackets) and separate this from the title with a tab (you may use sequence fields for automatically numbering references, see clause 6.9.2 of [EDRs](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx))) (see example).

EXAMPLE:

[i.1]*[tab]* *<*Standard Organization acronym*> <*document number*> <*V#*>: "<*Title*>".* *(style EX)*

[i.2]*[tab]* ETSI TR 102 469: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Architecture". *(style EX)*

# 3 Definition of terms, symbols and abbreviations *(style H1)*

~~Delete from the above heading the word(s) which is/are not applicable.~~

*~~[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~* ~~[(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~*~~[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),~~* ~~clause 2.11.~~

*~~Definitions and abbreviations extracted from ETSI deliverables can be useful when drafting documents and can be consulted via the~~* ***~~Terms and Definitions Interactive Database (TEDDI)~~*** *~~(~~*[*~~https://webapp.etsi.org/Teddi/~~*](https://webapp.etsi.org/Teddi/)*~~).~~*

## 3.1 Terms *(style H2)*

~~Clause numbering depends on applicability. The terms shall:~~

* ~~not take the form of, or contain, a requirement.~~
* ~~be presented in alphabetical order~~
* *~~have a definition that~~* ~~can replace the terms in context. Additional information shall be given only in the form of examples or notes.~~ *~~I~~**~~f there are several notes or examples for the same term,~~* *~~the notes and examples shall be numbered. (See examples below).~~*~~.~~

~~The following text block applies.~~

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

* ~~Use the~~ **~~Normal~~** ~~style.~~
* ~~The term shall be in~~ **~~bold~~**~~, and shall start with a lower case letter (unless it is always rendered with a leading capital) followed by a colon, one space, and the definition of term starting with a lower case letter and no ending full‑stop.~~

*~~<~~***~~term~~***~~>~~***~~:~~***~~<~~*~~definition of term~~*~~>~~*

*~~EXAMPLE 1:~~*

**~~communal site:~~** ~~location at which there is more than one fixed transmitter~~ *~~(style Normal)~~*

~~NOTE: There are two types of communal site; one having separate equipment and antennas but housed in a common equipment room, and the other having an engineered system employing common antenna working where the isolation between equipment is determined by the filter system.  
At all communal sites equipment installed on the site meet the limits as specified in the relevant standards.~~ *~~(style NO)~~*

*~~EXAMPLE 2:~~*

**~~fast channel:~~** ~~channel with low latency but higher BER in comparison to the slow channel~~ *~~(style Normal)~~*

~~EXAMPLE: In contrast to the slow channel, the fast channel is not interleaved.~~ *~~(style EX)~~*

## ~~3.2 Symbols~~ *~~(style H2)~~*

~~Clause numbering depends on applicability. The symbols list shall:~~

* ~~contain the symbols and their corresponding explanations.~~
* ~~be presented in alphabetical order.~~
* ~~have entries not numbered.~~

~~The following text block applies.~~

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

* ~~Use the~~ **~~EW~~** ~~style and separate this from the definition with a tab. Use the~~ **~~EX~~** ~~style for the last term.~~

*~~<~~*~~1~~~~st~~ ~~symbol~~*~~>~~* ~~~~*~~[tab]<~~*~~1~~~~st~~ ~~Definition of symbol~~*~~>~~**~~(style EW)~~*

*~~<~~*~~2~~~~nd~~ ~~symbol~~*~~>~~* ~~~~*~~[tab]<~~*~~2~~~~nd~~ ~~Definition of symbol~~*~~>~~**~~(style EX)~~*

*~~EXAMPLE:~~*

~~dB decibel~~ *~~(style EW)~~*

~~DDI Direct Dialling-In, or direct dialling-in~~ *~~(style EX)~~*

## ~~3.3 Abbreviations~~ *~~(style H2)~~*

~~Clause numbering depends on applicability.~~ ~~The abbreviations list shall:~~

* ~~contain the abbreviations and their corresponding full form.~~
* ~~be presented in alphabetical order.~~
* ~~have entries not numbered.~~

~~The following text block applies.~~

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

* ~~Use the~~ **~~EW~~** ~~style and separate this from the definition with a tab. Use the~~ **~~EX~~** ~~style for the last term.~~

*~~<~~*~~1~~~~st~~ ~~ABBREVIATION~~*~~>~~* ~~~~*~~[tab]<~~*~~Definition of abbreviation~~*~~>~~**~~(style EW)~~*

*~~<~~*~~2~~~~nd~~ ~~ABBREVIATION~~*~~>~~* ~~~~*~~[tab]<~~*~~Definition of abbreviation~~*~~>~~**~~(style EX)~~*

*~~EXAMPLE:~~*

~~DPC Dynamic Power Control~~ *~~(style EW)~~*

~~CCI Co-Channel Interference~~ *~~(style EX)~~*

# ~~4 User defined clause(s) from here onwards~~ *~~(style H1)~~*

~~From clause 4, the technical content of the ETSI deliverable shall be inserted. Each clause~~ **~~shall have a title~~**~~For numbered clauses the title shall be placed after its number~~

~~A clause can have numbered subdivisions, e.g. 5.1, 5.2, 5.1.1, 5.1.2, etc. This process of subdivisions may be continued as far as the sixth heading level (e.g. 6.5.4.3.2.1).~~

~~For numbering issues, see clause 2.12.1 of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~.~~

* ~~Use the~~ **~~Heading~~** ~~style appropriate to its level (see~~ ~~ETSI styles" table in~~ [*~~editHelp!~~*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx)~~website).~~
* ~~Separate the number of the heading and the text of the heading with a tab.~~
* ~~Treat clause titles as normal text (i.e.~~ **~~no additional capitalization~~**~~),~~ **~~but~~** ~~no full stop.~~

~~Notes and examples~~

~~Notes and examples integrated in the text shall only be used for giving additional information intended to assist the understanding or use of the ETSI deliverable. Notes and examples shall not contain requirements. For more details see clauses 5.5 and 2.12.1 of the~~ [~~EDRs~~](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~).~~

~~A single note in a clause shall be preceded by "NOTE" in upper case. When several notes occur within the same element (e.g. clause, figure or table), they shall be designated "NOTE 1:", "NOTE 2:", "NOTE 3:", etc.~~

~~Use the~~ **~~NO~~** ~~style.~~

~~Separate NOTE: from the text of the note with a tab.~~

~~EXAMPLE:~~

~~NOTE 1: Text formatted with the~~ **~~NO~~** ~~style will be formatted~~ **~~with~~** ~~a space after the paragraph. (Style NO)~~

~~NOTE 2: This is the second note contained in a clause.~~ *~~(Style NO)~~*

~~A single example in a clause shall be preceded by "EXAMPLE:" in upper case. When several examples occur within the same element (e.g. clause, figure or table), they shall be designated "EXAMPLE 1:", "EXAMPLE 2:", "EXAMPLE 3:", etc.~~

~~When there is a danger that it may not be clear where the example ends and the normal text continues, then the end of the example may be designated by "END of EXAMPLE".~~

~~Use~~ **~~EX~~** ~~style.~~

~~Separate EXAMPLE: from the text of the example with a tab.~~

~~EXAMPLE:~~

~~EXAMPLE 1: This is the first example of the clause.~~ *~~(Style EX)~~*

~~EXAMPLE 2: This is the second example of the clause.~~ *~~(Style EX)~~*

~~END of EXAMPLE~~

~~Figures~~

~~Figures shall be prepared in accordance to clauses~~ ~~5.1 and/or 7.2 of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~.~~ ~~Details concerning "~~[~~Supported file formats~~](https://portal.etsi.org/Services/editHelp!/Howtostart/Supportedfileformats.aspx)~~" and "How to copy a figure" are available in~~[*~~editHelp!~~*](https://portal.etsi.org/edithelp/Files/other/Graphics_editHelp!.pdf) ~~website.~~ ~~For an easy application of the ETSI styles download~~ ~~"The ETSI styles toolbar" from~~ [*~~editHelp!~~*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles.aspx) ~~website.~~

* ~~The figure number and title shall be below the figure. An explicit figure title is optional.~~
* *~~Notes to figures~~* ***~~shall~~*** *~~be treated independently from notes integrated in the text,~~* ~~see clause 5.1.5 of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) *~~for more details.~~*
* *~~To generate a list of figures see clause 2.3.2 of the~~*[*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~.~~*
* ~~Use~~ **~~TF~~** ~~style for the figure number and title.~~
* ~~Use~~ **~~FL~~** ~~style on the paragraph which contains the figure itself.~~
* ~~Use~~ **~~NF~~** ~~style for the notes to figures. Separate "NOTE:" from the text of the note with a tab.~~
* ~~If applicable, the figure number is followed by a colon, a space and the table title.~~
* ~~Maximum width for figures is 17 cm and maximum height is 22 cm.~~
* ~~For automatic figure numbering see clause 6.9.2 of the~~ ~~[EDRs](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx).~~

~~Figure numbering~~

~~Figures may be numbered sequentially throughout the ETSI deliverable without regard to the clause numbering, e.g. first figure is figure 1 and the twentieth figure is figure 20.~~

~~Figures may also be numbered taking account of clause numbering.~~

~~EXAMPLE 1: First figure in clause 5 is figure 5.1, second figure in clause 5.1.1 is figure 5.2, third figure in clause 5.2.3 is figure 5.3.~~

~~EXAMPLE 2: First figure in clause 7.3.2 is figure 7.3.2.1, fifth figure in clause 7.3.2 is figure 7.3.2.5.~~

~~One level of subdivision only is permitted (e.g. table 1 may be subdivided as 1 a), 1 b), 1 c), etc.). See also clause 2.12.1.0 of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~.~~*

~~Figures of an annex shall be preceded by the letter designating that annex followed by a full-stop (e.g. figure B.1, figure C.4.1.1). The numbering shall start afresh with each annex.~~

~~Layout of a figure~~

~~EXAMPLE:~~

~~Figure~~ *~~(style FL)~~*

~~NOTE: This is a note to figure 1.~~ *~~(style NF)~~*

~~Figure 1: Details of apparatus~~ *~~(style TF)~~*

~~Tables~~

~~Tables shall be prepared in accordance to clauses 5.2 of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)~~.~~ ~~For an easy application of the ETSI styles download "the ETSI styles toolbar" from~~[*~~editHelp!~~*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles.aspx) ~~website~~*~~.~~*

* ~~The figure number and title shall be above the table itself. An explicit table title is optional.~~
* *~~If the table continues over more than one page, the column headings~~* ***~~shall~~*** *~~be repeated on all pages after the first.~~*
* *~~Notes to figures~~* ***~~shall~~*** *~~be treated independently from notes integrated in the text,~~* ~~see clause 5.1.5 of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) *~~for more details.~~*
* *~~To generate a list of figures see clause 2.3.2 of the~~*[*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~.~~*
* *~~For numbering issues see clause 5.1.3~~* ~~of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~.~~*

~~Details concerning "ETSI Styles" for tables are available on the~~[*~~editHelp!~~*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx) ~~website.~~

|  |
| --- |
| * ~~Use the following styles:~~ * **~~TH~~** ~~for the table number and title.~~ * **~~TAH~~** ~~for table headings~~ * **~~TAL~~** ~~for text left aligned~~ * **~~TAC~~** ~~for text centred~~ * **~~TAR~~** ~~for text right aligned~~ * **~~TAN~~** ~~for the note to table. Separate NOTE: from the text of the note with a "Ctrl" + "→" (tab). Include notes to a table within its borders in one cell, at the bottom.~~ * **~~TB1~~** ~~for the list of level 1~~ * **~~TB2~~** ~~for the list of level 2~~ * ~~If applicable, the table number is followed by a colon, a space and the table title.~~ * ~~To repeat the column heading on all pages, use the table headings tool (~~**~~Table, Heading Rows Repeat~~**~~).~~ * ~~For automatic figure numbering see clause 6.9.2 of the~~ ~~[EDRs](http://portal.etsi.org/Help/editHelp!/Howtostart/ETSIDraftingRules.aspx)).~~ |

~~Centre tables horizontally.~~

~~The "space between columns" is 0,1 pt or 0,05 cm (default cell margins Left 0,05 pt & Right 0,19 pt).~~

~~Maximum width for tables in portrait orientation: 17 cm and for landscape orientation: 22 cm.~~

~~Set table columns widths in centimetres (not inches).~~

~~Use borders to separate the rows and columns of tables, as appropriate; the precise format will depend on the structure of each table, but be consistent throughout a deliverable (or series of related deliverables). Borders should be ¾ pt single line.~~

~~Each table shall be followed by an empty "Normal" style paragraph (↵ "Enter" key).~~

~~Table numbering~~

~~Tables may be numbered sequentially throughout the ETSI deliverable without regard to the clause numbering, e.g. the first table is table 1 and the twentieth table is table 20.~~

~~Tables may also be numbered taking account of clause numbering.~~

~~EXAMPLE 1: First table in clause 5 is table 5.1, second table in clause 5.1.1 is table 5.2, third table in clause 5.2.3 is table 5.3.~~

~~EXAMPLE 2: First table in clause 7.3.2 is table 7.3.2.1, fifth table in clause 7.3.2 is table 7.3.2.5.~~

~~One level of subdivision only is permitted (e.g. table 1 may be subdivided as 1 a), 1 b), 1 c), etc.). See also clause 2.12.1.0~~ *~~of the~~*[*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~.~~*

~~Tables of an annex shall be preceded by the letter designating that annex followed by a full-stop (e.g. table B.1, table C.4.1.1). The numbering shall start afresh with each annex.~~

~~Layout of a table~~

~~The title shall be above the table. An explicit table title is optional. See the following examples. The first word in the heading of each column shall begin with a capital letter. The units used in a given column shall generally be indicated within the column heading.~~

~~EXAMPLE:~~

~~Table 1: Electrical properties~~ *~~(style TH)~~*

|  |  |  |  |
| --- | --- | --- | --- |
| **~~Type~~** *~~(style TAH)~~* | **~~Linear density (kg/m)~~** *~~(style TAH)~~* | **~~Inside diameter (mm)~~** *~~(style TAH)~~* | **~~Outside diameter (mm)~~** *~~(style TAH)~~* |
| ~~Text~~*~~(style TAL)~~* | ~~Text~~ *~~(style TAC)~~* | ~~Text~~ *~~(style TAR)~~* |  |
| ~~NOTE 1: This is a note to table.~~ *~~(style TAN)~~*  ~~NOTE 2: This is a merged cell.~~ *~~(style TAN)~~* | | | |

~~Mathematical formulae~~

~~Mathematical formulae shall be prepared in accordance to clause 5.3 of the~~ [*~~EDRs~~*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*~~.~~* ~~Details concerning tools that shall be used for editing "Mathematical formulae" are available on the~~ *~~[editHelp!](https://portal.etsi.org/Services/editHelp!/Tohelpyouinyourwork/Furtherresources/Mathematicalformulae.aspx)~~* ~~website.~~

~~For an easy application of the ETSI styles download "the ETSI styles toolbar" from~~ *~~[editHelp!](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles.aspx)~~* ~~website.~~

* ~~Use~~ **~~EQ~~** ~~style.~~
* ~~Insert one tab before the equation to centre it.~~
* ~~For automatic equation numbering see clause 6.9.2 of the~~ ~~[EDRs](http://portal.etsi.org/Help/editHelp!/Howtostart/ETSIDraftingRules.aspx).~~

~~Equation numbering~~

~~If it is necessary to number some or all of the formulae in an ETSI deliverable in order to facilitate cross‑referencing, Arabic numbers in parentheses shall be used, beginning with 1:~~

~~EXAMPLE 1:~~

~~x~~~~2~~ ~~+ y~~~~2~~ ~~< z~~~~2~~ ~~(style EQ) (1)~~

~~Equations may be numbered sequentially throughout the ETSI deliverable without regard to the clause numbering, e.g. first equation is equation 1 and the twentieth equation is equation 20.~~

~~Equations may also be numbered taking account of clause numbering.~~

~~EXAMPLE 2: First equation in clause 5 is equation 5.1, second equation in clause 5.1.1 is equation 5.2, third equation in clause 5.2.3 is equation 5.3.~~

~~EXAMPLE 3: First equation in clause 7.3.2 is equation 7.3.2.1, fifth equation in clause 7.3.2 is equation 7.3.2.5.~~

~~Equations of an annex shall be preceded by the letter designating that annex followed by a full-stop (e.g. table B.1, table C.4.1.1). The numbering shall start afresh with each annex.~~

~~<<Editor Note: transpose any agreed text into sections 4, 5, 6 …>>~~

# 4 Introduction to main areas of application of PDL technologies and role of standards

<<Editor Note: this is brief overview to ensure concepts are mentioned, other WI will cover specific use cases in detail>>

* Special verticals
  + eGov
  + eHealth
  + Energy sector, SmartMetering, ..
  + IoT and trust relationships
  + …
* Services
  + FINTECH
  + Logistics
  + Assurance of product identification and supply-chain validation
  + Identity Management

# 5 Current activities in standardisation

<<Editor Note: this is re “who is doing what”, NOT a recapitulation and comparisons of 20 different specs and architectures>>

Framework of standards

Raise awareness on standardization activities impacting existing technical bodies.

* : ISO/TC 307 Blockchain and Distributed Ledger Technologies since 2016 has 41 participating members and 11 observing members this 20th February 2019. It has [liaisons committees to ISO/TC 307 and from ISO/ TC307.](https://www.iso.org/committee/6266604.html) There are also organizations in liaison like European Commission, Enterprise Ethereum Alliance Inc, Institute of Electrical and Electronic Engineers Inc, ITU, OECD, SWIFT, UNECE and International Federation of Surveyors.



Figure 1. ISO TC307- **STANDARDS UNDER DEVELOPMENT**

* : CEN (European Committee for Standardization) and CENELEC (European Committee for Electrotechnical Standardization) are recognized by the EU and EFTA as European Standardization Organizations responsible for developing standards at European level. These standards set out specifications and procedures in relation to a wide range of materials, processes, products and services. The members of CEN-CENELEC are the National Standardization Bodies and National Electrotechnical Committees of 34 European countries. European Standards and other standardization deliverables adopted by CEN-CENELEC are accepted and recognized in all these countries. For Blockchain and Distributed Ledger Technologies the Focus Group in 2019 will identify specific European needs and release a new version of its technical white paper for the successful implementation of Blockchain and DLT in Europe.

There are numerous standards under development within CEN-CENELEC and the strategy which is public consider between their pivotal highlights Digital transformation, International cooperation like task force with Gulf, India, Japan, China and Africa; seminars and workshops. Some of the interesting standards under development are: For Digital Society, CEN/WS 084 Self-Sovereign Identifier for Personal Data Ownership and Usage Control, CEN/CLC/WS SEP2 Industry Best Practices and Industry Code of Conduct for Licensing of Standard Essential Patents in the field of 5G and Internet of Things, CLC/TC108X Safety of electronic equipment within the fields of Audio/Video, Information Technology and Communication Technology, CLC/TC 209 Cable networks for television signals, sound signals and interactive services. For Mechanical and machinery mainly focus for safety and segments like entertainment technology and amusement park machinery and structures. For services CEN/TC 445 Digital Information Interchange in the Insurance Industry, CEN/TC 278 Intelligent transport systems. Recently CEN-CENELEC has approved liaison with ETSI ISG PDL and a new TC will act as mirror with ISO TC307.

ITU The Focus Group for Distributed ledger technologies (DLT) was established in May 2017 and the last plenary session of the Focus Group will be held by next July 29 until 2nd August 2019. A parent group is TSAG (Telecommunication Standardization Advisory group) the participation in FG DLT is open. Next announcement and details can be found at <https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx>



Note: SG 13 of ITU-T about Future Internet, the Work Item is Decentralized Network Infrastructure.

* IEEE Standards Association is doing prospection in some areas with some projects for Blockchain and Distributed ledger with some report and documents that can be found herein <https://blockchain.ieee.org/standards>

Identified common standards terminology for PDL ~~e.g.:~~

# 6 Current activities in research

<<Editor Note: H2020 projects are often required to be proactive so if we contact them be prepared for introductory inputs etc. Maybe consider later a combined workshop >>

* H2020 projects A, B, C …( Activities from the European Commission related Proof of Concept for Distributed PKI, IoT interoperability Sofie,…) (Note: Add details from EC presentation at ETSI)
* University group XYZ
* European Blockchain Observatory and Forum which is launched in 2018 by the European Commission involving private stakeholders and public authorities in technical and regulatory discussions about the future development and applications of blockchain technology. Among its tasks, it will gather the best European experts in in thematic workshops on important subjects such as Blockchain and GDPR, o Blockchain innovation, and [produce reports](https://www.eublockchainforum.eu/reports), which will help European stakeholders to deploy blockchain based services in Europe.
* **End to End Billing with Smart Contracts in Wireless** **– Kings College London**

Our project investigates and proposes the methods to implement short-term dynamic mobile service contracts. One of the several advantages (which we have discussed in detail in our work) of the short-term contracts with the Smart Contracts and Permissioned ledgers, is that operator does not have any liability towards universal coverage. As the user can switch the operator where there is no or poor coverage or possibly the reasons for cheaper contracts, operator can manage the back-haul congestion through high price offering.

* **Blockchain Platform for Industrial Internet of Things – Georgia Institute of Technology, Atlanta, GA, USA (http://bit.ly/331Olq2)**:

A blockchain platform to develop dApps for manufacturers. This platform implements smart contracts on the blockchain. Smart Contracts act as agreements between the service consumers and the manufacturing resources to provide on-demand manufacturing service. This work is similar to our work to some extent as the manufacturing services are distributed and consumers access those services through Smart contracts. The smart contract plays important role here as the IoT are plug and play and they contact the associated smart contract and exchange their data, which is then transferred to the cloud storage.

* **Blockchain-based architecture for content delivery network – University of Luxembourg (**[**http://bit.ly/2MtEcNi**](http://bit.ly/2MtEcNi)**):**

A blockchain based content delivery network. In this work the benefits of B-CDN is demonstrated via edge-caching application and a caching algorithm is proposed. B-CDN improves user quality of experience and reduces cost of delivery content for the CPs.

* **Content Distribution Network: DECENT Project** - [**https://decent.ch/dcore/**](https://decent.ch/dcore/)

Hosting data that traditionally sit and are called from large data centres in smaller devices closer to users, with the aim of reducing latency, hence increasing speed especially for low bandwidth areas. A blockchain solution which customizable AND suitable for storage of large files, helpful particularly in creating a CDN where consumer can access the content from the node close to their proximity.

* **Blockchain initiated handoff in 802.11- Kings College London**

Initiating handoff between WiFi access points based on data sensed by the blockchain for the purpose of reducing handoff delays significantly and dispersing network traffic among local and reachable access points. Due to the high speed demands of 802.11 MAC layer protocols, a permissioned ledger proves more ideal in terms of speed and sensitivity of user profiles as it pertains to identity protection.

* **Communication and Consensus Co-Design for Low-Latency and Reliable Industrial IoT Systems.**

<https://www.researchgate.net/publication/334558716_Communication_and_Consensus_Co-Design_for_Low-Latency_and_Reliable_Industrial_IoT_Systems>

Authors: Hyowoon Seo, Jihong Park, Mehdi Bennis, Wan Choi.

Designing a suitable consensus and communication protocol that meets the real-time needs of IoT based on speed of delivery and decision making.

* **SmartLog**

Kouvola Innovation, Tallinn University of Technology. <https://www.kinno.fi/en/smartlog>

Upon obtaining a grant from the European Union’s Interreg Central Baltic Program, Kouvola went on to utilising blockchain technology with the aid of IoT devices to work on real time physical device tracking. Streamlining Efficiency in Logistics with IoT. Related documents hint at the adoption of Fabric’s architecture.

* **Mobile Blockchain meets Edge Computing.**

<https://ieeexplore.ieee.org/document/8436042>

Authors: Zehui Xiong, Yang, Zhang, Dusit, Niyato, Ping Wang and Zhu Han

Deploying the blockchain technology on the edge for faster processing of real-time IoT data. This project is based on a proof of work ledger and the solutions provided are thus based. However, a private faster blockchain might be considered for operations at the edge, as the identity of the participating devices must be known.

* **Decentralised Email.**

Swiftmail ([www.Johnmcafeeswiftmail.com](http://www.Johnmcafeeswiftmail.com)), Cryptamail ([www.cryptamail.com](http://www.cryptamail.com)), Gmelius mail (<https://gmelius.com/email-stamping-blockchain.pdf>).

Implements a 256-bit end to end encryption for data protection. Gmelius utilises Ethereum blockchain to ensure the integrity of received emails by proving the source and chain of delivery of the emails. Although this is deployed on a public chain, from the documentation, it is clear that it is solely done due to the level of security the size of the chain possesses based on its reliance on proof of work.

* [~~European Blockchain Partnership~~](https://ec.europa.eu/digital-single-market/en/news/european-countries-join-blockchain-partnership) ~~was launched on the 10~~~~th~~ ~~April 2018 with the aim to develop a trusted, secure and resilient European Blockchain Services Infrastructure (EBSI) meeting the highest standards in terms of privacy, cybersecurity, interoperability and energy efficiency, as well as fully complaint with EU law. The European Blockchain Partnership will also develop a set of Guiding Principles and Specifications for the EBSI that will be enhanced to be recognised as a reference for development of Blockchain infrastructures and will propose a model to describe the overall policy and technical governance of the EBSI.~~
* ~~ICT Standardization priorities for the Digital Single Market:~~ [~~https://ec.europa.eu/digital-single-market/en/news/communication-ict-standardisation-priorities-digital-single-market~~](https://ec.europa.eu/digital-single-market/en/news/communication-ict-standardisation-priorities-digital-single-market)

# 7 Activities of professional initiatives and alliances

* <https://opentimestamps.org/> this is a relevant jointly initiative for a Timestamping Proof Standard
* [W3C](https://www.w3.org/) between other initiatives within this organization, last version about [Verifiable Credentials Data Model](https://www.w3.org/TR/2019/WD-verifiable-claims-data-model-20190208/) is published which is a standardization effort with relevant commonalities for identity management on distributed ledger technologies. There is also an open repository for technical specifications at github herein <https://github.com/w3c/vc-data-model/issues>
* [Alastria](https://alastria.io/index_en.html) (Non-profit Association and based on open source)
* Dutch Blockchain Coalition (Private Public Partnership Germany) <https://dutchblockchaincoalition.org/en>
  + [Hyperledger](https://www.hyperledger.org/)
  + [Enterprise Ethereum Alliance Inc](https://entethalliance.org/).
* Common denomitator with SEP (Standards Essential Patent) Landscape <http://ec.europa.eu/growth/content/landscaping-study-standard-essential-patents-europe-0_en>
* [INATBA](https://inatba.org/)
* Alliance for Internet of Thigs Innovation: <https://aioti.eu/>
* Industrial Internet Consortium: <https://www.iiconsortium.org/>
* IETF IRTF: A Research Group is in formation in the IRTF on the topic of Decentralized Internet Infrastructure (DIN). The Decentralized Internet Infrastructure Research Group (DINRG) will investigate open research issues in decentralizing infrastructure services such as trust management, identity management, name resolution, resource/asset ownership management, and resource discovery. The focus of DINRG is on infrastructure services that can benefit from decentralization or that are difficult to realize in local, potentially connectivity-constrained networks. Other topics of interest are the investigation of economic drivers and incentives and the development and operation of experimental platforms. DINRG will

operate in a technology- and solution-neutral manner, i.e., while the RG has an interest in distributed ledger technologies, it is not limited to specific technologies or implementation aspects. More details of the DIN RG are available. <https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#Ledger>

* [OASIS:](https://www.oasis-open.org/standards) Existing OASIS standards projects with e-commerce applications are being applied to defi ned blockchain-based serialization methods, as alternative representations of their content (such as e-invoices).

# 8 Highlights of PDL solutions and needs

* regulatory and legal aspects: There are a number of existing laws that are applicable to DLT like KYC (Know Your Customer) and AMl (Anti-Money Laundering) requirements, at the same time there are initiatives from countries to include exemptions or benefit to startups using DLT like Switzerland or the sandbox rule in Swiss banking law. Framnce and Germany proposed to introduce a uniform regulation of DLT in 2018 at G20 summit but did not convince the G20 for a suitable law. A number of countries are running recommendations from their central banks and other regulatory authorities which increase the proliferation of needs for a legal framework with no uncertainty. For pioneering countries which start DLT-specific legislation. Legislators are more focus on ICOs and STOs and financial regulation. CFT (Counter-financing of Terrorism or Combating the financing terrorism) involves investigating, analysing, deterring and preventing sources of funding activities for political achievement, religious or ideological goals thru violence. For financial industry there are a number of risk identified mainly for Cryptocurrencies.

On regards on the Node operators and within telecommunication law the instrument called “provider priviledge” in Europe it has been defined as per directive 2000/31/EC in particular with the liability of intermediary service providers in Section 4, article 12:

‘Mere conduit’

*1. Where an information society service is provided that consists of the transmission in a communication*

*network of information provided by a recipient of the service, or the*

*provision of access to a communication network, Member States shall ensure that the service provider is*

*not liable for the information transmitted, on condition that the provider:*

*(a) does not initiate the transmission;*

*(b) does not select the receiver of the transmission; and*

*(c) does not select or modify the information contained in the transmission*

Legal liability within permissioned and access restricted DLT systems, to preserve the trust in the immutability, a node operator should not be forced to delete some part of a DLT system even when it is known to be in conflict with the law. Conflicts arise for copyrights, trademarks, privacy, antitrust or unfair competition which in public blockchains these are conflicts indeed. There are some existing laws for instance in Data protection for personal data like GDPR and other countries (WHICH I HAVE MAPPED) It is a recommended practice to deal a PIA, Privacy Impact Assessment to assists organizations in identifying and minimizing the privacy risks.

In trade and logistic it is relevant the UN/CEFACT which is preparing a White Paper on Blockchain, and UNCITRAL environment is ideal to conferred multijurisdictional approach.

Government services are increasingly utilizing DLT to provide trust services, e-government initiatives are enhancing their frameworks, for instance in Europe exists TOOP which is a relatively new tool for interoperability. Anticipation is a relevant factor a new design with Policy Enforcement Points that are distributed among governed network. These areas can harmonize better data minimization and use limitation of data.

Regulation on electronic identification and trust services, there are a number of laws for digital signatures, electronic certificates and identification which sometimes are not neutral or consolidate a common denominator globally. eIDAS is a proper framework which is extensively improving these aspects.

Smart Contracts enforceability is other back-bone in permissioned distributed ledger systems.

* ecosystem and EU-market aspects:

[European Blockchain Partnership](https://ec.europa.eu/digital-single-market/en/news/european-countries-join-blockchain-partnership) was launched on the 10th April 2018 with the aim to develop a trusted, secure and resilient European Blockchain Services Infrastructure (EBSI) meeting the highest standards in terms of privacy, cybersecurity, interoperability and energy efficiency, as well as fully complaint with EU law. The European Blockchain Partnership will also develop a set of Guiding Principles and Specifications for the EBSI (European Blockchain Service Infrastructure) that will be enhanced to be recognised as a reference for development of Blockchain infrastructures and will propose a model to describe the overall policy and technical governance of the EBSI.

ICT Standardization priorities for the Digital Single Market: <https://ec.europa.eu/digital-single-market/en/news/communication-ict-standardisation-priorities-digital-single-market>

* special requirements of verticals: (data and additional requirements for mobility for instance,..)
* comparison of solutions according to above aspects

# 9 Enhancements and recommendations for further collaboration

* technical collaborations to be considered: CEN-CENELEC, ISO TC307, ITU-T FG DLT, W3C.
* policy and ecosystem collaborations needed
* timelines of external organisations/events and their impact on collaborations: <https://www.gsma.com/>

Annexes

Each annex **shall:**

* start on a new page (insert a page break between annexes A and B, annexes B and C, etc.).
* be designated by a heading comprising the word "Annex" followed by a capital letter designating its serial order, beginning with "A".
* have its heading followed by the indication "(normative):" or "(informative):", and by the title on the next line.

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),* clause 2.13.

*Numbers given to the clauses, tables, figures and mathematical formulae of an annex shall be preceded by the letter designating that annex followed by a full-stop. The numbering* ***shall start afresh with each annex****. A single annex shall be designated "Annex A".*

Clauses in annex A shall be designated "A.1", "A.2", "A.3", etc. (further details in clause 2.12.1 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)).

* Use the **Heading 9** style. Insert a line break ("shift" + ↵ "enter") between the colon and the title.
* For all annex clause headings use the appropriate Heading styles, starting from **Heading 1,** e.g. for clause A.1 use **Heading 1**, for clause A.1.1 use **Heading 2**. ("ETSI Styles" are available on the[*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx) website ).

EXAMPLE:

<PAGE BREAK>

Annex A:  
Title of annex *(style H9)*

<Text>.

<PAGE BREAK>

Annex B:  
Title of annex *(style H9)*

# B.1 First clause of the annex

## B.1.1 First subdivided clause of the annex

<Text>.

<PAGE BREAK>

Annex <L>:  
Authors & contributors *(style H9)*

The annex entitled "Authors & contributors" is optional. When present it describes the list of persons and companies that contributed to the elaboration of the present Group Report.

The following people have contributed to the present document:

**Rapporteur**:  
Title, Firstname, Lastname, company

**Other contributors**:Title, Firstname, Lastname, company

<PAGE BREAK>

Annex <L+1>:  
Bibliography *(style H9)*

The "Bibliography" annex identifies additional reading material not mentioned anywhere in an ETSI deliverable including annexes. These publications might or might not be publicly available (no check is made by the Secretariat).

The Bibliography **shall include** list of standards, books, articles, or other sources on a particular subject which are not cited anywhere in an ETSI deliverable including annexes.

The Bibliography **shall not include** *documents listed in clauses 2.1 and 2.2.*

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),* clause 2.14.

* Use **Heading 9** style for the "Bibliography" annex, see clause 2.13 of the [EDRs](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) for examples.
* For the listed material use the **Normal** style or bulleted lists (e.g. **B1+**), do not use numbered references.

*EXAMPLE 1:*

*<*Publication*>*:"*<*Title*>".<*Edition*>*. *<*Year*>*, *<*Issue designation*>*, *<*Page location*>*. *(style Normal)*

WEAVER, William. "Command performances". December 1985, vol. 42, n° 12, p. 126-133). *(style Normal)*

*EXAMPLE 2:*

* <Publication>: "<Title>". *(style B1+)*
* ETSI EN 300 066: "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Float-free maritime satellite Emergency Position Indicating Radio Beacons (EPIRBs) operating in the 406,0 MHz to 406,1 MHz frequency band; Technical characteristics and methods of measurement". *(style B1+)*

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Annex <L+2>:  
Change History *(style H9)*

*The "Change history/Change request (history)" is an optional informative element.*

*The "Change history/Change request (history)" annex, if present, describes the list of changes implemented in a new version of the ETSI deliverable. It shall be presented as a table.*

"ETSI styles" for tables are available in[*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx) website.

| Date | Version | Information about changes |
| --- | --- | --- |
| October 2011 | 1.1.1 | First publication after approval (30 September - 2 October 2011; Prague) |
| February 2012 | 1.2.1 | Implemented Change Requests:  Error message information clarifications  update of figure 3 clause 9.2  These CRs were approved by <ISG shortname> (3 - 5 February 2012; Sophia)  Version 1.2.1 prepared by the Rapporteur |

<PAGE BREAK>

# History *(style H1)*

*The "History" clause shall start on a new page and be the final unnumbered clause of an ETSI deliverable.*

*History shall be prepared in accordance to clause 2.16 of the* [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.*

Use **Heading 1** style for the title.

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

A few examples:

|  |  |  |
| --- | --- | --- |
| **Document history** | | |
| V1.1.1 | April 2018 | Publication |
| V1.2.2 | June 2017 | Pre-Processing done before TB approval e-mail: <mailto:edithelp@etsi.org> |
| V1.3.0 | July 2018 | Clean-up done by ***editHelp!*** e-mail: <mailto:edithelp@etsi.org> |
|  |  |  |
|  |  |  |

*Latest changes made on 2018-10-22*