MapRT DICOM Conformance Statement

For MapRT v1.0

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Vision RT Ltd.
Dove House
Arcadia Avenue
London N3 2JU
UK

EN-US

1 OVERVIEW

MapRT is a treatment delivery simulation system used to aid the treatment planning process and alert the user to potential collisions with equipment or patient. To support this, it acts as a provider of service supporting transfer of RT Plans.

This document explains the assumptions, limitations, and supported format.

SOP Classes		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
Transfer			
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes

Figure 1 – Network Services Supported by MapRT

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3 INTRODUCTION

3.1 Revision history

Date	Rev	Author	Comments
22 Jun 2023	1.0	Andrzej Wawrzyńczyk	Initial version for MapRT 1.0 using the NEMA template at: https://dicom.nema.org/medical/dicom/2022d/output/pdf/part02.pdf (Chapter A)

3.2 Audience

The target audience are hospital IT support staff, and service and support engineers of other radiotherapy product vendors, who need to configure DICOM interoperability between MapRT and their products.

It is assumed that the reader is familiar with the DICOM standard.

The document is structured based on the template definition in Part 2 of the DICOM standard (edition 2022d).

3.3 Remarks

It is essential that this DICOM Conformance Statement is thoroughly reviewed when using MapRT with other DICOM capable systems.

3.4 Definitions, Terms, and Abbreviations

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms, and is available for download at https://www.dicomstandard.org/current

Abbreviation/Term	Explanation
Abstract Syntax	The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.
AE	**Application Entity** An end point of a DICOM information exchange, including the DICOM network or media interface software. This may be software that sends or receives DICOM information objects or messages. A single device may have multiple AEs.
AET	**Application Entity Title** The externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

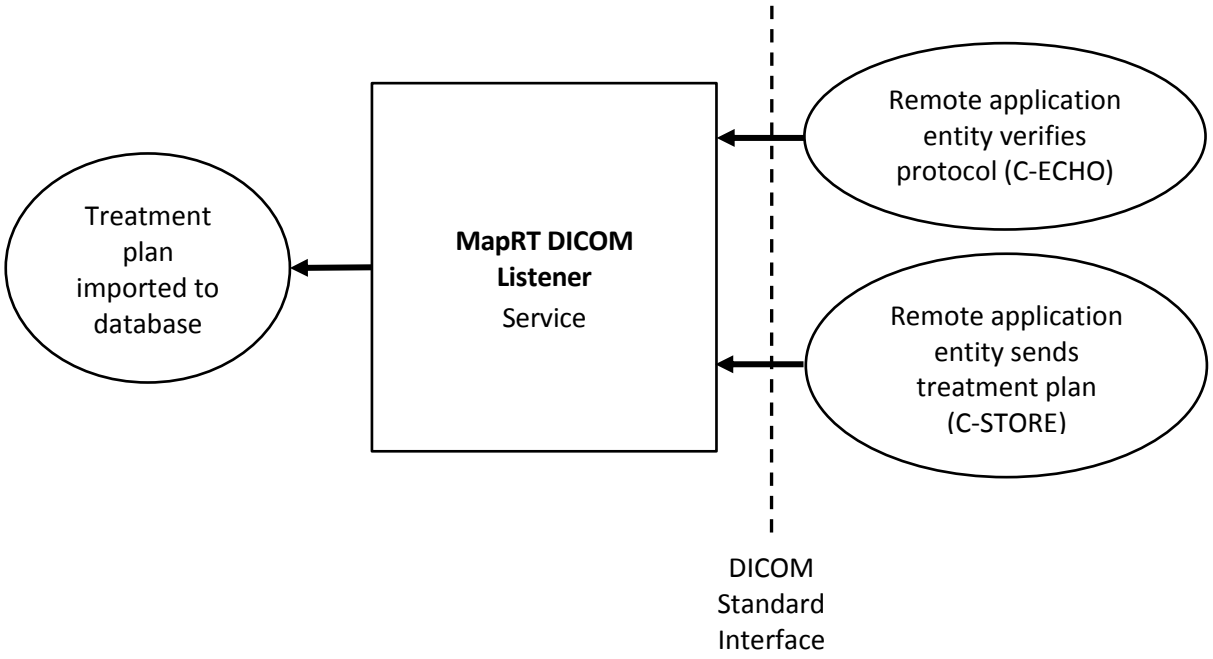
Abbreviation/Term	Explanation
Attribute	A data element identified by a Tag in an object definition. This may itself be a complex data structure (Sequence) composed of lower-level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).
DICOM	**Digital Imaging and Communications in Medicine** A standard for the management and transmission of medical images and related data used in many healthcare facilities.
IOD	**Information Object Definition** The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.
Module	A set of Attributes that are logically related to each other within an IOD. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.
NEMA	**National Electrical Manufacturers Association** The standards body that publishes the DICOM standard; https://www.nema.org/
PACS	**Picture Archiving and Communication System** A medical imaging technology used primarily in healthcare organizations to securely store and digitally transmit electronic images and clinically relevant reports.
RT	**Radiotherapy / Radiation Therapy** A treatment that uses high-energy x-ray or other particles to destroy cancer cells.
SCP	**Service Class Provider** The role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity. Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Abbreviation/Term	Explanation
SCU	**Service Class User** The role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)
Sequence	A structure of repeated data within a DICOM file. Members of a sequence are identified using the symbol '>' before their Attribute or Module names.
SOP	**Service Object Pair** Specifies the network or media transfer (service) of a particular type of data; the fundamental unit of DICOM interoperability specification. A valid DICOM file shall have one (and only one) SOP class UID assigned to it. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.
Tag	**Data Element Identifier** A 32-bit identifier, represented as a pair of four-digit hexadecimal numbers describing the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element].
TPS	**Treatment Planning System** A computer system aiding the radiation treatment planning. E.g., Varian Eclipse, Philips Pinnacle, RaySearch RayStation, Elekta Monaco.
UID	**Unique Identifier** A globally unique "dotted decimal" string that identifies a specific object instance or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID such as 1.2.826.0.1.3680043.2.120.20000624
VR	**Value Representation** The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

4 NETWORKING

4.1 Implementation Model

4.1.1 Application Data Flow



4.1.2 Functional Definition

The MapRT DICOM Listener application entity is implemented as a Windows service. It is started at server start-up and accepts storage and verification requests from remote DICOM nodes. It acts as a service class provider (SCP) for C-ECHO and C-STORE requests. It only accepts an incoming connection and never initiates a new connection.

4.1.3 Sequencing of Real-World Activities

Not applicable.

4.2 Specification

4.2.1 SOP Classes

The MapRT DICOM Listener provides Standard Conformance to the following class(es):

SOP Classes		User of Service (SCU)	Provider of Service (SCP)
Name	UID		
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes

4.2.2 Association Policies

4.2.2.1 General

The DICOM standard application context shall be used:

Name	UID
DICOM standard application context	1.2.840.10008.3.1.1.1

4.2.2.1 Number of Associations

The service only accepts one incoming connection.

4.2.2.2 Asynchronous Nature

The service does not support asynchronous operations and will not perform asynchronous window negotiation.

4.2.2.3 Implementation Identifying Information

The following fields will be used to identify the implementation:

Field	Value
Implementation class UID	1.3.6.1.4.1.30071.8
Implementation version name	fo-dicom 4.0.4

4.2.3 Association Initiation Policy

The service does not initiate associations.

4.2.4 Association Acceptance Policy

The service accepts remote association requests for the following reasons:

- Verify the DICOM protocol communication.
- Store plans from a remote system to the MapRT database.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The MapRT DICOM Listener application works over any physical medium available on the operating system and hardware it is installed on.

4.3.2 Additional Protocols

None.

4.3.3 IPv4 and IPv6 Support

The MapRT DICOM Listener application supports both IPv4 and IPv6.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles.

The application entity title (AET) and TCP/IP port are set in the DICOM server configuration.

4.4.1.2 Remote AE Title/Presentation Address Mapping

Not applicable.

4.4.2 Parameters

The following configuration parameters are set when installing the MapRT DICOM listener:

Name	Default
EntityTitle	Local
Port	106

5 MEDIA INTERCHANGE

The MapRT DICOM Listener application does not support Media Interchange.

6 TRANSFORMATION OF DICOM TO CDA

The MapRT DICOM Listener does not output HL7 clinical document architecture reports.

7 SUPPORT OF CHARACTER SETS

The MapRT DICOM Listener application supports all character sets specified by the specific character set attribute (0008,0005) and it is recommended that all DICOM files set this to control how strings are decoded.

If not set, the MapRT DICOM Listener application will default to the UTF7 code page to decode strings. This means that non-ASCII characters, such as accents, can be decoded against a different code page to the one used to encode them, which can result in unexpected behavior such as them being displayed incorrectly.

8 SECURITY

8.1 Security Profiles

No Security Profiles are supported.

8.2 Association Level Security

The MapRT DICOM Listener application will refuse association open requests arriving with an AE title different to that configured.

8.3 Application-Level Security

Local administrative credentials are required to stop, (re)start, or change the configuration of the MapRT DICOM Listener application.

9 ANNEXES

9.1 IOD Contents

9.1.1 Created SOP Instance(s)

No SOP instances are created.

9.1.2 Usage of Attributes from Received IODs

DICOM files stored by the MapRT DICOM Listener can be selected in the following Vision RT product workflows:

9.1.2.1 Clearance Mapping Based on TPS Plan

This process applies to the following SOP classes:

SOP Classes	
Name	**UID**
RT Plan	1.2.840.10008.5.1.4.1.1.481.5

The MapRT DICOM Listener receives RT plans for evaluation from a hospital's treatment planning system (TPS). The patients these refer to will automatically be added to the MapRT database.

It is also possible to manually add a patient by clicking the Add Patient button on the Select Patient screen and selecting a RT plan from the hard disk.

To load an RT plan the following DICOM tags are used:

Tag	Name	Description	Notes
(0008,0005)	Specific Character Set	Character set to expand or replace the basic set.	Optional. Required if an expanded or replacement set is used. Default assumes UTF7.
(0008,0016)	SOP Class UID	Uniquely identifies the SOP class.	Mandatory and one of: • 1.2.840.10008.5.1.4.1.1.481.5
(0008,0018)	SOP Instance UID	Uniquely identifies the SOP instance.	Mandatory. Must contain a valid UID (cannot be empty). Duplicate plans (SOP Instance UID already in database) are rejected.
(0010,0010)	Patient Name	Patient's full name.	Mandatory. Must contain first and last name,

Tag	Name	Description	Notes
			other elements are ignored. If subsequent RT plan with the same Patient ID contains different names than the previous plan imported to database, the plan is rejected.
(0010,0020)	Patient ID	Primary identifier for the Patient.	Mandatory. Must contain a valid UID (cannot be empty).
(0010,0030)	Patient Birth Date	Birth date of the Patient.	Mandatory. Cannot be a future date.
(0010,0040)	Patient Sex	Sex of the patient	Optional. One of 'M' (male), 'F' (female), or 'O' (other). Default is 'O' other.
(0018,5100)	Patient Position	Patient position descriptor relative to the equipment.	Mandatory. Must be one of HFP, HFS, HFDL, HFDR, FFP, FFS, FFDL or FFDR. Used to convert from DICOM to Vision RT coordinates when later constructing 3D surfaces.
(300A,0002)	RT Plan Label	User-defined label for treatment plan.	Mandatory. Can be an empty string.
(300A,00B0)	Beam Sequence	Sequence of treatment beams for this RT plan.	Mandatory. When set, the sequence must describe at least one beam.

Tag	Name	Description	Notes
>(300A,00C0)	Beam Number	Identification number of the beam	Mandatory. Must be unique in this plan.
>(300A,00C2)	Beam Name	User-defined name for beam.	Optional. Default sets an empty string.
>(300A,00B2)	Treatment Machine Name	User-defined name identifying treatment machine used for treatment delivery.	Optional.
>(300A,0111)	Control Point Sequence	Sequence of machine configs describing this treatment beam.	Mandatory. When set it must contain at least one control point.
>>(300A,011E)	Gantry Angle	Gantry angle of the radiation source.	Mandatory in first item of the control point sequence. Optional in subsequent items.
>>(300A,0122)	Patient Support Angle	Orientation of the patient support coordinate system (couch) in degrees with respect to the fixed reference coordinate system.	Mandatory in the first Item of the control point sequence. Optional in subsequent items.
>>(300A,011F)	Gantry Rotation Direction	Direction of Gantry Rotation when viewing gantry from isocenter, for segment following Control Point.	Mandatory for the first item of the control point sequence, or if gantry rotation direction changes during beam. One of ‘CW’ (clockwise), ‘CC’ (counter-clockwise), ‘NONE’ (no rotation).

Tag	Name	Description	Notes
>>(300A,012C)	Isocenter Position	The 3D co-ordinates (X, Y, Z) of the upper left-hand corner in mm (center of first voxel transmitted).	Mandatory in the first Item of the control point sequence. Optional in subsequent items.
(300A,0180)	Patient Setup Sequence	Sequence of patient setup data for the current plan.	Mandatory. One or more items shall be included in this Sequence. Used to access patient position (0018,5100) for this beam.

9.1.3 Attribute Mapping

No attribute mapping is performed.

9.1.4 Coerced/Modified Fields

No attributes are coerced or modified.

9.2 Data Dictionary of Private Attributes

Private Attributes within received files are ignored.

9.3 Coded Terminology and Templates

No Coded Terminology or Templates are supported.

9.4 Grayscale Image Consistency

No additional grayscale adjustments are made when displaying images.

9.5 Standard Extended/Specialized/Private SOP Classes

No Standard Extended, Specialized, or Private SOP Classes are supported.

9.6 Private Transfer Syntaxes

No Private Transfer Syntaxes are supported.