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Dentistry — Interoperability of CAD/CAM systems

Médecine bucco-dentaire — Interopérabilité des systèmes de CFAO

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 106, *Dentistry*, Subcommittee SC 9, *Dental CAD/CAM systems,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 55, *Dentistry,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 18618:2022), which has been technically revised.

The main change compared to the previous edition is as follows:

— The XML schema for IDS (interface for dental CAD/CAM systems) examples of interoperability of digital dental products relating to inlay, onlay, crown, dental implant systems, removables, dental appliances, orthodontics, and dentures have been updated in Annex A due to the fast nature of the software system innovation and the need for ongoing testing.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Manufacturers of dental CAD/CAM systems differ in how they exchange manufacturing information and three-dimensional data. This causes difficulty in data processing, design processes and manufacturing processes for users of those systems. In order to overcome these interoperability issues, this document has been prepared to facilitate open interoperability between CAD/CAM systems in dentistry.

Dentistry — Interoperability of CAD/CAM systems

1 Scope

This document specifies an extensible markup language (XML) format to facilitate the transfer of dental case data and CAD/CAM data between software systems.

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.

ISO 1942, *Dentistry — Vocabulary*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country code*

ISO 3950, *Dentistry — Designation system for teeth and areas of the oral cavity*

ISO 16443, *Dentistry — Vocabulary for dental implants systems and related procedure*

ISO 18739, *Dentistry — Vocabulary of process chain for CAD/CAM systems*

W3C — Extensible Markup Language (XML) 1.0 (Fifth Edition), November 2008

W3C XML Schema Definition Language (XSD) 1.1, April 2012

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1942, ISO 16443, ISO 18739, W3C XML 1.0, W3C XML XSD 1.1 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 General terms

3.1.1
broker
entity that acts as a middleman or intermediary

Note 1 to entry: Such entities take multiple orders from multiple sources and consolidate them into a single order for a provider. Alternatively, they take single orders from an originator and split them among multiple providers. They also pass orders between originators and providers.

3.1.2
interface for dental CAD/CAM systems
IDS
nodes immediately within the enveloping root element that provide traceability and source identification features as well as information on how to reply to a document transaction

Note 1 to entry: The IDS schema organizes the IDS document into structures for specific transactions. The structures represent a submission, a query, an update of a previous submission, a notification of an event or status change and a series of catalogues. A single IDS document can contain a combination of different transaction nodes or consist of only a single transactional node.

3.1.3
originator
entity (organization or person) that is responsible for creating the current document, order or submission

Note 1 to entry: An originator is typically a dental practice. In some cases, an originator is a dental laboratory that is outsourcing work to another laboratory.

3.1.4
provider
entity that is responsible for supplying the services or products that are being requested in an order

Note 1 to entry: An entity can be a company, a laboratory.

Note 2 to entry: A provider is typically a dental laboratory or manufacturer.

3.2 Terms relating to XML content

3.2.1
brokerID
identifiers used by a *broker* (3.1.1) to identify itself, or by an *originator* (3.1.3) and a *provider* (3.1.4) to identify a broker

3.2.2
CADDataCatalogue
collection of nodes describing CAD data associated with one or more of either the orders or restorations, or both

Note 1 to entry: A CADDataCatalogue can include either a digital scan or design files, or both.

3.2.3
case
set of one or more orders for dental appliances, products or services, all of which are submitted for a single patient

EXAMPLE A case can contain one order for a crown and another order for a bridge.

3.2.4
catalogue
data that are referenced in other elements or areas

Note 1 to entry: Catalogues are subdivided by the data they group, which makes them easier to manage and reference.

3.2.5
character data
CDATA
certain portion of the document that is a general single character, rather than a non-character or character with a more specific, limited structure

Note 1 to entry: CDATA is used for distinct, but related, purposes in the markup languages SGML and XML.

3.2.6
DataQuery
method to request data from another system or entity

Note 1 to entry: DataQuery provides elements to define the data elements to be searched or matched on as well as elements to define the data requested in response.

3.2.7
DeliveryRequest
information for the out-going, finished order, which is sent to the *originator* (3.1.3) (or an originator's agent) as a separate delivery

Note 1 to entry: A delivery is either physical or electronic, or both.

3.2.8
dentist
node that defines the responsible clinician who requested the order

3.2.9
DentistCatalogue
collection of *dentist* (3.2.8) nodes that provides attributes and elements to define the dentists being referenced in the *interface for dental CAD/CAM systems* (3.1.2) schema

Note 1 to entry: The definition can include billing information and license information.

3.2.10
ExtraInfo
child node that can be used to extend the schema with undefined XML

Note 1 to entry: Many of the elements contain child nodes with the suffix "ExtraInfo" (e.g. <DentistExtraInfo>, <OrderExtraInfo>). These elements are intended to be areas that can be used to extend the defined schema with proprietary or undefined XML.

EXAMPLE 1 An implementation can use one (or more) of these elements to embed XML that is only of use to the implementer for an internal workflow.

EXAMPLE 2 Another use can be two business partners using these elements to experiment with XML they intend to propose for future versions or to pass proprietary XML they have previously defined between themselves.

Note 2 to entry: The interface dental CAN/CAM system (IDS) (3.1.2) schema and XML schema definition ignore the contents of these so they are not validated as part of the IDS schema. If these elements are used, it is highly recommended that any XML be enclosed within some proprietary element tag so that if the XML document passes through multiple handlers, there are no conflicts. For example:

```
<DentistExtraInfo>
    <MyCompanyData>
        data specific and of use only to "MyCompany"…
    </MyCompanyData>
</DentistExtraInfo>
```

3.2.11
FileCatalogue
collection of <IDSFile> nodes that describe files associated with the <Case>, <Order> or CAD data (scans, design files, etc.)

3.2.12
host service
system that receives the *interface for dental CAD/CAM systems* (3.1.2) document and processes the contents

3.2.13
IDMapCatalogue
collection of <IDMapItem> nodes which provide a means of defining alternate identifiers for key elements within the *interface for dental CAD/CAM systems* (3.1.2)

3.2.14
notification
means for publishing or returning a defined status, event or message related to an order

Note 1 to entry: Within the notification node is an untyped element that can be defined in accordance with the needs of the parties exchanging information.

3.2.15
order
request for a self-contained dental appliance, service or product that is being requested by an originator

Note 1 to entry: Each order in a case can be created or manufactured by a different provider. Each order contains its own delivery (or reply) instruction nodes.

3.2.16
OrderCatalogue
collection of <Order> nodes that provide attributes and elements necessary to define or describe an order

Note 1 to entry: An <Order> often contains one or more <Restoration> nodes but can omit these nodes when not needed.

3.2.17
parcel
physical package that is mailed

3.2.18
patient
node that defines the person for whom a case is being manufactured

Note 1 to entry: Patient information is not a mandatory part of the *interface for dental CAD/CAM systems* (3.1.2) schema.

3.2.19
PatientCatalogue
collection of <Patient> nodes that provide attributes and elements to define patients that are referenced in the <Order> or <Case> elements

Note 1 to entry: Because patients are referenced in either multiple <Order> nodes or multiple <Case> nodes, or both, the patient information is grouped into a catalogue.

3.2.20
prescription
written directive from the dentist or responsible clinician to the supplier specifying the product that should be manufactured for the patient

3.2.21
ProductCatalogue
means for a *provider* (3.1.4) or *broker* (3.1.1) to publish the products that are available for ordering

Note 1 to entry: The node provides attributes and elements to define a product, includes multiple descriptions in different languages and specifies ordering options and variations.

3.2.22
productSKU
product stocking unit used by manufacturers to identify their products to their internal systems

3.2.23
providerID
identifier used by a *broker* (3.1.1) and an *originator* (3.1.3) to identify a *provider* (3.1.4), or by a provider to identify itself

3.2.24
submission
batch or group of one or more <Cases> described in the *interface for dental CAD/CAM systems (IDS)* (3.1.2) document

Note 1 to entry: In traditional (non-digital) dentistry, a submission is equivalent to receiving a physical package [*parcel* (3.2.17)] containing one or more cases. In the digital IDS realm, the submission represents any combination of one or more either physical or digital, or both, cases that are being submitted to a provider for production.

3.2.25
universally unique identifier
UUID
label used for identifying key elements

Note 1 to entry: UUIDs are denoted in the document as string(36) to correspond to the XML schema definition for the UUIDTypeDef. 128-bit (16 bytes) number represented as a 36-character string of its hexadecimal presentation (32 characters + separators including leading 0 values) in the format: XXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXX.

Note 2 to entry: An <IDMap> within the <Catalogues> of the document provides a means of equating the UUID with alternate identifiers that carry external meaning, such as a laboratory management system *interface for dental CAD/CAM systems (IDS)* (3.1.2) for a dentist, case or patient.

Note 3 to entry: UUID values can have multiple alternate IDS in the <IDMap> but each UUID is defined only once and used on a single key element.

EXAMPLE If the UUID "107face6-fc51-4366-805d-2ee23014d835" is assigned to the dentist "Smith", it is possible that UUID value is not used on any other element as a key identifier and can only be used as a reference in other elements needing to associate with that specific dentist.

3.2.26
update
means to send an abbreviated set of data elements to refresh or modify a previously submitted <Order>

Note 1 to entry: Update contains elements that allow the update to match expected values in addition to providing the new values.

4 Data security and storage methods

The internet has proven to be an effective means of communication, yet its vulnerability to interception raises issues of privacy, authentication and integrity of the communicated message. Therefore, data security is of utmost importance to users of dental information systems.

Health records are personal and private, so dental practitioners are expected to understand the security issues associated with data at rest and data in transit.

NOTE This document is not intended to explain security concepts and the risks associated with the maintenance of data in storage and transit, and over an internet connection. The ADA Standards Committee on Dental Informatics has published a series of technical reports that provide dental practitioners with guidelines in addressing issues of security of data in storage and transmission over the internet.

A ZIP file format is recommended for transport of the IDS XML file and related files. However, implementation of a file container is the responsibility of the implementer.

5 Naming

The file name shall end with a .ids extension. The file name can be prepended with any naming convention that the user desires.

6 Numbering system for teeth and areas of the oral cavity

In this document, the numbering of teeth and areas of the oral cavity shall be based on ISO 3950.

7 Measurement units

All units are in millimetres unless otherwise specified.

8 Additional restrictions on IDS XML documents

In addition to the information provided in Clause 3 to Clause 7, a valid IDS document shall also meet the following requirements:

a) The total size of the document shall not exceed 2 MB.

b) The document shall contain a unique identifier for ProviderIDs.

c) The document shall contain a unique identifier for BrokerIDs.

9 XSD Description

The definition of the elements of the XSD schema provided in Annex A shall be used. A sample XML schema of IDS is shown in Annex B. The XSD definition document shall be downloaded from: https://standards.iso.org/iso/18618/ed-3/en/.

Annex A
(normative)

XML schema for IDS

A.1 General

This annex provides a description of the IDS schema. The following conventions are used in this annex:

a) An asterisk (*) denotes a required XML node or attribute. Unless marked with an asterisk, all nodes and attributes are considered optional. Some optional nodes have required attributes, which means that if the node is present at all, the attributes marked with * are also present.

b) For nodes and attributes of type “String,” the allowed length of the string is unlimited unless the length is specified [e.g. String(100)].

c) The data type “Datetime UTC” implies a date and time value, as defined in ISO 8601-1.

d) All data types refer to the XML schema data types: string, integer, Boolean, datetime, etc.

A.2 XML schema for IDS root

The detailed information of XML schema for IDS root and subdirectories are given from Table A.1, Table A.2 and Table A.3.

Table A.1 — Description of the root directory of IDS

IDS *		
The root node for all IDS documents.		
Attribute	**Data type**	**Description**
IDSVersion *	String(10)	The version identifier of the XML schema of the message.
IDSUUID *	String(36)	A globally unique identifier for the IDS message.

Table A.2 — Description of the directory of IDS/IDSSource

IDS/IDSSource		
An optional node describing the system from which the document originates.		
Attribute	**Data type**	**Description**
HostName	String(100)	The network name of the source host system creating and sending the message.
IPAddress	String(15)	An IPv4 address of the source host system creating and sending the message.
IPAddress6	String(45)	An IPv6 address of the source host system creating and sending the message.
MACAddress	String(15)	A MAC address of the source host system creating and sending the message.
OperatorID	String(100)	A network user identifier for the user account on the source host system creating and sending the message.
NetworkDomain	String(100)	A network name identifier for the domain containing the system sending the message.
ApplicationName	String(100)	A value indicating the application (by name) that was used to generate or originate the IDS message.
SystemName	String(100)	A value indicating the system (by name) that the IDS document originated in.

Table A.2 *(continued)*

IDS/IDSSource		
An optional node describing the system from which the document originates.		
Attribute	**Data type**	**Description**
SystemID	String(100)	A value indicating the originating system by identifier or version.
SubSystemName	String	A value identifying the name of the subsystem originating the message.
SubSystemID	String	A value indicating the originating subsystem by identifier or version.
SystemVersion	String	The software or system version information from the system originating the message.

Table A.3 — Description of the directory of IDS/IDSReplies/ReplyTo

IDS/IDSReplies/ReplyTo		
An element specifying address information used for IDS message responses.		
Attribute	**Data type**	**Description**
Address	String(200)	The text of an address. The address itself can be in one of a variety of formats.
AddressType	String(5)	An enumerated value identifying the format of the address provided. Acceptable values are: — URL — WCF — MSMQ — IPV4 — IPV6 — UNC

A.3 XML schema for IDS <Submission> request

The detailed information of XML schema for IDS <Submission> request and subdirectories are given from Table A.4 to Table A.34.

Table A.4 — Root directory of IDS/Submission

IDS/Submission *		
The root node for the submission XML.		
Attribute	**Data type**	**Description**
UUID *	String(36)	A globally unique identifier for this submission. This UUID can change for each new submission and should be provided by the originator.
DateUTCSubmitted	Datetime UTC	The date and time that the submission was first submitted to the receiver.
DateUTCReceived	Datetime UTC	The date and time that the submission was received by the receiver. This value is populated by the receiver (broker or provider) and should be omitted (or left blank) on new submissions.