



BSI Standards Publication

Framework for energy market communications

Part 451-8: HVDC Scheduling process, contextual and assembly models for European style market

National foreword

This British Standard is the UK implementation of EN IEC 62325-451-8:2022. It is identical to IEC 62325-451-8:2022.

The UK participation in its preparation was entrusted to Technical Committee PEL/57, Power systems management and associated information exchange.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2022
Published by BSI Standards Limited 2022

ISBN 978 0 539 11995 4

ICS 33.200

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2022.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

English Version

**Framework for energy market communications - Part 451-8:
HVDC Scheduling process, contextual and assembly models for
European style market
(IEC 62325-451-8:2022)**

Cadre pour les communications pour le marché de l'énergie
- Partie 451-8: Processus de programmation de liaisons
HVDC, modèles contextuels et modèles d'assemblage pour
le marché de style européen
(IEC 62325-451-8:2022)

Kommunikation im Energiemarkt - Teil 451-8:
Hochspannungsgleichstrom (HGÜ)- Prozesse,
Kontextbezogene Modelle und Einbindungsmodelle für den
europäischen Markt
(IEC 62325-451-8:2022)

This European Standard was approved by CENELEC on 2022-04-28. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 57/2452/FDIS, future edition 1 of IEC 62325-451-8, prepared by IEC/TC 57 "Power systems management and associated information exchange" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62325-451-8:2022.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2023-01-28 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2025-04-28 document have to be withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62325-451-8:2022 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 62325-301 NOTE Harmonized as EN IEC 62325-301

IEC 62325-451-7 NOTE Harmonized as EN IEC 62325-451-7

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC/TS 61970-2	-	Energy management system application program interface (EMS-API) - Part 2: Glossary	CLC/TS 61970-2	-
IEC 62325-351	2016	Framework for energy market communications - Part 351: CIM European market model exchange profile	EN 62325-351	2016
IEC 62325-450	2013	Framework for energy market communications - Part 450: Profile and context modelling rules	EN 62325-450	2013
IEC 62325-451-1	-	Framework for energy market communications - Part 451-1: Acknowledgement business process and contextual model for CIM European market	EN 62325-451-1	-
IEC 62325-451-3	-	Framework for energy market communications - Part 451-3: Transmission capacity allocation business process (explicit or implicit auction) and contextual models for European market	EN 62325-451-3	-
IEC 62361-100	-	Power systems management and associated information exchange - Interoperability in the long term - Part 100: CIM profiles to XML schema mapping	EN 62361-100	-

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	10
4 Document contextual model and message assembly model basic concepts	11
4.1 Overview.....	11
4.2 European style market package structure (ESMP)	12
4.3 From the European style market profile to the document contextual model	14
4.4 From the document contextual model to the message assembly model	14
4.5 From the assembly model to the XML schema	14
5 The HVDC Link scheduling business process	14
5.1 General.....	14
5.2 Roles	15
5.2.1 The Scheduling Area Responsible role	15
5.2.2 Sub-roles	15
5.3 HVDC Link scheduling business process	15
5.4 Use Cases	16
5.4.1 General Overview	16
5.4.2 HVDC Link constraints.....	16
5.4.3 HVDC Link configuration.....	16
5.4.4 HVDC Link schedule	17
5.5 Sequence Diagram	17
5.6 Electronic documents used	18
5.6.1 HVDC Link Document	18
5.6.2 Capacity Document	18
5.7 Generic business rules for documents	19
5.7.1 General	19
5.7.2 Document instance implementation	19
5.8 Rules governing the HVDCLink_MarketDocument.....	20
5.8.1 Retransmission of historical information.....	20
5.8.2 Rules governing the TimeSeries class	20
6 Contextual and assembly models.....	20
6.1 HVDCLink document contextual model	20
6.1.1 Overview of the model	20
6.1.2 IsBasedOn relationships from the European style market profile.....	21
6.1.3 Detailed HVDCLink document contextual model	21
6.2 HVDCLink document assembly model.....	29
6.2.1 Overview of the model	29
6.2.2 IsBasedOn relationships from the European style market profile.....	30
6.2.3 Detailed HVDCLink document assembly model.....	31
6.2.4 Primitives	35
6.2.5 Datatypes	35
6.2.6 Enumerations	43
7 XML Schema	43
7.1 XML schema URN namespace rules	43

7.2	Code list URN namespace rules.....	44
7.3	URI rules for model documentation	44
7.3.1	Datatype.....	44
7.3.2	Class.....	44
7.3.3	Attribute.....	45
7.3.4	Association end role name.....	45
7.4	HVDCLink_MarketDocument schema.....	45
7.4.1	Schema structure	45
7.4.2	Schema description	48
	Bibliography.....	53
	Figure 1 – IEC 62325-450 modelling framework.....	12
	Figure 2 – Overview of European style market profile dependency.....	13
	Figure 3 – Steps of the HVDC Link scheduling business process	15
	Figure 4 – HVDCLink Scheduling Process Overview	16
	Figure 5 – Generic sequence diagram of the information flows	18
	Figure 6 – HVDCLink document contextual model.....	20
	Figure 7 – HVDCLink document assembly model	30
	Figure 8 – HVDCLink_MarketDocument XML schema structure (1/2)	46
	Figure 9 – HVDCLink_MarketDocument XML schema structure (2/2)	47
	Table 1 – Dependency table outline for the HVDC Link scheduling process	19
	Table 2 – IsBasedOn dependency.....	21
	Table 3 – Attributes of HVDCLink document contextual model::HVDCLink_MarketDocument	22
	Table 4 – Association ends of HVDCLink document contextual model::HVDCLink_MarketDocument with other classes.....	22
	Table 5 – Attributes of HVDCLink document contextual model::DateAndOrTime	23
	Table 6 – Attributes of HVDCLink document contextual model::Domain	23
	Table 7 – Attributes of HVDCLink document contextual model::Exchange_Quantity	23
	Table 8 – Attributes of HVDCLink document contextual model::HVDCMode_AttributeInstanceComponent	24
	Table 9 – Attributes of HVDCLink document contextual model::MarketParticipant.....	24
	Table 10 – Association ends of HVDCLink document contextual model::MarketParticipant with other classes	24
	Table 11 – Attributes of HVDCLink document contextual model::MarketRole	24
	Table 12 – Attributes of HVDCLink document contextual model::Measure_Unit.....	25
	Table 13 – Attributes of HVDCLink document contextual model::Point	25
	Table 14 – Association ends of HVDCLink document contextual model:: Point with other classes	25
	Table 15 – Attributes of HVDCLink document contextual model::Process.....	26
	Table 16 – Attributes of HVDCLink document contextual model::Quantity	26
	Table 17 – Attributes of HVDCLink document contextual model::Reason	26
	Table 18 – Attributes of HVDCLink document contextual model::RegisteredResource.....	26
	Table 19 – Attributes of HVDCLink document contextual model::Series_Period	27

Table 20 – Association ends of HVDCLink document contextual model:: Series_Period with other classes	27
Table 21 – Attributes of HVDCLink document contextual model::Time_Period.....	27
Table 22 – Attributes of HVDCLink document contextual model::TimeSeries.....	28
Table 23 – Association ends of HVDCLink document contextual model:: TimeSeries with other classes	28
Table 24 – IsBasedOn dependency.....	30
Table 25 – Attributes of HVDCLink document assembly model::HVDCLink_MarketDocument	31
Table 26 – Association ends of HVDCLink document assembly model::HVDCLink_MarketDocument with other classes.....	32
Table 27 – Attributes of HVDCLink document assembly model::Point.....	32
Table 28 – Attributes of HVDCLink document assembly model::Reason.....	32
Table 29 – Attributes of HVDCLink document assembly model::Series_Period.....	33
Table 30 – Association ends of HVDCLink document assembly model:: Series_Period with other classes	33
Table 31 – Attributes of HVDCLink document assembly model::TimeSeries	33
Table 32 – Association ends of HVDCLink document assembly model:: TimeSeries with other classes	34
Table 33 – Attributes of ESMPDataTypes::Action_Status	35
Table 34 – Attributes of ESMPDataTypes::ESMP_DateTimeInterval	36
Table 35 – Attributes of ESMPDataTypes::AreaID_String.....	36
Table 36 – Restrictions of attributes for ESMPDataTypes::AreaID_String	36
Table 37 – Attributes of ESMPDataTypes::BusinessKind_String	36
Table 38 – Attributes of ESMPDataTypes::CurveType_String	37
Table 39 – Attributes of ESMPDataTypes::EnergyProductKind_String	37
Table 40 – Attributes of ESMPDataTypes::ESMP_DateTime	37
Table 41 – Restrictions of attributes for ESMPDataTypes::ESMP_DateTime.....	37
Table 42 – Attributes of ESMPDataTypes::ESMPVersion_String	38
Table 43 – Restrictions of attributes for ESMPDataTypes::ESMPVersion_String.....	38
Table 44 – Attributes of ESMPDataTypes::HVDCMode_String	38
Table 45 – Attributes of ESMPDataTypes::ID_String.....	38
Table 46 – Restrictions of attributes for ESMPDataTypes::ID_String.....	39
Table 47 – Attributes of ESMPDataTypes::MarketRoleKind_String.....	39
Table 48 – Attributes of ESMPDataTypes::MeasurementUnitKind_String	39
Table 49 – Attributes of ESMPDataTypes::MessageKind_String	39
Table 50 – Attributes of ESMPDataTypes::ObjectAggregationKind_String.....	40
Table 51 – Attributes of ESMPDataTypes::PartyID_String.....	40
Table 52 – Restrictions of attributes for ESMPDataTypes::PartyID_String.....	40
Table 53 – Attributes of ESMPDataTypes::Position_Integer	40
Table 54 – Restrictions of attributes for ESMPDataTypes::Position_Integer	41
Table 55 – Attributes of ESMPDataTypes::ProcessKind_String	41
Table 56 – Attributes of ESMPDataTypes::ReasonCode_String	41
Table 57 – Attributes of ESMPDataTypes::ReasonText_String.....	41
Table 58 – Restrictions of attributes for ESMPDataTypes::ReasonText_String.....	41

Table 59 – Attributes of ESMPDataTypes::ResourceID_String	42
Table 60 – Restrictions of attributes for ESMPDataTypes::ResourceID_String	42
Table 61 – Attributes of ESMPDataTypes::Status_String	42
Table 62 – Attributes of ESMPDataTypes::YMDHM_DateTime	42
Table 63 – Restrictions of attributes for ESMPDataTypes::YMDHM_DateTime	43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FRAMEWORK FOR ENERGY MARKET COMMUNICATIONS –

Part 451-8: HVDC Scheduling process, contextual and assembly models for European style market

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62325-451-8 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
57/2452/FDIS	57/2468/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This IEC standard includes Code Components i.e. components that are intended to be directly processed by a computer.

Such content is any text found between the markers <CODE BEGINS> and <CODE ENDS>, or otherwise is clearly labelled in this standard as a Code Component. The code component of this document is the XML schema file defined in Clause 7.

The purchase of this IEC standard carries a copyright license for the purchaser to sell software containing Code Components from this standard to end users either directly or via distributors, subject to IEC software licensing conditions, which can be found at: <http://www.iec.ch/CCv1>.

A list of all parts in the IEC 62325 series, published under the general title *Framework for energy market communications*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document is one part of the IEC 62325 series for deregulated energy market data exchanges based on the European style market profile. This part of IEC 62325 defines the document contextual models, the message assembly models as well as the XML schemas to be used for the HVDC Link Scheduling process.

The principal objective of the IEC 62325 series is to produce standards which facilitate the integration of market application software developed independently by different vendors into a market management system, between market management systems and market participant systems. This is accomplished by defining message exchanges to allow these applications or systems access to public data and exchange information independent of how such information is represented internally.

The common information model (CIM), i.e. IEC 62325-301, IEC 61970-301 and IEC 61968-11, specifies the basis for the semantics for message exchange.

This European style market profile is based on different parts of the CIM IEC standards and specifies the content of the messages exchanged.

This document provides, for the European style market profile, the necessary information to be exchanged between Scheduling Area Responsibilities (this role is mostly performed by Transmission System Operators) about their HVDC Links. This part of IEC 62325 was originally based upon the work of the European Network of Transmission System Operators (ENTSO-E) CIM Expert Group (formerly Working Group EDI).

FRAMEWORK FOR ENERGY MARKET COMMUNICATIONS –

Part 451-8: HVDC Scheduling process, contextual and assembly models for European style market

1 Scope

This part of IEC 62325 specifies a UML package for the HVDC Link scheduling business process and its associated document contextual models, assembly models and XML schemas for use within the European style electricity markets.

This part of IEC 62325 is based on the European style market contextual model (IEC 62325-351). The business process covered by this part of IEC 62325 is described in Subclause 5.3.

The relevant aggregate core components (ACCs) defined in IEC 62325-351 have been contextualised into aggregated business information entities (ABIEs) to satisfy the requirements of the European style market HVDC Link scheduling business process.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

IEC 62325-351:2016, *Framework for energy market communications – Part 351: CIM European market model exchange profile*

IEC 62325-450:2013, *Framework for energy market communications – Part 450: Profile and context modelling rules*

IEC 62325-451-1, *Framework for energy market communications – Part 451-1: Acknowledgement business process and contextual model for CIM European market*

IEC 62325-451-3, *Framework for energy market communications – Part 451-3: Transmission capacity allocation business process (explicit or implicit auction) and contextual models for European market*

IEC 62361-100, *Power systems management and associated information exchange – Interoperability in the long term – Part 100: CIM profiles to XML schema mapping*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61970-2, as well as the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE General glossary definitions can be found in IEC 60050, *International Electrotechnical Vocabulary*.

3.1

aggregate business information entity

ABIE

re-use of an aggregate core component (ACC) in a specified business

3.2

aggregate core component

ACC

collection of related pieces of business information that together convey a distinct business meaning, independent of any specific business context

Note 1 to entry: Expressed in modelling terms, this is the representation of an object class, independent of any specific business context.

[SOURCE: ISO TS 15000-5:2005, Clause 9, modified (second sentence has been transformed into Note 1 to entry)]

3.3

application program interface

API

set of public functions provided by an executable application component for use by other executable application components

3.4

assembly model

assembly model is a model that prepares information in a business context for assembly into electronic documents for data interchange

3.5

based on

IsBasedOn

use of an artefact that has been restricted according to the requirements of a specific business context

[SOURCE: IEC 62325-450:2013, 3.4]

3.6

business context

formal description of a specific business circumstance as identified by the values of a set of context categories, allowing different business circumstances to be uniquely distinguished

[SOURCE: UN/Cefact, Unified Context Methodology Technical Specification]

3.7

European style market profile

ESMP

European style market profile, the object of IEC 62325-351, describing the set of classes and associations used to generate all the parts of the IEC 62325-451 series

3.8

information model

representation of concepts, relationships, constraints, rules, and operations to specify data semantics for a chosen domain of discourse

Note 1 to entry: It can provide shareable, stable, and organized structure of information requirements for the domain context.

[SOURCE: IEC 62325-450:2013, 3.6]

3.9

market management system

MMS

computer system comprised of a software platform providing basic support services and a set of applications providing the functionality needed for the effective management of the electricity market

Note 1 to entry: These software systems in an electricity market may include support for capacity allocation, scheduling energy, ancillary or other services, real-time operations and settlements.

3.10

message business information entity

MBIE

aggregation of a set of ABIEs that respects a defined set of assembly rules

3.11

profile

basic outline of all the information that is required to satisfy a specific environment

[SOURCE: IEC 62325-450:2013, 3.7]

4 Document contextual model and message assembly model basic concepts

4.1 Overview

IEC 62325-450 defines a set of CIM profiles that follows a layered modelling framework as outlined in Figure 1 going from the common information model (CIM), to different regional contextual models and their subsequent contextualized documents for information exchange; the final step being the message specifications for information interchange.

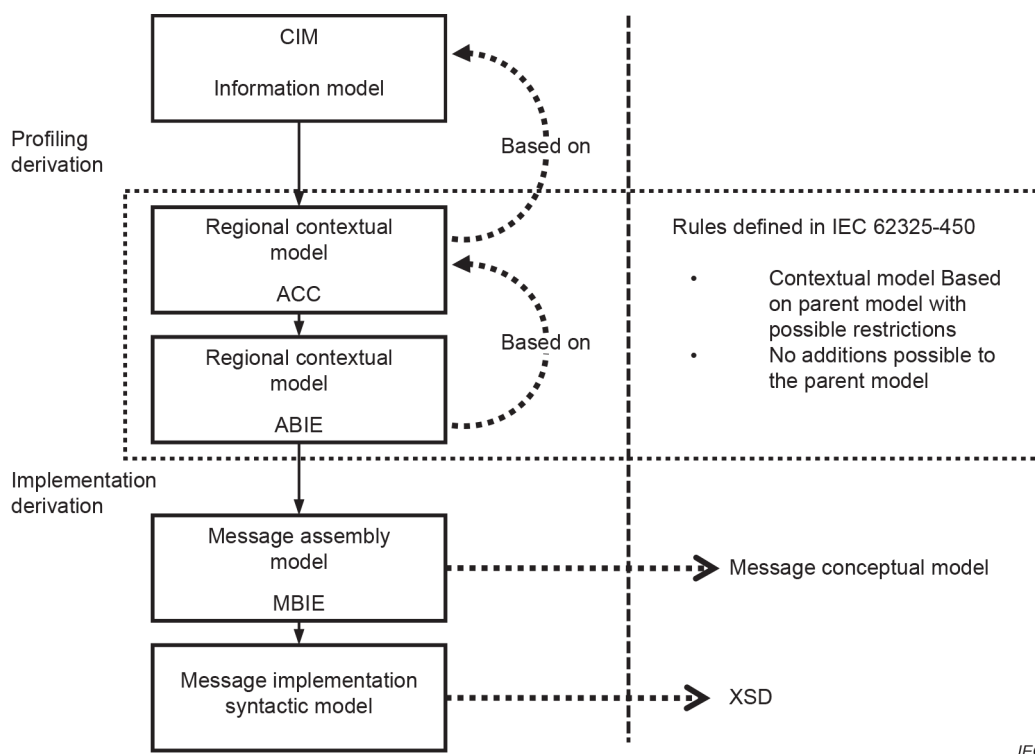


Figure 1 – IEC 62325-450 modelling framework

The regional contextual models are the basic components that are necessary to build electronic documents for information interchange. The European style market contextual model (IEC 62325-351) is, as an example, a regional contextual model based on IEC 62325-301. The components are also termed aggregate core components (ACCs).

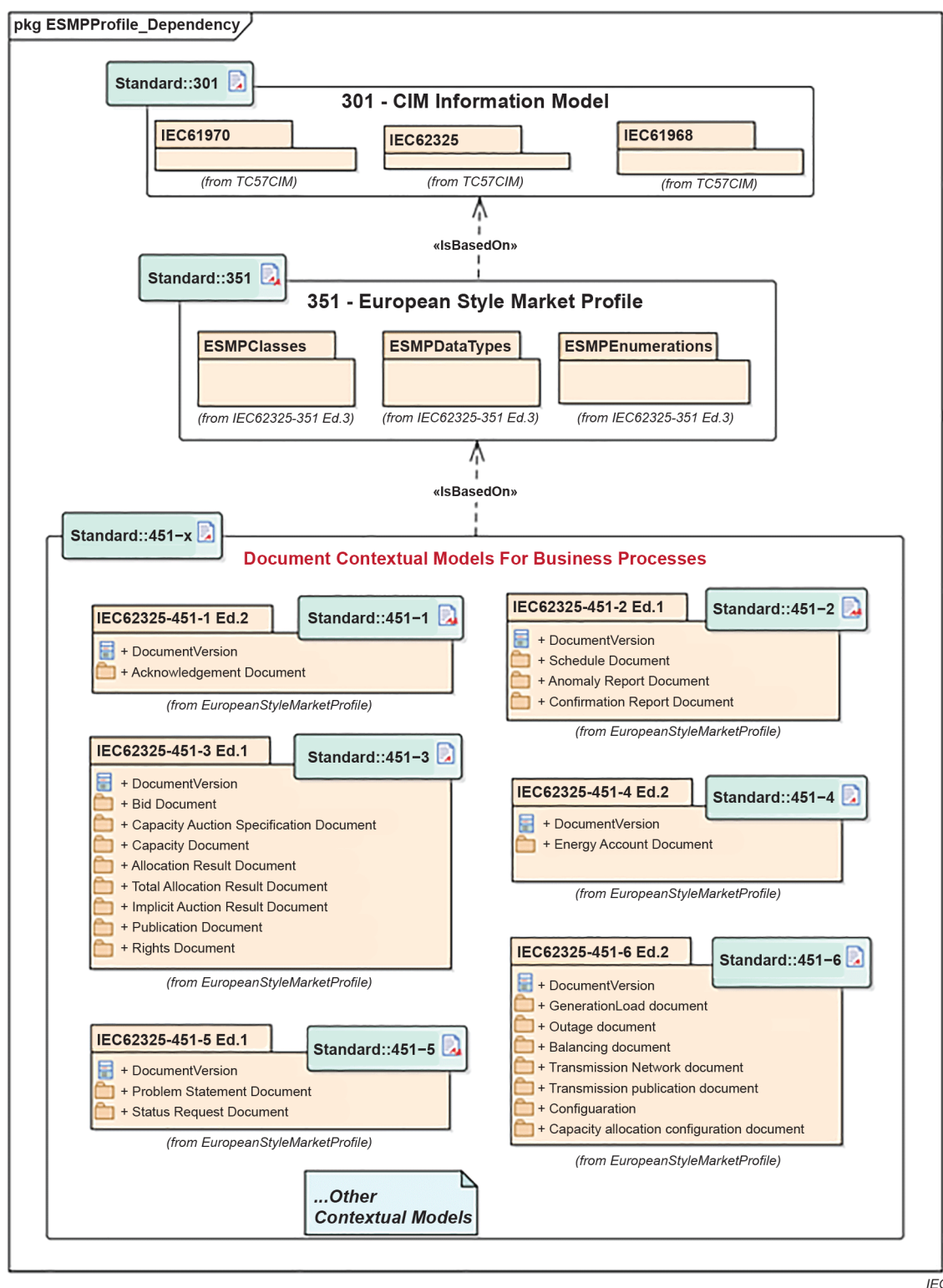
A document contextual model is based upon a specific business requirements specification and is constructed from the contextualisation of the ACCs that can be found in the European style market contextual model. The contextualised ACCs at this stage are termed aggregate business information entities (ABIEs). These ABIEs are the constructs that are assembled together into a specific electronic document to satisfy the information requirements outlined in the business requirements specification. The transformation from an ACC to an ABIE shall respect the rules defined in IEC 62325-450.

Once a document contextual model that meets the business requirements has been built, a message assembly model can be automatically generated from it. The automatic generation respects the rules defined in IEC 62361-100.

XML schema then may be automatically generated from the message assembly model. If necessary, specific mapping can take place at this stage to transform the CIM class and attribute names into more market resilient names.

4.2 European style market package structure (ESMP)

The main package structure of the European style market profile is described in Figure 2.



IEC

Figure 2 – Overview of European style market profile dependency

For each business process, a business process package is described in an IEC 62325-451 standard. A business process package contains:

- the document contextual model (ABIE) and the automatically generated message assembly model (MBIE) for each electronic document required to enable the completion of the business process. Each document is a sub contextual model derived by restriction from the European style market profile;