ENERGINET eSett FINGRID Statnett SVENSKA KRAFTNÄT

Common Nordic XML rules and recommendations

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1 INTRODUCTION

1.1 About the Ediel Common Nordic XML rules and recommendations

The purpose of this document is to ensure that information can be sent between parties in the Nordic energy industry, in different countries, based on the same framework. The document contains common Nordic XML rules and recommendations to be followed when exchanging business documents specified by the Nordic Market Expert Group (NMEG). This includes use of codes and code lists, date and time formats, time zones, terms and notation, etc.

The document will cover rules and recommendations to be used when exchanging documents in XML syntax. For rules and recommendations related to EDIFACT syntax, see the Ediel Functional description [9].

1.2 Interchange agreement

As data interchange may have financial and/or contractual consequences it is recommended that there is some form of an interchange agreement between the involved parties.

1.3 Objectives

The objective of this document is to ensure that actors exchanging electronic business documents in the Nordic energy market, uses the same technical rules when exchanging information. The rules and recommendations shall provide a basis for facilitation and harmonisation in the Nordic and European energy market.

1.4 Scope

- The rules and recommendation focus on the automated exchange of business documents.
- It should be possible to use the same infrastructure towards all collaboration partners, nationally and internationally.
- The rules and recommendations shall as far as possible be based on international accepted standards, so that the result can be understood and used by as many as possible.

1.5 NMEG

This document is maintained by the Nordic Market Expert Group (NMEG), which is a permanent Nordic working group. NMEG has members from the four Nordic TSOs Energinet, Fingrid, Statnett and Svenska kraftnät.

1.6 Comments to the document

If there are comments or suggestions to the document, please contact the editor Ove Nesvik (ove.nesvik@edisys.no).

1.7 References

[1] ebIX® Business Requirements for Acknowledgments, see http://www.ebix.org/
[2] ebIX Common rules and recommendations, see https://www.ebix.org/artikel/documents

[3] RFC 822, The standard for the format of ARPA Internet text messages, see https://www.rfc-editor.org/rfc/pdfrfc/rfc822.txt.pdf
[4] RFC 1521, Mime, part one, see https://www.rfc-editor.org/rfc/pdfrfc/rfc1521.txt.pdf
[5] RFC 1522, Mime, part two, see https://www.rfc-editor.org/rfc/pdfrfc/rfc1522.txt.pdf
[6] RFC 1767, Mime, part two, see https://www.rfc-editor.org/rfc/pdfrfc/rfc1767.txt.pdf
[7] The Harmonised Role Model – ENTSO-E, ebIX® and EFET, see https://www.ebix.org/artikel/role_model
[8] ENTSO-E Implementation Guides (IG), see https://www.entsoe.eu/publications/electronic-data-interchange-edi-library/
[9] Ediel Functional description, see https://ediel.org/guides/
[10] IEC 62325: Framework for energy market communications, Part 451, see http://www.iec.ch/ (Part 451-1 Acknowledgement business process)

1.8 Change log

Ver/rel/rev	Date	Changed by	Changes
1.9.A	20210430	Ove Nesvik	• Addition of ENTSO-E Quantity Quality codes chapter 3.6. • Advice using a resolution of zero for timeseries with only one observation in chapter 3.13. • Addition of ENTSO-E national codes in chapter 4.1. • Replacing Market Balance Area with Scheduling Area and Bidding Zones. • Removal of max interchange size in chapter 6.4. • Removal of Appendix B, Model Interchange Agreement. • Removal of Appendix C, Communication envelope. • Update of spelling errors and addition of clarifying text.
1.8.A	20210315	Ove Nesvik	• Update of chapter “5 Acknowledgement process” to latest CIM version of the Acknowledgement document. • Update of spelling errors and addition of clarifying text.
1.7.A	20210125	Ove Nesvik	• Addition of a new paragraph 3.12, Resolution for timeseries with only one observation.
1.6.A	20180629	Ove Nesvik	• Addition of a new paragraph 4.5 Structure of codes and enumerations. • Reamed NEG to Ediel or NMEG where applicable. • Addition of clarifying text and error corrections.
1.5.C	20170505	Ove Nesvik	• Changed sequence of “Time Series Rejection” and “Reason (Acknowledgement Document level)” in paragraph 5.4.1 (Attribute usage: ENTSO-E Acknowledgement Document). • Rephrased “On Object Rejection level” to “On Time Series Rejection level”.
1.5.B	20170213	Ove Nesvik	• Addition of a new paragraph “3.12 Versioning”. • Updated logos on the front page. • Replaced Nord Pool and NPS with Market Operator. • Replaced Elspot with Day-ahead. • Replaced Elbas with Intraday. • Updated NTC and NEG member list.
1.5.A	20161121	Ove Nesvik	• Addition of a new paragraph “2.5 Time format in Validity Start and Validity End”. • Addition of a new paragraph “3.6 Quantity quality”. • Addition of a new paragraph “3.11 Namespace Prefix and schemaLocation”. • Paragraph “2.3 Summertime and wintertime” is updated with Finnish rules.
1.4.C	20160305	Ove Nesvik	• Corrected the cardinality of Receiver role in the Acknowledgement document on Document level to [0..1]. • Addition of a new chapter 2.5, Usage of Resolution and Position.

1.4.B	20160201	Ove Nesvik	• Addition of a new chapter 3.9, Resending of documents. • Corrected the cardinality of Reason Text in the Acknowledgement document on Document level to [0..1].
1.4.A	20150509	Ove Nesvik	• Addition of a new chapter 4.4, Code and Identifier schemes. • Addition of text related to conversions in chapter 5.4.2, Acknowledgement of ebIX® documents and Role conversions. • Addition of rules for use of signed values. • Textual corrections. • Removal of non-relevant references. • Addition of a note stating that an acknowledgement document shall not be sent as responses to an acknowledgement document.
1.3.B	20141017	Ove Nesvik	• Update of date and time rules, including removal of the rule that period formats shall not be used within XML messages. • Addition of clarifying text related to Time Series identification.
1.3.A	20140422	Ove Nesvik	• Rename of the document to NEG Common rules and recommendations. • Addition of clarifying text related to the Acknowledgement process. • Rename of Object Rejection to Time Series Rejection in the Acknowledgement document (ENTSO-E term). • Addition paragraph 3.5, Identification of Transactions and Time Series. • Addition paragraph 3.7, Extra (not specified) data elements in documents.

1.2.A	20131110	Ove Nesvik	• Updated Acknowledgement process.
			• Updated member list.
			• Addition of definitions:
			  ○ Portfolio.
			  ○ FCR-D and FCR-N.
			  ○ FRR-A and FRR-M.

1.1.A	20100713	Ove Nesvik	Addition of ancillary services in Appendix A.
1.0.A	20091127	Ove Nesvik	First published version.

2 BASIC RULES FOR DATES, TIMES AND PERIODS

2.1 Terms and Notation

CET	Central European Time = UTC + 1.
CEST	Central European daylight-Saving Time = UTC + 2.
GMT	Greenwich Mean Time, in practice the same as UTC.
UTC	Universal Time Coordinated, in practice the same as GMT.
Local time	UTC + time zone. In central Europe, the local time is CET during winter and CEST during summer.
Normal time	UTC + time zone. In central Europe, the normal time is CET all year around.

2.2 Date, time and period formats

Basic rules:

- Time is always expressed in UTC time (UTC+0). This is expressed in the time format by using the Z (Zulu time) parameter.
- In the electricity sector the day starts at 00:00 local time, except for Sweden where the day starts at 00:00 UTC+1 (Swedish normal time).
- In the gas sector the day starts at 06:00 local time.
- All time intervals (periods) are expressed using an inclusive start date/time and an exclusive end date/time.

Date and/or time shall always be in one of the following formats, ref ISO 8601:

- YYYY-MM-DDTHH:MM:SSZ
- YYYY-MM-DDTHH:MMZ/YYYY-MM-DDTHH:MMZ
- YYYY-MM-DD
- PnD (n = number of days)
- PTnH (n = number of hours)
- PTnM (n = number of minutes)

2.3 Summertime and wintertime

A day is always expressed in local time (except in Sweden), i.e.:

- For electricity in Denmark and Norway:
  - A day is from 23:00 to 23:00 during wintertime.
  - A day is from 22:00 to 22:00 during summertime (daylight saving time).
  - When changing from wintertime to summertime there are 23 hours in the time series (from 23:00 the day before to 22:00).
  - When changing from summertime to wintertime there are 25 hours in the time series (from 22:00 the day before to 23:00).
- For electricity in Finland:
  - A day is from 22:00 to 22:00 during wintertime.
  - A day is from 21:00 to 21:00 during summertime (daylight saving time).
  - When changing from wintertime to summertime there are 23 hours in the time series (from 22:00 the day before to 21:00).
  - When changing from summertime to wintertime there are 25 hours in the time series (from 21:00 the day before to 22:00).

- For electricity in Sweden:
  - For Sweden, a day is always from 23:00 to 23:00 (note that when receiving documents from parties outside of Sweden, the time series may be in local time).
- For gas in Denmark and Sweden:
  - A day is from 05:00 to 05:00 during wintertime.
  - A day is from 04:00 to 04:00 during summertime (daylight saving time).
  - When changing from wintertime to summertime there are 23 hours in the time series (from 05:00 the day before to 04:00).
  - When changing from summertime to wintertime there are 25 hours in the time series (from 04:00 the day before to 05:00).

2.4 Use of processing start/end date

In several business documents the beginning and ending of the processing date/period is required. The period shall be used for control purposes. A message with a period in the detailed section not within the period in the header section shall be discarded.

2.5 Time format in Validity Start and Validity End

To be in line with other date/time elements, the format for Validity Start and Validity End shall be YYYY-MM-DDTHH:MM:SSZ.

Denmark, Finland and Norway use “local time”, while Sweden use “normal time”. This means that the Validity Start and Validity End date/time always should use the following times:

- Finland will always use YYYY-MM-DDT22:00:00Z, the day before, during wintertime.
- Finland will always use YYYY-MM-DDT21:00:00Z, the day before, during summertime.
- Denmark and Norway will always use YYYY-MM-DDT23:00:00Z, the day before, during wintertime.
- Denmark and Norway will always use YYYY-MM-DDT22:00:00Z, the day before, during summertime.
- Sweden will always use YYYY-MM-DDT23:00:00Z, the day before, during both summertime and wintertime.

2.6 Usage of Resolution and Position

The resolution of a time series period shall always be expressed according to ISO 8601, e.g. **PT1H** or **PT60M.**

The time interval defined in the period class shall always be a multiple of its resolution.

The position must begin with 1 and increment by 1 for each subsequent position forming a series of contiguous numbers covering the complete range of the Period, unless other ways stated in a BRS.

Note: The rules in the ENTSO-E ESS IG are that the “resolution of a time series period shall always be expressed in minutes”, while Nordic implementations of ESS allow for other resolutions, such as **PT1H** or **PT1D**”.

3 COMMON RULES FOR XML DOCUMENTS

3.1 Direction

Quantities are normally non-signed values, but might as an exception be specified with a direction, using positive and negative values, e.g. for netted values and combined generation and pumping power plants. In the latter case, specific rules must be defined in the relevant BRS.

3.2 Energy flow direction

To ensure that the direction of an energy flow can be established it is important to clearly establish a set of business rules concerning the content of a document. There is frequently confusion between the origin or destination of a flow and its direction. The UseCase showed in **Figure 1** outlines what is necessary for the balancing process. In this diagram, a production responsible party, who is normally the source of the energy, from a balancing point of view, puts the energy into an area. In a similar fashion *Consumption responsible*, takes the energy out of an area.

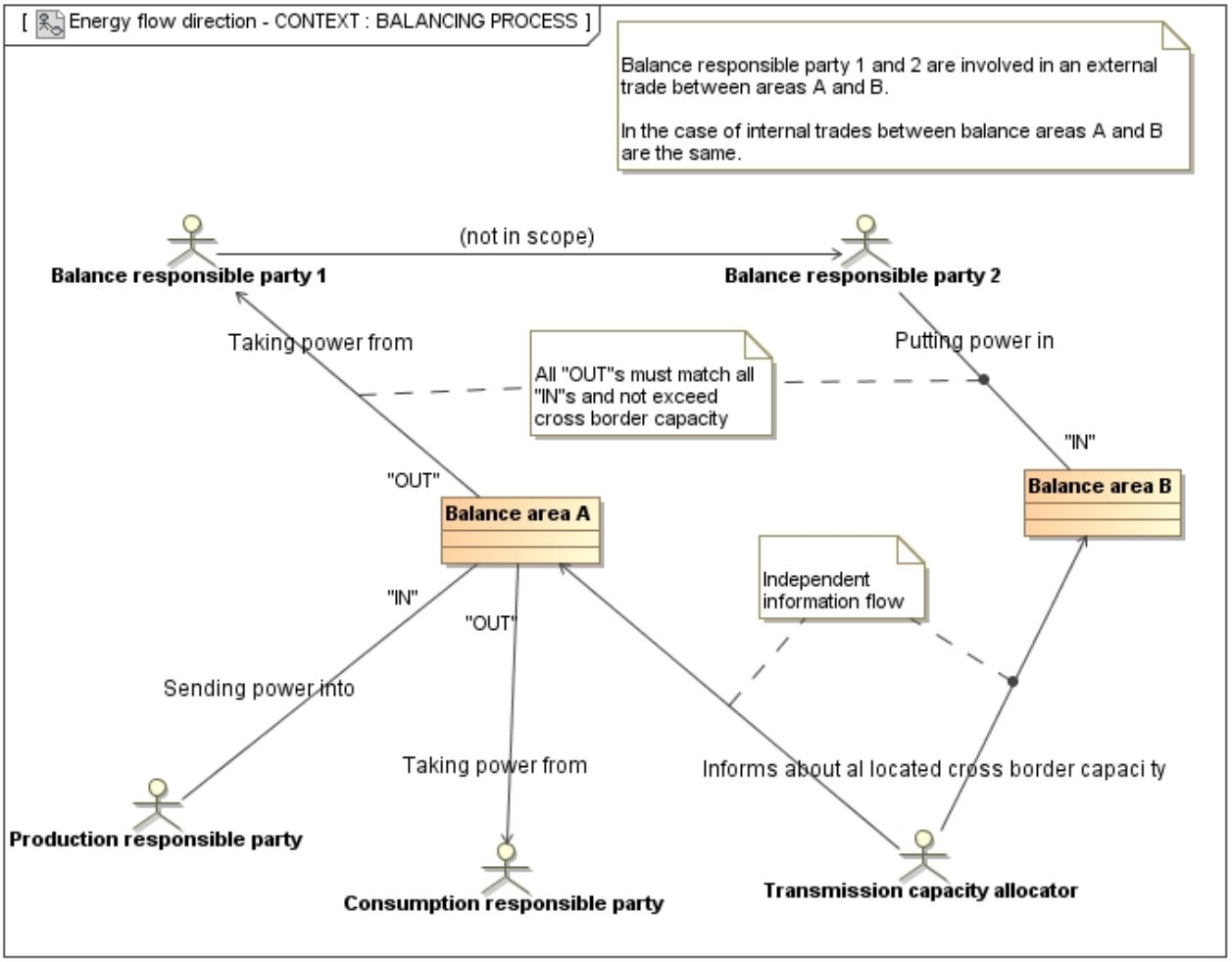

Figure 1: Energy flow direction

In the case of trades between parties within an area the “out area” will always be the same as the “in area”. An error condition shall be raised if these values are not equal. The direction of the energy flow therefore can be determined as going from the “out party” (seller) to the “in party” (buyer).

In the case of trades between parties in different areas the “out area” shall always be different to the “in area”. If this is not the case, then an error condition shall be raised. The energy flow shall always go from the “out area” to the “in area”. In the case of external trades the “out party” need not be different to the “in party”. With the application of these principles an area can be said to be balanced if all the “outs” are equal to all the “ins”.

To ensure that the areas and parties are clearly identified in the document, the terms “in” and “out” will be used in the area and party names.

3.3 Rounding rules

The rounding rules to be used within a message exchange shall be defined in the BRS, if relevant. There are two preferred principles for rounding, both using normal arithmetic rounding rules, i.e. rest values less than 5 are rounded downwards and, 5 and above are rounded upwards:

- Rest values are ignored.
- Rest values are added to the next period value within the same time series.

3.4 Signed values

The following rules apply for usage of signed values:

- All quantities shall be positive (without sign) unless explicitly stated otherwise, such as for netted exchange between Metering Grid Areas (MGA)
- Consumption and production are always reported (exchanged) as positive values
- Pumping is reported in separate time series as aggregated consumption
- Amounts can be both positive and negative
- Positive values are sent without sign and negative values are sent with a leading minus

3.5 Measurement unit qualifier for power and energy

The following rules shall be used for measurement unit when sending power and energy values in time series:

- MW, kW, MVAr or kVAr connected to a period are used if sending average power over a period.
- MW, kW, MVAr or kVAr connected to a point in time are used if sending an instantaneous value or a peak value.
- MWh, kWh, MVArh or kVArh connected to a period are used if sending the total energy over a period.

The measure unit qualifiers MWh/h, kWh/h, MVArh/h and kVArh/h shall not to be used.

3.6 Quantity quality

For metered data from one MP there are three quantity qualities available:

21 (Temporary) The value has an uncertainty. The “temporary” quality is typically used for unreliable values, such as if the values are outside limits and need to be manually checked. Temporary values should be replaced by “Estimated, approved for billing” or “Metered” before used for billing.

56 (Estimated, approved for billing) This quality is used when the data is final, but estimated. E.g. if it is not possible to get data from the meter.

"No code" (Metered) No code is the default value and is used for metered values that is within the limits.

For aggregate data from several MPs there are the same three qualities available.

21 (Temporary) The value has an uncertainty. The "temporary" quality is typically used for unreliable values, such as if there are missing values in the relevant hour for one or more of the underlying MPs or if the values are outside limits and need to be manually checked. Temporary values should be replaced by "Estimated, approved for billing" or "Metered" before used for billing.

56 (Estimated, approved for billing) This quality is used when one or more of the underlying MPs have estimated values, but are final.

"No code" (Metered) No code is the default value and is used when all underlying MPs have a quality of metered.

In CIM documents there is no Missing Value attribute, hence if there are missing values, a code must be used in the Quantity Quality attribute, i.e. **46** (Does not exist).
Or these:

A01	Adjusted	The contents of the object have been adjusted.
A02	Not available	The contents of the object are not available (46 Does not exist).
A03	Estimated	The contents of the object are estimated (56 Estimated).
A04	As provided	The contents of the object are as provided (No code).
A05	Incomplete	The contents of the object are calculated based on incomplete data (21 Temporary).

Note:

- It should be avoided mixing UN/CEFACT codes and ENTSO-E codes. Which code set to use must be documented in implementation guides, user guide or similar.

3.7 Identification of Transactions and Time Series

The Time Series ID or Transaction ID, the latter used for identification of document payloads that are not a Time Series, shall be unique over time for the sender in question. This rule also applies for resent Time Series or Transactions, i.e. if a Time Series or Transaction is resent, the Time Series ID or Transaction ID shall be updated. Note that this is a Nordic rule that is stricter than what is stated in the ENTSO-E implementation guides, which only requires the Time Series Identification to be unique within the document.

In earlier document exchanges (e.g. when using MSCONS and DELFOR) a "Serial-ID" was required. The Serial-ID was a fixed ID for a specific time series, not changed for new periods of time. The "Time series-ID" used in newer exchanges must follow the rules above, i.e. be unique over time.

3.8 Number of digits (meter/register characteristic)

When sending the meter or register characteristic "Number of digits" as additional information in a business document the number of digits shall be the integer part (the digits before the decimal point) of the digits in the register.

3.9 Extra (not specified) data elements in documents

It is recommended that the receiver accept XML-documents with data elements that are not required, dependent or bilaterally agreed, if the XML document is valid. However, it is not necessary to process elements that are not specified within the relevant process.

3.10 Resending of documents

When resending a document, the previous quantities (or values, amounts etc.) will be overwritten, unless otherwise explicitly stated in a BRS or other documentation

3.11 Namespace Prefix and schemaLocation

XML namespaces provide a method to avoid element name conflicts, while the "xsi:schemaLocation" attribute provide the path to the physical location of XML schema. Neither Namespace prefixes nor a "xsi:schemaLocation" attribute are required in a XML instance document.

Examples of xml instance files will often have a "xsi:schemaLocation" attribute. The inclusion of the "xsi:schemaLocation" attribute can be useful during development. However, when exchanging XML documents in production, the sender cannot know the exact location of the XML schemas at the receiver site, hence the "xsi:schemaLocation" attribute should be avoided.

Examples of xml instance files will also often have namespace prefixes, declared by the "xmlns" attribute. It is up to sender of a xml instance file if qualified namespace (namespace prefixes) are used or not. eSett will for instance not use qualified namespaces in the documents sent.

3.12 Versioning and project sets

General principles:

- There will be one set of Ediel schemas, which includes all schemas used in various Nordic projects and always consist of the latest updated schemas.
- In addition, there will be Nordic project sets, such as Market Operator schemas and NBS schemas, with the set of schemas used by the project.
- Every time a schema is updated, including addition of new codes, the common set of Ediel schemas should be updated.
- All changes to a schema, except for code additions, shall imply a new version of the schema.
- For error corrections the versioning must be decided in each case.
- We will change the release number when a change is backwards compatible and the version number when not backwards compatible or it is seen as a major update.

3.13 Resolution for timeseries with only one observation

If sending a time series with only one observation (instant values), the following values are advised:

Curve Type: **A02**. Point

Resolution: **0 seconds**, i.e. PT0S

Note:

- In this case only one repetition of the Point class is possible.

4 CODES AND IDENTIFIERS

4.1 Code prefixes

The following prefixes are used to describe the origin of a code:

Z	Temporary codes issued by Nordic Market Expert Group
A	Codes issued by ENTSO-E
E	Codes issued by ebIX®

The code list responsible agency for codes issued by Nordic Market Expert Group (Ediel) shall always be "**330** Nordic Ediel Group" when using documents issued by ebIX®.

In CIM documents having a Code List Responsible, the ENTSO-E national codes shall be used:

NNN	Nordic code list
NDK	Danish code list
NFI	Finish code list
NNO	Norwegian code list
NSE	Swedish code list

4.2 Codes and qualifiers format

Codes and qualifiers are case sensitive. Uppercase is normally used.

4.3 XML code lists

Code lists will be maintained in XML as separate code lists for separate code list responsible agencies. Union is used in XML to merge code lists when needed.

4.4 Code and Identifier schemes

A code or identifier scheme is used to uniquely identify the responsible agency for the code or identifier of an object, such as a party, a domain (Metering Point, Area etc.), a product etc. In the Nordic country, objects are identified using one of two international schemes, GS1 or EIC, or by using a national scheme.

The following table shows how to convert between ebIX® and ENTSO-E Identifier schemes:

Identifier scheme	ebIX®		ENTSO-E
	Scheme Agency Identifier	Scheme Identifier	Coding Scheme
EIC	305	Not used	A01
GS1	9	Not used	A10
Danish national coding scheme	260	DK	NDK
Finnish national coding scheme	260	SLY	NFI

Norwegian national coding scheme	260	SM	NNO
Swedish national coding scheme	260	SVK	NSE

Table 1: Usage of Coding Schemes in the Nordic countries

The following table shows which schemes that are used for parties and a selection of domains in the Nordic countries:

	Denmark		Finland		Norway		Sweden	
	ebIX®	ENTSO-E	ebIX®	ENTSO-E	ebIX®	ENTSO-E	ebIX®	ENTSO-E
Parties	9 or 305	A10 or A01	260/SLY	NFI	9	A10	260/SVK	NSE
MGA	260/DK	NDK	260/SLY	NFI	Not decided (9 or 305?)	Not decided (9 or 305?)	260/SVK	NSE
BZ and SA	305	A01	305	A01	305	A01	305	A01
MP	9	A10	260/SLY	NFI	9	A10	9 or 89	A10 or NSE
RO	9	A10	260/SLY	NFI	260/SM	NNO	260/SVK	NSE

Table 2: Usage of Coding Schemes in the Nordic countries

Abbreviations:

MGA	Metering Grid Area
BZ	Bidding Zones
SA	Scheduling Areas
MP	Metering point
RO	Resource objects
ENTSO-E	European Network of Transmission System Operators for Electricity
ebIX®	European forum for energy Business Information eXchange
EIC	European Identification Code, issued by ENTSO-E
GS1	Issuing body of GS1 identification schemes

In ebIX® document the list Agency or scheme Agency Identifier can be:

GS1	code 9
ENTSO-E	code 305
ebIX®	code 260

For national code Lists or identification Schemes the list Agency or scheme Agency Identifier will be ebIX® (code 260) and, in addition, a list Agency or scheme Identifier that will identify the country:

DK	Danish Ediel group
SLY	Finnish Electricity Association
SM	Norwegian code list
SVK	Svenska kraftnät

In ENTSO-E documents the list- or scheme Agency Identifier can be:

GS1	A10
EIC	A01
Denmark	NDK
Finland	NFI
Norway	NNO
Sweden	NSE

4.5 Structure of codes and enumerations

When creating new code lists and/or enumerations, the structure should be based on one of the following three principles:

a) Recognisable based on standard and context (e.g. country codes “SE”, “US”, “NO”)
b) Transparent based on standard (e.g. time period “PT1H”)
c) Synthetic code with a value (e.g. “A123”)

Self-explanatory free text (e.g. Status = “read”) should be avoided since it is easy to make spelling differences in clear text, such as different usage of upper/lover cases, it may be differences in granularity, and it may give problems with future harmonisation.

5 ACKNOWLEDGEMENT PROCESS

5.1 Business Partner View, Acknowledge business document

In addition to the roles defined in the ebIX, EFET and ENTSO-E Harmonised role model [7] the following partner types have been identified as relevant for the Acknowledgement process.

Definitions:

Sender:	A party sending a business document (originator).
Receiver:	A party receiving a business document (recipient).

5.2 Business Entity View, Acknowledge business document

In addition to the domains defined in the ebIX, EFET and ENTSO-E Harmonised role model [7] the following business entities have been identified as relevant for the Acknowledgement process.

Acknowledgement of receipt:	A message (business signal) rejecting the receipt of a business document with syntactical errors. This technical Acknowledgement of receipt may be either through an XML Acknowledgement document or through another form of communication.
Acknowledgement of processing:	A message (business signal) confirming or rejecting the processing of a received business document.

5.3 Business area: Acknowledge business document

The main part of this chapter is taken from the ENTSO-E ECAN IG [8].

The acknowledgement process is specifying a generic technical acknowledgement document and an application acknowledgement document that can be used in all relevant processes.

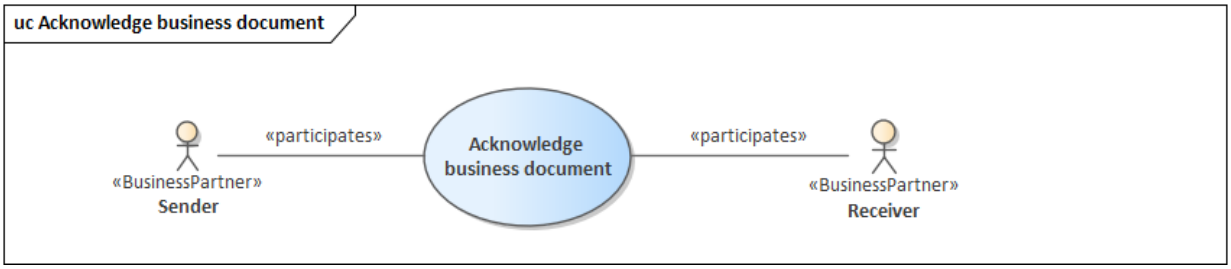

Figure 2: UseCase: Acknowledge business document

A document is controlled within the system environment at two levels:

1. It is first controlled at system level to detect syntax errors (XML parsing errors, file processing errors, etc.).
2. It is thereafter controlled at the application level to detect any semantic errors (invalid data, wrong process, etc.).

If there is a problem encountered at the first level then an Acknowledgment of receipt, i.e. a technical acknowledgement, shall be sent to inform the originator of the problem, if possible. If errors are encountered at the second level or if the application can successfully process the information, then an Acknowledgment of processing, i.e. an application acknowledgement, shall be sent to inform the

originator of the situation. Note however that positive Acknowledgment of processing is only sent if specified within the relevant process.

The Acknowledgement document transmission to the party concerned should not be delayed.

The Acknowledgement document fits into a general acknowledgement process as outlined in the figure below.

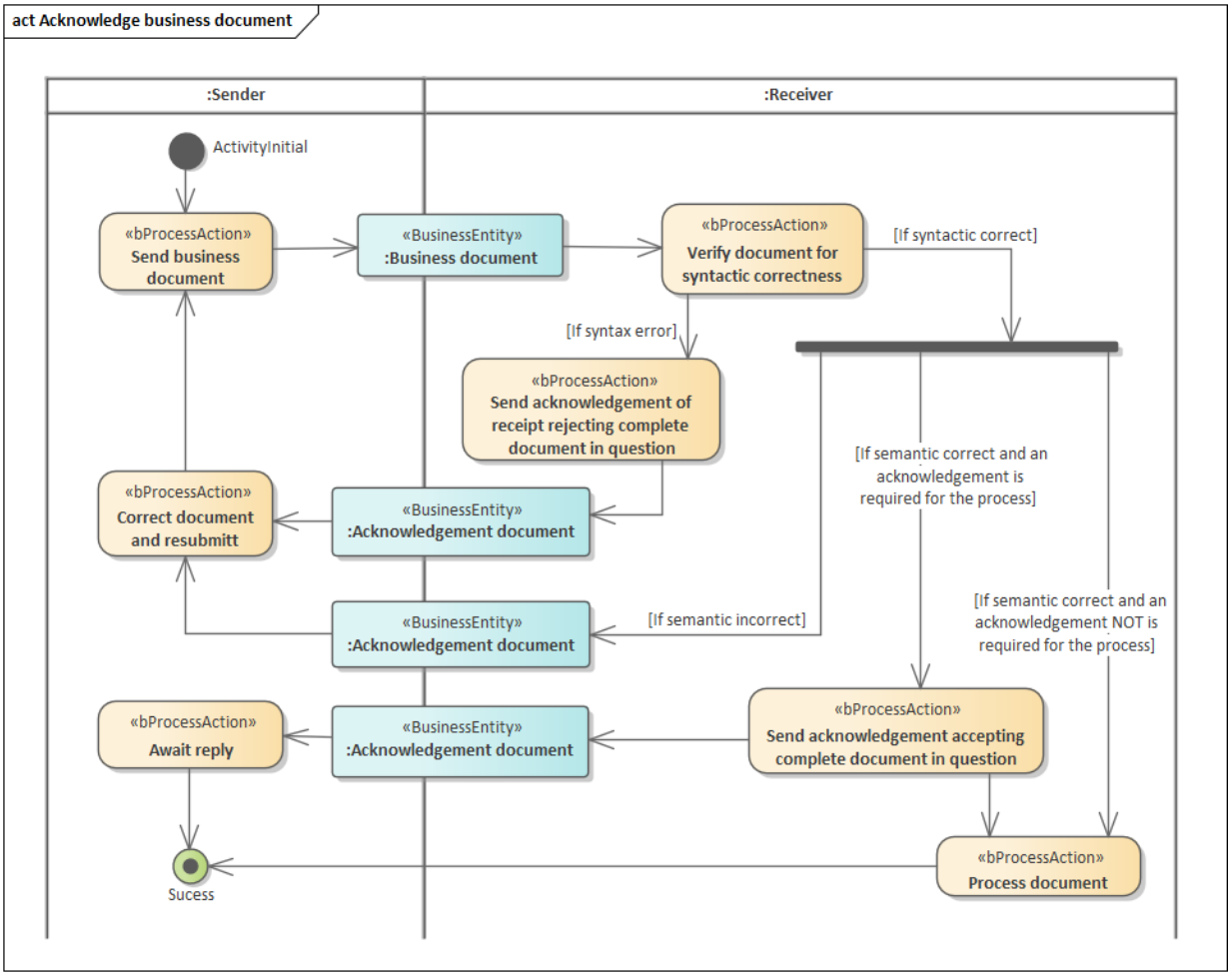

Figure 3: Activity diagram: Acknowledge business document

5.3.1 Acknowledgement of receipt

An Acknowledgment of receipt occurs when an XML document is received that cannot be correctly processed for submission to the application. Such an error could occur for example whenever the XML parser cannot correctly parse the incoming document. Other instances could be the incapacity of correctly identifying the sender of the document in relation to the process requested. In such a case an Acknowledgment of receipt can be sent to the document sender providing the information that the XML document in question cannot be correctly processed by the system.

5.3.2 Acknowledgment of processing

An Acknowledgment of processing is required for the transmission of all electronic documents between the Nordic TSOs. Each of the electronic documents received shall follow the procedure outlined in **Figure 3**. For other communication, e.g. between the TSOs and other actors, the acknowledgement principles will be stated in the Business requirement specification.

When a document is received it will be verified at the application level to ensure that there are no faults that could prevent its correct processing. A document that is valid after this verification shall necessitate the generation of an Acknowledgment of processing accepting in its entirety the document in question.

A document in error shall generate an Acknowledgment of receipt or an Acknowledgment of processing that completely rejects the document in question. This acknowledgment sequence is not described in the normal business processes but shall be considered an integral part of each transmission.

5.4 Business Entity View, Acknowledge business document

In this chapter the details of the IEC 62325-451-1 Ed.2 Acknowledgement Document are described, see [10].

The Acknowledgement Document described below is the general IEC Acknowledgement Document. Nordic restrictions to the element usage are shown in chapter 5.4.4.

An Acknowledgement document, either Acknowledgement of receipt or Acknowledgement of processing, is sent to the originator of the business document to acknowledge receipt of the document identified in the acknowledgement document. For example, an Acknowledgement of processing may be sent to confirm reception of a schedule document immediately after a first level series of validations have been carried out. The originator of the acknowledgement document is the receiver of the document being acknowledged. The receiver of the acknowledgment document is the sender of the document being acknowledged.

The document being acknowledged will have been validated in situ to ensure that it may be correctly processed by the application. The validation can also be carried out against a previous version of the same document (to identify an incomplete time series set for example).

5.4.1 Class diagram: IEC/CIM Acknowledgement Document contextual model

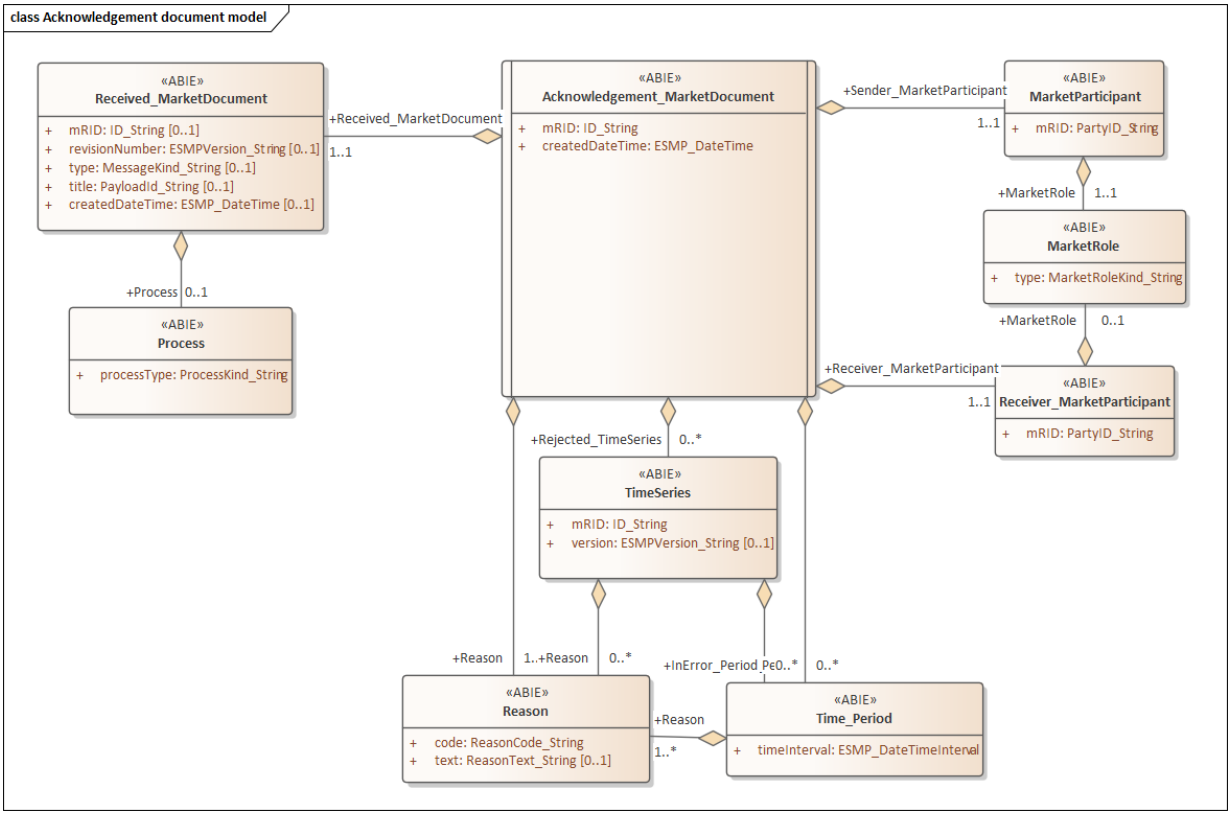

Figure 4 Class diagram: IEC 62325-451-1 Ed.2 Acknowledgement Document contextual model

5.4.2 Class diagram: IEC/CIM Acknowledgement Document assembly model

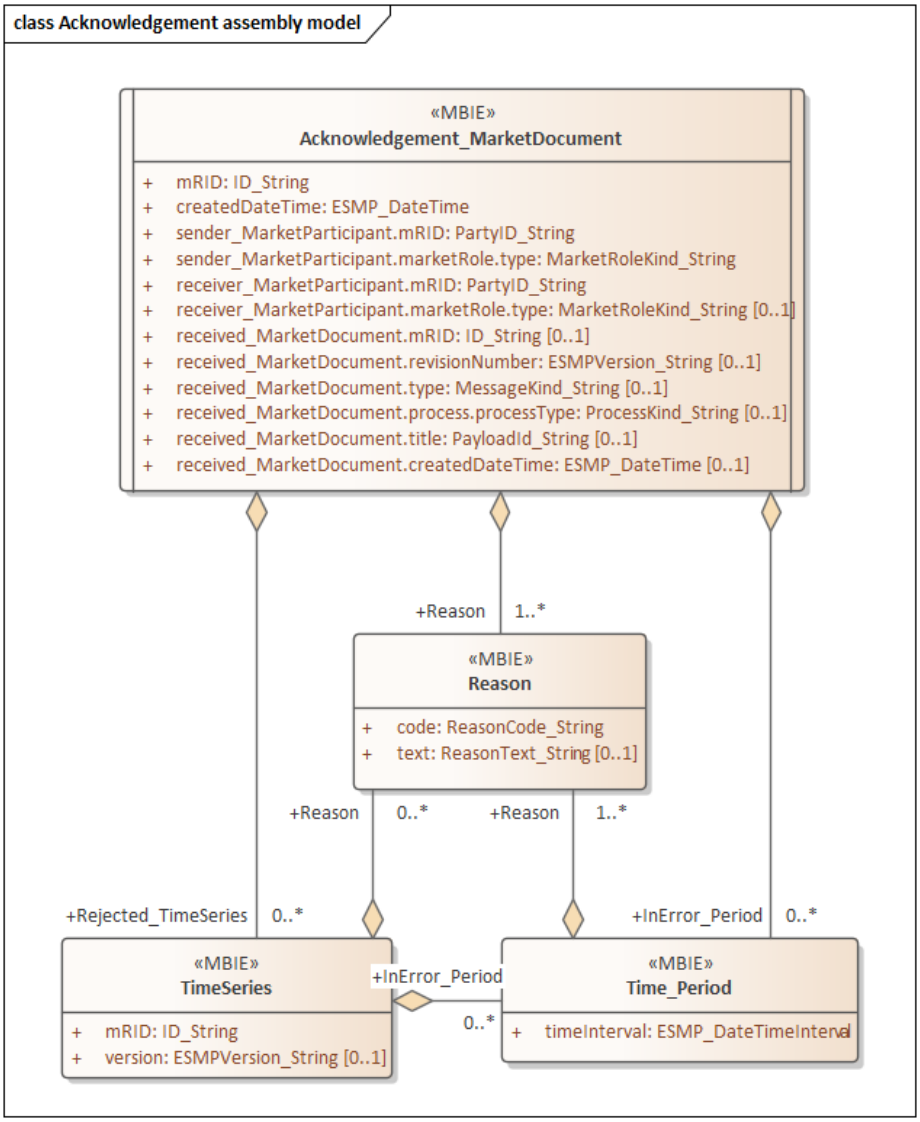

Figure 5 Class diagram: IEC 62325-451-1 Ed.2 Acknowledgement Document assembly model

5.4.3 Rules governing the Reason class:

- If the acknowledgement of a document is without error only one Reason element is necessary at the acknowledgement header level.
- If there are errors, then there may be as many Reason elements as are necessary to describe any errors discovered in the received document.
- At least one reason element must appear associated with the header part of the document.
- Acknowledgement documents are always referencing a received document in the Nordic countries. However, it is possible to have partial confirmations and rejections, i.e. to reject single occurrences of a payload.
- A Reason code is used to state the status of the Acknowledgement. The following rules apply for the reason code:
    - On Acknowledgement Document Level:
      Code **A01** (Message fully accepted) Positive acknowledgement of processing

Code **A02** (Message fully rejected)	Negative acknowledgement of receipt or processing

- On Time Series Rejection level:

Code **999** (General error)	Only used if negative acknowledgement of receipt or processing, Reason code = **A02** on Acknowledgement Document Level

Note: An acknowledgement document shall not be sent as responses to an acknowledgement document, not even for erroneous ones. Such errors must be handled manually.

5.4.4 Attribute usage: IEC 62325-451-1 Ed.2 Acknowledgement Document

Below is shown the attributes used in the Nordic countries, including restrictions to the cardinalities.

Attribute	Cl.	Descriptions and comments
Acknowledgement MarketDocument	[1]	
mRID	[1]	Unique identification of the Acknowledgement Document.
createdDateTime	[1]	Date and time of creation of the Acknowledgement Document.
sender_MarketParticipant.mRID	[1]	Unique identification of the sender of the Acknowledgement Document. The Sender ID shall be the same as the Receiver ID in the original document that is acknowledged.
sender_MarketParticipant.marketRole.type	[1]	The Role of the sender of the Acknowledgement Document. The Sender Role shall be the same as the Receiver Role in the original document that is acknowledged. For conversion between ebIX® and ENTSO-E Role Codes, see chapter 5.4.5 below.
receiver_MarketParticipant.mRID	[1]	Unique identification of the receiver of the Acknowledgement Document. The Receiver ID shall be the same as the Sender ID in the original document that is acknowledged.
receiver_MarketParticipant.marketRole.type	[0..1]	The Role of the receiver of the Acknowledgement Document. The Receiver Role shall be the same as the Sender Role in the original document that is acknowledged. For conversion between ebIX® and ENTSO-E Role Codes, see chapter 5.4.5 below. The Receiver role shall be used if available, see chapter 5.4.5 below.

Attribute	Cl.	Descriptions and comments
received_MarketDocument.mRID	[1]	Unique identification of the received business document.
received_MarketDocument.revisionNumber	[0..1]	The version of the received business document. **Note:** Only used if used in the original business document.
received_MarketDocument.type	[0..1]	The Document Type (Message type) of the received business document. **Note:** Shall be used if available, i.e. always in positive acknowledgements.
received_MarketDocument.process.processType	[0..1]	The Process Type of the received business document. **Note:** Only used if used in the original business document.
Rejected_TimeSeries	[0..*]	Only used if the original business document is rejected, i.e. the Reason Code on Acknowledgement Document level = **A02.**
mRID	[1]	Unique identification of the object, such as a Time Series Id or a Transaction Id.
Reason (Rejected_TimeSeries level)	[0..*]	Only used if the original business document is rejected, i.e. the Reason Code on Acknowledgement Document level = **A02.**
code	[1]	**999** General error
text	[1]	The Reason Text should be as detailed as possible, i.e. the recipient is able to understand way the business document has been rejected.
Reason (Acknowledgement_MarketDocument level)	[1]	
code	[1]	**A01** Message fully accepted **A02** Message fully rejected
text	[0..1]	The Reason Text should be as detailed as possible, so that the recipient is able to understand why the business document have been rejected. **Note:** Only used if not approved (**Reason Code ≠ A01**)

Table 3: ENTSO-E Acknowledgement Document

5.4.5 Acknowledgement of ebIX® documents and Role conversions

There are some differences between ebIX® and ENTSO-E when it comes to usage of roles, i.e.:

- ebIX® documents use UN/CEFCAT codes for roles, while ENTSO-E documents use ENTSO-E codes.
- ebIX® only use the “Business Process Role” in the document header, while ENTSO-E always use a Sender Role and a Receiver Role. The ebIX® “Business Process Role” is normally the

Sender Role in a requesting document and the Receiver Role in a responding document or a notification (e.g. documents containing a time series).

In the Nordic countries it is agreed to always use the ENTSO-E acknowledgement document when acknowledging an XML document. This means that the UN/CEFACT role code used by ebIX® must be converted to ENTSO-E role codes used by ENTSO-E. Further on, the identifier schemes used for identifying the relevant parties must be converted.

The conversion of identifier schemes is detailed in chapter 4.4, while the conversion from ebIX® to ENTSO-E role codes is detailed below:

ebIX® Energy Business Process Role Code (from original ebIX® document)	ENTSO-E Role Code (used in the acknowledgement)	Role name
DDE	A24	Metered data collector
DDK	A08	Balance responsible party
DDM	A17	Grid access provider
DDQ	A12	Balance supplier
DDX	A05	Imbalance settlement responsible
DDZ	A26	Metering point administrator
DEA	A09	Metered data aggregator
DEB	A23	Meter operator
DEC	A20	Party connected to grid
DED	A22	Profile maintenance party
DGG	A46	Balancing Service Provider
EZ	A04	System operator
GD	A21	Producer
MAD	A19	Meter administrator
MDR	A25	Metered data responsible
UD	A13	Consumer
Z06	A38	Reconciliation Responsible
Z07	A37	Reconciliation Accountable
Z08	A10	Billing agent
Z09	A11	Market operator

Table 4: Conversion table for ebIX® and ENTSO-E role codes

The following role codes will be used for documents related to the Nordic Balance Settlement:

ebIX® document	ebIX® Energy Business Process Role Code (from original document)	Sender role in ENTSO-E Acknowledgement Document	Receiver role in ENTSO-E Acknowledgement Document
Ediel (ebIX® based) Validated Data for Settlement for Aggregator (E66, E44)	**DEA** Metered data aggregator	**A09** Metered data aggregator[1]	**A25** Metered data responsible
Ediel (ebIX® based) Aggregated Data per MGA (E31, E44)	**DDX** Imbalance settlement responsible	**A05** Imbalance settlement responsible	**A09** Metered data aggregator
	DDK Balance responsible party	**A08** Balance responsible party	**A09** Metered data aggregator
	DDQ Balance power supplier	**A12** Balance supplier	**A09** Metered data aggregator
Ediel (ebIX® based) Aggregated Data Per Neighbouring Grid For Settlement Responsible (E31, E44)	**DDX** Imbalance settlement responsible	**A05** Imbalance settlement responsible	**A09** Metered data aggregator
Ediel Confirmation of Aggregated Data Per Neighbouring Grid From Settlement Responsible (A07/A08, Z44)	**DEA** Metered data aggregator	**A09** Metered data aggregator	**A05** Imbalance settlement responsible

Table 5: Conversion table for ebIX® and ENTSO-E role codes for NBS related documents

[1] According to the ebIX® model this is the Metered Data Aggregator role within eSett

6 COMMUNICATION

6.1 SMTP

When SMTP is used, the message must be in the MIME format, see [3], [4], [5] and [6]. The actual message must be sent as an attached file, not as a part of the body text. There should not be any meaning (e.g. routing information) in the attached file name or file extension. There shall only be one attachment in one SMTP-exchange.

- Ref ftp://ftp.rfc-editor.org/in-notes/rfc7303.txt
  - All xml schemas and documents shall use “<?xml version="1.0" encoding="UTF-8"?>”
  - All SMTP messages shall use:

    MIME-version: 1.0
    Content-Type: application/XML; charset="utf-8"
    Content-Transfer-Encoding: base64

6.2 Web Services (WS)

SOAP over HTTP is to be used to expose a web service. The message should be contained in a child element of the SOAP Body element.

When a message has been submitted to the web service the web service should then be polled for an acknowledgement (asynchronous request/response). If the acknowledgement is not returned within 5 minutes after submission the message should be considered lost.

There are two preferred communication types to choose from:

- The client poll the web service to retrieve messages.
- The web service performs call-back on acknowledgements, so the client does not have to poll the web service.

HTTP Secure should be used in favour of WS-Security but local rules can be applied.

6.3 Time synchronisation

Each party shall undertake that the time in their mail and EDI systems is within 10 seconds of the national local time. For countries using Central European daylight-Saving Time (CEST), this means that server time shall be set to UTC+1 during wintertime and to UTC+2 during summertime.

6.4 Interchange size

The interchange size is dependent on the communication channel used; hence no Nordic advise is given for the max size.

If compression is used, the ZIP format is the preferred solution.

7 SECURITY

Security mechanisms are for the time being handled nationally.

Appendix A DICTIONARY

AAC: Already Allocated Capacity is the total amount of allocated transmission rights, whether they are capacity or exchange programmes depending on the allocation method.

Allocated capacity market: A market area where the transmission capacity between the balance areas is given to the Balance Responsible Parties according to rules carried out by a Transmission Capacity Allocator. Trade between balance areas is carried out on a bilateral or unilateral basis.

Ancillary services: Ancillary services consist of primary, secondary and tertiary reserves, characterised by their activation time:

- The primary reserve is instantaneous and is activated automatically as a function of the frequency or to be more exact, the deviation from 50 Hz. The settings of the generators define how much they contribute when there is a frequency deviation.
- The secondary or fast reserves are reserves that within 15 minutes shall be able to eliminate the unbalance between generation and load and thus re-establish the primary or instantaneous reserve.
- The tertiary or slow reserve shall have such qualities that it can replace the fast reserves. Economical judgement is taken into account when decision is taken regarding the speed of the slow reserves. The activation of tertiary reserves is handled manually.

ATC: *Available Transmission Capacity* is the part of NTC that remains available, after each phase of the allocation procedure, for further commercial activity. ATC is given by the following equation: **ATC** = **NTC-AAC.**

The ATC is exchanged between *System operators* and between *System operators* and the *Transmission capacity allocator*. The ATC for a certain market cannot be changed after the closure of the relevant market. The ATC may be negative.

Bidding Zone: Refer to ebIX, EFET and ENTSO-E Harmonised Electricity Role Model definition.

Corridor: A corridor is a group of power cables/lines. Corridors are used in order to give details about individual cables. The information is used in balance management to present details of import/export plans (individual plans display) and to compute surplus/deficit of each control area. For example, Skagerrak corridor has 3 cables and can be defined as two HVDC corridors (Skagerrak1-2 and Skagerrak3). The Corridors can be split into three types:

- Elspot corridor
- Cut corridor
- External corridor

Explicit auctioning: **S**ignifies that what is auctioned is the transmission capacity rights to transfer energy.

Allocation type	Implicit Auction	Explicit Auction

Flow based	ENTSO-E – Europex flow-based market coupling	Not yet implemented
ATC based	• Market coupling, e.g. Belpex • Market splitting	ECAN V1 • All bilateral auctions, e.g. Energinet.dk - E.ON. • Coordinated auctions, e.g. CEPS, VE-T, PSE-O, E.ON, SEPS E.G. TSO Auction B.V.

FCR-D: *Frequency Containment Reserves, Disturbance* (earlier ***FDR,*** *Frequency control disturbance reserve*) is operating reserves activated for stabilizing System Frequency after an imbalance. **FCR-D** is an energy reserve that is automatically activated when the frequency falls below 49.90 Hz. It is a requirement that the stationary frequency not falls below 49.50 Hz in the interconnected Nordic energy system and that all **FCR-D** must be activated when the frequency is higher than this. See also **FCR-N**.

FCR-N: *Frequency Containment Reserves, Normal* (earlier ***FNR***, *Frequency control* reserve) is operating reserves activated for stabilizing System Frequency after an imbalance. **FCR-N** is energy reserve that is automatically activated in both directions around a set point when the frequency varies between 50.10 Hz and 49.90 Hz. See also **FCR-D**.

Implicit auctioning: **S**ignifies that what is auctioned is both the energy itself and transmission capacity rights together.

FRR-A: *Frequency Restoration Reserves*, *Automatic* (earlier ***LFC,*** *Load Frequency Control*) is reserves activated to restore System Frequency to the Nominal Frequency and, where applicable, power balance to the scheduled value.

FRR-M: *Frequency Restoration Reserves*, *Manual* (earlier ***LFC,*** *Load Frequency Control*) is reserves activated to restore System Frequency to the Nominal Frequency and, where applicable, power balance to the scheduled value. **FRR-M** is not used in the Nordic countries (by January 2013)**.**

NTC: *Net Transfer Capacity* is defined as NTC = TTC – TRM and corresponds to the maximum exchange between two areas compatible with security standards applicable in both areas and taking into account the technical uncertainties on future network conditions.

TTC: The *Total Transfer Capacity* is the maximum exchange program between two areas compatible with operational security standards applicable at each system if future network conditions, generation and load patterns were perfectly known in advance.

OC: *Operational capacity* is exchanged between *System operators*. The OC is the available transfer capacity as established during the operational day, i.e. the capacity available after closure of the Elbas market. The OC is used for system operation and not for market purposes. The OC may be both higher and lower than the ATC. The OC may be negative.

Offered Capacity: Is a part of or equivalent to the ATC that will be offered by the Transmission Capacity Allocator to the market. Depending on Market Rules, the calculation of the Offered Capacity may include the consideration of firm exchange programs in one direction, to increase the Offered Capacity in the other direction. This is generally known as Netting aimed at maximising Offered Capacity.

Portfolio: An entity held by the Market Operator linking all bids from a participant, within one country and currency.

Prognosis: A prognosis is a plan that is not binding for the sender and is not used directly in a settlement and/or operational process, see also *Schedule* below.

Schedule: A *Schedule* is a plan that is binding and used directly in settlement and/or operational processes, see also *Prognosis* above.

Scheduling area: Refer to ebIX, EFET and ENTSO-E Harmonised Electricity Role Model definition.

System Operator: Refer to ebIX, EFET and ENTSO-E Harmonised Electricity Role Model definition.

Transfer capacity: Capacity exchanged between *System operators* and between *System operators* and the *Transmission capacity allocator*. The *Transfer capacity* can be split into *Operational capacity* (OC) and *Available Transfer Capacity* (ATC).

Transmission Capacity Allocator: Manages, on behalf of the System Operators, the allocation of available transmission capacity for an Allocated capacity area. He offers the available transmission capacity to the market, allocates the available transmission capacity to individual Capacity Traders and calculates the billing amount of already allocated capacities to the Capacity Traders.

TRM: *Transmission Reliability Margin* is a security margin that copes with uncertainties on the computed TTC values arising from:

a) Unintended deviations of physical flows during operation due to the physical functioning of load-frequency regulation
b) Emergency exchanges between SOs to cope with unexpected, unbalanced situations in real time
c) Inaccuracies, e.g. in data collection and measurements.

TTC: *Total Transfer Capacity* is the maximum exchange program between two areas compatible with operational security standards applicable at each system if future network conditions, generation and load patterns were perfectly known in advance.

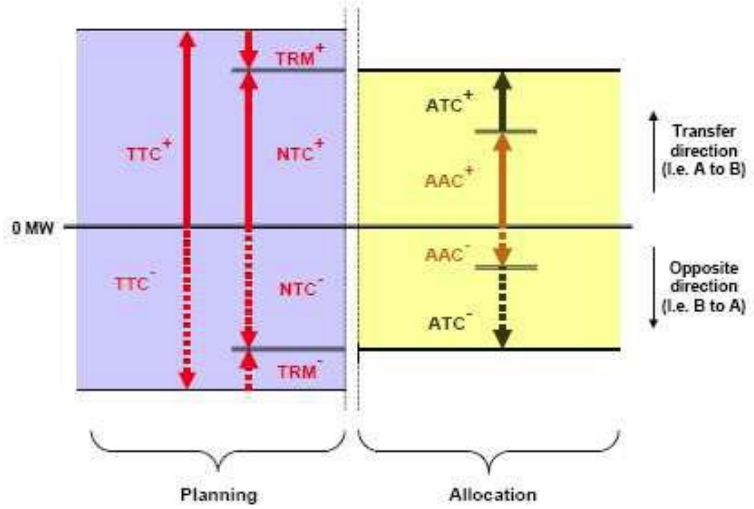

Figure 6: **Transfer capacity definitions**

The figure above describes a simplified calculation of the TTC. In addition there might be other elements, such as FDR (Frequency controlled Disturbance Reserve).

Appendix B INTRODUCTION TO UMM AND UML

B.1 Introduction to UMM

The methodology basis for Nordic TSO Market model for data exchange is the UN/CEFCAT modelling Methodology (UMM). UMM is a UML modelling approach to design the business services that each partner must provide to collaborate. It provides the business justification for the services to be implemented in a service-oriented collaboration architecture. UMM focuses on developing a global choreography of inter organizational business processes and their information exchanges. UMM models are notated in UML syntax and are platform independent models. The platform independent UMM models identify which services need to be realised in a service-oriented architecture, implementing the business collaboration. This approach provides insurance against technical obsolescence.

UMM consists of three views each covering a set of well-defined artifacts:

- Business Requirements View
- Business Choreography View
- Business Information View

Only the first view is used in the Nordic TSO Market model for data exchange. The latter two views are replaced by ENTSO-E implementation guides, see [8].

A UMM business collaboration model is a special kind of an UML model, based on the UML meta model. It provides a UML Profile consisting of stereotypes, tagged definitions and constraints. Stereotypes are used as a description of the type of UMM elements used and works as a placeholder for tagged values. The stereotypes are also used to show the organisation of the model and for transformation to syntax specific information exchanges.

B.2 Business Requirements View

The Business Requirements View is used to gather existing knowledge. It identifies the business processes in the domain and the business problems that are important to stakeholders. It is important at this stage that business processes are not constructed but discovered. Stakeholders might describe intra organizational as well as organizational business processes. All of this takes place in the language of the business experts and stakeholders. The business requirements view results in a categorization of the business domain (manifested as a hierarchical structure of packages) and a set of relevant business processes (manifested as UseCase s). The result may be depicted in UseCase diagrams. In order to model the dynamics of each business process, one may use a Business Process Activity Model, or a Sequence Diagram, which would be placed beneath the Business Process UseCase.

As a practical note, the Business Process Activity Model may depict a process or processes which involve one or more Business Partners. A Sequence Diagram will depict information exchanges between two or more Business Partners. The Business Partners are described within their own package (Business Partner View).

A Business Process Activity Model may show state changes to Business Entities. Business Entities are “real world things” having business significance and are shared among the business partners involved in the collaboration. The Business Entities and their lifecycles of state changes are modelled in the Business Entity View. Furthermore, the Business Entity View also contains one or more packages which represent the conceptual data structures of the Business Entities.

Business Partner View

A business partner is an organization type, an organizational unit type or a person type that participates in a business process. A *Business Partner View* must contain at least two *Business Partners*. A stakeholder is a person or representative of an organization who has a stake – a vested interest – in a certain business category or in the outcome of a business process. By definition, a business partner always has a vested interest in the business processes which they are participating in. Therefore, a *Business Partner* is a special type of a *Stakeholder*. In UML, specific relationships between Actors MAY be defined. The business partner view does not restrict the definition of those relationships between business partners and/or stakeholders. For example, generalizations between business partners and/or stakeholders. For example, generalizations between business partners MAY be defined.

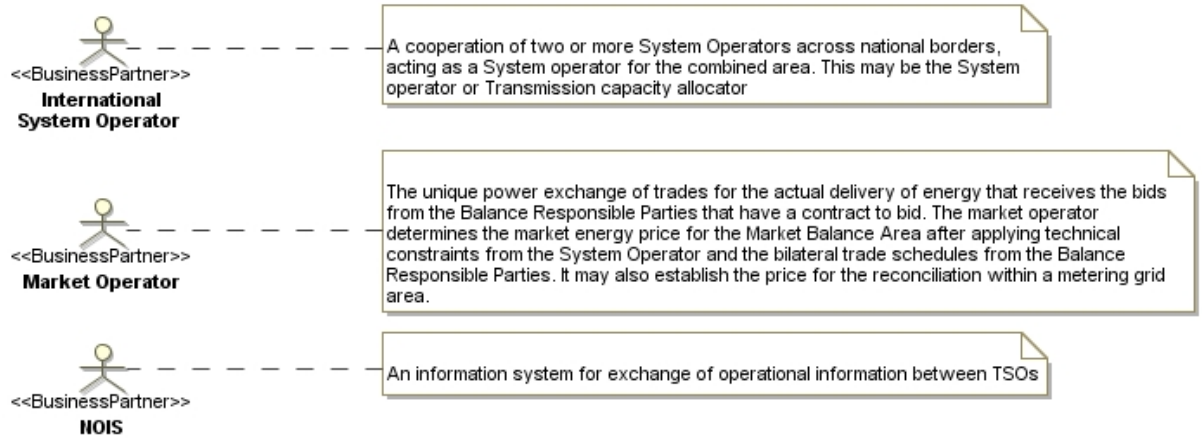

Figure 7 *Business Partners (example)*

Business Entity View

A business entity is a real-world thing having business significance that is shared between two or more business partners in a collaborative business process (e.g. “order”, “account”, etc.). Within the business entity view at least one, but possibly more business entities are described.

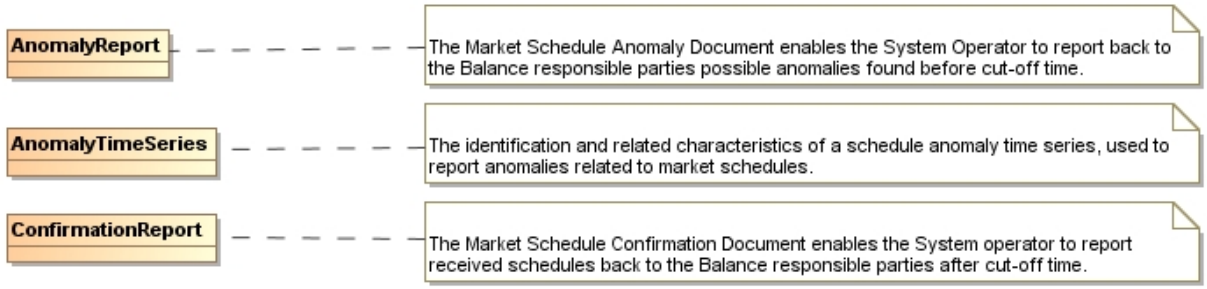

Figure 8 *Business Entities (example)*

Business entity states

The lifecycle of a business entity MAY be described as a flow of business entity states. Depending on the importance of the business entity lifecycle, the lifecycle may or may not be included. A lifecycle is described using a UML State Diagram. The lifecycle represents the different business entity states a business entity can exist in. The lifecycle of a business entity consists of at least one business entity state. Therefore, the lifecycle of a business entity is composed of one or more *Business Entity States*.

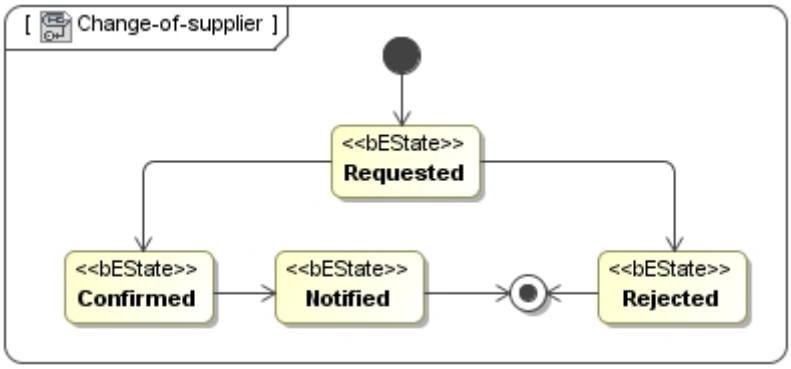

Figure 9 *Business Entity State Diagram (example)*

Business Data Views

A business entity is a potential candidate for becoming a business document in later steps of the UMM. A business data view MAY be used to elaborate a first conceptual design of a business entity. Within a business data view, A UML class diagram is used to describe the assembly of a business entity.

B.3 UseCase diagrams

A UseCase diagram is used to show relationships between UseCases and Roles. A UseCase is the specification of a set of actions performed by a system, such as a SCADA system, which yields an observable result that is, typically, of value for one or more actors or other stakeholders of the system.

The following notations are used in UseCase diagrams:

Generalisation:

A generalisation is used to show a relationship between a general role and one or more specific roles. A Generalisation is shown as a line with a hollow triangle as an arrowhead between the symbols representing the involved classifiers. The arrowhead points to the symbol representing the general classifier.

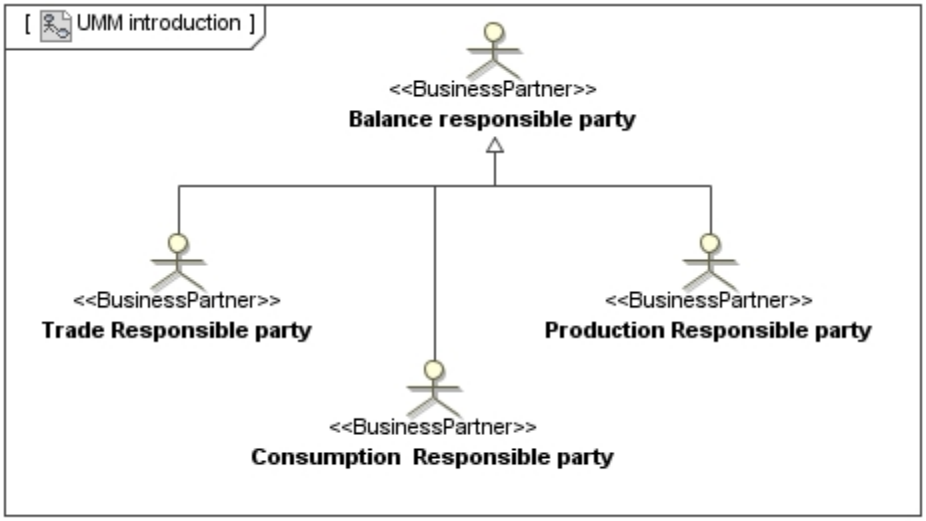

Figure 10 UseCase diagram, generalisation

Include relationship:

An *Include relationship* from use case A to use case B indicates that an instance of the use case A will also contain the behaviour as specified by B. *Include relationship* is used to split a system into smaller parts.

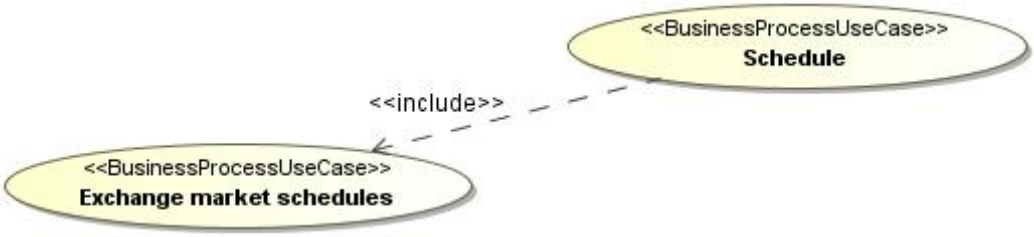

Figure 11 UseCase diagram, include relationship

Extend relationship:

An *Extend relationship* from use case A to use case B indicates that an instance of the use case A may contain the behaviour as specified by B, dependent on the condition specified for the extend relationship.

Figure 12 UseCase diagram, extend relationship

Participate relationship:

A *Participate relationship* is used to show that a certain role participates in a specific UseCase.

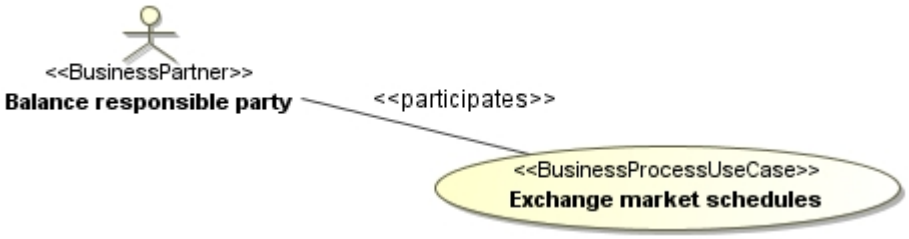

Figure 13 UseCase diagram, participate relationship

Roles:

A role is of a logical nature (such as a *Balance responsible party*) which acts within a given domain (such as a *Metering Grid Area*). In the same context it is not necessary for any two parties to play the same set of roles. The roles have been atomically decomposed to satisfy the minimal information flows for a given process required by the electricity market. A legal entity can therefore play one or more of the roles for a given domain.

<<Business partner>>

A business partner stereotype is an organization type, an organizational unit type or a person type that participates in a business process. Business partner types typically provide input to and/or receive output from a business process. Since a business partner type participates in a business process, they have, by default, a vested interest in the business process.

B.4 Activity diagrams

The focus of activity modelling is the sequence and conditions for coordinating lower-level behaviours, rather than which classifiers own those behaviours. These are commonly called control flow and object flow models. The behaviours coordinated by these models can be initiated because other behaviours finish executing, because objects and data become available, or because events occur external to the flow. An activity *execution* is the execution of an activity, ultimately including the executions of actions within it. Note, however, that a *call behaviour action* may reference an activity definition, in which case the execution of the call action involves the execution of the referenced activity and its actions.

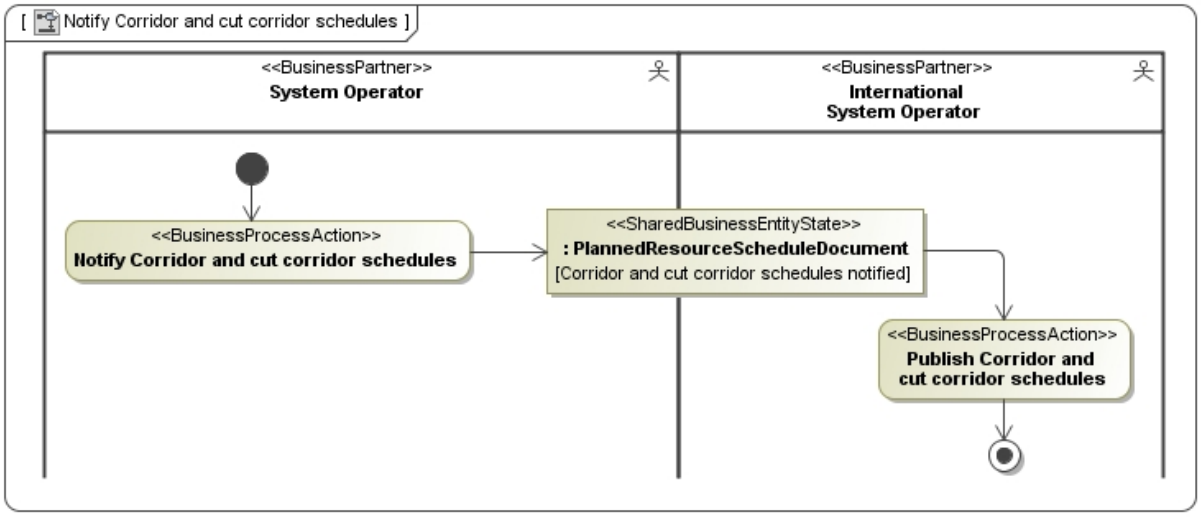

Figure 14 Activity diagrams

B.5 Sequence diagrams

A sequence diagram is a time-oriented view of the interaction between roles. Sequence diagrams model the fact that the document exchange does take place, in what order, and under what constraints. The sequence diagram has two dimensions: the vertical axis represents time, while the horizontal axis represents participating roles. The business documents, shown as arrows in the sequence diagrams, are further decomposed in class diagrams.

Related to the documents (arrows) it may be defined time constraints (shown within brackets) for when the documents are exchanged, e.g.:

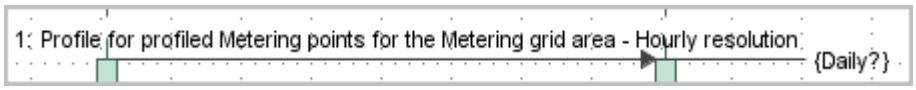

Figure 15 Sequence diagrams, time constrain

B.6 Classes and Class diagram

Classes

A class describes a set of objects that share the same specifications of features, constraints, and semantics. A class is a kind of classifier whose features are attributes and operations. Attributes of a class are represented by instances of Property that are owned by the class. The purpose of a class is to specify a classification of objects and to specify the features that characterize the structure and behaviour of those objects.

A class is often shown with three compartments. The middle compartment holds a list of attributes while the bottom compartment holds a list of operations. Additional compartments may be supplied to show other details, such as constraints, or to divide features.

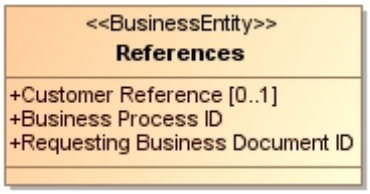

Figure 16 Class

Data types

A data type is a type whose instances are identified only by their value. A Data Type may contain attributes to support the modelling of structured data types. A typical use of data types would be to represent programming language primitive types. For example, integer and string types are often treated as data types.

Enumeration

An enumeration is a data type whose values are enumerated in the model as enumeration literals.