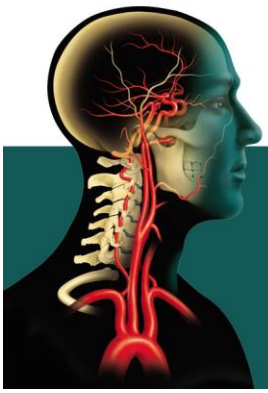

COMPUMEDICS DWL
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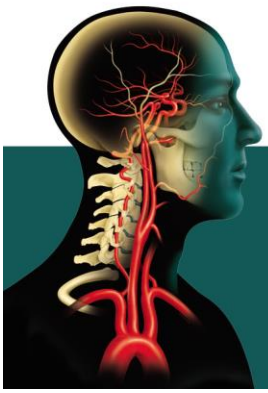
QL DICOM Conformance Statement

for QL Software from version 3.6.15

Compumedics Germany GmbH | Josef-Schuettler-Strasse 2 | 78224 Singen | Germany | Phone +49 7731 79769-0 | info@dwl.de | www.dwl.de



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Overview

DICOM Modality framework exposes a set of APIs that implement a DICOM modality worklist SCU and a DICOM store SCU.

The modality worklist module allows queries of a specified DMWL SCP by patient's last name, patient ID, modality, date range, and/or status. It then allows iterating through the query's results.

The DICOM Store module allows creating Store jobs with bitmap images and adding them to a Queue.
The framework will store them to a specified DICOM STORE SCP in order, optionally compressing them. There are APIs for terminating the queue or waiting for it to end.

Table of Contents

Intended Audience
This document has been written for system integration and deployment engineers involved in configuration and troubleshooting DICOM data exchange and communication between software using the DICOM modality framework and 3rd party products. Software designers may use this document to create software that can communicate with DICOM modality framework components. The Reader of this document should be familiar with the DICOM 3.0 standard.

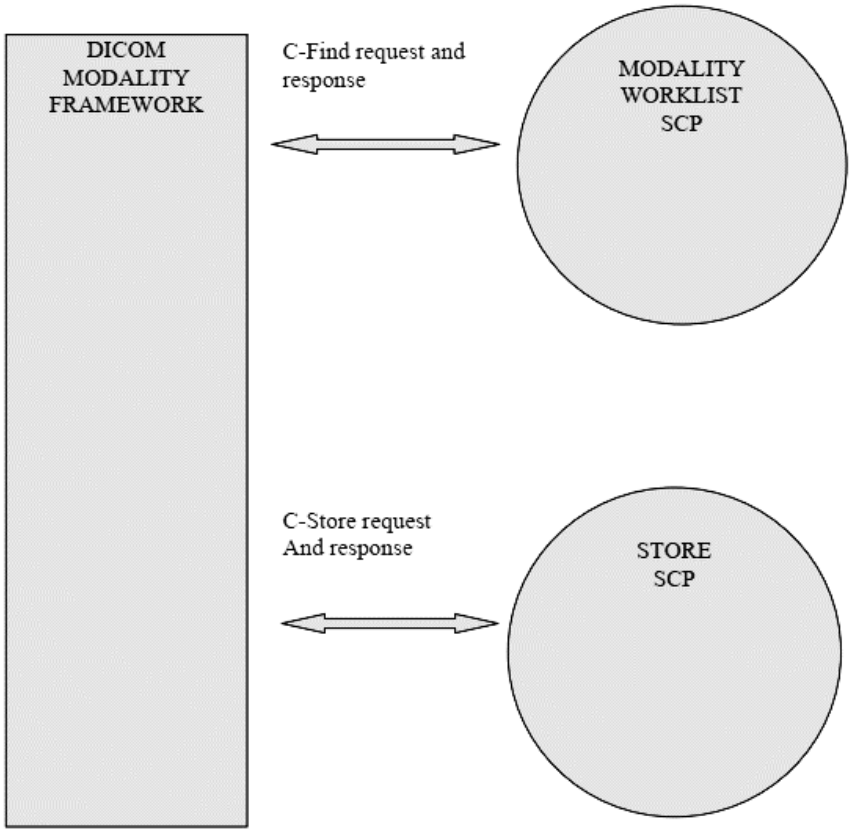
References
See Digital Imaging and Communications in Medicine (DICOM), parts 1 through 12 (NEMA PS 3.1-12).

Definitions
See Digital Imaging and Communications in Medicine (DICOM), parts 1 through 12 (NEMA PS 3.1-12).

Symbols and Abbreviations
See Digital Imaging and Communications in Medicine (DICOM), parts 1 through 12 (NEMA PS 3.1-12).

Implementation Model

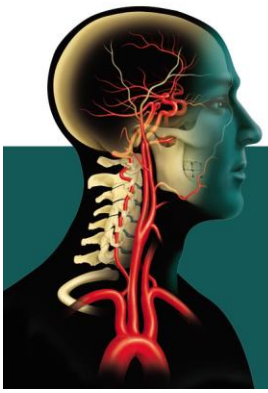
Application Data Flow



Functional Definitions of AEs

- Send Study Images (Store SCU)
  Software using the Modality DICOM framework store module sends study images to a DICOM Store SCP.

- Modality worklist SCU
  Software using the Modality DICOM framework MWL module sends a MWL query requests to a DICOM MWL SCP.



AE Specifications

Store SCU

The framework provides standard conformance to the following DICOM SOP classes as an SCU:

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33

DICOM Implementation class and version

Implementation class UID	1.2.36.6374974.5.0.3.5.3
Implementation version	3.5.3

Maximum PDU size

The maximum accepted PDU size for the storage SCP is 16384

Maximum Number of Associations

Storage SCU: Manually invoked store jobs in the framework are executed in a sequential order. Thus, the maximum number of associations for Storage SCU is 1.

Asynchronous Nature

Storage SCU will not perform asynchronous operations window negotiation.

Transfer Syntax

Storage SCU will try to use LittleEndianExplicitTransferSyntax uncompressed bitmaps and JPEGProcess1TransferSyntax for compressed images.

Name List	UID List
Little Endian Explicit Transfer Syntax (uncompressed images)	1.2.840.10008.1.2.1
JPEG Process 1 Transfer Syntax (compressed images)	1.2.840.10008.1.2.4.50
Little Endian Implicit Transfer Syntax	1.2.840.10008.1.2
Big Endian Explicit Transfer Syntax	1.2.840.10008.1.2.2

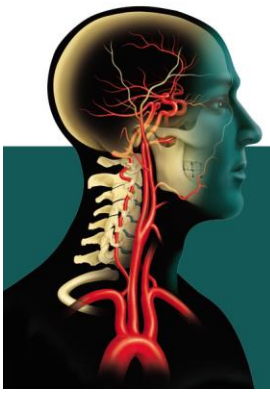
If the number of proposed presentation contexts (combinations of transfer syntaxes and SOPClassUID's) exceeds 127, the number of proposed presentation contexts will be truncated to 127.

Association Initiation Policy

Storage SCU will initiate an association on a user interface command. If a storage job could not be executed successfully, the system will return a failure message to the calling SW.

The following matching keys are guaranteed to be filled with valid values:

Description	Tag
AccesionNumber	0008, 0050
StudyInstanceUID	0020, 000D
PatientName	0010, 0010
PatientID	0010, 0020
DocumentTitle (Encapsulated PDF only)	0042, 0010



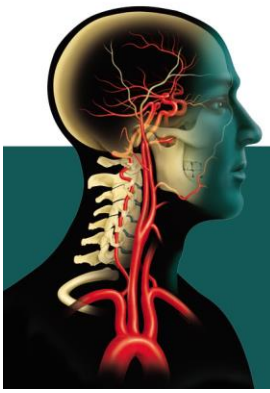
The following fields can be filled with values received from a previous MWL response:

Description	Tag
AccesionNumber	0008, 0050
StudyInstanceUID	0020, 000D
PatientName	0010, 0010
PatientID	0010, 0020
ScheduledProcedureStepStartDate	0040, 0002
PatientSex	0010, 0040
PatientAddress	0010, 1040
PatientsBirthDate	0010 ,0030
PatientEthnicGroup	0010, 2160
StudyID	0020, 0010
StudyDescription	0008 ,1030
StudyDate	0008, 0020
StudyTime	0008, 0030
PerformingPhysiciansName	0008, 1050
OperatorsName	0008, 1070
ReferringPhysiciansName	0008 ,0090
InstitutionName	0008, 0080
Manufacturer	0008, 0070
ManufacturerModelName	0008, 1090
SoftwareVersion	0018, 1020
ScheduledProcedureStepStartDate	0040, 0002
ScheduledProcedureStepStartTime	0040, 0003
Modality	0008, 0060
ScheduledProcedureStepStatus	0040, 0020
SpecificCharacterSet	0008, 0005
ConversionType	0008, 0064
RequestedProcedureDescription	0032, 1060
ScheduledProcedureStepDescription	0040, 0007
ScheduledProcedureStepID	0400, 0009
RequestedProcedureID	0040, 1001
PatientOrientation	0020, 0020
Station	0008, 1010
RequestAttributesSequence Containing fields RequestedProcedureID, AccessionNumber, StudyInstanceUID, RequestedProcedureDescription	0040, 0275

Error codes

The following error codes will be returned to the framework user:

Name	Code	Meaning
MDF_STATUS_SUCCESSFULL	0	Success
MDF_STATUS_ERROR_OPENING_ASSOC	1	Failure opening DICOM association
MDF_STATUS_ERROR_CLOSING_ASSOC	2	Failure closing DICOM association
MDF_STATUS_ERROR_CREATING_DICOM	3	Failure creating a DICOM image/pdf from input data
MDF_STATUS_ERROR_SENDING_DICOM	4	Failure sending image/pdf
MDF_STATUS_ERROR_BAD_PARAMS	5	Failure converting input params to dataset
MDF_STATUS_ERROR_OTHER	99	Failure another error



Modality worklist SCU

The framework provides standard conformance to the following DICOM SOP classes as an SCU:

SOP Class Name	SOP Class UID
Modality Worklist Query Find	1.2.840.10008.5.1.4.31

DICOM Implementation class and version

Implementation class UID	1.2.36.6374974.5.0.3.5.3
Implementation version	3.5.3

Transfer Syntax

The transfer syntax for C-Find is always DICOM Implicit VR Little Endian

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2

Maximum Number of Associations

Only one association at a time is attempted.

Asynchronous Nature

There is no asynchronous activity in this implementation.

Association Initiation Policy

Modality framework SCU will initiate an association on a user interface command. If a storage job could not be executed successfully, the system will return a failure message to the calling SW.

Depending on user action, the following matching keys can be set:

Description	Tag
ScheduledProcedureStepStartDate	0040, 0002
ScheduledProcedureStepStartTime	0040, 0003
Modality	0008, 0060
ScheduledProcedureStepStatus	0040, 0020
PatientName	0010, 0010
PatientID	0010, 0020
SpecificCharacterSet	0008, 0005

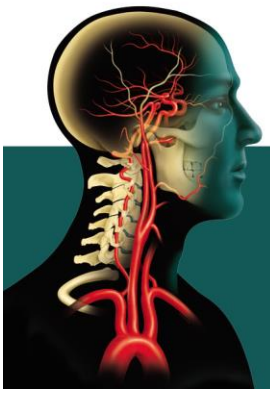
The following required keys that MUST be included in the response:

Description	Tag
AccesionNumber	0008, 0050
StudyInstanceUID	0020, 000D
PatientName	0010, 0010
PatientID	0010, 0020

Error codes

The following error codes will be returned to the framework user:

Name	Code	Meaning
MDF_STATUS_SUCCESSFULL	0	Success
MDF_STATUS_ERROR_OPENING_ASSOC	1	Failure opening DICOM association
MDF_STATUS_ERROR_CLOSING_ASSOC	2	Failure closing DICOM association
MDF_STATUS_ERROR_CREATING_DICOM	3	Failure creating a DICOM image/pdf from input data
MDF_STATUS_ERROR_SENDING_DICOM	4	Failure sending image/pdf
MDF_STATUS_ERROR_BAD_PARAMS	5	Failure converting input params to dataset
MDF_STATUS_ERROR_EXCEPTION	6	Failure - Exception
MDF_STATUS_ERROR_OTHER	99	Failure another error



Comprehensive SR

If a study contains labeled spectrograms with measurement, values a “Vascular Ultrasound Procedure Report” object can be included with the study’s images transmitted. This can be used by reporting software to extract these numeric measurement values and include them in medical reports.
The template “Vascular Report” described in DICOM Standard Supplement 71 has been used as much as possible for the format of this structured report.

SR Document Content Module Attributes

Attribute	Tag	Type	Description
Value Type	(0040,A040)	1	CONTAINER
Continuity of Content	(0040,A050)	1C	SEPARATE
Concept Name Code Sequence			125100, Vascular Ultrasound Procedure Report

The product uses the fixed (non-configurable, non-extensible) coded terminology in SR Document attributes, as described in Section 6 Secondary Capture Information Object Implementation. The following measurement values can be included for each spectrogram.

Measurement Value Internal ID	Concept Name	Units
SystoleFlow	11726-7", "LN", "Peak Systolic Velocity"	"cm/s", "UCUM", "1.4", "cm/s"
DiastoleFlow	"11665-7", "LN", "Minimum Diastolic Velocity"	"cm/s", "UCUM", "1.4", "cm/s"
MeanFlow	"20352-1", "LN", "Time averaged mean velocity"	"cm/s", "UCUM", "1.4", "cm/s"
PulsatilityIndex	"12008-9", "LN", "Pulsatility Index"	"1", "UCUM", "1.4", "no units"
ResistivityIndex	"12023-8", "LN", "Resistivity Index"	"1", "UCUM", "1.4", "no units"
SystolicDiastolicVelocityRatio	"12144-2", "LN", "Systolic to Diastolic Velocity Ratio"	"1", "UCUM", "1.4", "no units"
CriticalClosingPressure	"1000-1", "DWL", "Critical Closing Pressure"	"mmHg", "UCUM", "1.4", "mmHg"
IWMMax	"1000-2", "DWL", "Intensity Weighted Mean Max Flow"	"cm/s", "UCUM", "1.4", "cm/s"
IWMMin	"1000-3", "DWL", "Intensity Weighted Mean Min Flow"	"cm/s", "UCUM", "1.4", "cm/s"
IWMMean	"1000-4", "DWL", "Intensity Weighted Mean Mean Flow"	"cm/s", "UCUM", "1.4", "cm/s"

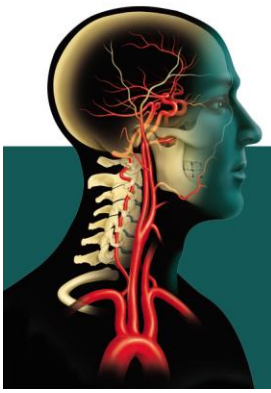
Measurement Parameters

The following measurement parameters are added as measurement values, as the vascular template does not have the necessary concept modifiers

Measurement Parameter Internal ID	Concept Name	Unit
DopplerAngle	"125106", "DCM", "Doppler Angle"	"deg", "UCUM", "1.4", "degrees"
Depth	"125107", "DCM", "Sample Volume Depth"	"cm", "UCUM", "1.4", "cm"
ProbeFrequency	"122098", "DCM", "Transmit Frequency"	"Hz", "UCUM", "1.4", "Herz"

For each spectrogram’s Measurement Group the following concept modifiers are set:

Concept Modifier	Concept Modifier Coded Name	Possible Values
Finding Site	"G-C0E3", "SRT", "Finding Site"	See table „Finding Site – Label mapping“ below
Laterality	"G-C171", "SRT", "Laterality"	"G-A103","SRT","Unilateral"



		"G-A101","SRT","Left" "G-A100","SRT","Right"
Location	"G-A1F8", "SRT", "Topographical Modifier"	"G-036A","SRT","Origin Of Vessel" "G-A119","SRT","Distal" "G-A118","SRT"," Proximal" "G-A188","SRT"," Mid-longitudinal"

Finding Site – Label mapping

Each spectrogram can be labelled by the user with a set of predefined labels. The following mapping translates these user-applied spectrogram labels into Finding Site codes in the structured report.

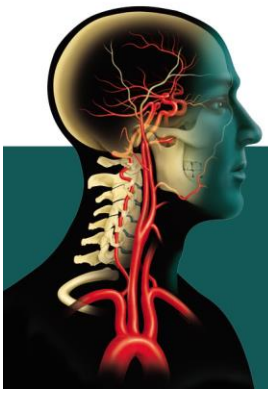
User Label	**Coded value used in "Finding Site"**
MCA	T-45600,SNM3,"middle cerebral artery"
ACA	T-45540, SNM3,"anterior cerebral artery"
PCA	T-45900, SNM3, posterior cerebral artery
CCA	T-45100, SNM3, common carotid artery
ICA	T-45300, SNM3, "internal carotid artery"
ECA	T-45200, SNM3, "external carotid artery"
SUBCL	T-46100, SNM3, "Subclavian artery"
BULB	T-45170, SNM3, "Carotid Bulb"
STR	D-40001, DWL, "supratrochlear artery"
UL	T-47200, SNM3, "ulnar artery"
VA	T-45700, SNM3," vertebral artery"
TIBP	T-47600, SNM3, "Posterior Tibial Artery"
DORP	T-47741, SNM3, "dorsalis posterior"
POP	T-47500, SNM3, "popliteal artery"
FEM	T-47400, SNM3, "femoralis"
RAD	T-47300, SNM3, "radialis"
BRA	T-47160, SNM3, "brachialis"
OPTH	T-45400, SNM3, "ophthalmic artery"
SIPH	T-45308, SNM3, "siphon"
BAS	T-45800, SNM3, "basilaris"

If any other user-defined labels are used, the spectrogram's values will not be included in the SR.

DWL Coding Scheme

Codes for the following values and finding sites have not been defined by any coding scheme to our knowledge. Therefore, DWL herewith defines codes for these values as below. The coding scheme is called "DWL".

Code	**Name**	**Description**
1000-1	Critical Closing Pressure	Measurement value; A lower blood pressure limit at which intracranial blood flow will cease. Unit usually: mmHg
1000-2	Intensity Weighted Mean Max Flow	Doppler Index, calculated value; Unit: cm/s
1000-3	Intensity Weighted Mean Min Flow	Doppler Index, calculated value; Unit: cm/s
1000-4	Intensity Weighted Mean Mean Flow	Doppler Index, calculated value; Unit: cm/s
D-40001	supratrochlear artery	Finding Site; Supra-Trochlear Artery



Character Sets

The store SCU module supports only the default encoding

The modality worklist module supports the following encodings:
ISO_IR 100, ISO_IR 101, ISO_IR 109, ISO_IR 110, ISO_IR 144, ISO_IR 127, ISO_IR 126, ISO_IR 138, ISO_IR 148, ISO_IR 13, ISO_IR 166, ISO 2022 IR 6, ISO 2022 IR 100, ISO 2022 IR 101, ISO 2022 IR 109, ISO 2022 IR 110, ISO 2022 IR 144, ISO 2022 IR 127, ISO 2022 IR 126, ISO 2022 IR 138, ISO 2022 IR 148, ISO 2022 IR 13, ISO 2022 IR 166, ISO 2022 IR 87, ISO 2022 IR 159, ISO 2022 IR 149