
**Health informatics — Digital imaging
and communication in medicine
(DICOM) including workflow and data
management**

*Informatique de santé — Imagerie numérique et communication
en médecine (DICOM) incluant le déroulement des opérations et la
gestion des données*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 12052:2017](https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0afe915598/iso-12052-2017)

<https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0afe915598/iso-12052-2017>



iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 12052:2017

<https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0afe915598/iso-12052-2017>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

	Page
Foreword	iv
0 Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Abbreviated terms	3
5 Requirements	4
5.1 Provisions.....	4
5.2 Conformance.....	4
6 Overview of the content of the DICOM standard	4
6.1 Document structure.....	4
6.2 PS3.2: Conformance.....	5
6.3 PS3.3: Information object definitions.....	7
6.4 PS3.4: Service class specifications.....	8
6.5 PS3.5: Data structure and semantics.....	8
6.6 PS3.6: Data dictionary.....	8
6.7 PS3.7: Message exchange.....	9
6.8 PS3.8: Network communication support for message exchange.....	9
6.9 PS3.9: Retired (formerly point-to-point communication support for message exchange).....	10
6.10 PS3.10: Media storage and file format.....	10
6.11 PS3.11: Media storage application profiles.....	11
6.12 PS3.12: Storage functions and media formats for data interchange.....	12
6.13 PS3.13: Retired (formerly print management point-to-point communication support).....	12
6.14 PS3.14: Grayscale standard display function.....	13
6.15 PS3.15: Security and system management profiles.....	13
6.16 PS3.16: Content mapping resource.....	13
6.17 PS3.17: Explanatory information.....	13
6.18 PS3.18: Web services.....	13
6.19 PS3.19: Application hosting.....	13
6.20 PS3.20: Imaging reports using HL7 clinical document architecture.....	14
7 Referencing the DICOM standard	15
Bibliography	17

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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html. (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 215, *Health informatics*.

This second edition cancels and replaces the first edition (ISO 12052:2006), of which it constitutes a minor revision.

The changes made are as follows:

- [Clause 1](#), [6.18](#), [6.19](#), [6.20](#) and [Clause 7](#) have been revised;
- informative material has been added to the Introduction.

0 Introduction

Digital Imaging and Communications in Medicine (DICOM) is the standard for the communication and management of medical imaging information and related data.

0.1 History

With the introduction of computed tomography (CT) followed by other digital diagnostic imaging modalities in the 1970s, and the increasing use of computers in clinical applications, the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) recognized the emerging need for a standard method for transferring images and associated information between devices manufactured by various vendors. These devices produce a variety of digital image formats.

The American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) formed a joint committee in 1983 to develop a standard to:

- promote communication of digital image information, regardless of device manufacturer;
- facilitate the development and expansion of picture archiving and communication systems (PACS) that can also interface with other systems of hospital information;
- allow the creation of diagnostic information databases that can be interrogated by a wide variety of devices distributed geographically.

ACR-NEMA standards Publication No. 300-1985, published in 1985, was designated version 1.0. The standard was followed by two revisions: No. 1, dated October 1986 and No. 2, dated January 1988. These standards publications specified a hardware interface, a minimum set of software commands, and a consistent set of data formats.

ACR-NEMA standards Publication No. 300-1988, published in 1988, was designated version 2.0. It included version 1.0, the published revisions, and additional revisions. It also included new material to provide command support for display devices, to introduce a new hierarchy scheme to identify an image, and to add data elements for increased specificity when describing an image.

In 1993, ACR-NEMA/Standard 300 was substantially revised and replaced by this document, designated Digital Imaging and Communications in Medicine (DICOM). It embodies a number of major enhancements to previous versions of the ACR-NEMA standard, as listed below.

- It is applicable to a networked environment. The ACR-NEMA standard was applicable in a point-to-point environment only; for operation in a networked environment, a Network Interface Unit (NIU) was required. DICOM supports operation in a networked environment using the industry standard networking protocol TCP/IP.
- It is applicable to offline media exchange. The ACR-NEMA standard did not specify a file format or choice of physical media or logical filesystem. DICOM supports operation in an offline media environment using industry standard media such as CD-R, DVD-R and USB and common file systems.
- It is a service-oriented protocol, specifying the semantics of commands and associated data, and how devices claiming conformance to the DICOM standard react to commands and data being exchanged. Specified services include support for management of the workflow of an imaging department. The ACR-NEMA standard was confined to the transfer of data with only implicit service requirements.
- It specifies levels of conformance. The ACR-NEMA standard specified a minimum level of conformance. DICOM explicitly describes how an implementor must structure a Conformance Statement to select specific options.

In 1995, with the addition of DICOM capabilities for cardiology imaging supported by the American College of Cardiology, the ACR-NEMA Joint Committee was reorganized as the DICOM Standards Committee, a broad collaboration of stakeholders across all medical imaging specialities.

0.2 Principles

0.2.1 Global applicability and localization

DICOM is a world-wide standard that can be used in every locale. It provides mechanisms to handle data that support cultural requirements, such as different writing systems, character sets, languages, and structures for addresses and person names. It supports the variety of workflows, processes and policies used for biomedical imaging in different geographic regions, medical specialities and local practices.

Localization to meet the requirements of national or local health and workflow policies can be done without deviating from the DICOM standard. Such localization may include specifying code sets (e.g. procedure codes) or profiling data element usage (both specifying locally-allowed values, and making elements that are optional in the DICOM standard mandatory for local use).

Localization and profiling can be specified in a number of mechanisms outside the purview of the DICOM standard. One such mechanism is Integration Profiles from the Integrating the Healthcare Enterprise (IHE) organization. It is important that Profiling adhere to the concept of non-contradiction. A Profile can add requirements but should not contradict DICOM requirements, as that would make it impossible to comply with both DICOM and the Profile.

0.2.2 Continuous maintenance

The DICOM standard is an evolving standard and it is maintained in accordance with the Procedures of the DICOM Standards Committee. Proposals for enhancements are welcome from all users of the DICOM standard and may be submitted to the Secretariat. Supplements and corrections to the DICOM standard are balloted and approved several times a year. When approved as Final Text, each change becomes official, is published separately, and goes into effect immediately. At intervals, all of the approved Final Text changes are consolidated and published in an updated edition of the DICOM standard. Once changes are consolidated into an updated edition of the DICOM standard, the individual change documents are not maintained; readers are directed to use the consolidated edition of the DICOM standard.

A requirement in updating the DICOM standard is to maintain effective compatibility with previous editions.

The maintenance process may involve retirement of sections of the DICOM standard.

Retirement does not imply that these features cannot be used. However, the DICOM Standards Committee will not maintain the documentation of retired features. The reader is referred to earlier editions of the DICOM standard.

The use of the retired features is discouraged for new implementations, in favour of those alternatives remaining in the DICOM standard.

0.2.3 Information objects and unique object identification

Many DICOM services involve the exchange of persistent information objects, such as images. An instance of such an information object may be exchanged across many systems and many organizational contexts, and over time. While minor changes may be made to the attributes of an instance to facilitate its handling within a particular organization (e.g. by coercing a Patient ID to the value used in a local context), the semantic content of an instance does not change.

Each instance is identified by a globally unique object identifier, which persists with the instance across all exchanges. Changes to the semantic content of an instance are defined to create a new instance, which is assigned a new globally unique object identifier.

0.2.4 Conformance

Conformance to the DICOM standard is stated in terms of Service-Object Pair (SOP) Classes, which represent Services (such as Storage using network, media, or web) operating on types of Information Objects (such as CT or MR images).

SOP Class specifications in the DICOM standard are only changed in a manner that is intended to be forward and backward compatible for all editions of the DICOM standard. Conformance requirements

and conformance claims are therefore referenced to the identifier of the SOP Class, and never referenced to an edition of the DICOM standard.

Each implementation is required to provide a Conformance Statement, in accordance with a consistent pro forma structure, facilitating comparison of products for interoperability.

0.2.5 Consistency of information model

A large number of information objects defined in the DICOM standard follow a common composite information model with information entities representing Patient, Study, Series, Equipment, Frame of Reference, and the specific instance data type. This information model is a simplification of the real world concepts and activities of medical imaging; for acquisition modalities, a Study is approximately equivalent to an ordered procedure, and a Series is approximately equivalent to a performed data acquisition protocol element. In other domains, such as Radiotherapy, the Study and Series are less clearly related to real world entities or activities, but are still required for consistency. This simplified model is sufficient for the pragmatic needs of managing imaging and related data collected in routine practice.

New information objects defined in DICOM will typically conform to this existing common information model, allowing reuse of implementations with minimal changes to support the new objects.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 12052:2017](https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0afe915598/iso-12052-2017)

<https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0afe915598/iso-12052-2017>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 12052:2017

<https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0afe915598/iso-12052-2017>

Health informatics — Digital imaging and communication in medicine (DICOM) including workflow and data management

1 Scope

This document, within the field of health informatics, addresses the exchange of digital images and information related to the production and management of those images, between both medical imaging equipment and systems concerned with the management and communication of that information.

This document facilitates interoperability of medical imaging equipment by specifying:

- for network communications, a set of protocols to be followed by devices claiming conformance to this document;
- the syntax and semantics of Commands and associated information which can be exchanged using these protocols;
- for media communication, a set of media storage services to be followed by devices claiming conformance to this document, as well as a File Format and a medical directory structure to facilitate access to the images and related information stored on interchange media;
- information that is to be supplied with an implementation for which conformance to this document is claimed.

This document does not specify: <https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0af915598/iso-12052-2017>

- the implementation details of any features of the DICOM standard on a device claiming conformance;
- the overall set of features and functions to be expected from a system implemented by integrating a group of devices each claiming conformance to this document;
- a testing/validation procedure to assess an implementation's conformance to this document.

This document pertains to the field of medical informatics. Within that field, it addresses the exchange of digital information between medical imaging equipment and other systems. Because such equipment may interoperate with other medical devices and information systems, the scope of this document needs to overlap with other areas of medical informatics. However, this document does not address the full breadth of this field.

This document has been developed with an emphasis on diagnostic medical imaging as practiced in radiology, cardiology, pathology, dentistry, ophthalmology and related disciplines, and image-based therapies such as interventional radiology, radiotherapy and surgery. However, it is also applicable to a wide range of image and non-image related information exchanged in clinical, research, veterinary, and other medical environments.

This document facilitates interoperability of systems claiming conformance in a multi-vendor environment, but does not, by itself, guarantee interoperability.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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>

3.1 attribute

property of an *information object* (3.10)

Note 1 to entry: An Attribute has a name and a value which are independent of any encoding scheme.

3.2 command

request to operate on information across a network

3.3 command element

encoding of a parameter of a *command* (3.2) which conveys this parameter's value

3.4 command stream

result of encoding a set of DICOM *Command Elements* (3.3) using the DICOM encoding scheme

3.5 conformance statement

formal statement that describes a specific product implementation that uses the DICOM standard

Note 1 to entry: It specifies the *Service Classes* (3.14), *Information Objects* (3.10), and communication protocols supported by the implementation.

3.6 data dictionary

registry of DICOM Data Elements which assigns a unique tag, a name, value characteristics, and semantics to each *Data Element* (3.7)

3.7 data element

unit of information as defined by a single entry in the *data dictionary* (3.6)

3.8 data set

exchanged information consisting of a structured set of *Attributes* (3.1)

Note 1 to entry: The value of each Attribute in a data set is expressed as a *Data Element* (3.7).

3.9 data stream

result of encoding a *Data Set* (3.8) using the DICOM encoding scheme (Data Element Numbers and representations as specified by the *Data Dictionary* (3.6))

3.10 information object

abstraction of a real information entity (e.g. CT Image, Structured Report, etc.) which is acted upon by one or more DICOM Commands

Note 1 to entry: Information object is also referred to in the DICOM standard as an Information Object Definition.

Note 2 to entry: This term is primarily used in DICOM PS3.1, with a few references in DICOM PS3.3. It is an informal term corresponding to a formal term that is introduced in DICOM PS3.3. In all other parts of the DICOM standard, this formal term is known as an Information Object Definition.

3.11

information object class

formal description of an *Information Object* (3.10) which includes a description of its purpose and the *Attributes* (3.1) it possess

Note 1 to entry: It does not include values for these attributes. Also referred to in the DICOM standard as a SOP Class or Service-Object Pair Class.

Note 2 to entry: This term is only used in DICOM PS3.1. It is an informal term corresponding to a formal term that is introduced in DICOM PS3.4. This formal term is known as a Service-Object Pair Class or more commonly as a SOP Class.

3.12

information object instance

representation of an occurrence of a real world entity, which includes values for the *Attributes* (3.1) of the *Information Object Class* (3.11) to which the entity belongs

Note 1 to entry: Information object instance is also referred to in the DICOM standard as a SOP Instance.

Note 2 to entry: This term is only used in DICOM PS3.1. It is an informal term corresponding to a formal term that is introduced in DICOM PS3.4. This formal term is known as a Service-Object Pair Instance or more commonly as a SOP Instance.

3.13

message

data unit of the Message Exchange Protocol exchanged between two cooperating DICOM Applications

Note 1 to entry: A Message is composed of a *Command Stream* (3.4) followed by an optional *Data Stream* (3.9).

3.14

service class

structured description of a service which is supported by cooperating DICOM Applications using specific DICOM Commands acting on a specific class of *Information Object* (3.10)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 12052:2017
<https://standards.iteh.ai/catalog/standards/sist/c2564900-9b79-4be7-89de-9b0afe915598/iso-12052-2017>

4 Abbreviated terms

ACSE	Association Control Service Element
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
HIS	Hospital Information System
IOD	Information Object Definition
JIRA	Japan Medical Imaging and Radiological Systems Industries Association
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication Systems
REST	Representational State Transfer
RESTful	A RESTful Web service is a Web service implemented using REST architecture and HTTP (see http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf)