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Building information models — Information delivery manual —

Part 2: Interaction framework

Modèles des informations de la construction — Contrat d'interchange —
Partie 2: Cadre d'interaction

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 29481 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 29481-2 was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 13, *Organization of information about construction works*.

ISO 29481 consists of the following parts, under the general title *Building information models — Information delivery manual*:

— *Part 1: Methodology and format*

— *Part 2: Interaction framework*

The following parts are under preparation:

— *Part 3: Model view definitions*

Introduction

Building information modelling provides a concept for describing and displaying information required in the design, construction, and operation of constructed facilities. It can bring together the diverse sets of information used in construction into a common information environment — reducing, and often eliminating, the need for the many types of paper documentation currently in use.

An information delivery manual (IDM) provides significant help in getting the full benefit from a building construction information model (BIM). If the information required is available when it is needed and the quality of information is satisfactory, the construction process itself will be greatly improved. For this to happen, there should be a common understanding of the building processes and of the information that is needed for and results from their execution.

This part of ISO 29481 focuses on aspects of the construction process that refer to management and coordination of the involved parties. Coordination is dependent on communication, which should be well structured, unambiguous, explicit, and prompt. Due to a sharp focus on coordination and interaction, this part of ISO 29481 provides a natural complement to standards that focus on building modelling like ISO 10303-239 and ISO 16739.

This part of ISO 29481 sets out a methodology and format for describing coordination acts between actors in a construction project. It describes how to identify and define the coordination processes undertaken and the information required for their execution. The resulting interaction frameworks enable standardization of interaction in building processes on national, local, and project level. It also gives a format to support solutions provided by ICT-solution providers. Support of this part of ISO 29481 in different ICT-solutions means that this joins together different process management systems. In doing so, it provides a basis for reliable information exchange/sharing for users, so that they can be confident that the information they are sending or receiving is accurate and sufficient for the coordination activities they need to perform.

The development of this part of ISO 29481 has been driven by the need of users for reliability in information exchange. It is mainly based on the Dutch VISI standard developed in 2003.

Building information models — Information delivery manual —

Part 2: Interaction framework

1 Scope

This part of ISO 29481 specifies a methodology and format for describing 'coordination acts' between actors in a building construction project during all life cycle stages.

It therefore specifies

— a methodology that describes an interaction framework,

— an appropriate way to map responsibilities and interactions that provides a process context for information flow,

— a format in which the interaction framework should be specified.

This part of ISO 29481 is intended to facilitate interoperability between software applications used in the construction process, to promote digital collaboration between actors in the building construction process, and to provide a basis for accurate, reliable, repeatable, and high-quality information exchange.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 29481-1, *Building information modelling — Information delivery manual — Part 1: Methodology and format*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
IDM
Information Delivery Manual
documentation which captures the business process and gives detailed specifications of the information that a user fulfilling a particular role would need to provide at a particular point within a project

3.2
interaction framework
formal description of the elements of interaction, including definition of roles, transactions, messages in transaction, and data elements in messages

3.3
interaction framework schema
formal description of the rules with which an interaction framework must comply

3.4
interaction schema
formal description of the rules with which sent and received messages must comply

3.5
promotor
algorithm that generates an interaction schema from an interaction framework, interaction framework schema, and templates file as input

3.6
templates file
file containing a number of templates, independent of the interaction framework, for generating an interaction schema

3.7
VISI
acronym for Dutch standard for communication between partners in construction projects

Note 1 to entry: VISI stands for "Voorwaarden scheppen voor Invoeren Standaardisatie ICT in de Infrastructuur-sector" which translates as "Creating conditions for the implementation of ICT standardization for the construction industry")

4 Standard principles

4.1 General

This clause is included to highlight and help explain essential concepts on which this part of ISO 29481 is based.

4.2 BIM and IDM

Building information modelling brings together the diverse sets of information used in construction into a common information environment. For this to happen, there should be a common understanding of the building processes and the information that is needed for and from their execution.

ISO 29481 is a standard that sets out a method for the development of an Information Delivery Manual.

The IDM methodology given in ISO 29481-1 shall be used for all references to development and use of IDM.

4.3 Components of IDM

The methodology and components of IDM are described in ISO 29481-1. In that part, an illustration is given that diagrammatically shows what the different components of IDM are and how they are related.

Within IDM, there are two perspectives. These are seen as user requirements and technical solutions. Within the two perspectives, there are a number of zones that characterize the various components of IDM (see Figure 1).

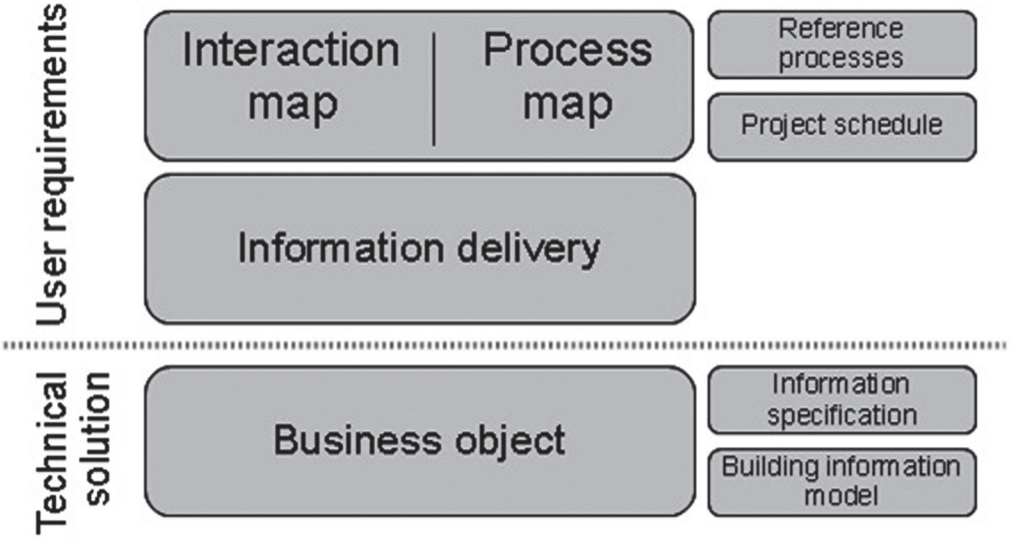

Figure 1 — IDM zones

Within the user-requirements perspective, these zones are

— interaction maps, describing the roles and interactions between them,

— process maps, describing the overall process in which information exchange occurs,

— information delivery, describing the information exchange needs,

— reference processes (stored exchange descriptions),

— the project schedule (occurrences of processes in the context of a project).

The technical-solution perspective includes

— the business objects comprising the exchange requirement model,

— the information specification, describing the schema on which the information exchange is based,

— the building information model.

This part of ISO 29481 focuses on the interaction map and is based on general principles of business communication.

4.4 Basic principles of business communication

Once a client or customer has asked to deliver a product or provide a service, there will be a chain of activities in operation, whose combined effect is to provide the product or service. Such a chain of activities is called a business process. More specifically, we speak here of a primary business process because it is initiated externally.

Part of the business process is the communication between the involved parties. This part of ISO 29481 concentrates on the communication that relates to the delivery of an outcome (performative communication). The initiation and execution of a request is through communicative actions. In a communicative action, two parties are always involved: the person who performed the action and the person to whom the action is directed. The handling of a request appears to occur in a particular pattern called the transaction.

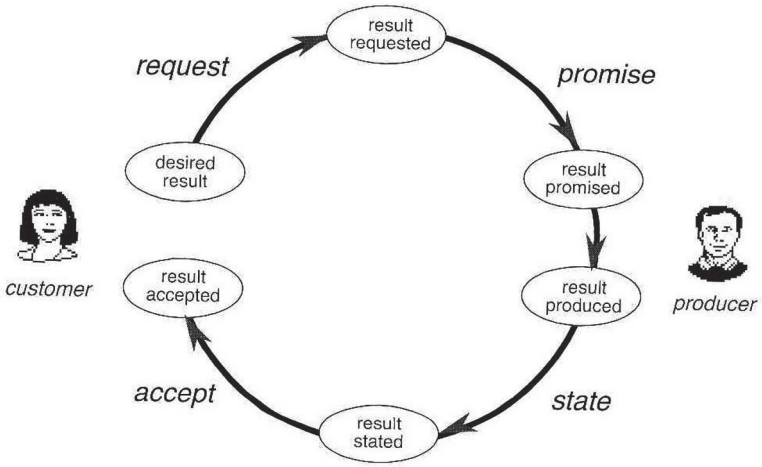

Figure 2 — A transaction pattern (Dietz, 2006)

In Figure 2, the simplest form of this transaction pattern is presented. It shows that bringing about of a new production result (for example, the 'desired result' is the delivery of a document) starts with requesting of this result by someone in the role of customer from someone in the role of producer. This brings the process to the state "result requested". The producer responds to the request by promising to produce the desired result, which brings the process to the state "result promised". This presents a to-do item for the producer: he has to comply with the promise by actually preparing the document and deciding to deliver the document. In the act of handing over the document to the customer, he states that he has complied with his promise. The customer responds to this state by accepting the result as produced. This act completes the transaction.

In the execution of the business process, often many actors are involved. Their behaviour is dependent on their role in the process. Roles/actors do business with other roles/actors by executing transactions. A useful representation of the interaction between roles/actors is called the interaction map.

4.5 Interaction map

An interaction map shall identify the relevant role types and transaction types for a certain process. IDM draws a distinction between a role that makes a request, the initiator, and the role that gives effect to that request, the executor. A transaction shall have only one initiating role and only one executing role. Figure 3 shows the components of the interaction map.

NOTE The notation of the interaction map is based on the construction model as described in the publication of Prof. Jan L.G. Dietz. This notation differs from BPMN and is used to prepare maps that are as simple as possible. Also, it provides the concept of 'transaction', which is not available in BPMN.

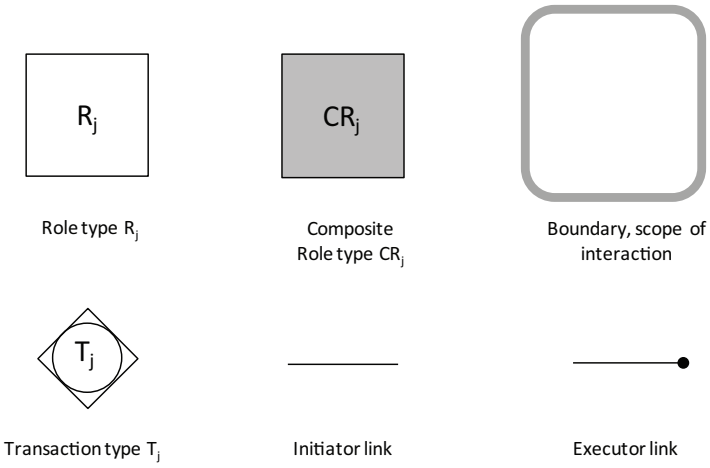

Figure 3 — Components of the interaction map

The advantage of the interaction map is that it focuses attention on the interfaces between roles while hiding the complexity of the process within the domain of the roles and hiding the details of the interaction between the roles. The use of abstract roles makes the interaction map valid for many different situations. The interaction map is a valuable tool for analysing and defining essential elements of a business process. Figure 4 shows a simplified example of an interaction map of a design office.

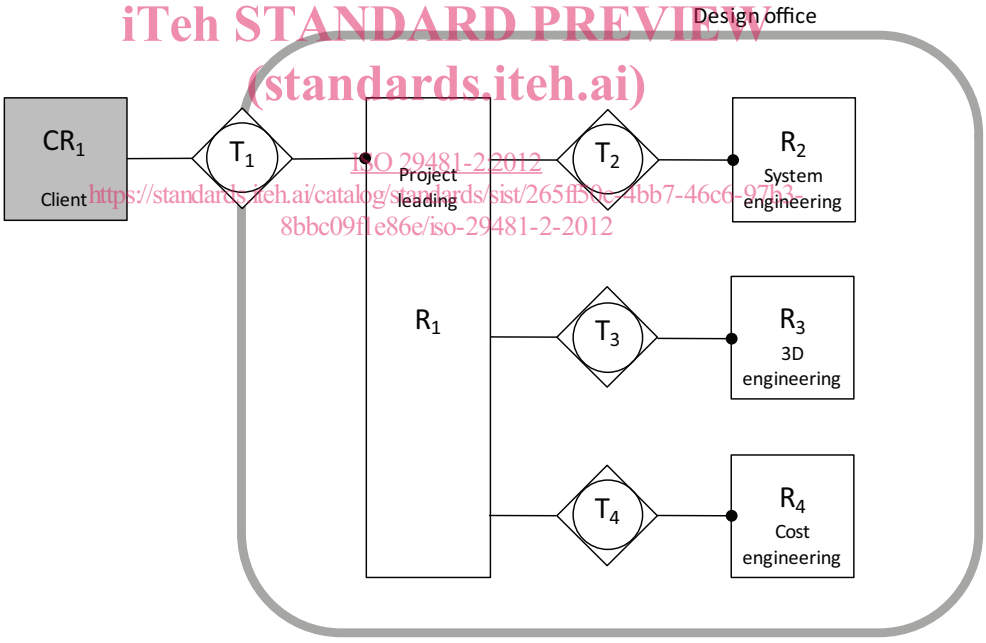

Figure 4 — Example of an interaction map

In an interaction map, all transactions needed for the handling of required contributions of relevant roles to the BIM shall be included. All roles and transactions within the interaction map shall have a unique identity and name. The numbering is arbitrary. The name of the role is derived from the main activity undertaken by the role; this brings focus on the contribution of the role to the BIM. A composite role is a role which may consist of multiple roles but whose composition is unknown or not relevant.

The interactions can be summarized in a transaction table.

Table 1 — Transaction table of a simplified design office

Transaction result	Transaction type
Design is delivered	T_1, Deliver design
System specification is delivered	T_2, Deliver system specification
3D model is delivered	T_3, Deliver 3D model
Cost calculation is delivered	T_4, Deliver cost calculation

4.6 Messages in transaction

A transaction shall contain a set of messages that are exchanged for a particular purpose. The transaction also stipulates the participating roles, point in the life cycle, and the sequence in which messages should be delivered (if appropriate).

An example of a transaction is the handling of a request for a 3D model. See Figure 5, which shows the messages in a transaction as a sequence diagram in UML notation. The transaction can only be initiated by R1 Project leading with the message 'Request for 3D model'. The 3D engineer (role R3) can respond with a message 'Work done and request for approval'. After a message 'Work approved' or 'Work not approved', the transaction is completed.

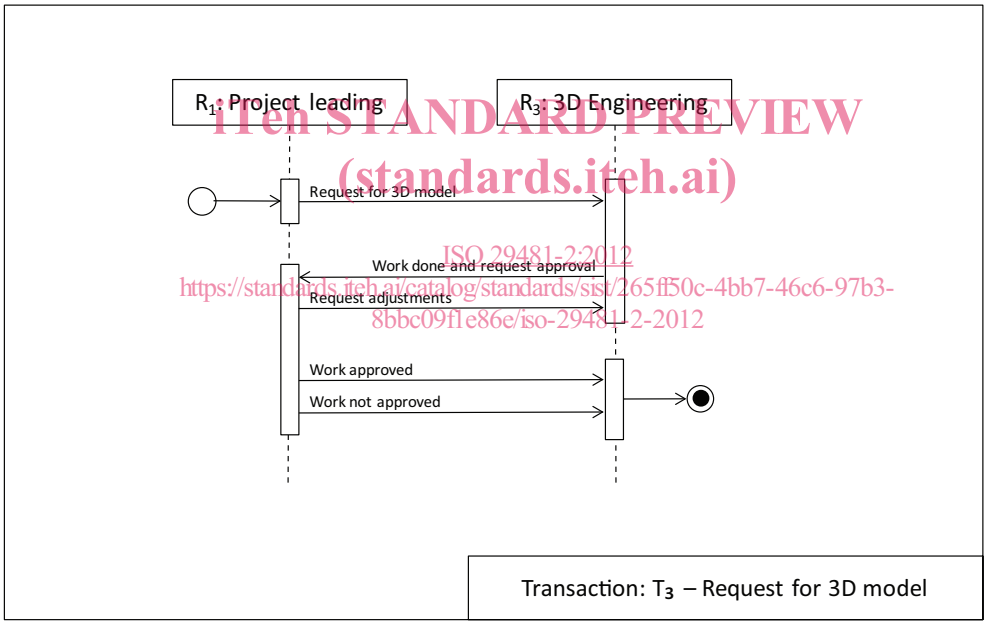

Figure 5 — Example of messages in a transaction

A message is a populated information model and contains data. Attachments may be linked to messages. As an attachment, an exchange requirement can be transferred to the executing role, and the result (contribution to the BIM) is delivered to the initiating role. By using transactions, the information transfer is brought in a process context.

4.7 Interaction framework

In order to give guidance to a process and information transfer, the elements of interaction need to be described in a coherent manner. This coherent description is called an interaction framework. An interaction framework shall include

— definition of relevant roles,

— transactions,

— messages in transaction,

— the order of messages in transaction,

— data elements in messages.

An interaction framework can be prepared for a defined application area and used as a standard on (inter-)national level, organization level, or project level. For example, in the Netherlands, an interaction framework is developed at the national level for the completion of all contractual procedures during the execution of a construction project. This part of ISO 29481 is used as a template by organizations and projects and adjusted to specific needs.

EXAMPLE An interaction framework may include the attribute CostEstimation as an instance of SimpleElementType to be used as a mandatory element for a certain message. It also may include a restriction on the format of the attribute CostEstimation (e.g. only euros with two decimals).

4.8 Supporting the software solutions

4.8.1 Overview

The next step is to support the interaction framework with software solutions. The aim is

— to support the editing of an interaction framework,

— to guarantee the completeness and validity of an interaction framework,

— to support the portability of an interaction framework,

— to support the operation of information systems,

— to support the interoperability of communication.

In the support of software solutions, two levels can be identified. The first level concerns the interaction framework. The second level concerns the actual communication which is based on the interaction framework. This part of ISO 29481 applies to both levels.

An overview on how the software solutions are supported is given in Figure 6. The following sections provide an explanation.

4.8.2 Supporting the interaction framework

In order to support the portability of an interaction framework, it should be clear with which rules an interaction framework must comply. These rules shall be included in an interaction framework schema, which is recorded as an XSD schema file. An interaction framework comprises instances of classes defined in the schema and shall be recorded as an XML file.

EXAMPLE The interaction framework schema defines that you may include the definition of attributes (SimpleElementType) and restrictions to attributes (UserdefinedType) in an interaction framework.

Chapter 5 describes the interaction framework schema and the available classes.

Every interaction framework should comply with the interaction framework schema.

An interaction framework editor should use the interaction framework schema to validate the produced frameworks.

4.8.3 Promotor

Once a valid interaction framework is available, it can be interpreted by a suitable information system. Then this system can support the communications in accordance with the options set out in the interaction framework. Finally, it is desirable to be able to validate the received and sent messages; this is done with the interaction schema.

The interaction schema is generated with a generic algorithm called Promotor. The Promotor 'promotes' XML instances tot XSD classes. The input is

— interaction framework (XML),

— interaction framework schema (XSD),

— templates file (XSD), containing a number of templates not described in an interaction framework but are valid for every interaction schema, for example the message header.

The output is an interaction schema recorded as an XSD file.

EXAMPLE The 'Promotor' takes information from the interaction framework to include the attribute CostEstimation to be used as a mandatory element for a certain message and creates an interaction schema which defines the message with the CostEstimation attribute.

Annex B describes the templates XSD file.

Annex D gives the principles of the Promotor.

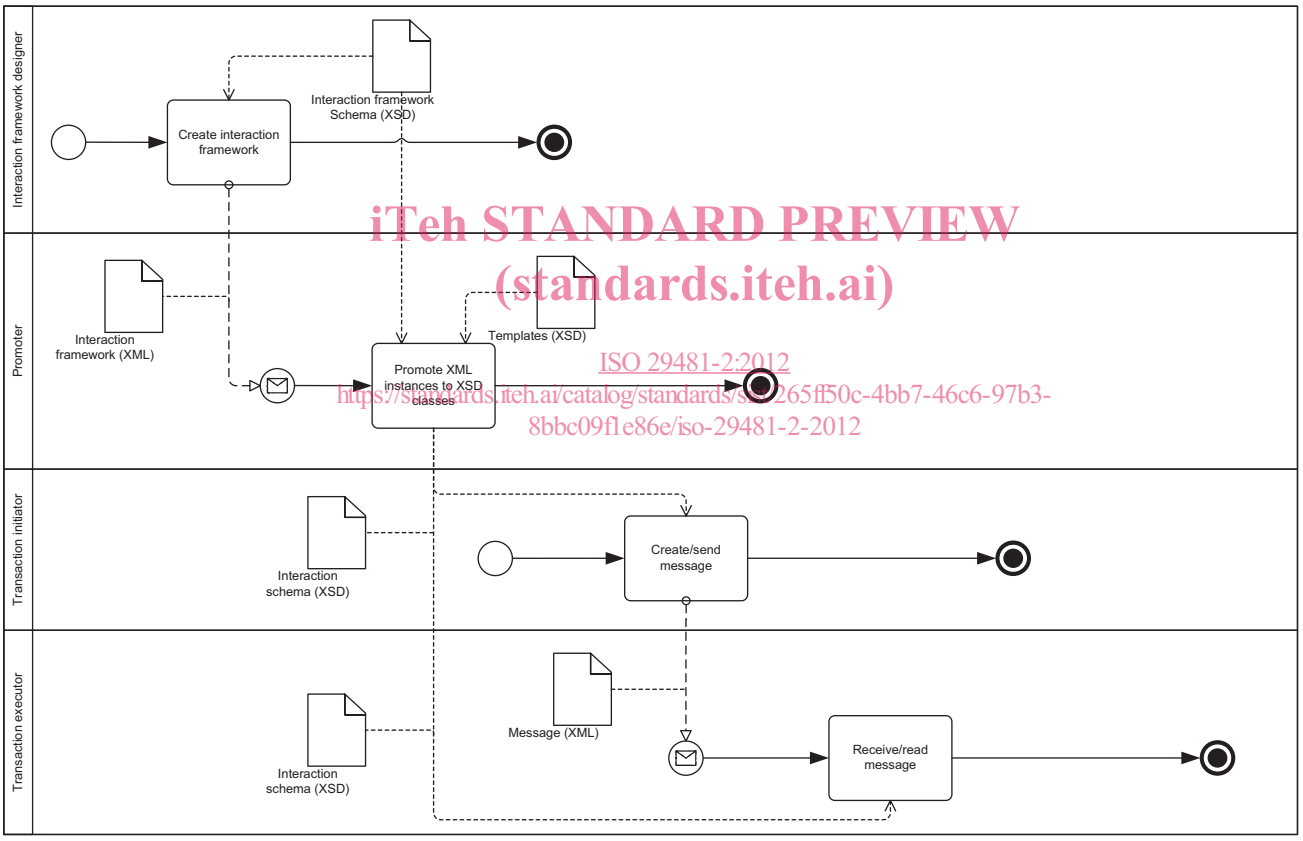

Figure 6 — How software solutions are supported

4.8.4 Supporting communication

Every information system that participates in the communication, as defined in the interaction framework, should operate on the basis of the corresponding interaction framework and interaction schema. Every message that is sent or received should be valid according to the interaction schema.

4.8.5 Technical implementation of communication

In order to ensure that messages with attachments in technical sense can be exchanged between information systems, there is a need for implementation guidelines. Topics to be covered include

— communication protocol,

— communication architecture/servers,

— encryption,

— SOAP function calls.

Implementation guidelines are beyond the scope of this part of ISO 29481.

5 Format of an interaction framework

5.1 Introduction

Clause 4 explains that, in order to support software solutions, every interaction framework must comply with the interaction framework schema. This clause is included to define the format of an interaction framework through a description of the interaction framework schema.

5.2 provides an overview of the information classes that can occur in an interaction framework and are defined in the interaction framework schema. Since an interaction framework is defined in XML, the word 'type' is used rather than class. Annex A gives the full description of the interaction framework schema. Annex C provides an example of an instance of an interaction framework.

5.2 Information types in the interaction framework schema

5.2.1 Introduction

A schema is populated by many classes or types. In this section, a short description is given of the available types in the interaction framework schema. Annex A contains a full description in XML of the interaction framework schema. An interaction framework shall be created from instances of these types and shall have a header which points to the schema with the defined available types.

5.2.2 AppendixType

The AppendixType is a definition to define the structure of elements regarding metadata. An instance of an AppendixType is used to define certain types of files or documents which can be part of the send/received messages. The structure of the elements related to an instance of an AppendixType represents the specific metadata which is required for a certain type of file or document.

5.2.3 ComplexElementType

A ComplexElementType is a collection of SimpleElementTypes. Every SimpleElementType occurs exactly the number of times it is related to.

5.2.4 ElementCondition

An instance of an ElementCondition describes the behaviour of element values in successive messages. For example, when an instance of the type ElementCondition is created with the value FIXED, it indicates that elements in successive messages must be copied when the same element is available and the value cannot be changed. An ElementCondition can refer to different levels in a framework. It can be directly related to a SimpleElement but it is also possible to relate an ElementCondition to a ComplexElement or a MessageInTransactionType. In this case, the ElementCondition is valid for all elements which are part of the element structure/collection of the related types.