

SYNAPSE

RIS Interface Specification

Software Version 4.1

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1. Project/Product Identification

Project/Product Identification: Synapse 4.1

2. Overview

This document defines an interface standard between an external HIS/RIS and the FUJIFILM Medical Systems' PACS. It is intended to give a general understanding to the integrated clinic / hospital about the information that will be stored on the Fuji PACS and how each message may be used on the PACS.

The HIS/RIS Interface (HIIS) supports HL7 standard and non-HL7 messages. The messages shall be in a format that is agreed upon between Synapse and the external system. HIIS supports two modes of operation: message broadcasting and file based.

3. HL7 Messages

According to HL7 standard, the person or entity that places the order is referred to as the "placer"; the person or entity that carries out the order is referred as the "filler." The role of a HIS/RIS is a placer for an imaging service and the role of Fuji PACS is its filler. The terms "placer" and "filler" will be used throughout this document.

In general, HL7 messages are sent from the HIS/RIS to the Fuji PACS via the HIIS service using the TCP/IP protocol. Most HIS/RIS systems send messages one at a time with an ACK response expected on a message before sending the next one. Other HIS/RIS systems batch multiple messages together and wait for an ACK for each individual message. HIIS supports both message sending mechanisms.

Refer to the section File-Based Messages for information about receiving messages from a file, rather than using the TCP/IP protocol. HIIS will support the original mode of the acceptance acknowledgement. When HIIS receives a message from the placer, HIIS will validate the message syntactically; if it fails, a reject message is constructed and returned to the placer. If it does not fail, the message will be sent to a process, which updates the PACS database. HIIS will create a response message to the placer.

The following sections will discuss these topics:

- Message Control
- Acknowledgement Messages
- HL7 messages syntax and their use on the Fuji PACS
 - ADT
 - Patient Demographic Change

- Order Entry
- Order Complete
- Scheduling
- Report Transfer

3.1 Messages Definition

HIIS supports HL7 encoding rules such that each message consists of data fields that are of variable length and separated by a field separator character. A message is the atomic unit of data transferred between systems. It is comprised of a group of segments in a defined sequence. Each message has a message type that defines its purpose. For example, the ADT message type is used to transmit portions of a patient’s ADT data from one system to another. A three-character code contained within each message identifies its type.

A segment is a logical grouping of data fields. Segments of a message may be required or optional. Brackets, [. . .], used in this document, indicate the group of enclosed segments are optional. Braces, { . . . }, also used in this document, indicate the group of enclosed segments may have one or more repetitions.

A field is a string of characters. When fields are transmitted, they are sent as character strings. The HIIS treats null as a ‘don’t care’ field. That means it will not be used to update the PACS database; the old value should remain unchanged.

Delimiter	Value
Segment Terminator	<cr> hex 0D
Field Separator	
Component Separator	^
Subcomponent Separator	&
Repetition Separator	~
Escape Character	\

Delimiter & Value Table

Each message starts with an ACSII code 'VI' (hex value 0B) and ends with code 'FS' (hex value of 1C) and 'code 'CR' (hex value 0D). Each segment is separated by an ASCII code 'CR' (hex value 0D).

3.2 Data Types

Category	Data type	Data Type Name	Format
Alphanumeric	ST	String	
	TX	Text data	
Numerical	CQ	Composite quantity with units	<Quantity (NM)> ^ <units (CE)>
	NM	Numeric	
	SI	Sequence ID	
Identifier	ID	Coded values for HL7 tables	
	IS	Coded value for user-defined tables	
	EI	Entity identifier	<entity identifier (ST)> ^ <namespace ID (IS)> ^ <universal ID (ST)> ^ <universal ID type (ID)>
	PT	Processing type	<processing ID (ID)> ^ <processing mode (ID)>
	PL	Person location	<point of care (IS)> ^ <room (IS)> ^ <bed (IS)> ^ <facility (HD)> ^ < location status (IS)> ^ <person location type (IS)> ^ <building (IS)> ^ <floor (IS)> ^ <location description (ST)>
	HD	Hierarchic designator	<namespace ID (IS)> ^ <universal ID (ST)> ^ <universal ID type (ID)>
Date/Time	DT	Date	YYYY[MM[DD]]
	TM	Time	HH[MM[SS.S[S[S[S]]]]][+/-ZZZZ]
	TS	Time stamp	YYYY[MM[DD][HHMM[SS.S[S[S[S]]]]][+/-ZZZZ] ^ <degree of precision>
Code Values	CE	Coded element	<identifier (ST)> ^ <text (ST)> ^ <name of coding system (ST)> ^ <alternate identifier (ST)> ^ <alternate text (ST)> ^ <name of alternate coding system (ST)>
	CK	Composite ID with check digit	<ID number (NM)> ^ <check digit (NM)> ^ <code identifying the check digit scheme employed (ID)> ^ < assigning authority (HD)>
	CN	Composite ID number and name	<ID number (ST)> ^ <family name (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)> ^ <prefix (e.g., DR) (ST)> ^ <degree (e.g., MD) (ST)> ^ <source table (IS)> ^ <assigning authority (HD)>
	CX	Extended composite ID with check digit	<ID (ST)> ^ <check digit (ST)> ^ <code identifying the check digit scheme employed (ID)> ^ < assigning authority (HD))> ^ <identifier type code (IS)> ^ < assigning facility (HD)
Generic	CM	Composite	No new CMs are allowed after HL7 Version 2.2. Hence, there are no new CMs in Version 2.3.
Demographics	AD	Address	<street address (ST)> ^ < other designation (ST)> ^ <city (ST)> ^ <state or province (ST)> ^ <zip or postal code (ST)> ^ <country (ID)> ^ <address type (ID)> ^ <other geographic designation (ST)>
	PN	Person name	<family name (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)> ^ <prefix (e.g., DR) (ST)> ^ <degree (e.g., MD) (ST)>
	TN	Telephone number	[NN] [(999)999-9999[X99999][B99999][C any text]
	XAD	Extended address	In Version 2.3, replaces the AD data type. <street address (ST)> ^ <other designation (ST)> ^ <city (ST)> ^ <state or province (ST)> ^ <zip or postal code (ST)> ^ <country (ID)> ^ < address type (ID)> ^ <other geographic designation (ST)> ^ <county/parish code (IS)> ^ <census tract (IS)>
	XPN	Extended person name	In Version 2.3, replaces the PN data type. <family name (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)> ^ <prefix (e.g., DR) (ST)> ^ <degree (e.g., MD) (ST)> ^ <name type code (ID) >
	XON	Extended composite name and ID number for organizations	<organization name (ST)> ^ <organization name type code (IS)> ^ <ID number (NM)> ^ <check digit (NM)> ^ <code identifying the check digit scheme employed (ID)> ^ <assigning authority (HD)> ^ <identifier type code (IS)> ^ <assigning facility ID (HD)>
	XTN	Extended telecommunications number	In Version 2.3, replaces the TN data type. [NNN] [(999)999-9999 [X99999] [B99999] [C any text] ^ <telecommunication use

Category	Data type	Data Type Name	Format
			code (ID)> ^ <telecommunication equipment type (ID)>^ <email address (ST)> ^ <country code (NM)> ^ <area/city code (NM)> ^ <phone number (NM)> ^ <extension (NM)> ^ <any text (ST)>
Time Series	TQ	Timing/quantity	<quantity (CQ)> ^ <interval (*)> ^ <duration (*)> ^ <start date/time (TS)> ^ <end date/time (TS)> ^ <priority (ID)> ^ <condition (ST)> ^ <text (TX)> ^ <conjunction (ID)> ^ <order sequencing>

3.3 Message Control Segments

Message control segments define construction rules, encoding rules, acknowledgment methods, etc. The message control segments supported by HIIS are MSH and MSA.

Before each segment is discussed, it is important to understand how a message is processed and handled by the HIIS. When a message is sent from an external HIS/RIS, the HIIS will do the following:

- 1) Accept the message.
- 2) Validate MSH according to the following rules:
 - Check the value in *MSH-4* to ensure it's one of the supported sites.
 - Checks the value in *MSH-9-message type* is supported by HIIS.
 - Checks the value in *MSH-12-version ID* is '2.2' or above.
 - Checks the value in *MSH-11-processing ID* to ensure that the value is 'P'.
- 3) Validate that all necessary segments and required fields are provided.
- 4) Return response to the placer accordingly.

3.3.1 MSH - Message Header Segment

The MSH segment defines the intent, source, destination, and some specifics of the syntax of a message. All HL7 messages start with a MSH segment.

Note that the HISS does not support the sequence number protocol.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Expected Values
1	1	ST	R		Field Separator	See Delimiter & Value table.
2	4	ST	R		Encoding Characters	See Delimiter & Value table.
3	180	HD	O		Sending Application	Not used
4	180	HD	O		Sending Facility	Site ID, for enterprise setting
5	180	HD	O		Receiving Application	Not used
6	180	HD	O		Receiving Facility	Not used
7	26	TS	O		Date/Time Of Message	Not used
8	40	ST	O		Security	Not used
9	7	CM	R		Message Type	Consists of: <message type> ^ < event type (ID)> See message type table and event type table for details.
10	20	ST	O		Message Control ID	Unique ID that that uniquely identifies the message. The receiving system echoes this ID back to the sending system in the Message acknowledgment segment (MSA).
11	3	PT	R		Processing ID	Processing mode, P for production. Messages to PACS must be in 'P'.
12	8	ID	R		Processing ID	Value must be 2.2 or above.
13	15	NM	O		Sequence Number	Not used
14	180	ST	O		Continuation Pointer	Not used
15	2	ID	O		Accept Acknowledgment Type	HIIS will always return an acknowledgement to the sender. It can be configured to send an AA even in cases where an AR/AE would normally be returned (to handle systems that cannot handle an AR/AE return code).
16	2	ID	O		Application Acknowledgment Type	Not used
17	2	ID	O		Country Code	Not used
18	6	ID	O		Character Set	Not used
19	60	CE	O		Principal Language Of Message	Not used

3.3.2 Supported Message Types

Value	Description
ACK	General acknowledgment message
ADT	ADT message
ORM	Order message
ORU	Observ result/unsolicited

3.3.3 Supported Event Types

Value	Description
ADT^A01	ADT/ACK - Admit / visit notification
ADT^A02	ADT/ACK - Transfer a patient
ADT^A03	ADT/ACK - Discharge/end visit
ADT^A04	ADT/ACK - Register a patient
ADT^A08	ADT/ACK - Update patient information
ADT^A18	ADT/ACK - Merge patient information
ADT^A34	ADT/ACK - Merge patient information - patient ID only
ADT^A35	ADT/ACK - Merge patient information – account number only
ADT^A47	ADT/ACK - Change internal ID
ORM^O01	ORM - Order message
ORU^R01	ORU/ACK - Unsolicited transmission of an observation message

3.3.4 MSA – Message Acknowledgment Segment

This segment is used to send acknowledgment (success or error message) to the placer. As mentioned in the ‘Overview’ section, the HIIS will support only original mode of the acceptance acknowledgement. The HIIS will process and send acknowledgment to the placer as follows:

1. Validate the message.
 - If HIIS rejects the message for any reason, HIIS creates an ACK message with **AR** in *MSA-1-acknowledgment code*
 - If an error occurs during processing, HIIS sends an error response, providing error information with a value of **AE** in *MSA-1-acknowledgment code* and error message in *MSA-3-text message*
 - If the message is processed successfully, HIIS generates a response message with a value of **AA** in *MSA-1-acknowledgment code*
 - If an AA acknowledgment is always requested, then HIIS will always send an AA in *MSA-1-acknowledgment code* regardless of the actual code that was generated.
2. If the message is successfully parsed, it is passed onto the receiving application. If the receiving application is the interface to Fuji PACS, it will process the message and update the Fuji PACS.

The segments used to send acknowledgment to the placer and the content of the MSA are listed as follows:

Segment	Description	Comments
MSH	Message Header	See previous section.
MSA	Message Acknowledgement	

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Accepted Values
1	2	ID	R		Acknowledgment Code	Original Mode: AA: Accept AE: Error AR: Reject Enhanced Mode: CA: Commit Accept CE: Commit Error CR: Commit Reject
2	20	ST	R		Message Control ID	Same as MSH-10
3	80	ST	O		Text Message	Error message
4	15	NM	O		Expected Sequence Number	Not used
5	1	ID	B		Delayed Acknowledgment Type	Not used
6	100	CE	O		Error Condition	Not used

MSA – Message Acknowledgment Segment

3.4 Patient-Related Messages

Patient-related messages include ADT (admission, discharge, and transfer) and patient demographic changes. The patient-related messages are sent from the HIS/RIS to the PACS. The message format for patient-related messages is listed as follows:

3.4.1 ADT - Patient Message Definition

Segment	Description	Comments
MSH	Message Header	See previous section.
[EVN]	Event Type	Event type
PID	Patient Identification	See the following section.
PV1	Patient Visit	See the following section.

3.4.1.1 EVN – Event Type Segment

The EVN segment is used to communicate necessary trigger event information to receiving applications:

Figure 3-1. EVN attributes

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACSs Equivalent / Acceptable Value
1	3	ID	O		Event Type Code	Event type
2	26	TS	O		Recorded Date/Time	Not used
3	26	TS	O		Date/Time Planned Event	Not used
4	3	IS	O		Event Reason Code	Not used
5	60	XCN	O		Operator ID	Not used
6	26	TS	O		Event Occurred	Not used

3.4.1.2 PID – Patient Identification Segment

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS's Equivalent / Acceptable Value
1	4	SI	O		Set ID – Patient ID	Not used
2	20	CX	O		Patient ID (External ID)	PACS will store it in RIS patient ID column
3	20	CX	R	Y	Patient ID (Internal ID)	Patient unique identifier, PACS uses it to identify a patient
4	20	CX	O	Y	Alternate Patient ID – PID	PACS will store it in the alias patient name table
5	48	XPN	R		Patient Name	Patient name
6	48	XPN	O		Mother's Maiden Name	Mother's maiden name
7	26	TS	O		Date/Time of Birth	Date of birth
8	1	IS	O		Sex	Gender (F, M, O, U)
9	48	XPN	O	Y	Patient Alias	PACS will store it in the alias patient name table
10	1	IS	O		Race	Race
11	106	XAD	O	Y	Patient Address	Patient address
12	4	IS	B		County Code	Not used
13	40	XTN	O	Y	Phone Number – Home	Home phone
14	40	XTN	O	Y	Phone Number – Business	Business phone number
15	60	CE	O		Primary Language	Not used
16	1	IS	O		Marital Status	Not used
17	3	IS	O		Religion	Not used
18	20	CX	O		Patient Account Number	Not used
19	16	ST	O		SSN Number – Patient	Patient social security number
20	25	CM	O		Driver's License Number – Patient	Not used
21	20	CX	O	Y	Mother's Identifier	Not used
22	3	IS	O		Ethnic Group	Not used
23	60	ST	O		Birth Place	Not used
24	2	ID	O		Multiple Birth Indicator	Not used
25	2	NM	O		Birth Order	Not used
26	4	IS	O	Y	Citizenship	Not used
27	60	CE	O		Veterans Military Status	Military status
28	80	CE	O		Nationality	Not used
29	26	TS	O		Patient Death Date and Time	Not used
30	1	ID	O		Patient Death Indicator	Not used

3.4.1.3 PV1 – Patient Visit Segment

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent / Acceptable Value
1	4	SI	O		Set ID – PV1	Not used
2	1	IS	R		Patient Class	Class: inpatient, outpatient or unknown
3	80	PL	O		Assigned Patient Location	Patient location <point of care (IS)> ^ <room (IS)> ^ <bed (IS)> ^ <facility (HD)> ^ < location status (IS)> ^ <person location type (IS)> ^ <building (IS)> ^ <floor (IS)> ^ <location description (ST)>
4	2	IS	O		Admission Type	Not used
5	20	CX	O		Pre-admit Number	Not used
6	80	PL	O		Prior Patient Location	Not used
7	60	XCN	O	Y	Attending Doctor	Attending Doctor <ID number (ST)> ^ <family name (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)> ^ <prefix (e.g., DR) (ST)> ^ <degree (e.g., MD) (ST)> ^ <source table (IS)> ^ <assigning authority (HD)> ^ <name type code (ID)> ^ <identifier check digit (ST)> ^ <code identifying the check digit scheme employed (ID)> ^ <identifier type code (IS)> ^ <assigning facility (HD)>
8	60	XCN	O	Y	Referring Doctor	Referring doctor
9	60	XCN	O	Y	Consulting Doctor	Not used
10	3	IS	O		Hospital Service	Not used
11	80	PL	O		Temporary Location	Patient current location <point of care (IS)> ^ <room (IS)> ^ <bed (IS)> ^ <facility (HD)> ^ < location status (IS)> ^ <person location type (IS)> ^ <building (IS)> ^ <floor (IS)> ^ <location description (ST)>
12	2	IS	O		Pre-admit Test Indicator	Not used
13	2	IS	O		Readmission Indicator	Not used
14	3	IS	O		Admit Source	Not used
15	2	IS	O	Y	Ambulatory Status	Pregnancy B6 – Pregnant Other – Not Pregnant
16	2	IS	O		VIP Indicator	Y or N
17	60	XCN	O	Y	Admitting Doctor	Not used
18	2	IS	O		Patient Type	Not used
19	20	CX	O		Visit Number	Unique identifier for each visit
20	50	CM	O	Y	Financial Class	Not used
21	2	IS	O		Charge Price Indicator	Not used
22	2	IS	O		Courtesy Code	Not used
23	2	IS	O		Credit Rating	Not used
24	2	IS	O	Y	Contract Code	Not used
25	8	DT	O	Y	Contract Effective Date	Not used
26	12	NM	O	Y	Contract Amount	Not used
27	3	NM	O	Y	Contract Period	Not used
28	2	IS	O		Interest Code	Not used
29	1	IS	O		Transfer to Bad Debt Code	Not used
30	8	DT	O		Transfer to Bad Debt Date	Not used

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent / Acceptable Value
31	10	IS	O		Bad Debt Agency Code	Not used
32	12	NM	O		Bad Debt Transfer Amount	Not used
33	12	NM	O		Bad Debt Recovery Amount	Not used
34	1	IS	O		Delete Account Indicator	Not used
35	8	DT	O		Delete Account Date	Not used
36	3	IS	O		Discharge Disposition	Not used
37	25	CM	O		Discharged to Location	Not used
38	2	IS	O		Diet Type	Not used
39	2	IS	O		Servicing Facility	Not used
40	1	IS	B		Bed Status	Not used
41	2	IS	O		Account Status	Not used
42	80	PL	O		Pending Location	Not used
43	80	PL	O		Prior Temporary Location	Not used
44	26	TS	O		Admit Date/Time	Admission Date/Time
45	26	TS	O		Discharge Date/Time	Not used
46	12	NM	O		Current Patient Balance	Not used
47	12	NM	O		Total Charges	Not used
48	12	NM	O		Total Adjustments	Not used
49	12	NM	O		Total Payments	Not used
50	20	CX	O		Alternate Visit ID	Not used
51	1	IS	O		Visit Indicator	Not used
52	60	XCN	O	Y	Other Healthcare Provider	Not used

3.4.2 Supported Event Types (MSH-9)

The following event types are supported in phase one by the HIIS:

Event Type Value	Description	Direction
A01	Admit/visit notification	HIS/RIS -> PACS
A02	Transfer a patient	HIS/RIS -> PACS
A03	Discharge/end visit	HIS/RIS -> PACS
A04	Register a patient	HIS/RIS -> PACS
A08	Update patient information	HIS/RIS -> PACS, PACS-> HIS/RIS (future)

3.4.3 Patient Admit

When a Patient Admit message is sent to the PACS, the patient class will be changed to in-patient. The PACS should also mark all the exams for that day to be 'Arrived'. The 'Arrived' status allows a site to configure an acquisition work list for technologist. The minimum required data for Patient Admit message is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ADT^A01
PID	3	Patient ID Internal	Text
PV1	2	Patient Class	I, O, or U

Sample Message:

```
MSH|^~\&|ADT1|MCM|LABADT|MCM|198808181126|SECURITY|ADT^A01|MSG00001-
|P|2.3|<cr>
EVN|A01|198808181123||<cr>
PID|||PATID1234^5^M11||JONES^WILLIAM^A^III||19610615|M||C|1200 N ELM
STREET^^GREENSBORO^NC^27401-1020|GL|(919)379-1212|(919)271-3434||S||
PATID12345001^2^M10|123456789|987654^NC|<cr>
PV1|1|I|2000^2012^01|||004777^LEBAUER^SIDNEY^J.|||SUR|||ADM|A0|<cr>
```

3.4.4 Patient Transfer

When a patient’s location is changed, the HIS/RIS should send a Patient Transfer message to notify the PACS. The patient’s new location will be updated on the PACS and the PACS will mark any exams as ‘Arrived’ that are related to the new location for that day. In addition, if a site uses patient location to configure its workflow, the patient’s information will appear in the folder with the new location, not in the old one. The minimum required data for Patient Transfer message is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ADT^A02
PID	3	Patient ID Internal;	Text
PV1	2	Patient Class	I, O, or U

Sample Message:

```
MSH|^~\&|REGADT|MCM|IFENG||199601110500||ADT^A02|000001|P|2.3|||<CR>
EVN|A02|199601110520||01||199601110500<CR>
PID|||191919^^^GENHOSP|253763|MASSIE^JAMES^A||19560129|M|||171
ZOBERLEIN^^ISHPEMING^MI^49849^""^|(900)485-5344|
(900)485-5344||S|C|10199925|371-66-9256||
(900)545-1200|EM^EMPLOYER|19940605||PROGRAMMER||ACME SOFTWARE
COMPANY<CR>
PV1||I|SICU^0001^01^GENHOSP||6N^1234^A^GENHOSP|0200^JONES,
GEORGE|0148^ADDISON, JAMES||ICU|||
|||0148^ANDERSON, CARL|S|1400|A|||||||GENHOSP|||199501
102300|<CR>
```

3.4.5 Patient Discharge

When a patient is no longer at the hospital, the HIS/RIS may send a Patient Discharge message to the PACS. The PACS may use this information to migrate images from a cache to long-term archive storage. A site may also use this information to configure its workflow. The minimum required data for Patient Discharge message is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ADT^A03
PID	3	Patient ID Internal;	Text
PV1	2	Patient Class	U

Sample Message:

```
MSH|^~\&|REGADT|MCM|IFENG||199601121005||ADT^A03|000001|P|2.3|||<CR>
EVN|A03|199601121005||01||199601121000<CR>
PID|||191919^^^GENHOSP|253763|MASSIE^JAMES^A||19560129|M|||171
ZOBERLEIN^^ISHPEMING^MI^49849^""^|| (900)485-5344|
(900)485-5344||S|C|10199925|371-66-9256||
(900)545-1200|EM^EMPLOYER|19940605||PROGRAMMER|||ACME SOFTWARE
COMPANY<CR>
PV1||U|6N|||0100^ANDERSON, CARL|0148^ADDISON, JAMES||SUR|||0148^AND
ERSON, CARL|S|1400|A|||SNF|ISH^ISHPEMING NURSING
HOME||GENHOSP|||199601102300|199691121005<CR>
```

When James A. Massie's condition became more stable, he returned to 6N for another day (transfer not shown) and then was discharged to the Ishpeming Nursing Home.

3.4.6 Patient Demographic Change

The HIS/RIS should send a Patient Demographic Change message to PACS when any patient information has changed. It is recommended that the A08 transaction be used to update fields that are not related to any of the other trigger events. The minimum required data for Patient Demographic Change message is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ADT^A08
PID	3	Patient ID Internal	Text
PV1	2	Patient Class	I, O, or U

Sample Message:

```
MSH|^~\&||001S08|PACS||19971106102800||ADT^A08|1234567|P|2.3|||NE|NE
PID|||110455|018-55-1333|MARY^PUPPIN^F||19660921|F||B|
13322 Lincoln Ave^San Francisco^CA^94133|| (415) 833-1228 |
(415) 733-9988
PV1||I|||||||||||W4
```

3.4.7 Patient Arrival

The Patient Arrival event will be triggered when a patient is admitted or a patient’s location is updated. The PACS will use this information as a notification to mark exams that are scheduled for that day at ‘PV1-11-temporary patient location’ as ‘Arrived’. If this field is null (no value is provided), PV1-3-assigned patient location will be used. Modalities may use DICOM acquisition work list protocol to query the Fuji PACS for all the ‘arrived’ exams for that day.

3.4.8 Patient Merge

The segment for patient merge is not the same as Patient ADT messages. The segment construction does not allow for a repeating set of PID and MRG.

Segment	Description
MSH	Message Header
PID	Patient Identification
MRG	Merge Information

The HUIS only supports merge (A18, A34, & A35) and change identifier (A46 & A47) functions in the patient merge. No move capabilities will be implemented. A merge event signals that two distinct records have been combined together into a single record with a single set of identifiers and data surviving at the level of the merge. A change identifier event signals that an identifier has been changed. Supported message types for patient merge are A18 and A34. (During mapping, convert the A34 into A18 for the merge). After the merge, only the primary patient will be kept in the Fuji PACS database. The secondary patient will no longer exist in the database. An A35 (merge patient information-account number only) event is intended for merging or changing a visit number only.

3.4.9 MRG - Merge Information Segment

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent/ Acceptable Value
1	20	CX	R		Prior Patient ID - Internal	Patient unique number
2	16	CX	O		Prior Alternate Patient ID	Alias patient name table
3	20	CX	O		Prior Patient Account Number	Used for A35
4	16	CX	O		Prior Patient ID - External	User-displayable ID

Sample Message:

```
MSH|^~\&|REPOSITORY|ENT|RSP1P8|MCM|199601051530|SEC|ADT^A46|000008|P|2.3
<cr>
EVN|A46|199601051530<cr>
PID||E2|||JONES^SALLY|...<cr>
MRG|||E3<cr>
```

```
MSH|^~\&|REGADT|MCM|RSP1P8|MCM|199601051530|SEC|ADT^A47|00000002|P|2.3<c
r>
EVN|A47|199601051530<cr>
PID||MR1^^^XYZ||MEYERS^JOHN||19501010|M|||987 SOUTH
STREET^^NY^NY^10021|||(212) 111-3333|||S||ACCT1<cr>
MRG|MR2^^^XYZ||ACCT1<cr>
```

Note: Examples are for changing external (A46, change E3 to E2) and internal (A47, change from M2 to M1) identifiers.

```
MSH|^~\&|REGADT|MCM|RSP1P8|MCM|199601051530|SEC|ADT^A35|00000002|P|2.3<c
r>
EVN|A35|199601051530<cr>
PID||MR1^^^XYZ||MEYERS^JOHN||19501010|M|||987 SOUTH
STREET^^NY^NY^10021|||(212) 111-3333|||S||ACCT2<cr>
MRG|MR2^^^XYZ||ACCT1<cr>
```

Note: Example is for changing account number (A35, change ACCT1 to ACCT2)

3.5 Order-Related Messages

Fuji PACS treats an order the same as a study; therefore, the terms ‘order’ and ‘study’ will be used interchangeably in this document. The supported trigger events for order-related messages are: study creation, modification, cancellation, completion, and report transfer. Details about report transfer will be discussed in the next section.

Order messages that are originated from the external HIS/RIS and are accepted by HIIS are patient related. The patient identification segment is required. If the order contains a patient that does not exist in the Fuji PACS database, a new patient will be created using the information provided in the message. If patient identification is provided and the patient already exists, HIIS will use the given information to update the patient in the Fuji PACS database.

3.5.1 ORM - Order Message Definition

Segment	Description	Comments
MSH	Message Header	MSH-9 = ORM^O01
PID	Patient Identification	See previous section for details.
[PV1]	Patient Visit	See previous section for details.
{ORC	Common Order	
OBR	Observation Request	Optional if ORC-1 = CA
{ NTE }	Notes and Comments	
[ZDS] }	Additional Identification Information (based on IHE Technical Framework)	

3.5.1.1 ORC - Common Order Definition

The Common Order segment (ORC) is a common segment for all orders. It is used to transmit fields that are common to all orders (all types of services that are requested). The ORC segment is required in the Order (ORM) message.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
1	2	ID	R		Order Control	See 'order control' table.
2	22	EI	R		Placer Order Number	ID uniquely identifies an order (or called accession number in DICOM).
3	22	EI	O		Filler Order Number	Not used
4	22	EI	O		Placer Group Number	Not used
5	2	ID	O		Order Status	See 'order status' table.
6	1	ID	O		Response Flag	Not used
7	200	TQ	C		Quantity/Timing	Not used
8	200	CM	O		Parent	Not used
9	26	TS	O		Date/Time of Transaction	Not used
10	120	XCN	O		Entered By	<staff ID (ST)> ^ <family name (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)>
11	120	XCN	O		Verified By	Not used
12	120	XCN	O		Ordering Provider	Identifies one who orders the order, i.e., ordering physician. This field will override OBR-16 <staff ID (ST)> ^ <family name (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)>
13	80	PL	O		Enterer's Location	Ordering department <point of care (IS)> ^ <room (IS)> ^ <bed (IS)> ^ <facility (HD)> ^ < location status (IS)> ^ <person location type (IS)> ^ <building (IS)> ^ <floor (IS)> ^ <location description (ST)>
14	40	XTN	O	Y/2	Call Back Phone Number	Not used
15	26	TS	O		Order Effective Date/Time	Not used
16	200	CE	O		Order Control Code Reason	Reason for an order ^ <text (ST)>
17	60	CE	O		Entering Organization	Identify the referring service < location ID > ^ < location name > ^ site ID
18	60	CE	O		Entering Device	Not used

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
19	120	XCN	O		Action By	Not used

3.5.1.1.1 Order Control Code

Note that 'RE' is used for reports (or called observations). When 'RE' is used, results can be transmitted with an order as one or more OBX segments without the necessity of including the ORC and OBR segments. Details will be discussed in the 'Reports' section.

Value	Description	Originator ¹
NW	New order	HIS/RIS
CA	Cancel order request	HIS/RIS
XO	Change order request	HIS/RIS
RE	Observations to follow	HIS/RIS, PACS
SC	Status changed	HIS/RIS, PACS

¹The originator of the trigger events for an order is the RIS/HIS in phase one release. The Fuji PACS may be one of the originators of the trigger events in phase two.

3.5.1.1.2 Order Status Code

Value	Description	Originator
CM	Complete order	HIS/RIS
CA	Cancel order request	HIS/RIS
IP	In Progress	HIS/RIS
SC	Status changed	HIS/RIS, PACS

3.5.1.2 OBR - Observation Request Segment

The Observation Request (OBR) segment is used to transmit information specific to an order for a diagnostic study or observation.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
1	4	SI	O		Set ID - OBR	Not used
2	75	EI	O		Placer Order Number	ID uniquely identifies a study (or called accession number in DICOM).
3	75	EI	C		Filler Order Number	Not used
4	200	CE	R		Universal Service ID	Performing procedure information <procedure code> ^ procedure description ^ <name of coding system or site ID>
5	2	ID	B		Priority	Not used
6	26	TS	B		Requested Date/time	Not used
7	26	TS	C		Observation Date/Time	Not used
8	26	TS	O		Observation End Date/Time	Not used
9	20	CQ	O		Collection Volume	Not used
10	60	XCN	O	Y	Collector Identifier	Not used
11	1	ID	O		Specimen Action Code	Not used
12	60	CE	O		Danger Code	Not used
13	300	ST	O		Relevant Clinical Info.	Comment related to the order. Store in the 'comment' column of the study table.
14	26	TS	C		Specimen Received Date/Time	Not used
15	300	CM	O		Specimen Source	Not used
16	80	XCN	O	Y	Ordering Provider	Identifies one who orders the order, i.e., ordering (requesting) physician. <staff ID (ST)> ^ <family name (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)>
17	250	XTN	O	Y/2	Order Callback Phone Number	Ordering Physician telephone: ^^^^^^ Phone number ^^ pager number [NNN] [(999)]999-9999 [X99999] [B99999] [C any text] ^<telecommunication use code (ID)> ^ <telecommunication equipment type (ID)> ^ <email

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
						address (ST)> ^ <country code (NM)> ^ <area/city code (NM)> ^ <phone number (NM)> ^ <extension (NM)> ^ <any text (ST)>
18	60	ST	O		Placer field 1	Not used
19	60	ST	O		Placer field 2	Not used
20	60	ST	O		Filler Field 1	Not used
21	60	ST	O		Filler Field 2	Not used
22	26	TS	C		Results Rpt/Status Change - Date/Time	Verification date/time if control code = SC Otherwise, date/time related to the reports / results
23	40	CM	O		Charge to Practice	Not used
24	10	ID	O		Diagnostic Serv Sect ID	Identifies diagnostic service where the order was performed. This information should associate with the procedure information. Modality type can be stored in here.
25	1	ID	C		Result Status	Identify study status
26	400	CM	O		Parent Result	Not used
27	200	TQ	C	Y	Quantity/Timing	Indicate the schedule date & time and the order's priority. ^^^ <start date/time> ^^ <priority> priority component: S = STAT R = Routine <quantity (CQ)> ^ <interval (*)> ^ <duration (*)> ^ <start date/time (TS)> ^ <end date/time (TS)> ^ <priority (ID)> ^ <condition (ST)> ^ <text (TX)> ^ <conjunction (ID)> ^ <order sequencing>
28	150	XCN	O	Y/5	Result Copies To	Not used
29	150	CM	O		Parent	Not used
30	20	ID	O		Transportation Mode	Not used
31	300	CE	O	Y	Reason for Study	Reason for an order ^ <text (ST)>
32	200	CM	O		Principal Result Interpreter	Physician or other clinician who interpreted the observation and is responsible for the report content.
33	200	CM	O	Y	Assistant Result Interpreter	Clinical observer who assisted with the interpretation of the study.
34	200	CM	O	Y	Technician	Performing technician
35	200	CM	O	Y	Transcriptionist	Not used
36	26	TS	O		Scheduled Date/Time	Not used
37	4	NM	O		Number of Sample Containers	Not used
38	60	CE	O	Y	Transport Logistics of Collected Sample	Not used
39	200	CE	O	Y	Collector's Comment	Not used
40	60	CE	O		Transport Arrangement Responsibility	Not used
41	30	ID	O		Transport Arranged	Not used
42	1	ID	O		Escort Required	Not used
43	200	CE	O	Y	Planned Patient Transport Comment	Not used

3.5.1.3 NTE – Notes and Comments

The NTE segment is a common format for sending notes and comments. It can come in any message type. HIIS processes notes and documents sent in this format for ORM and ORU messages only. A single document will be created in the Synapse system, with the values in the NTE.3 field.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
1	4	SI	O		Set ID – NTE	Not used
2	8	ID	O		Source of comment	Not used
3	64k	FT	O		Comment	Notes/comments for a study

3.5.1.4 ZDS Segment

The custom ZDS segment is used to transmit information not currently defined in the HL7, but is sent to the external system. If the external system supports sending study instance UID in the incoming message, then a ZDS segment can be used for that purpose also.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
1	200	RP	R		Study Instance UID	See below for details.
2	255	ST	O		Remote AE Title	Remote AE Title in the Synapse database
3	26	ST	O		Study Date Time	The study date time that is stored in the Synapse database.
4	5024	ST	O		Reserved	Reserved for site-specific use.
5	10	ST	O		Image count	The study image count at the time the message is sent. Note that this value is not absolute but will be updated as the images arrive.

Components of the study instance UID field shall be encoded as shown in the following table:

Component Number	Component Name	Shall Contain	Optionality
1	Reference Pointer	DICOM compliant study instance UID value	
2	Application ID	Implementation Specific	O
3	Type of Data	"Application"	O
4	Subtype	DICOM	O

3.5.2 Create an Order

The external HIS/RIS may use this event (ORC-1 = NW) to create a new study on the Fuji PACS. If an order is created, the default order status on the Fuji PACS is ‘Scheduled’. The external HIS/RIS may use ‘Study Modification’ to change the order status. The minimum required data for creating an order is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ORM^O01
PID	3	Patient ID (internal)	Text
	5	Patient name	Text
	7	Date of birth	Date
	8	Sex	M/F/O
ORC	1	Order control	NW
	2	Placer order number	Text (ID identifies an order)
OBR	2	Placer order number	Text (ID identifies an order)
	4	University Service ID	Procedure code information
	27	Quantity/Timing	Schedule date/time & priority

3.5.3 Update an Order

The external HIS/RIS may use this event (ORC-1 = XO) to modify an existing exam on the Fuji PACS. The site-configurable parameter allows a site to create a patient and/or a study if they are not found in the system. Any non-null field from the message will be used to update the Fuji PACS database. The possible usage of this event is updating study information and changing the study status. The study status is one of the most important elements to configure workflow of a clinical institution. For example, the HIS/RIS may use this event to change the study status from ‘Scheduled’ to ‘Arrived’, which will make the study appear in the acquisition ‘arrived’ work list. The HIS/RIS may also use the Study Status Change event to modify the study status. The minimum required data for updating the patient information on PACS is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ORM^O01
PID	3	Patient ID (internal)	Text
	5	Patient name	Text
	7	Date of birth	Date

Segment	Sequence	Description	Value
	8	Sex	M/F/O
ORC	1	Order control	XO
	2	Placer order number	Text (ID identifies an order)
OBR	2	Placer order number	Text (ID identifies an order)
	4	University Service ID	Procedure code information
	27	Quantity/Timing	Schedule date/time & priority

3.5.4 Cancel an Order

The external HIS/RIS may use this event (ORC-1 = CA) to cancel an existing exam on the Fuji PACS.

Segment	Sequence	Description	Value
MSH	9	Message Type	ORM^O01
ORC	1	Order control	CA
	2	Placer order number	Text (ID identifies an order)
OBR	2	Placer order number	Text (ID identifies an order)

3.5.5 Change an Order's Status

The external HIS/RIS may use this event (ORC-1 = SC) to modify the study status (e.g., arrived, complete, etc.) of an existing order on the Fuji PACS database. If the specified order cannot be found, the request will be rejected. Note that the originator of the study completion notification is a site-configurable parameter in the PACS database. In phase one, it is possible that the notification may be sent by the external HIS/RIS or by the Fuji PACS, but not both.

3.5.5.1 Arrive an Order

This message is mainly for acquisition work list. The minimum required data for marking a study ‘Arrived’ on PACS is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ORM^O01
ORC	1	Order control	SC
	2	Placer order number	Text (ID identifies an order)
	5	Order status	SC
OBR	2	Placer order number	Text (ID identifies an order)
	4	University Service ID	Procedure code information

3.5.5.2 Complete a Study

This message is also used to configure clinic workflow. A site may configure a folder that only contains studies that are completed. The minimum required data for marking a study ‘Completed’ on PACS is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ORM^O01
ORC	1	Order control	SC
	2	Placer order number	Text (ID identifies an order)
	5	Order status	CM
OBR	2	Placer order number	Text (ID identifies an order)
	4	University Service ID	Procedure code information

3.5.6 Scheduling

Scheduling may not result in an order being created. Scheduling is used for a clinic visit, where the patient comes back to review the results with his/her physicians. Clinic visit may result in pre-fetching historical studies prior to the patient's arrival. The minimum required data for scheduling is:

Segment	Sequence	Description	Value
MSH	9	Message Type	ORM^O01
ORC	1	Order control	SC
	2	Placer order number	Text (ID identifies an order)
OBR	2	Placer order number	Text (ID identifies an order)
	4	University Service ID	Procedure code information
	25	Result Status	S
	27	Quantity/Timing	Schedule date/time & priority

3.6 Reports / Observations

The Fuji PACS supports reports transfer as an unsolicited message in phase one. That means the latest reports or observations will be sent from the external HIS/RIS to Fuji PACS as soon as it is available.

3.6.1 ORU - Message Definition (Unsolicited)

Segment	Description	Comments
MSH	Message Header	MSH-9 = ORU^R01
PID	Patient Identification	See previous section for details.
[PV1]	Patient Visit	See previous section for details.
{[ORC]}	Common Order	
OBR	Observation Request	
{ NTE }	Notes and Comments	
{OBX}	Observation/Results	
[ZDS]	Additional Identification Information (based on IHE Technical Framework)	

3.6.1.1 OBX - Observation/Result Segment

The OBX segment is used to transmit a single report or observation fragment. It represents the smallest unit of a report or observation. Observation can be a report or information related to an observation.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS equivalent Value / Comment
1	10	SI	O		Set ID - OBX	Not used
2	2	ID	C		Value Type	Format of the observation CE = Code Entry ST = String TX = Text (Display)
3	590	CE	R		Observation Identifier	Identify type of observation ^IMP^, other types will be identified later
4	20	ST	C		Observation Sub-ID	Not used
5	65536 ²	*	C	Y	Observation Value	Report text
6	60	CE	O		Units	Not used
7	10	ST	O		References Range	Not used
8	5	ID	O	Y/5	Abnormal Flags	Diagnostic code
9	5	NM	O		Probability	Not used
10	2	ID	O	Y	Nature of Abnormal Test	Not used
11	1	ID	R		Observation Result Status	P: preliminary C: correction, amendment F: finalized
12	26	TS	O		Date Last Obs Normal Values	Not used
13	20	ST	O		User-Defined Access Checks	Not used
14	26	TS	O		Date/Time of the Observation	Not used
15	60	CE	O		Producer's ID	Not used
16	80	XCN	O		Responsible Observer	Not used
17	60	CE	O	Y	Observation Method	Not used

Minimum required data for a report message is listed as follows:

Segment	Sequence	Description	Value
MSH	9	Message Type	ORU^O01
PID	3	Patient ID (internal)	Text
	5	Patient name	Text

2 The length of the observation value field is variable, depending upon value type.

Segment	Sequence	Description	Value
ORC	1	Order control	RE
	2	Placer order number	Text (ID identifies an order)
OBR	2	Placer order number	Text (ID identifies an order)
	4	University Service ID	Procedure code information
	25	Result status	P, C, or F
OBX	2	Value type	ST
	5	Observation value	String
	11	Observation result status	F

Note that the OBX segment can be repeated in a message.

3.7 Bi-directional Messages

Bi-directional messages are originated from Fuji Synapse PACS and sent to the external HIS/RIS. Status change messages sent from RIS will not trigger a status change message sent from Synapse.

In the first phase, Fuji PACS will send status change (also referred to as status update) messages to the external HIS/RIS. This will be an ORM message. If Fuji PACS changes a study's status to any of the following, an outbound ORM can be sent: Complete, Dictated, Started, or Sent. Not all status changes have to trigger an outbound message: trigger activation is site configurable. Refer to section above for detailed information on the segments.

The pertinent information in the bi-directional message is as follows.

Segment	Sequence	Description	Comments
MSH	4	Sending Facility	Text – the site ID for enterprise version of Synapse
	9	Message Type	ORM^O01
	10	Message Control ID	Unique message identifier
PID	2	External Patient ID	Text (ID identifies a patient)
	3	Patient ID (internal)	Text (ID identifies a patient)
	5	Patient name	Text
	7	Date of birth	Date
	8	Sex	M/F/O
PV1	2	PatientClass	Text
	19	Visit number	Text
ORC	1	Order control	Text Value is SC
	2	Placer order number	Text (ID identifies an order)
OBR	2	Placer order number	Text (ID identifies an order) Accession number is not more than 16 characters.
	4	University Service ID	Procedure code and description information
	24	Diagnostic Service ID	Study Modality
	25	Result Status	The status change that is sent to the external system. Complete, Dictated, Started, Sent
	27	QuantityTiming/StartTime/Time/TimeStampDate/Time	Study scheduled date time
ZDS	1	Study Instance EUID	The study instance EUID in the Synapse database
	2	Remote AE Title	Remote AE Title in the Synapse database
	3	Study Date Time	The study date time that is stored in the Synapse database.
	4	Reserved	Reserved for site-specific use
	5	Image count	The study image count at the time the message is sent. Note that this value is not absolute but will be updated as the images arrive.

The bi-directional messages will be sent to the external HIS/RIS on a separate port other than the incoming messages.

3.7.1 Acknowledgment Message to Fuji Synapse PACS

Refer to section 2.3.4 for detailed information on the MSA segment.

HIIS will send an HL7 message and wait for an ACK message to be sent back by the external HIS/RIS. The interface will check acknowledgement code (MSA[1]) ‘AA’ for successful transmission. It will put the sent message on the reject queue if it is ‘AR’ or ‘AE’.

MSA	1	Acknowledgement Code	Original Mode: AA: Accept AE: Error
-----	---	----------------------	---

			AR: Reject Enhanced Mode: CA: Commit Accept CE: Commit Error CR: Commit Reject
--	--	--	--

3.7.2 Bidirectional Support for Secure URL

3.7.2.1 Encryption Key

For sites requiring secure URLs, encryption keys are defined by administrators using SWAT. For information on administering encryption keys, refer to ENG-0025737-A, Synapse Advanced SWAT Manual, Secure URL Key Management.

On start up of the HIIS Bidirectional service, HIIS Encryption Keys will be retrieved from the database and set in environment variables. The environment variables will use a client identifier string as the name of a variable and the key as the value of the variable. The environment variables will be available only to the current process.

3.7.2.2 URL Encryption

Currently, a plain text URL is created and put into the OBX,5 segment during the XSL transformation when the HL7* message is converted to HL7. A javascript function will be defined to retrieve the HIIS Encryption Key from the environment and create an encrypted URL using an Encrypt3DES function. The encrypted URL will be put into the OBX,5 segment during the message transformation.

Using the HIISConfig tool, the javascript function is added to the HIIS Configuration and is available to the RIS Interface Engineers. The RIS Interface Engineer must know the client identifier to use and put it in the function in order to retrieve the correct key. Additionally, the function can be modified by the RIS Engineers on a site-by-site basis if additional parameters such as username/password are required for the path.

To implement the encryption in the HIIS Bidirectional configuration, create an ORM-to-ORU translation in the bidirectional .cfg file.

Map all appropriate fields and map OBR/PlacerOrderNumber to OBX/Observation value. Set the OBX/ObservationValue to be conditional and apply the Encrypt function. A sample of the Encrypt function is shown below. Note that <client_identifier> and <server> must be replaced with appropriate values. Also, the items between the square brackets [] for the path are optional.

Function Pseudo Code:

Function Encrypt(OriginalValue)

```
{
  // Get the encryption key
```



```
var wshShell = new ActiveXObject("WScript.Shell");
var wshEnv = wshShell.Environment("PROCESS");
var key = wshEnv("<client_identifier>");

// Get the encryption object
var Encryptor = new ActiveXObject("Synapse.FujiSecureUrl");

// Create the path string
Var path = "path=/Session/Working%20Studies/AccessionNumber=" + OriginalValue [+
"&userid=<username>&password=<password>]";

// Encrypt the path
Var encryptedPath = Encryptor.Encrypt3DES(key, path);

// Create the URL
Var url = "http://<server>/explore2?token=" + encryptedPath;

Return url;
}
```

4. Non-HL7 Messages

Non-HL7 messages will be based on a schema similar to the HL7 schema that is agreed upon between the external system and FUJIFILM Medical Systems. The schema will be defined by the RIS integrator and used to map messages to the Fuji HL7 Star format for updating the database.

The following is a sample non-HL7 schema that can be used by an external system. The message shall be composed of segments, and each segment shall consist of multiple fields of variable length separated by a field separator. The segment separator is the hex character 0D.

Note: The segment names given below can be changed as agreed upon between the external system and FUJIFILM Medical Systems. For example, the MSH segment can be called HDR segment. In this draft, we are using the same segment names as in the HL7 message, but the definitions are different based on the schema that they decide to implement.

4.1 Patient-Related Messages

Patient-related messages shall consist of the following segments:

Segment Name	Comments
MSH	Message header – required MSH,3 = ADT
PID	Patient identification – required
[PV1]	Visit information – optional
MRG	Merge segment – required if this is a merge message

4.2 Study-Related Messages

Study-related messages should consist of the following segments:

Segment Name	Comments
MSH	Message header – required MSH,3 = ORM
PID	Patient identification – required
[PV1]	Visit information – optional
ORC	Order information – required
OBR	Study information – required
[{NTE}]	Study notes information – optional

4.3 Report Messages

Report messages shall consist of the following segments:

Segment Name	Comments
MSH	Message header – required MSH,3 = ORU
PID	Patient identification – required
[PV1]	Visit information – optional
ORC	Order information – required
OBR	Study information – required
[[NTE]]	Study notes information – optional
{OBX}	Study report – required

4.4 Segments

4.4.1 MSH Segment

This segment identifies the type of the message and the sender. Each message shall have one and only one MSH segment. This segment defines the field separator used in the message and any encoding characters used.

SEQ	LEN	DT	OP T	RP/ #	ELEMENT NAME	PACS Expected Values
0	3	ST	R		MSH	Segment identifier
1	1	ST	R		Field Separator	
2	4	ST	R		Repeating Character	~
3	3	ST	R		Message Type	Message Type
4	3	ST	O		Event Code	Event Code
5	180	ST	O		Sending Application	Site ID, for enterprise setting

4.4.2 PID Segment

This segment identifies the patient and is a required segment.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS's Equivalent / Acceptable Value
0	3	ST	R		PID	Segment identifier
1	255	ST	O		Patient ID (External ID)	PACS will store it in RIS patient ID column
2	255	ST	R		Patient ID (Internal ID)	Patient unique identifier; PACS uses it to identify a patient.
3	255	ST	O		Alternate Patient ID – PID	PACS will store it in the alias patient name table.
4	255	ST	R		Patient Full Name	Patient fullname in the format: LastName^FirstName^Middle^Suffix
5	26	ST	O		Date/Time of Birth	Date of birth
6	1	ST	O		Sex	Gender (F, M, O, U)
7	255	ST	O		Patient Address	
8	255	ST	O		Social Security Number	Personal identification number
9	255	ST	O		Patient Alias FullName	Patient alias fullname in the format: LastName^FirstName^Middle^Suffix
10	255	ST	O		Patient Account Number	Not used (can be used to send in visit number)

Note: For the name field, the RIS integrator would have to map the whole name to the last name field in the Fuji HL7 Star schema on the output side.

4.4.3 PV1 Segment

This segment identifies the visit and is an optional segment.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent / Acceptable Value
0	3	ST	R		PV1	Segment identifier
1	1	ST	R		Patient Class	Class: inpatient, outpatient, or unknown
2	20	ST	O		Visit Number	Unique identifier for each visit
3	26	ST	O		Admit Date/Time	Admission Date/Time
4	255	ST	O		Primary Location Name	Patient location
5	255	ST	O		Primary Location EUID	Primary location EUID
6	20	ST	O		Primary Location Site EUID	Primary Location Site EUID
7	255	ST	O		Attending Doctor Fullname	Fullname in the format: LastName^FirstName^Middle^Suffix
8	255	ST	O		Referring Doctor LastName	Fullname in the format: LastName^FirstName^Middle^Suffix
9	255	ST	O		Temporary Location Name	
10	255	ST	O		Temporary Location EUID	
11	20	ST	O		Temporary Location Site EUID	
12	1	ST	O		Ambulatory Status	Pregnancy Y/N
13	1	ST	O		VIP Indicator	Y or N

4.4.4 ORC Segment

ORC is a common segment for all orders. It is used to transmit fields that are common to all studies.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
0	3	ST	R		ORC	Segment identifier
1	2	ST	R		Order Control	See 'order control' table
2	22	ST	O		Placer Order Number	ID uniquely identifies an order (or called accession number in DICOM)
3	255	ST	O		Ordering Dept Name	Ordering dept
4	255	ST	O		Ordering Dept EUID	
5	20	ST	O		Ordering Dept site EUID	
6	255	ST	O		Referring Service Name	Referring Service
7	255	ST	O		Referring Service EUID	
8	20	ST	O		Referring Service site EUID	

4.4.5 OBR Segment

This segment is used to transmit information specific to a study for a diagnostic study or observation. The OBR segment is required in the Order message.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent Value/ Comments
0	3	ST	R		OBR	Segment identifier
1	75	ST	O		Placer Order Number	ID uniquely identifies a study (or called accession number in DICOM)
2	200	ST	R		Procedure Code	
3	200	ST	R		Procedure Description	
4	255	ST	O		Requesting Physician fullname	Fullname in the format: LastName^FirstName^Middle^Suffi x
5	10	ST	O		Diagnostic Serv Sect ID	Modality
6	1	ID	C		Result Status	Identify study status
7	16	ST	C		Schedule Date Time	
8	1	ST	O		Priority	S = STAT R = ROUTINE
9	300	CE	O		Reason for Study	Reason for an order ^ <text (ST)>

4.4.6 OBX Segment

This segment is used to transmit the diagnostic report for a study. The external system can send one line of comment in one OBX segment or it can send multiple lines in one OBX segment using a predefined separator to indicate where the line breaks should be inserted.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS equivalent Value / Comment
0	3	ST	O		OBX	Segment identifier
1	2	ST	C		Value Type	Format of the observation CE = Code Entry ST = String TX = Text (Display)
3	65536 ³	*	C	Y	Observation Value	report text
4	1	ID	R		Observ Result Status	P: preliminary C: correction, amendment F: finalized

3 The length of the observation value field is variable, depending upon value type.

4.4.7 NTE Segment

This segment is used to transmit notes/comments about the order. Synapse will accept only the notes/comments relating to the order. The external system can send one line of comment in one NTE segment or it can send multiple lines in one NTE segment using a predefined separator to indicate where the line breaks should be inserted.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS equivalent Value / Comment
0	3	ST	R		NTE	Segment identifier
1	65536	ST	R		Value Type	Notes/comments for a study

4.4.8 MRG Segment

This segment is used to transmit information about the record to be merged.

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME	PACS Equivalent/ Acceptable Value
1	20	ST	R		Prior Patient ID - Internal	Patient unique number
2	16	CX	O		Prior Alternate Patient ID	Alias patient name table
3	20	CX	O		Prior Patient Account Number	Used for A35
4	16	CX	O		Prior Patient ID - External	User-displayable ID

5. Localization Issues

Some of the fields in the Synapse database could be localized for a particular site. One common example is the study status. The RIS integrator is responsible for making sure that the status sent into the Synapse database matches the localized status defined in the Synapse database.

6. Reading File-Based Messages

HIIS supports reading message data from one or more files in a predefined folder. Fuji can configure the following using the HIIS Configuration tool:

- The location of the files
- The time interval to check if more files are available in the folder, once the service completes the processing of all current files in the folder

The messages can be one per file or multiple messages per file. If there is only one message, begin and end of message indicators are optional. If there is more than one message in a file, the messages must have begin and end of message indicators that shall be configured using the configuration tool.

Once the messages are successfully processed, the files will be deleted. If there is any error during processing (before being sent to the destination), the files will be moved to a backup directory. The messages will not be sent again for processing.

If the messages are rejected by the destination, it will be saved in a rejected messages log file.

The messages will be based on a schema file that is agreed upon between Fuji PACS and the external system, i.e., the messages may be HL7 or non-HL7.

7. Appendix

7.1 Sample HL7 Messages

7.1.1 ADT Message

```
MSH|^~\&|SMS FILLER|SMS|FUJI MGR|FUJI:ge-7-3^3326^GE MGR^GE:tiani-1-
1^2300^TIANI^MGR^TIANI|200110091319||ADT^A08|1|P|2.3.1|EVN|A08|200110091
319|||200110091319^PID||5633^^ADT1||BARTON^Patrick^R^^|19361008|M||2
217^E
ANDOVER^^SEATTLE^WA^98104^|||||101489||Pv1||E|^XYZ HOSPITAL|||V|ER
S||^PLW-31|C|||||XYZ_HOSPITAL|||200110090000|||V|AL1
```

7.1.2 ORM Message

```
MSH|^~\&|QUADRIS|Openlink|EXTERNAL
SYSTEM|20010517091054||ORM^001|ORDERE-010517-
1753012^P|2.2^PID|1|1021343|1021343^^MRN|1021343|TEST^MADELINE||19371113
0000^F|B|131^ABC AVE^NYACK^NY^10960||358-
3779||S||000015405657^^MRN|115-30-1348PV1||I|4SO
420B^420^B^IA|||||20010424212000ORC|N
W|1239574|OPN^N|1^^20010517091200^ST||20010517091200||804849^PIPER^
JAMES^MD^4SOOBR|1||1239574|71010^CHEST PORTABLE^99RADCODE^CXR-
PORTAB^CHEST PORTABLE^99RADABBR|ST|20010517091200|||NONE
NO IODINE OR LATEX ALLERGY CONTRAIND:N NO
LABS AVAILABLE NO DATA FOR THIS MODALITY
||804849^PIPER^JAMES^MD||1476086||M-
ROUTINE||1^^20010517091200^^ST||PO|^NEW LINE, CHECK POSITION
ALLERGIES:
NKDA ISOL: PAGER:0000001531 HEPATOCELLULAR CARCINOMA
PREG: NTE|1||IS THE PATIENT KNOWN TO BE PREGNANT? N
NTE|2||DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRIL
LATOR|
```

7.1.3 Multiple Studies in One ORM Message

```
MSH|^~\&|SMS FILLER|SMS|FUJI MGR|FUJI|200110091357||ORM^O01|1|P|2.3.1|PI
D|200014^^ADT1||PRENTICE^George^^|19691009|M|WH|^101487
Pv1|O||||5101^NELL^FREDERICK^P^DR||B02|||||
V|ORC|NW|26020^PLW-
OIF^IHEDEM|647|SC|1^once^200110091402^JH||7101^ESTRADA^JAMIE^P^
^DR|LWGH^E^OBR|1|26020^PLW-OIF^IHEDEM|647|10710^Transabdominal
ultrasound
scan^IHEDEMO^910710^US:Transabdominal^IHEDEMO|||||7101^ESTRAD
A^JAMIE^P^DR||647|647|647||US||1^once^200110091402^A||ZDS|1.2
.840.113696.119911.501.647^SMS^Application^DICOM|ORC|NW|26021^PLW-
OIF^IHEDEM|648|SC|1^once^200110091409^JH||7101^ESTRADA^JAMIE^P^
^DR|LWGH^E^OBR|1|26021^PLW-OIF^IHEDEM|648|10910^Computed tomography:
chest^IHEDEMO^910910^CT:chest^IHEDEMO|||||7101^ESTRADA^JAMIE^
P^DR||648|648|648||1^once^200110091409^A||NTE|1||IS THE
PATIENT KNOWN TO BE PREGNANT? N
NTE|2||DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRIL
LATOR|ZDS|1.2.840.113696.119911.501.648^SMS^Application^DICOM|ORC|NW|260
23^PLW-
OIF^IHEDEM|650|SC|1^once^200110091418^JH||7101^ESTRADA^JAMIE^P^
^DR|LWGH^E^OBR|1|26023^PLW-OIF^IHEDEM|650|11210^Angiography: procedure
1^IHEDEMO^911210^XA:Procedure
1^IHEDEMO|||||7101^ESTRADA^JAMIE^P^DR||650|650|650|||XA||1
^once^200110091418^A||NTE|1||IS THE PATIENT KNOWN TO BE PREGNANT?
N
```

```

NTE|2||DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRIL
LATOR|
ZDS|1.2.840.113696.119911.501.650^SMS^Application^DICOM|

```

7.1.4 ORU Message

```

MSH|^~\&|QUADRI|Openlink|EXTERNAL
SYSTEM||20010517091051||ORU^R01|TXT_RSLT-010517-
1753008|P|2.2^PID|1|0767384|0767384^^MRN|0767384|TEST^MARTIN||1926030500
00|M||B|10 ABC STREET^WHITE PLAINS^NY^10601||428-
2377|S|000015431380^^MRN|547-36-2621^PV1|1|I|4SO 417
A^417^A|IA|||20010515213200^ORC|RE||
1239114|CO N|1^^20010516020300^20010516171658^RO||20010516020300||040
527^PRICE^GREGORY^D|ERH||20010516^OBR|1||1239114|78580^NM LUNG PERFUSION
ONLY^99RADCODE^LUNG PERF^NM LUNG PERFUSION
ONLY^99RADABBR|RO|20010516020300|20010516171658|20010516171658|||0|^CREA
TININE 2.0 NO IODINE OR LATEX ALLERGY DIA:N
TPN:N NRS: NO LABS AVAILABLE NM LAST
30:N CNTRAST LAST 90:N 000LB
000000OZ 000KG 000000GM
||040527^PRICE^GREGORY^D|||1475507|ADD^ADD|||N-
WAG VER||^20010516020300^20010516171658^RO||ST|^R PLEURITICI CHEST
PAIN, ALLERGIES: O2:N VENT:N SVC:MDGEN AA GRADIENT 54
NKA ISOL: PAGER:0000001409 HTN, DM, S/P CABG
PREG: MON:N |KRP&KROOP&STEVEN&MD&DR.^20010517
091047||KRP&KROOP&STEVEN&MD&DR.^20010516 1733000000NTE|1||IS THE
PATIENT KNOWN TO BE PREGNANT? N|
NTE|2||DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRIL
LATOR|
OBX|1|TX|RADCHART|1|
~ Verified Result
~ HISTORY: Status-post CABG, hypertension, right pleuritic chest pain,
~ increased A-a gradient; evaluate for possible pulmonary emboli.
~
~ After the inhalation of Tc-99m DTPA aerosol, ventilation views of the
~ lungs were obtained in multiple projections. This was followed by
~ the ~ intravenous administration of 4.2 mCi Tc-99m MAA, and
perfusion views ~ of the lungs in the same projections.
~
~ There is a sharply marginated wedge-like segmental or multi-segmental
~ ventilation-perfusion mismatch at the lateral aspect of the right
~ lower lung. There is relative elevation of the right hemidiaphragm.
~ No other ventilation-perfusion mismatches are identified. There is
~ matching somewhat inhomogeneous distribution of ventilation and
~ perfusion tracer activity in the left lung.
~
~ Prior radiographs of the same date demonstrate relative elevation of
~ the right hemidiaphragm and mild probable plate-like atelectatic
~ densities at the right base, in this patient status post CABG.
~
~ IMPRESSION:
~ The above combination of radiographic and scintigraphic findings is
~ consistent with an intermediate-high probability for pulmonary
emboli.
~
~ Resident Radiologist:
~**** end of result ****|||P

```

7.1.5 Multiple Reports in One ORU Message

```

MSH|^~\&||QPA1|||200109250855||ORU^R01|QPA1GTPACS.1.1164|D|2.2PID|1||J00
0013313|J13609|CAMPBELL^BILLY^|^19540410|M|||||J00000235616ORC|R
E||D|N|||QPA1^HOBR|1|000006658&N&N|-US ABDOMEN ABD^-US
ABDOMEN^US R|200109180758|200109180758|||SULAS|SULAS|||P|||
|^TESTING CMS 3790|^200109250855|||200109180758 NTE|1||IS THE PATIENT
KNOWN TO BE PREGNANT? N|
NTE|2||DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRIL
LATOR|
OBX|1|TX|000006658^-US ABDOMEN^ABD|1|~ QPA1 MAIN HOSPITAL CAMPUS
FULL NAME: CAMPBELL,BILLY~ ADDRESS LINE ONE FOR QPA1 MAIN
ATTENDING DR: SULLIVAN,ASHLEY SANDER~ ADDRESS LINE TWO FOR QPA1 MAIN
DOB: 04/10/1954 AGE: 47 SEX: M~ ADDRESS LINE THREE FOR QPA1 MA
ACCT: J00000235616 LOC: J.ER ~ PHONE #: PHONE 4 QPA1 MA
EXAM DATE: 09/18/2001 STATUS: REG ER~ FAX #: FAX 4 QAP1 MAIN
RADIOLOGY NO: ~ UNIT NO:
J000013313~~~~ EXAMS:
CPT CODE:~ 000006658 US ABDOMEN
76700~~ TESTING CMS 3806 - MAKING SURE THE FLAG DOES NOT APPEAR
SAYING CHANGES~ CANNOT BE UNDONE TO A DRAFT REPORT WHEN USING THE
MOVE/ADD/DELETE~ ROUTINE.~~~
-----
Reported by:
GILLEY,ANDREA THE RAD DX ENTRY
CC: ASHLEY SANDERS SULLIVAN~~ DICTATED DATE/TIME: 09/25/2001 (0852)~
TECHNOLOGIST: ANDREA KYA-QPA1,CS TECHNOLOGIS~ TRANSCRIBED DATE/TIME:
09/25/2001 (0855)~ TRANSCRIPTIONIST: 1CSAXG5647~ PRINTED
DATE/TIME: 09/25/2001 (0855) BATCH NO: N/A ~~~ PAGE 1
Draft Report
~ZDS|1.2.840.113696.119911.501.648^SMS^Application^DICOM|ORC|RE|||D|N||
||QPA1^HOBR|1|000006659&N&N|-US ABDOMEN ABD^-US
ABDOMEN^US R|200109180758|200109180758|||SULAS|SULAS|||P|||
|^TESTING CMS 3790|^200109250855|||200109180758 NTE|1||IS THE PATIENT
KNOWN TO BE PREGNANT? N|
NTE|2||DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRIL
LATOR|
OBX|1|TX|000006659^-US ABDOMEN^ABD|1|~ QPA1 MAIN HOSPITAL CAMPUS
FULL NAME: CAMPBELL,BILLY~ ADDRESS LINE ONE FOR QPA1 MAIN
ATTENDING DR: SULLIVAN,ASHLEY SANDER~ ADDRESS LINE TWO FOR QPA1 MAIN
DOB: 04/10/1954 AGE: 47 SEX: M~ ADDRESS LINE THREE FOR QPA1 MA
ACCT: J00000235616 LOC: J.ER ~ PHONE #: PHONE 4 QPA1 MA
EXAM DATE: 09/18/2001 STATUS: REG ER~ FAX #: FAX 4 QAP1 MAIN
RADIOLOGY NO: ~ UNIT NO:
J000013313~~~~ EXAMS:
CPT CODE:~ 000006658 US ABDOMEN
76700~~ TESTING CMS 3806 - MAKING SURE THE FLAG DOES NOT APPEAR
SAYING CHANGES~ CANNOT BE UNDONE TO A DRAFT REPORT WHEN USING THE
MOVE/ADD/DELETE~ ROUTINE.~~~
-----
Reported by:
GILLEY,ANDREA THE RAD DX ENTRY
CC: ASHLEY SANDERS SULLIVAN~~ DICTATED DATE/TIME: 09/25/2001 (0852)~
TECHNOLOGIST: ANDREA KYA-QPA1,CS TECHNOLOGIS~ TRANSCRIBED DATE/TIME:
09/25/2001 (0855)~ TRANSCRIPTIONIST: 1CSAXG5647~ PRINTED
DATE/TIME: 09/25/2001 (0855) BATCH NO: N/A ~~~ PAGE 1
Draft Report
~ZDS|1.2.840.113696.119911.501.649^SMS^Application^DICOM|

```

7.1.6 Bidirectional Message

```

MSH|^~\&||SYNAPSE DEFAULT|||ORM^O01|20040517113548|||
PID||413588361||Buckner^James^A||19361101|M|||||
PV1||<unknown>|||||
ORC|SC|
OBR|000030200005029||PT PET WB INIT LUNG CANC^PET WB INIT LUNG
CANC|CR|Complete|^20060208152553|
ZDS|1.2.840.113619.2.55.1.1762893669.2079.1019135771.222|ADVT|20060208152553|RESERVED

```


7.2 Sample Non-HL7 Messages

7.2.1 ADT Message

```
MSH|^~|^ADT|A01|MS_FILLER
PID|5633EX|5633|^BARTON^Patrick^R^^|19361008|M|AnyCity^AnyState^USA^0999
9|123-34-4567|
PV1|I|VISIT_NUM|200110090000|
```

7.2.2 ORM Message

```
MSH|^~|^ORM|O01|MS_FILLER
PID|5633EX|5633|^BARTON^Patrick^R^^|19361008|M|AnyCity^AnyState^USA^0999
9|123-34-4567|
PV1|I|VISIT_NUM|200110090000|
ORC|NW|1239574
OBR|1239574|71010|CHEST PORTABLE|Smith^John|||200110090000|R|Routine
Checkup
NTE|IS THE PATIENT KNOWN TO BE PREGNANT? N
NTE|DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRILLATOR
```

7.2.3 ORU Message

```
MSH|^~|^ORU|R01|MS_FILLER
PID|5633EX|5633|^BARTON^Patrick^R^^|19361008|M|AnyCity^AnyState^USA^0999
9|123-34-4567|
PV1|I|VISIT_NUM|200110090000|
ORC|NW|1239574
OBR|1239574|71010|CHEST PORTABLE|Smith^John|||200110090000|R|Routine
Checkup
NTE|IS THE PATIENT KNOWN TO BE PREGNANT? N
NTE|DOES PT HAVE PACEMAKER OR IMPLANTED DEBIFRILLATOR: D - IMPLANTED
DEFIBRILLATOR
```

```
OBX|TX|                                     ~ ~Verified Result ~
HISTORY: Status-post CABG, hypertension, right pleuritic chest pain,
~ increased A-a gradient; evaluate for possible pulmonary emboli.
~
~ After the inhalation of Tc-99m DTPA aerosol, ventilation views of the
~ lungs were obtained in multiple projections. This was followed by the
~ intravenous administration of 4.2 mCi Tc-99m MAA, and perfusion views
~ of the lungs in the same projections.
~
~ There is a sharply margined wedge-like segmental or multi-segmental
~ ventilation-perfusion mismatch at the lateral aspect of the right
~ lower lung. There is relative elevation of the right hemidiaphragm.
~ No other ventilation-perfusion mismatches are identified. There is
~ matching somewhat inhomogeneous distribution of ventilation and
~ perfusion tracer activity in the left lung.
```

~
~ Prior radiographs of the same date demonstrate relative elevation of
~ the right hemidiaphragm and mild probable plate-like atelectatic
~ densities at the right base, in this patient status post CABG.
~
~ IMPRESSION:
~ The above combination of radiographic and scintigraphic findings is
~ consistent with an intermediate-high probability for pulmonary emboli.
~
~ ~ Resident Radiologist:
~ ~**** end of result ****|P