
**Industrial automation systems and
integration — Product data
representation and exchange —**

Part 28:

**Implementation methods: XML
representations of EXPRESS schemas
and data**

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*Systèmes d'automatisation industrielle et intégration — Représentation
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*Partie 28: Méthodes d'implémentation: représentations XML de
schémas et de données EXPRESS*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

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

ISO/TS 10303-28 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. A complete list of parts of ISO 10303 is available from the Internet:

<<http://www.nist.gov/sc4/editing/step/titles/>>.

This part of ISO 10303 is a member of the implementation methods series.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 specifies means by which schemas specified using the EXPRESS language (ISO 10303-11) and data governed by EXPRESS schemas can be represented as an XML document (Extensible Markup Language W3C Recommendation). Readers of this part of ISO 10303 should have knowledge of the EXPRESS language, XML and XML-related standards in order to understand its technical content.

For the representation of EXPRESS schemas, this part of ISO 10303 specifies an XML markup declaration set based on the syntax of the EXPRESS language. EXPRESS text representation of schemas is also supported.

For the representation of data corresponding to an EXPRESS schema, this part of ISO 10303 takes two broad approaches. One approach is to specify a single markup declaration set that is independent of the EXPRESS schema and can represent data for any schema. This approach is called late binding. The second approach is to specify the results of the generation of a markup declaration set that is dependent on the EXPRESS schema. This approach is called early binding.

This part of ISO 10303 specifies one late binding and two early bindings. Future editions of this part of ISO 10303 are expected to include additional early bindings.

The markup declaration sets in this part of ISO 10303 are intended as formal specifications for the appearance of markup in conforming XML documents. These declarations may appear as part of Document Type Definitions (DTDs) for such documents. Future editions of this part of ISO 10303 are expected to include specifications for the use of XML Schema [3] for this purpose.

EXAMPLE 1 For the following EXPRESS schema:

```
SCHEMA my_schema;
  ENTITY an_entity;
    attr1 : STRING;
  END_ENTITY;
END_SCHEMA;
```

The corresponding XML markup would be:

```
<schema_decl>
  <schema_id>my_schema</schema_id>
  <entity_decl>
    <entity_id>an_entity</entity_id>
    <explicit_attr_block>
      <explicit_attr>
        <attribute_id>attr1</attribute_id>
        <base_type><string/></base_type>
      </explicit_attr>
```

```

    </explicit_attr_block>
  </entity_decl>
</schema_decl>

```

The late binding is a single markup declaration set that can be used to represent data corresponding to any EXPRESS schema. Additionally, the late binding can be used as the base architecture for early bindings as specified by the Architectural Form Definition Requirements in ISO 10744:1997 (HyTime). One such early binding is specified in this part of ISO 10303. That early binding, called the EXPRESS-typed Early Binding, preserves many of the data types defined in EXPRESS schemas.

EXAMPLE 2 For the following EXPRESS schema:

```

SCHEMA my_schema;
  ENTITY an_entity;
    attr1 : STRING;
  END_ENTITY;
END_SCHEMA;

```

a set of late-bound data as XML markup might be:

```

<schema_instance schema_name="my_schema" id="id1">
  <entity_instance express_entity_name="an_entity" id="id2">
    <attribute_instance express_attribute_name="attr1">
      <string_literal>an attr1 value</string_literal>
    </attribute_instance>
  </entity_instance>
</schema_instance>

```

and the same data using the EXPRESS-typed Early Binding is:

```

<My_schema-schema id="id1" schema_name="My_schema"
  schema_identifier="My_schema Edition 2">
  <An_entity id="id2">
    <An_entity.attr1><string>an attr1 value</string></An_entity.attr1>
  </An_entity>
</My_schema-schema>

```

Early bindings can also be specified that are not architecturally compatible with the late binding. In this part of ISO 10303, these bindings are related to the late binding through the specification of a means of transforming data represented using that early binding into the same data represented using the late binding. Transformations of this nature are specified that use XSLT (XSL Transformations W3C Recommendation). XSLT is a language for transforming one XML document into another XML document. One such early binding and XSLT transformation generation is specified in this part of ISO 10303. That early binding, called the Object Serialization Early Binding, is based on object serialization patterns for programming languages.

EXAMPLE 3 For the following EXPRESS schema:

```

SCHEMA my_schema;
  ENTITY an_entity;
    attr1 : STRING;
  END_ENTITY;
END_SCHEMA;

```

a set of Object Serialization Early Binding data as XML markup might be:

```
<uos c="id2" schema_name="My_schema" unset="unset">  
  <An_entity x-id="id2" Attr1-r="id3"/>  
  <string x-id="id3">an attr1 value</string>  
</uos>
```

Several components of this part of ISO 10303 are available in electronic form. This access is provided through the specification of Universal Resource Locators (URLs) that identify the location of these files on the Internet. If there is difficulty accessing these files contact the ISO Central Secretariat, or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

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Industrial automation systems and integration — Product data representation and exchange — Part 28: Implementation methods: XML representations of EXPRESS schemas and data

1 Scope

This part of ISO 10303 specifies use of the Extensible Markup Language (XML) to represent schemas specified using the EXPRESS data specification language, ISO 10303-11, and data that is governed by EXPRESS schemas.

The following are within the scope of this part of ISO 10303:

— specification of XML markup declarations that enable EXPRESS schemas to be represented using XML;

— specification of a single XML markup declaration set that is independent of the EXPRESS schema and formally describes the XML representation of data governed by any schema;

NOTE 1 XML markup declarations specified using this method are referred to as late bound, in that they may be used without change to represent data governed by any EXPRESS schema. This part of ISO 10303 allows for a number of choices in representing the data.

— for an arbitrary EXPRESS schema, specification of an XML markup declaration set that corresponds to the schema and formally describes the XML representation of data governed by that schema;

NOTE 2 XML markup declarations specified using these methods are referred to as early bound, in that they are specific to a given EXPRESS schema.

— specification of the mapping between XML markup declarations corresponding to a specific schema and the XML markup declarations independent of any schema;

— specification of the form of XML documents containing EXPRESS schemas and data governed by EXPRESS schemas;

— specification of the representation of EXPRESS primitive data type values as element content and as XML attribute values.

The following are outside the scope of this part of ISO 10303:

— specification of XML markup declarations corresponding to an EXPRESS schema that depend on the semantic intent of the EXPRESS schema;

— specification of mappings from XML markup declarations to an EXPRESS schema;

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NOTE 3 Given a set of XML markup declarations and one or more corresponding data sets, it is feasible to create an EXPRESS schema that captures the semantic intent of the data. However, this requires an understanding of the meaning and use of the data that may not be captured by the XML markup declarations.

- specification of the mapping to an EXPRESS schema from an XML representation of that schema;
- specification of the mapping to an EXPRESS schema from XML markup declarations that have been derived from that schema;
- any mapping to or use of XML schema [3].

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO 6093:1985, *Information processing — Representation of numerical values in character strings for information interchange*

ISO/IEC 6429:1992, *Information technology — Control functions for coded character sets*

ISO 8601:1988, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 8824-1:1998, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO 10303-22:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 22: Implementation methods: Standard data access interface*

ISO 10303-23:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 23: Implementation methods: C++ language binding to the standard data access interface*

ISO 10744:1997, *Information technology — Hypermedia/Time-based Structuring Language (HyTime)*

Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies. Internet Engineering Task Force RFC 2045 November 1996 [cited 2000-08-15]. Available from World Wide Web: <<http://www.ietf.org/rfc/rfc2045.txt>>

Uniform Resource Identifiers (URI): Generic Syntax. Internet Engineering Task Force RFC 2396 August 1998 [cited 2000-08-07]. Available from World Wide Web: <<http://www.ietf.org/rfc/rfc2396.txt>>

URN Syntax. Internet Engineering Task Force RFC 2141 May 1997 [cited 2000-09-28]. Available from World Wide Web: <<http://www.ietf.org/rfc/rfc2141.txt>>

Extensible Markup Language (XML) 1.0. World Wide Web Consortium Recommendation 10 February 1998 [cited 2000-04-26]. Available from World Wide Web: <<http://www.w3.org/TR/1998/REC-xml-19980210>>

Namespaces in XML. World Wide Web Consortium Recommendation 14 January 1999 [cited 2000-04-26]. Available from World Wide Web: <<http://www.w3.org/TR/1998/REC-xml-19990114>>

XML Linking Language (XLink) Version 1.0. World Wide Web Consortium Candidate Recommendation 3 July 2000 [cited 2000-08-08]. Available from World Wide Web: <<http://www.w3.org/TR/2000/CR-xlink-20000703>>

XML Transformations (XSLT) Version 1.0. World Wide Web Consortium Recommendation 16 November 1999 [cited 2000-08-07]. Available from World Wide Web: <<http://www.w3.org/TR/1999/REC-xslt-19991116>>

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3 Terms, definitions, and abbreviations

3.1 Terms defined in ISO 10303-1

For the purposes of this document, the following terms defined in ISO 10303-1 apply:

- data;
- information.

3.2 Other terms and definitions

For the purposes of this document, the following terms and definitions apply. Terms defined in the XML 1.0 Recommendation and ISO 10303-11 are repeated below for convenience.

NOTE Definitions copied verbatim from other standards are followed by a reference to the source standard in brackets. Definitions that have been adapted from other standards are followed by an explanatory note.