



HL7 Conformance Statement

Version 3.0.0.6: Dec 12, 2019

PBPM Version 3.0.0.6

PACS Version 5.8.0.0



“To become the leading medical informatics company in the world by continuously creating innovative products, cementing strong relationships with customers and OEMs and empowering our employees to excel at all levels”



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Kindly note that any HL7 information detailed in this document should not be treated as a standalone but should be used in conjunction with the HL7 Standards.

A] General

Introduction

PACS Broker works as translator between RIS and modality. It translates HL7 data received from RIS to the DICOM format that modality understands. This way, passing correct data in respective fields is responsibility of RIS. Broker will not validate the data received (except some very basic validations) from RIS.

Also, order scheduling is not a part of broker. Order scheduling should be done on RIS and scheduled orders should be sent to Broker.

Workflow

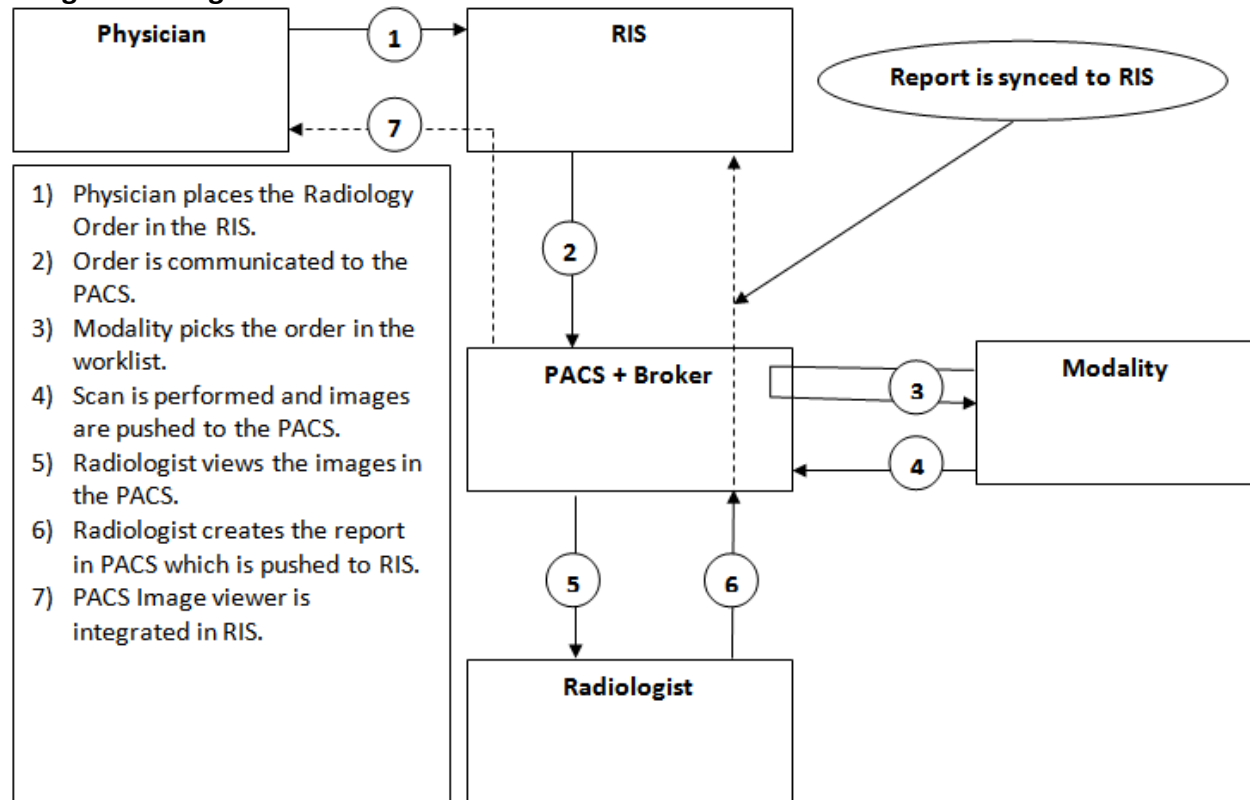
PACS Broker accepts order (patient demographic, study details and scheduling details) data from RIS using HL7 specifications. Modality queries the broker (periodically or manually) using DICOM specifications to fetch this data. On receiving the query from modality, broker provides matching data to modality. On receiving the data, modalities conduct the study using schedule information. Modality will then transfer images for conducted study to PACS using DICOM specifications. After diagnosis, radiologist will generate the report for the study. PACS will transfer the report to broker. Broker will send the report back to RIS using HL7 specifications.

PACS Broker also accepts the report from RIS using HL7 specifications in case report is generated on RIS.

Accession number (Placer Order Number) is used as unique identifier for each order. The accession number should be transferred without any change throughout the integration cycle.

B] Broker at glance**Broker overview**

Feature	Broker to RIS	RIS to Broker
Communication Protocol	<i>MLLP over TCP/IP</i>	
Concurrent connections	<i>1</i>	<i>1</i>
HL7 version	<i>2.3</i>	<i>2.3</i>
Message types	<i>ORU</i>	<i>ORM, ORU, ADT</i>
Bulk messages	<i>No</i>	<i>No</i>
Acknowledgements	<i>Supported and Mandatory</i>	

Integration Diagram

C] Communication protocol and message format

Socket

Message communication will happen through a TCP/IP socket connection to an agreed upon port and IP address.

There is no asynchronous activity in this implementation. Only one concurrent connection is allowed on broker. Only one concurrent connection is established by broker.

Bulk messages (multiple messages on single connection) are not supported. Only one message should be transferred on one connection.

Connection should be immediately closed by RIS when message sending is finished and acknowledgement is received or timed out.

MLLP Implementation

Broker follows MLLP Specifications. Broker uses the standard HL7 format for messages, thus starting and ending characters delimit each message.

Description	HEX	ASCII	Symbol
Message starting character	0B	11	<VT>
Message ending characters	1C, 0D	28, 13	<FS>, <CR>

HL7 Delimiter Characters

Description	HEX	ASCII	Symbol
Segment separator character	0D	13	<CR>
Fields separator character	7C	124	
Component separator character	5E	94	^
Subcomponent separator character	26	38	&
Field repetition separator	7E	126	~
Escape character	5C	92	\

The MSH segment of each message contains following identification fields: -

- MSH(3,1) contains sending application.
- MSH(4,1) contains sending facility.
- MSH(5,1) contains receiving application.
- MSH(6,1) contains receiving facility.
- MSH(10,1) contains message control id. This must be unique for each message including acknowledgements.

HL7 Version

Broker works on HL7 version 2.3.

D] Supported messages

Following messages are supported by broker: -

Message	Event	Path	Mandatory
ORM	O01	RIS to Broker	Yes
ORU	R01	RIS to Broker	No
		Broker to RIS	No
ADT	A08	RIS to Broker	No
ADT	A40	RIS to Broker	No

a. Order Update (ORM^O01)

An Order Update message is expected from RIS whenever new order is scheduled, existing order updated, existing order cancelled, existing order is completed. Only one occurrence of each segment will be permitted in a message.

Example Message

```
MSH|^~\&|HIS_APP|HIS_FACILITY|PACS_APP|PACS_FACILITY|20130614131415||ORM^O01|MsgCtrlId_ORM|P|2.3
PID|1||PatientID||Patient Name||20000514/F|||||||AdmID
PV1|1|OP|||||^Ref Phy|||||||50
ORC|NW|||||||^Req Phy||||^Institution Name
OBR|1|ACC.NO.01||SPSID^SPSDesc|ROUTINE|||||||RPDesc||SSName|RPID|SPSLocation|SSAETitle
||CT|||||Reason For Proc||SchPerPhyName||20130614132030
ZDS|StudyIUID
```

Order Types

Order updating and Order cancellation is supported.

Order type is identified from value of ORC(1,1) field as follows: -

- If value is “NW”, it is new order message.
- If value is “NW”, and accession number (Placer Order Number) already exists in broker, it is update order message.
- If value is “CA”, it is cancel order message. Order will be deleted from broker database.
- If value is “CM”, it is complete order message. This order will not be sent to modality.

b. Report Update (ORU^R01)

A Report Update message is queued when a diagnostic report is added or modified. In case report is created on RIS, only one occurrence of OBX segment will be permitted in a message. This is because; PACS support only one report per study.

Example Message

```
MSH|^~\&|PACS_APP|PACS_FACILITY|HIS_APP|HIS_FACILITY|20130614111345||ORU^R01|MsgCtrlId_ORU|P|2.3|1|||||
PID|1||PatientID||Patient Name||20000514|F|||||||AdmID|||||||
PV1|1|OP|||||^Ref Phy|||||||50|||||||
ORC|NW|||||||^Req Phy|||||^Institution Name|||||
OBR|1|ACC.NO.01||SPSID^SPSDesc|ROUTINE|||||||RPDesc||SSName|RPID|SPSLocation|SSAETitle
||CT|||||Reason For Proc||SchPerPhyName||20130614132030|||||
OBX||TX|StudyID^StudyDescription||This is sample report for accession number
ACC.NO.01.\X0D\X0A\This is sample report only.\X0D\X0A\|||||F||20130614111317||Read Phy
ID^Read Phy|
```

Report Types

Report cancellation is not supported.

Report updating is supported as follows: -

- If report for received accession number (Placer Order Number) already exists in broker, it is update report message.
- Otherwise, it is new report message.

c. Admit Discharge Transfer - Patient Information Update (ADT^A08)

A Patient Information Update message is expected from RIS whenever patient demographic information is updated in RIS.

Example Message

```
MSH|^~\&/HIS_APP/HIS_FACILITY/PACS_APP/PACS_FACILITY/20130614131415||ADT^A08/MsgCtrlId_A  
DT/P/2.3  
EVN/A08/20130614131415  
PID/1||PatientID||Patient Name||F|||||||AdmID
```

Following fields are allowed for update: -

- Patient Name
- Patient Sex
- Admission ID

This message will update all the orders for given patient id with new information.

d. Admit Discharge Transfer - Patient Merge (ADT^A40)

A Patient Merge message is expected from RIS whenever two patient ids are merged on RIS.

Example Message

```
MSH|^~\&/HIS_APP/HIS_FACILITY/PACS_APP/PACS_FACILITY/20130614131415||ADT^A40/MsgCtrlId_A  
DT/P/2.3  
EVN/A40/20130614131415  
PID/1||PatientID_New  
MRG/PatientID_Old
```

This message will update all the orders for old patient id with new one.

E] ORU message details**Encoding characters in report data in ORU message**

While reading/writing report data from/to ORU message, encoding characters are mapped with their respective escape sequences as per HL7 specifications.

Encoding character	Mapped with
Segment separator character	\X0D\
Fields separator character	\F\
Component separator character	\S\
Subcomponent separator character	\T\
Field repetition separator	\R\
New line character (Symbol <LF>; ASCII = 10)	\X0A\

Following is an example of report content with encoding characters: -

This is sample report for Xyz^Pqr.

This is an example report only.

Following is example of same report above with mapped encoding characters: -

This is sample report for Xyz\S\Pqr.\X0D\This is an example report only.

Observe that carriage return is replaced with “\X0D\” and “^” is replaced with \S\.

Segment Swapping

While creating ORU message, following segments are swapped from its respective ORM message: -

- PID
- PV1
- ORC
- OBR

Additional segment OBX is inserted which contains report details.

Report Formats (Broker to RIS)

Report data could be provided to RIS in following formats: -

Format	Size	Notes
Plain text	Small	Formatting and images will be lost
RTF text	Large	Formatting and images will be preserved

Report Formats (RIS to Broker)

Report data could be received from RIS in following formats: -

Format	Size	Notes
Plain text	Small	Formatting and images will be lost

F] Acknowledgements

Original Mode HL7 Acknowledgement is supported and mandatory. Both the 15th and 16th fields of the MSH segment of the out-bound messages will be empty. In case of in-bound messages, these fields will NOT be checked.

Broker only sends the acknowledgement when processing is finished.

Broker will always send acknowledgement (success or failure) to RIS with the reason for failure if any. Similarly, broker will always wait for acknowledgement (success or failure) from RIS.

Acknowledgements are communicated to the random port on same connection.

Broker does the following when it encounters a message that has been queued for broadcast:

- It attempts to establish a socket connection to the RIS
- It sends the message
- It waits for an acknowledgement

If an acknowledgement is not received within the specified time-out interval, then the above cycle is repeated. When positive acknowledgement (ACK) is received for a message that has just been sent, the broker removes the message from the outgoing queue, and proceeds to the next message on the queue.

If negative acknowledgement (NAK) is received from RIS, the event is logged and broker removes the message from the outgoing queue, and proceeds to the next message on the queue.

Following is the example ACK message Broker will send against received ORM message: -

```
MSH|^~\&|PACS_APP|PACS_FACILITY|HIS_APP|HIS_FACILITY|20130614105253||ACK^O01|MsgCtrlId_ACK|P|2.3|1|||91|||
MSA|AA|MsgCtrlId_ORM|Order registered.|||
```

ACK types

ACK type is identified from value of MSA(1,1) field as follows: -

- AA – Application Accept – Message is successfully processed and accepted on Broker.
- AR – Application Reject – Message is successfully processed on Broker but rejected. Read the reason and resend the message after correction.
- AE – Application Error – Broker is failed to process the message.

G] Field mapping**ORM message field mapping (RIS to Broker)**

* Indicates mandatory field.

Broker Field	HL7 Segment
Accession Number*	OBR(2,1)
Patient ID*	PID(3,1)
Patient Name*	PID(5,1)
Patient Sex*	PID(8,1)
Modality*	OBR(24,1)
Scheduled Station AE Title*	OBR(21,1)
Scheduled Station Name*	OBR(18,1)
Scheduled Procedure Step Start Date Time*	OBR(36,1)
Scheduled Procedure Step ID*	OBR(4,1)
Scheduled Procedure Step Description*	OBR(4,2)
Requested Procedure ID*	OBR(19,1)
Requested Procedure Description*	OBR(15,1)
Admission ID	PID(18,1)
Patient Weight	PV1(20,1)
Patient Birth Date	PID(7,1)
Ref Physician Name	PV1(8,2)
Requesting Physician	ORC(12,2)
Scheduled Performing Physician Name	OBR(34,1)
Scheduled Procedure Step Location	OBR(20,1)
Reason For Requested Procedure	OBR(31,2)
Requested Procedure Priority	OBR(5,1)
Institution Name	ORC(17,2)
Study Instance UID	ZDS(1,1)

ORU message field mapping (RIS to Broker)

* Indicates mandatory field.

Field mapping for swapped segments should be same as that of ORM message. In addition, OBX segment should be added for transferring report details.

Broker Field	HL7 Segment
Report Text/Data*	OBX(5,1)
Report Date*	OBX(14,1)
Report Format	OBX(2,1)
Radiologist/Reading Physician ID	OBX(16,1)
Radiologist/Reading Physician	OBX(16,2)

ORU message field mapping (Broker to RIS)

Field mapping for swapped segments is same as that of ORM message. In addition, OBX segment is added for transferring report details.

Broker Field	HL7 Segment
Report Text/Data	OBX(5,1)
Report Date	OBX(14,1)
Report Format	OBX(2,1)
Radiologist/Reading Physician ID	OBX(16,1)
Radiologist/Reading Physician	OBX(16,2)
Study ID	OBX(3,1)
Study Description	OBX(3,2)
Report/Study Status	OBX(11,1)

Report/Study status meaning: -

Status	Meaning
I	STUDY COMPLETED
R	REPORT READ
F	REPORT FINAL
P	REPORT PRINT

Report Text/Data will only available for status value F. For other status values, Report Text/Data will NOT be available. ORU message with status value other than F should be treated as notification only.

ORU message with status value F will be sent twice; once without report contents and again with report contents. ORU message with status value F without report contents should be treated as notification (REPORT FINAL) only.

ORU message with status value F and with report contents is actual Result Update message.

ADT [Patient Information Update] message field mapping (RIS to Broker)

* Indicates mandatory field.

Broker Field	HL7 Segment
Patient ID*	PID(3,1)
Patient Name*	PID(5,1)
Patient Sex	PID(8,1)
Admission ID	PID(18,1)

ADT [Patient Merge] message field mapping (RIS to Broker)

* Indicates mandatory field.

Broker Field	HL7 Segment
Patient ID New*	PID(3,1)
Patient Name Old*	MRG(1,1)

H] Notes**Order Scheduling**

Scheduling means collection of fields which define location (where the order should be executed) and date-time (when the order should be executed) of the order.

Scheduling includes following fields: -

- Modality
- Scheduled Station AE Title
- Scheduled Station Name
- Scheduled Procedure Step Start Date Time
- Scheduled Procedure Step Location

Modality codes

CR	Computed Radiography
CT	Computed Tomography
DX	Digital Radiography
ES	Endoscopy
GM	General Microscopy
IO	Intra-oral Radiography
MG	Mammography
MR	Magnetic Resonance
NM	Nuclear Medicine
PX	Panoramic X-Ray
RF	Radio Fluoroscopy
OT	Other
PT	Positron emission tomography
SC	Secondary Capture Image
SM	Slide Microscopy
US	Ultrasound
XA	X-Ray Angiography
XC	External-camera Photography
ECG	Electrocardiography