



DICOM Grid HL7 Guide

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Introduction

This guide provides an overview of the DICOM Grid HL7 functionality. HL7 is one of the standard ways of passing medical information between systems. DICOM Grid can both receive (incoming) and send (outgoing) HL7 messages. In terms of receiving, DICOM Grid supports orders (ORM^O01), reports (ORU^R01), and admit, transfer, discharge messages (ADT^A08 or ADT^A31). In terms of sending, DICOM Grid supports orders (ORM^O01) and reports (ORU^R01).

This guide will discuss the following topics:

- Incoming (to DICOM Grid) messages and workflows
- Outgoing (from DICOM Grid) messages and workflows
- Sample messages
- HL7 message segments and fields

DICOM Grid Gateway & Account Configuration

DICOM Grid transmits (sends and receives) HL7 messages via a DG Gateway. A DG Gateway is a piece of software that sits on a Windows machine (VM or physical appliance) in the sending or target network. DICOM Grid also supports a cloud Gateway if preferred.

Incoming HL7 Messages

DICOM Grid complies with HL7 2.3. The messages DICOM Grid receives as well as the key fields for these messages are outlined below.

ORU^R01 HL7 message

An ORU^R01 message is an unsolicited transmission of an observation. Colloquially, we refer to ORU^R01s as reports. It is highly useful to store the report with the imaging. DICOM Grid receives the ORU^R01 and ties the report to the study, typically using the accession number as the linking key. In addition, DICOM Grid uses HTML that DICOM Grid configures to make the ORU^R01 appear as a formatted report. These are the incoming ORU workflows that DICOM Grid supports:

Site sends an ORU^R01 to DICOM Grid

Upon receipt, DICOM Grid automatically queries and retrieves the study from the PACS or VNA. Upon receipt of the complete package (report and study), DICOM Grid automatically shares the package with the referring physician.

Site sends an ORU^R01 to DICOM Grid after the study already exists in DICOM Grid

As soon as the ORU^R01 is received, the report appears attached to the study. Those with the appropriate permissions can search for, find and review the study and report at any time.

Below is an example ORU^R01 message. The key field is the accession number. This is the linking key between the report and the study. The accession number is generally pulled from OBR2 or OBR3 (see red text in sample message below). The field must contain only the accession number. It cannot contain any ^ or sub-fields. Although OBR2 or OBR3 is typically used, any segment and field in the ORU^R01 message can be defined as the field to link the report with the study.

```
MSH|^~\&|EMRIEMR||20040111181023||148|ORU^R01|487|D|2.3|| PID||14356
0^A^EPI||ECKLES^SAMUEL^A.^MR.^||19730211||MIECKLES^SAMUEL^A^
^||42 NORTH AVE^^CAMBRIDGE^MA^02138^US^^DNIDNI(857)721-3255-
I(857)721-3255||||111246~11480172~7734 ||14-80-2122||||^^NEW YORK^^
PD||||FRANKIN NEAR EAST LOCATION (CENTRAL)^537| Outgoing Imaging
Orders and Results Interface Technical Specification 10
PV||||^EMR^A^A^||||||522320|||||||V ORC||437951^EPCI2223^EP
C||Final||^200312071730^A^||200401211810||152^KARIS^LUCAS^A^||757^SP
ETZLER^CHRISTIAN^J^A^||467^A^537^A^A^||857)259-9167||
OBR||1437951||2255^EPCI73000^X-RAY CLAVICLE^A^X-RAY CLAVIC||||||
I757^SPETZLER^CHRISTIAN^J^A^||857)259- 9167||||||Final||^2003100717-
30^A^A^||2149^HITACHI^BENJAMIN^A^A^||148010^1A^FRANKLIN^X-
RAY^A^A^||DG||I9I810^CLAVICLE FRACTURE^I9I810^CLAVICLE FRACTURE||
OBX1||STIGDT||IX-ray suspected Clavicle fx. The quality of the film was good.||A
||Final||||1148010^1A^FRANKLIN^X-RAY^A^ OBX2||STIIMP|| Abnormal, Frac-
ture Present||A||Final||||1148010^1A^FRANKLIN^X-RAY^A^ OBX3||STIIMP||
Left lateral; surgery required||A||Final||||1148010^1A^FRANKLIN^X-RAY^A^
```

ORM^O01 HL7 message

An ORM^O01 message is a general order message that contains appointment and personal patient details. These are the incoming ORM workflows that DICOM Grid supports:

Outside study is sent to DICOM Grid

Outside orders are sent to DICOM Grid from the target facility. In DICOM Grid, the order is manually associated with study, and order information (MRN, accession number, patient name, DOB, gender, and study description) is used to update the study. After the update, study is sent to PACS. Study flows automatically into PACS because it has the right target PHI.

ORMs are used to drive routing: sending to referring physicians, sharing with specified physicians, sending to DICOM devices, and any other DICOM destination.

The ORM auto associates with the study using accession number as a linking key, and the routing rule is configured to fire based on information in a specified segment and field.

Below is an example ORM^O01 message. The key field is the accession number. This is the linking key between the report and the study. The accession number is generally pulled from OBR2 or OBR3 (see red type in sample message below). The field must contain only the accession number. It cannot contain any ^ or sub-fields. Although OBR2 or OBR3 is typically used, any segment and field in the ORM^O01 message can be defined as field to link the report with the study.

```
MSH|^~\&|EMRIEMR|||20041111072701||148|ORM^O01|497|D|2.3||
PID|||43560^^^^EPI||ECKLES^SAMUEL^A.^MR.^||19730211|M||AfrAml42
NORTH AVE^^CAMBRIDGE^MA^02138^US^^^DN|DNI(857)721-3255-
I(857)721-3255||S||11480003~2514705~7603~13412||14-82-1544|||^^^MA^^
NTE|||Comments go here
PD|||FRANKLIN NEAR EAST LOCATION (CENTRAL)^537|757^SPETZLER
^CHRISTIAN^J^
PV1|||^^^EMR^^^^|||509502|||V
ORCINWI363463^EPCI1858^EPCI|Final||^200308151200^^^^||200401220727|11
52^KARIS^LUCAS^^^||757^SPETZLER^CHRISTIAN^J^||467^^^537^^^|(85
7)259-9167||
OBR||1363463|1858^EPCI73610^X-RAY ANKLE 3+ VW^^^X-RAY ANKLE
|||||757^SPETZLER^CHRISTIAN^J^|||(857)259-9167|||||Final||^200308
151200^^^^|||2149^HITACHI^BENJAMIN^^^||1148010^1A^FRANKLIN^X-
RAY^^^|
DG1||I9|824^ANKLE FRACTURE^I9|ANKLE FRACTURE||
```

ORMs are also used to drive DICOM modality worklist in the modality. The appointment/order is made in the EMR or practice management system; the order is sent to DICOM Grid, via DG Gateway; DICOM Grid pulls the information from the ORM and acting as the service class provider (SCP) makes the information from the order available for DICOM modality worklist queries. When the patient arrives for a scan, instead of keying the MRN, accession number, name and other study information into the modality, the tech simply picks the patient name from a picklist.

[A DG Gateway must be installed](#)

DG Gateway is the service class provider (SCP). This means that the DG Gateway receives MWL queries from modalities, which are acting as the service class user (SCU).

[MWL is a standard supported by most modalities](#)

For the modality to be set up to query the modality worklist, the customer should not need to pay the modality vendor. The customer should either be able to do it themselves or do it through basic modality support.

[The queries are part of the log.log file in the DG Gateway](#)

This is a useful resource during configuration.

Configuration

[Appointment system/EMR/HIS](#)

Configure the appointment system/EMR/HIS to send HL7 orders to the DG Gateway. You must provide the appointment system/EMR/HIS the following information:

- IP address of the DG Gateway
- HL7 listening port of the DG Gateway. By default, this is 12000. See hl7_listening_ports in the DG Gateway.
- The orders (ORM^O01) should contain the following information. Please note that fields formatted like OBR4-2 mean the second subfield in OBR4.
 - MRN in PID2 or PID3
 - Patient name in PID5
 - Accession number in ORC3 or OBR3 or MHS10
 - Birth date in PID7
 - Sex in PID8
 - Modality in OBR20
 - Requested procedure id in OBR4-1 or ORC2
 - Requested procedure description in OBR4-2
 - Requested procedure step start date in OBR27-4
 - Requested procedure station aetitle in OBR19

Below is an example ORM^O01 message that is part of the modality workflow.

```
MSH|^~\&|EMRIEMR|||20041111072701||148|ORM^O01|497|D|2.3||
PID|||43560^EPI||ECKLES^SAMUEL^A.^MR.^||19730211|M||AfrAml42
NORTH AVE^^CAMBRIDGE^MA^02138^US^^^DN|DNI DNI(857)721-3255-
|(857)721-3255||S||11480003~2514705~7603~13412||14-82-1544|||^^^MA^^
NTE|||Comments go here
PD|||FRANKLIN NEAR EAST LOCATION (CENTRAL)^537|757^SPETZLE
R^CHRISTIAN^J^^^
PV1|||^^^EMR^^^^^^^^^^^^^^^^^^^^509502^^^^^^^^^^^^^^^^^^^^V
ORCINW|363463^EPC|1858^EPC||Final|||^^^200308151200^^^||200401220727|1
152^KARIS^LUCAS^^^^||757^SPETZLER^CHRISTIAN^J^^^|467^^^537^^^^^|
(857)259-9167||
OBR||1363463|1858^EPC|73610^X-RAY ANKLE 3+ VW^^^X-RAY ANKLE
||||||757^SPETZLER^CHRISTIAN^J^^^|(857)259-9167||||Final|||^^^200308
151200^^^|||2149^HITACHI^BENJAMIN^^^^||1148010^1A^FRANKLIN^X-
RAY^^^|
DG|||I9|824^ANKLE FRACTURE^I9|ANKLE FRACTURE||
```

DICOM Grid

Enable the orders_from_hl7 account switch. This must be done via the account/set call in the API.

Create the modality as a destination where:

- Port is filled in
- AE title is filled in
- IP address is filled in
- Type = DICOM (it defaults to DICOM if configured in the UI)

Remember that DG is acting as the SCP in this process, meaning it is receiving queries from the modality.

Modality

Modality workflow needs to be configured on the modality. This typically means a configuration checkbox and these fields:

- SCP (DG Gateway) IP address
- SCP (DG Gateway) ae title
- SCP (DG Gateway) port
- Also, please note that the modality must be able to talk with the DG Gateway.

Use

Patient arrives.

Tech picks patient from workflow on modality workstation.

All information from appointment/order is written to study.

ADT^A08 and ADT^A31 HL7 messages

ADT (ADT^A08 and ADT^A31) messages are used to sync data in your MPI (master patient index) and DICOM Grid. This is hugely valuable. This is how ADT messages are used in DICOM Grid:

Whenever there is a change to a patient record, an ADT message is sent to DICOM Grid.

The MRN is used to associate the ADT with the various studies that share the MRN. The PHI from the ADT including name, DOB, gender is written to the studies that share the MRN.

Below is an example ADT^A31 message. The key field is the MRN. This is the linking key between the ADT message and the study or studies. The MRN is generally pulled from PID2 or PID3 (see red text in sample message below).

```
MSH|^~\&|HQ|A^HH||201506130206||ADT^A31|082057154L0027316745|D|2.2
EVN|A31|201508190206||HPIU|IANWILSON
PID|0001|90442421|090442421^^^HQA^MR~90442421^^^HQ^PI||SMITH^ALB
ERT||19920430|M||X||||ENG|SICAT|||01
PV1|0001|N||||||||||||||||||||||||||||||||||||PERSONALDOC
ZPI|0001||||||20150818|N|||NONE^UNEMPLOYED
ZID|0001|||||04|'""
ZV2||Y|||||||||U||||N
ZEZIN
```

Outgoing HL7 Messages

ORU^R01 HL7 messages

The DICOM Grid HL7 generator is very flexible. The messages described below are the most common messages DICOM Grid generates; however, DICOM Grid can generate other types of HL7 messages as required.

ORU^R01 messages are used to send reports to RIS, EMR or patient portal systems.

Common workflows include:

A report is made using DG's reporting engine

When complete, the report can be sent via ORU^R01 to a target RIS or EMR.

An encrypted URL link is commonly sent from DG to an EMR or a patient portal via an ORU^R01 generated by DICOM Grid's HL7 engine.

For more information on encrypted URL links, please contact DICOM Grid. In addition to being an ORU generator, DICOM Grid can enrich ORUs received from other systems with an encrypted URL link or other data and then forward the enriched ORU to downstream RIS or EMR systems.

Below is an example ORU^R01 message with a URL link embedded in the message. The key field is the MRN. This is the linking key between the ADT message and the study or studies. The MRN is generally pulled from PID2 or PID3 (see red text in sample message below).

```
MSH|^~\&|RAD|^005^|||||ORU|0000000741|P|2.5||
PID|||14055||SMITH^ANDREA||19520908|F|||||||
PV1|||ENT|||||
OBR|||8999059211|NECK^1HEAD_NECK_PETCT|||||||
OBX|||URL|||REDIRECT LINK GOES HERE|||||
```

ORM^O01 HL7 messages

DICOM Grid generates ORMs as part of our automated study PHI normalization process, which enables no touch outside study ingestion. The outside procedure code is automatically determined, the order is automatically created and written to the study, and the study is automatically pushed to PACS. The workflow is:

DICOM Grid receives an outside study that is being sent to a downstream PACS.

As the study is coming from the outside, the MRN, the accession number and most likely the patient name, date of birth and gender will need to be normalized to the target system's information. DICOM Grid generates an ORM and sends it to the target's RIS or EMR. The ORM includes the patient information, the outside procedure code, the UUID of the study in DICOM Grid, and all other relevant information that can be scraped off the study including modality, study description, study date, image count, and any other data the target RIS or EMR requires. The RIS or EMR receives DG's order, automatically does a patient lookup, and if there is a match, automatically generates a real order that includes the study uuid that was sent in DICOM Grid's order, and sends the order to DICOM Grid. DICOM Grid receives the order, automatically applies the order information to the study, and approves the study, which triggers a send to PACS.

Below is an example ORM^O01 message that can help drive the workflow described above.

```
MSH|^~\&ISOARIANT|Target system||20141119125329||ORM^O01|726976|T|2.4
PID|||1006551^A^AMR ||ZZTRAIN^AMY||19630506000000|F|||||
ORC|NW|
OBR||5789345|||||O|FALSE|||
ZAI|DBID|||<Db ID>|||||
```

Message Segments and Fields

DICOM Grid supports message segments and fields as described here:

http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185