DCMburner

Version 7.2.0

DICOM Conformance Statement

DCMburner version 7.2

Conformance to the DICOM Standard (PS3.2)

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1. Introduction

1.1 Purpose and scope

This statement describes how **DCMburner 7.2** implements the DICOM Standard: which network services it provides and uses, and how it writes DICOM files on removable media (patient discs). It follows the structure of DICOM PS3.2. It is meant for system integrators and hospital IT staff.

1.2 Product summary

DCMburner receives DICOM objects, stores them unchanged in a local archive, can query and retrieve objects from other DICOM nodes, and writes CD, DVD and Blu-ray discs containing the objects, a DICOMDIR and a viewer. DCMburner is not intended for diagnostic use.

1.3 Implementation

Item	Value
Manufacturer	Sup-C
Product	DCMburner 7.2.0
DICOM toolkit	fo-dicom 5.2.6 (with fo-dicom.Codecs 5.16.7)
Implementation Class UID	1.3.6.1.4.1.30071.8 (supplied by the toolkit)
Implementation Version Name	fo-dicom 5.2.6
Maximum PDU length offered by the SCP	262144 bytes
Network	TCP/IP, IPv4

1.4 Definitions and abbreviations

AE = Application Entity; SCP = Service Class Provider; SCU = Service Class User; SOP = Service-Object Pair; PDU = Protocol Data Unit; FSC = File-set Creator.

2. Implementation model

2.1 Application data flow

```
Modality / PACS --C-STORE--> [Storage SCP (DCMBURNER)] --> Archive --> [Media FSC] --> Disc (DICOMDIR + files)
Modality / PACS --C-ECHO---> [Verification SCP]
[Query/Retrieve SCU] --C-FIND / C-MOVE / C-GET--> Remote node (PACS)
Remote node --C-STORE (C-MOVE: to DCMBURNER SCP, C-GET: on the same association)--> Archive
Watch folder / folder import (DICOM files, DICOMDIR) --> Archive
```

2.2 Functional definition of Application Entities

AE	Role	Function
Storage and Verification SCP	SCP	Listens on the configured port (default 4006). Accepts C-STORE and C-ECHO. The AE title is configurable (default: computer name in capitals).
Query/Retrieve SCU	SCU	Opens associations to configured remote nodes for C-ECHO, C-FIND (study level), C-MOVE and C-GET.
Media File-set Creator	FSC	Writes DICOM files and a DICOMDIR to a staging folder that is burned

		to disc or exported to a folder.
Media reader (import)	FSR (basic)	Imports DICOM files and DICOMDIR files from a folder.

2.3 Sequencing of real-world activities

A received study is complete when no new instance arrived for the **incoming study time-out** (default 20 seconds). Automatic burning starts after that. Retrievals and burn jobs run in the background and are listed on the **Jobs** page.

3. AE specifications

3.1 Storage and Verification SCP

3.1.1 SOP classes

SOP Class	UID	Role
Verification	1.2.840.10008.1.1	SCP
All Storage SOP classes known to the toolkit, and unknown or private storage classes	(many; for example CT 1.2.840.10008.5.1.4.1.1.2, MR ...1.4, CR ...1.1, DX ...1.1.1, US, XA, RF, NM, PT, SC, SR, PDF 1.2.840.10008.5.1.4.1.1.104.1, Presentation States, Video)	SCP

Presentation contexts for other services (query/retrieve, modality worklist, print, procedure step, storage commitment, unified worklist, relevant patient, hanging protocol) are **rejected** with 'Abstract Syntax Not Supported'. A modality worklist request was tested and rejected; a CT Image Storage request and C-ECHO were accepted.

3.1.2 Transfer syntaxes

Negotiation. For every Storage presentation context the receiver looks at the transfer syntaxes the sender proposes. It chooses **Explicit VR Little Endian** if it is proposed, otherwise **Implicit VR Little Endian**, otherwise the **first syntax in the proposal**. A context is refused ('Transfer Syntaxes Not Supported') only when the sender proposes no transfer syntax at all. So every transfer syntax of DICOM can be received; the list below names the ones that are in use today and says how DCMburner treats each one.

Storage. The object is stored exactly as it was received: no transcoding, no change of the pixel data, and the same transfer syntax is written on a disc or in an export.

Transfer syntax	UID	Received	Shown in the pages
Implicit VR Little Endian	1.2.840.10008.1.2	Yes (second choice)	Yes
Explicit VR Little Endian	1.2.840.10008.1.2.1	Yes (first choice)	Yes
Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99	Yes	Yes
Explicit VR Big Endian (retired)	1.2.840.10008.1.2.2	Yes	Yes
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	Yes	Yes (decoded)
JPEG Extended (Process 2 and 4)	1.2.840.10008.1.2.4.51	Yes	Yes (decoded)
JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57	Yes	Yes (decoded)
JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14, Selection Value 1)	1.2.840.10008.1.2.4.70	Yes	Yes (decoded)
JPEG-LS Lossless	1.2.840.10008.1.2.4.80	Yes	Yes (decoded)
JPEG-LS Lossy (Near-Lossless)	1.2.840.10008.1.2.4.81	Yes	Yes (decoded)
JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90	Yes	Yes (decoded)
JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91	Yes	Yes (decoded)

RLE Lossless	1.2.840.10008.1.2.5	Yes	Yes (decoded)
MPEG2 Main Profile / Main Level	1.2.840.10008.1.2.4.100	Yes	As video, if the browser can play it
MPEG2 Main Profile / High Level	1.2.840.10008.1.2.4.101	Yes	As video, if the browser can play it
MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	Yes	As video
MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103	Yes	As video
Any other transfer syntax (for example JPEG 2000 Part 2, High-Throughput JPEG 2000, HEVC)	as proposed	Yes, when it is the first one proposed	Stored; the pages say 'cannot be shown' when the picture cannot be decoded

'Decoded' means the pages decode the compressed pixel data with the built-in JPEG, JPEG-LS, JPEG 2000 and RLE decoders to show the image; the stored file is not changed by this. The viewer that is burned on a disc, Sup-C DCMviewer (`DCMviewer.exe`), is separate software with its own Conformance Statement. It shows uncompressed, deflated and big-endian data, JPEG Baseline and Extended (8 bit), JPEG Lossless, JPEG-LS, JPEG 2000 and RLE (8 and 16 bit); it does not show JPEG Extended 12 bit, RLE with 32-bit samples, High-Throughput JPEG 2000 and JPEG XL, and it opens MPEG video in the video player of Windows. The disc holds the objects in their original transfer syntax.

Not verified: Receiving was tested with Implicit and Explicit VR Little Endian, JPEG Baseline, JPEG 2000 Lossless, RLE and MPEG-4 AVC (see chapter 9). Displaying was checked for uncompressed images and JPEG 2000 Lossless. The other syntaxes in the table (Deflated, Big Endian and the other compressed ones) are handled by the same library, but each one was not tried with a real image.

3.1.3 Association policies

- **Called AE title**: not checked by default. When 'Check the called AE title' is on, a different called AE title is rejected (permanent, called AE not recognized).
- **Calling AE title**: when the list 'Only accept these senders' is not empty, other calling AE titles are rejected (permanent, calling AE not recognized).
- The called AE title of an association selects the **profile** (disc layout, labels, viewer, automatic burning). Unknown AE titles use the Default profile.
- Maximum PDU size and timeouts are the defaults of the toolkit.
- Association rejects and aborts are written to the log file.

3.1.4 C-STORE behaviour

- Success status 0000 is returned when the object was stored in the archive.
- Status **0110 Processing failure** is returned when it could not be stored.
- The data set is stored without change (no transcoding, no attribute changes, pixel data as received). The file meta information is written by the toolkit: Source Application Entity Title = calling AE title, Implementation Version Name = fo-dicom 5.2.6.
- The Source Application Entity Title from the file meta information (or the sender's AE title) is kept and can feed a label field.

3.1.5 Verification (C-ECHO)

Always answered with status 0000 (Success).

3.2 Query/Retrieve SCU

3.2.1 SOP classes

SOP Class	UID	Role
Verification	1.2.840.10008.1.1	SCU
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	SCU
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	SCU
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3	SCU
Storage SOP classes (for C-GET sub-operations)	up to 110 classes, as SCP role selection	SCP (role selection)

3.2.2 C-FIND (study level)

Query level STUDY. **Matching keys** (entered by the user): Patient's Name, Patient ID, Accession Number, Study ID, Study Description, Referring Physician's Name, Modalities in Study, Study Date (single date or range). Text values are sent as 'contains' (`*value*`) unless the user typed a wildcard. **Return keys**: Study Instance UID, Study Time, Patient's Birth Date, Patient's Sex, Number of Study Related Series, Number of Study Related Instances (plus the matching keys). Specific Character Set `ISO_IR 192` (UTF-8) is requested. At most 5000 results are taken.

3.2.3 C-MOVE

Sent with the **Move Destination = DCMburner's own AE title**. The remote node must know the AE title, host and port of the DCMburner Storage SCP (default port 4006). The objects arrive at the Storage SCP (3.1). The final status is shown in Jobs; a failure status (for example C000) is reported with a hint.

3.2.4 C-GET

DCMburner proposes SCP-role presentation contexts for the storage classes of all categories (except private) in these transfer syntaxes (the UIDs are in 3.1.2): Explicit VR LE, Implicit VR LE, Deflated Explicit VR LE, JPEG Baseline (Process 1), JPEG Extended (Process 2 and 4), JPEG Lossless SV1, JPEG-LS Lossless, JPEG-LS Near-lossless, JPEG 2000 Lossless, JPEG 2000, RLE Lossless, MPEG2 MP@ML, MPEG2 MP@HL, MPEG-4 AVC/H.264 High Profile L4.1, MPEG-4 AVC/H.264 BD-compatible L4.1. Not proposed with C-GET: Explicit VR Big Endian, JPEG Lossless Process 14 (.57), JPEG 2000 Part 2 and newer syntaxes; a node that holds an object only in such a syntax may refuse it, so use C-MOVE for it. Received objects are stored unchanged. A failed store sub-operation is counted as 'Failed'.

3.2.5 Association policies

- Calling AE title = the AE title of DCMburner; called AE title = the AE title configured for the node.
- Association request time-out: 30 seconds; release time-out: 5 seconds.
- No DICOM TLS is used (the node option for TLS is not offered in the user interface).

4. Media interchange: File-set Creator

4.1 General

DCMburner writes a **file-set** to a staging folder that is burned on a CD, DVD or Blu-ray disc, or exported to a folder. The staging folder holds the viewer, the DICOM files and a DICOMDIR.

4.2 File-set layout

```
DICOMDIR                                (root)
DICOM\PAT<n>\STUDY<n>\SERIES<n>\IM<n>   the DICOM files (optional extension .DCM)
DCMviewer.exe                     viewer (profile dependent; no runtime needed)
AUTORUN.INF, viewer.ini, START_VIEWER.BAT
```

- File names are the reference IDs `DICOM\PATn\STUDYn\SERIESn\IMn`. The numbers count from 0 inside the parent level.
- Option **Add .DCM to the file names** adds the extension. Option **Leave the DICOM files off the disc** writes only the viewer and extra files.
- Folder and file names are not longer than 8 characters per component and use only upper-case letters and digits.

4.3 DICOMDIR

- Media Storage SOP Class: Media Storage Directory Storage (1.2.840.10008.1.3.10).
- File-set ID: the last 16 characters of the session identifier (a time stamp).
- Directory records are created by the toolkit for each file (patient, study, series and image-level records).
- The option **Add a DICOMDIR** (per profile) can switch it off.

4.4 Image files

Image files are copied **unchanged** from the archive: the transfer syntax, SOP class and all attributes are the ones received. One exception: in **demonstration mode** (no licence) the Patient's Name is replaced by `DCMburner^Demo`.

4.5 Application profile

DCMburner does **not claim conformance to a particular DICOM Media Storage Application Profile**. Discs are written with the JOLIET or ISO 9660 level 2 file system (CD) or UDF (DVD, Blu-ray), readable by common DICOM viewers. Compressed transfer syntaxes are written as received.

4.6 Protected media

When protection is on, the disc holds no DICOM files in clear: only `Patient.enc` (AES-256, WinZip-compatible archive of the file-set) and the unpack program. This disc is **not** a DICOM file-set until it is unpacked.

4.7 Media import

A folder import and the watch folder accept DICOM Part 10 files and count DICOMDIR files in the import report (the DICOM files themselves are imported). Non-DICOM files are skipped and counted.

5. Communication profiles

Item	Value
Stack	DICOM Upper Layer over TCP/IP (IPv4)
Receiver port	4006 (configurable)
Secure transport	Not supported (no DICOM TLS)
Web module	HTTPS, default port 8088; this is not a DICOM interface

6. Extensions, specializations and privatizations

- No private attributes are added to stored or exported objects.
- No standard SOP classes are specialised. Unknown and private storage SOP classes are accepted and stored.
- Character sets: objects keep the character set of the sender. C-FIND requests ask for UTF-8 (`ISO_IR 192`).

7. Configuration

Parameter	Where	Default
AE title	Setup > DICOM receiver	Computer name, capitals
Port	Setup > DICOM receiver	4006
Check the called AE title	Setup > DICOM receiver	off
Only accept these senders	Setup > DICOM receiver	empty (all)
Incoming study time-out	Setup > DICOM receiver	20 s
Remote nodes (AE title, host, port, C-MOVE/C-GET)	Setup > DICOM nodes	none
Free label fields 1-5	Setup > DICOM receiver	Manufacturer, Study Description, Series Description, Body Part Examined, Source AE title
Profiles (AE title, DICOMDIR, viewer, labels)	Setup > Profiles	Default profile

8. Security

- DICOM associations are unauthenticated and unencrypted. Restrict the receiver with the firewall and *'Only accept these senders'*.
- The web module requires sign-in and always uses HTTPS.
- DCMburner is not intended for diagnostic use and does not alter pixel data.

9. Verification performed for this document

Check	Result
C-ECHO to the receiver (test SCU)	Success
Association with Verification, CT Image Storage and Modality Worklist contexts	Verification and CT accepted, Worklist rejected
C-FIND study level and C-GET against an Orthanc server	Success (5 studies found, 116 images retrieved)
C-MOVE against the same Orthanc server	Failure C000 because Orthanc did not know DCMburner as a destination (expected)
Disc content staged for a burn job	DICOM folder, DICOMDIR, viewer and AUTORUN.INF present
DICOMDIR dump (pydicom)	Media Storage Directory Storage, Explicit VR Little Endian, File-set ID of 16 characters, consistency flag 0; records: 3 PATIENT, 3 STUDY, 6 SERIES, 116 IMAGE; ReferencedFileID = DICOM, PAT0, STUDY0, SERIES0, IM0
Transfer syntax negotiation	CT with JPEG 2000 Lossless only: accepted. MR with JPEG Baseline and RLE: JPEG Baseline (the first proposed) accepted. PDF with MPEG-4 AVC: accepted. CT with Implicit and Explicit VR LE: Explicit VR LE chosen
Protected disc	Patient.enc is a WinZip AES archive; wrong password refused, master password accepted
C-STORE with JPEG 2000 from Horos	12 files received in 6 associations: 6 files JPEG 2000 Lossless

(192.168.68.53)	(1.2.840.10008.1.2.4.90; CT, MR, OT), 5 Explicit VR LE, 1 Implicit VR LE. Stored with their own transfer syntax; the JPEG 2000 CT image shows correctly in the viewer
Same files burned to disc (Epson simulator)	302 files on the disc, 302 byte-identical to the archive; the JPEG 2000 files stayed JPEG 2000
IOD validation of the 302 image files of a disc (dicom-validator 0.9.0, DICOM standard edition 2026d)	294 files without findings. 8 files have findings, all in data of the sending systems (extra or unexpected attributes such as Other Patient IDs, Pre-Medication or Scan Arc in CT, Conversion Type in DX, Patient's Sex value U, a missing Referring Physician's Name). The files are byte-identical to what was received, so DCMburner did not cause them. SOP classes: CT 115, MR 140, X-Ray Radiofluoroscopic 42, CR 3, DX 2
DICOMDIR structure check (351 records)	8 PATIENT, 8 STUDY, 33 SERIES, 302 IMAGE records; all records in use; required keys present on every record; all 302 referenced files exist and their SOP Class UID, SOP Instance UID and transfer syntax match the files; FileSetConsistencyFlag 0000; the record chain loads without error with pydicom
International patient names	Greek, Arabic, Hebrew and Japanese (multi-component) names were received and shown correctly in the patient list

Not verified: The DICOM network protocol (association and DIMSE messages) was tested with a test client (pynetdicom) and against Orthanc, but not with a formal protocol validator such as DVTk. The bytes that Horos sent were not compared with the stored file (the sender was not available for that); only the stored file, the disc file and the display were checked.