

# Integrating the Healthcare Enterprise



5

## IHE Laboratory Technical Framework Supplement

### Graphics and Simple Images in Results (GIR)

10

### Trial Implementation

15

Date: October 15, 2010  
Authors: Ken Iguchi, Shin-ichi Watanabe  
20 Email: [lab@ihe.net](mailto:lab@ihe.net)

## Foreword

25 This is a supplement to the IHE Laboratory Technical Framework V2.1. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

30 This supplement is submitted for Trial Implementation as of October 15, 2010 and will be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the results of testing. Following successful testing it will be incorporated into the Laboratory Technical Framework. Comments are invited and may be submitted on the IHE forums at <http://forums.rsna.org/forumdisplay.php?f=236> or by email [lab@ihe.net](mailto:lab@ihe.net).

35 This supplement describes changes to the existing technical framework documents and where indicated amends text by addition (**bold underline**) or removal (~~**bold strikethrough**~~), as well as addition of large new sections introduced by editor's instructions to "add new text" or similar, which for readability are not bolded or underlined.

"Boxed" instructions like the sample below indicate to the Volume Editor how to integrate the relevant section(s) into the relevant Technical Framework volume:

<i>Replace Section X.X by the following:</i>
--

40

General information about IHE can be found at: [www.ihe.net](http://www.ihe.net)

Information about the IHE Laboratory can be found at: <http://www.ihe.net/Domains/index.cfm>

Information about the structure of IHE Technical Frameworks and Supplements can be found at: <http://www.ihe.net/About/process.cfm> and <http://www.ihe.net/profiles/index.cfm>

45 The current version of the IHE Technical Framework can be found at: [http://www.ihe.net/Technical\\_Framework/index.cfm](http://www.ihe.net/Technical_Framework/index.cfm)

**CONTENTS**

50

Introduction..... 3

    Abstract ..... 3

    Open Issues ..... 3

    Closed Issues..... 3

55 **Volume 1 – Integration Profiles..... 4**

    1.7 History of Annual Changes ..... 4

    4.4 Laboratory Testing Workflow Integration Profile Options ..... 4

        4.4.2 Graph & simple Images in Results (GIR) Option ..... 4

    5.5 LDA Integration Profile Options ..... 8

60        5.5.1 Graph & simple Images in Results (GIR) Option ..... 8

    X.5 ILW Integration Profile Options ..... 9

**Volume 2 - Transactions..... 10**

    3.9.1 Representation of graphs and simple images in OBX segment ..... 10

65 **Introduction**

This supplement to the Laboratory Technical Framework describes a new option “GIR” to the LTW, LDA and ILW integration profiles.

**Abstract**

70 The GIR option (Graphs and simple Images in laboratory Results) is usable in the LTW, ILW and LDA profiles. This option specifies how simple images or graphs produced by laboratory devices (such as analyzer, microscope, and station) and attached to clinical test results can be incorporated into the laboratory results flows.

**Open Issues**

75 **Closed Issues**

80 GIR01: Images encapsulated versus images referenced. The method that is strongly recommended by this supplement to carry images and graphics in laboratory observation results messages, is to encapsulate these images or graphics, encoded in base 64 in an OBX-5 with OBX-2 = “ED”. An alternative method consisting in providing a reference pointer to the image (OBX-2 = “RP”) is tolerated by this supplement because it is used by some legacy systems, but this second method will be deprecated in the future, so implementers are strongly invited to implement the “encapsulate” method.

# Volume 1 – Integration Profiles

85 *This section describes the changes required in Volume 1 of the Technical Framework that result from including this Integration Profile.*

## 1.7 History of Annual Changes

*Add the following bullet to the end of the bullet list in section 1.7:*

- 90
- Added the GIR option to the LTW, LDA and ILW profiles, which specifies how simple images or graphs produced by laboratory devices (analyzer, microscope, station) attached to clinical test results, can be incorporated into the laboratory results flows.

## 4.4 Laboratory Testing Workflow Integration Profile Options

95 *In section 4.4 replace table 4-2 by the following*

**Table 4-2 Laboratory Testing Workflow - Actors and Options**

Actor	Options	Vol. & Section
Order Placer	<i>Report Fac-Simile For Order Group</i>	LAB TF-2: 4
Order Filler	<i>Report Fac-Simile For Order Group</i>	LAB TF-2: 6
	<i>Graphs &amp; simple Images in Results (GIR)</i>	LAB TF-2: 6
Order Result Tracker	<i>Report Fac-Simile For Order Group</i>	LAB TF-2: 6
	<i>Graphs &amp; simple Images in Results (GIR)</i>	LAB TF-2: 6
Automation Manager	<i>Graphs &amp; simple Images in Results (GIR)</i>	LAB TF-2: 8

*At the end of section 4.4, append the following sub-sections:*

### 4.4.2 Graph & simple Images in Results (GIR) Option

100 This option is associated with transactions LAB-3 “Order Results Management” and LAB-5 “Test Results Management”.

#### 4.4.2.1 Scope of the GIR Option

105 Some systems (analyzers, microscopes, stations), used in the clinical testing process, produce images or graphs that go together with the results. For example, when performing a CBC, the analyzer counts the number of blood cells (leukocytes, erythrocytes, platelets), classifies leukocytes, and creates a chart to show the result with measured value. These images are useful to the laboratory staff for verifying the test results (technical validation process), as well as to the bio-medical scientist for the clinical validation process. In addition, some of these images may be kept by the bio-medical scientist for the purpose of research. Some images can also accompany

110 the results sent out to the ordering physician to provide additional evidence and facilitate the diagnostic and/or interpretation of the results.

The usable images types in GIR are in JPEG, PNG or PDF format.

The strongly recommended data type is ED (encapsulated data). RP (reference pointer) is also kept for some legacy system, which support only this pointer mechanism. But it is expected that this data type will be deprecated in a future release of the technical framework.

115

Table 4-3 shows the images and graphs that are supported by this option:

**Table 4-3 Images and Graphs in laboratory**

#	Group	Population	Origin	Purpose of use	Remarks	Size (KB)	Images or Graphs	L	S
1	Hematology	Bone Marrow, Peripheral Blood	Photo device	Clinical diagnosis	Hematology disease etc	<100	I	+	+
		Blood Image (Scatter gram)	Analyzer	Record of evidence	Leukocyte classification scatter gram etc	<100	I or G	+	+
		Platelet aggregation pattern	Analyzer	Record of evidence	-	<500	I or G	+	+
2	Biochemistry, immunology	Serum Protein Electrophoresis	Analyzer	Record of evidence	HPLC(HbA1c).GC.MS etc	<50	I or G	+	+
		Fluorescent ANA pattern	Photo device, Media	Record of evidence	Fluorescence microscope photo	<100	I	+	-
		Reiber Diagramm	Photo device, Media	Record of evidence	German sphere	<100	I	+	+
		Electrophoresis pattern	Photo device, Media	Clinical diagnosis	Immunological electrophoresis etc	<200	I	+	+
3	Microbiology	Stain image of microscope	Photo device, Media	Record of evidence	-	<100	I	+	+
		Colony. Nutrient medium	Photo device, Media	Record of evidence	-	<100	I	+	-
4	Urinalysis and Parasite	Parasites	Photo device, Media	Record of evidence	-	<100	I	+	+
		Ovum of parasites	Photo device, Media	Record of evidence	-	<100	I	+	+
		Urinary sediment	Photo device, Media	Clinical diagnosis	-	<100	I	+	+

IHE Technical Framework Supplement – Graphics and Simple Images in Results (GIR)

#	Group	Population	Origin	Purpose of use	Remarks	Size (KB)	Images or Graphs	L	S
5	Other	Surface marker	Photo device, Media	Clinical diagnosis	-	<300	I or G	+	-
		Chromosome	Photo device, Media	Clinical diagnosis	-	<300	I	+	+
		Gene stain	Photo device, Media	Clinical diagnosis	Virus etc	<100	I	+	+

L:Lab. Necessity in laboratory S: Scientist. Necessity for use by scientist.

120

++: Useful, +: Less Useful, -: not used

The graph and image sizes may vary and depend on the technology and on the intended usage. They are given here for information.

125 The images listed here are simple images and graphs associated with laboratory tests. As a reminder, the anatomic pathology has its dedicated domain in IHE, and therefore is out of the scope of the IHE LAB domain.

**Table 4-4 The method for carrying images & graphs between Actors**

#	Group	Population	Origin	Images or Graphs	LD->AM	AM->OF	OF->ORT
1	Hematology	Bone Marrow, Peripheral Blood	Photo device	I	-	-	ED or RP
		Blood Image (Scatter gram)	Analyzer	I or G	ED	ED or RP	ED or RP
		Platelet aggregation pattern	Analyzer	I or G	ED	ED or RP	ED or RP
2	Biochemistry, immunology	Serum Protein Electrophoresis	Analyzer	I or G	ED	ED or RP	ED or RP
		Fluorescent ANA pattern	Photo device, Media	I	-	-	ED or RP
		ReiberDiagramm	Photo device, Media	I	-	-	ED or RP
		Electrophoresis pattern	Photo device, Media	I	-	-	ED or RP
3	Microbiology	Stain image of microscope	Photo device, Media	I	-	-	ED or RP
		Colony. Nutrient medium	Photo device, Media	I	-	-	ED or RP

#	Group	Population	Origin	Image s or Graph s	LD->AM	AM- >OF	OF- >ORT
4	Urinalysis and Parasite	Parasites	Photo device, Media	I	-	-	ED or RP
		Ovum of parasites	Photo device, Media	I	-	-	ED or RP
		Urinary sediment	Photo device, Media	I	-	-	ED or RP
5	Other	Surface marker	Photo device, Media	I or G	-	-	ED or RP
		Chromosome	Photo device, Media	I	-	-	ED or RP
		Gene stain	Photo device, Media	I	-	-	ED or RP

- 130 AM: Automation Manager Actor in LTW and LDA profiles.  
 LD: Laboratory Device Actor in LDA profile  
 OF: Order Filler Actor in LTW profile  
 ORT: Order Result Tracker Actor in LTW profile  
 ED: Image encapsulated as a result, in JPEG, PNG or PDF format
- 135 RP: Image files external to the message and referenced by its URI

#### 4.4.2.2 Use cases

##### Clinical Diagnosis:

140 Laboratory tests including the images and graphs results are requested from clinical side (doctors) to laboratory and then, implemented. This set of workflow is the same as LTW and LDA. There is no particular order of imaging itself because orders of laboratory test items already include imaging. These orders totally depend on operation of each facility.

After implementing the test, numerical value and images or graphs are available. Clinical experts use some images and graphs for verification of the test results. When reporting the result, value data with images or graphs are provided to clinicians.

##### 145 Research:

Research experts and clinicians use the above images and graphs for their research to improve diagnostic technique.

#### 4.4.2.3 Behavior of the GIR Option in the LTW profile

When this option is activated:

- 150 The Automation Manager is able to embed graphs and simple images in its test results sent to the Order Filler, using transaction LAB-5.



The Order Filler is able to embed graphs and simple images in its results sent to the Order Result Tracker, using transaction LAB-3.

The image itself is formatted in a common IT file, such as JPEG, PNG or PDF.

155

## 5.5 LDA Integration Profile Options

*In section 5.5 replace table 5-2 by the following:*

**Table 5-2 Laboratory Device Automation - Actors and Options**

Actor	Options	Vol. & Section
Automation Manager	<i>Management of Pre/Post-processor</i>	-
	<i>Graphs &amp; simple Images in Results (GIR)</i>	LAB TF-2: 11
Analyzer (1)	<i>Query mode WOS</i>	-
	<i>Download mode WOS</i>	-
	<i>Graphs &amp; simple Images in Results (GIR)</i>	LAB TF-2: 11
Pre/Post-processor (2)	<i>Query mode WOS</i>	-
	<i>Download mode WOS</i>	-

160

*At the end of section 5.5, append the following sub-sections:*

### 5.5.1 Graph & simple Images in Results (GIR) Option

This option is associated with transaction LAB-23 “AWOS Status Change”.

#### 5.5.1.1 Scope of the GIR Option

See section 4.4.2.1.

165

#### 5.5.1.2 Use cases

See section 4.4.2.2.

#### 5.5.1.3 Behavior of the GIR Option in the LDA profile

When this option is activated:

170

- The Analyzer is able to embed graphs and simple images in its test results sent to the Automation Manager, using transaction LAB-23.
- The image itself is formatted in a common IT file, such as JPEG, PNG or PDF.
- The image file can be referenced or embedded in the results message.

## X.5 ILW Integration Profile Options

175 *In section X.5 of the ILW supplement replace table X.5-1 by the following:*

**Table 5-2 Laboratory Device Automation - Actors and Options**

Actor	Options	Vol. & Section
Requester	<i>Input for Invoicing</i>	Y
	<i>Non-coded Orders</i>	Y
	<i>Report Fac-Simile For Order Group</i>	Z
	<i>Test addition approval</i>	Y
	<i>Graphs &amp; simple Images in Results (GIR)</i>	LAB TF-2: 11
Subcontractor	<i>Input for Invoicing</i>	Y
	<i>Non-coded Orders</i>	Y
	<i>Report Fac-Simile For Order Group</i>	Z
	<i>Test addition approval</i>	Y
	<i>Graphs &amp; simple Images in Results (GIR)</i>	LAB TF-2: 11

*At the end of section X.5, append the following paragraph:*

### **Graph & simple Images in Results (GIR)**

180 This option is associated with transaction “Sub-order Results Delivery” [LAB-36].

Its scope is described in section LAB TF-1:4.4.2.1 introduced by the GIR supplement. Use cases are described in section LAB TF-1:4.4.2.2 introduced by the GIR supplement.

When this option is activated:

- 185 • The Subcontractor is able to embed graphs and simple images in its results messages sent to the Requester, using transaction LAB-36.
- The image itself is formatted in a common IT file, such as JPEG, PNG or PDF.
- The image file is embedded in the results message.

## Volume 2 - Transactions

190 *At the end of section 3.9 Observation/Result Segment, append the following sub-section:*

### 3.9.1 Representation of graphs and simple images in OBX segment

This segment is populated with these fields:

Field	DT	Element name	Value	Comment
OBX-2	ID	Value Type	RP	<i>Reference Pointer</i>
			ED	<i>Encapsulated Data</i>
OBX-3	CE	Observation Identifier	<i>Refer to notes under the table</i>	
OBX-4	ST	Observation Sub-ID	-	<i>Set "1" as the code to show the ordered test (prior OBX segment). Set "2 or more" for the value of image segments.</i>
OBX-5	Varies	Observation Value	<i>Refer to notes under the table</i>	
OBX-6	CE	Units	-	<i>Omit units</i>
OBX-7	ST	References Range	-	<i>Omit reference range</i>
OBX-8	IS	Abnormal Flags	-	<i>Omit abnormal flags</i>
OBX-11	ID	Observation Result Status	-	<i>Set the same values as the code to show the ordered test</i>
OBX-14	TS	Date/Time of the Observation	-	<i>Set data/time of the observation</i>

#### OBX-3 Observation Identifier

195 In the case where the image represents an observation per se, it has a dedicated observation identifier.

In the case where the image or graphic is an illustration associated with a test result, the OBX carrying the image follows immediately the OBX carrying the test result, with the same observation identifier (OBX-2), but a different observation sub-id (OBX-4).

200 First Component: Identifier (ST)

Definition: a unique identifier for the observation.

Ex. 13169-8

Second Component: Text (ST)

205 Ex. Serum Immunoelectrophoresis

Third Component: Name of Coding System (ID)

Ex. “LN”, “JC10”

210 A number of coding systems are provide by HL7 table 0396 in Appendix A of the HL7 V2.5.1 standard.

### **OBX-5 Observation Value**

In the case of ED (image encapsulation is the strongly recommended method):

Ex. LIS^IM^JPEG^Base64^ABCDE...

215

First Component: Source application (HD)

System name

Second Component: Type of Data (ID)

220

Definition: ID Data Type showing general type of data

Refer to HL7 table 0191

Real Fixed “IM” ( Image data)

Third Component: Subtype (ID)

225

Definition: ID data type announcing data type of subcomponent (general type)

Refer to HL7 table 0291

Real one of ” JPEG”, ”PNG” or ”PDF” (The laboratory report is in jpeg, png or pdf format)

Fourth Component: Encoding (ID)

230

Definition: Encoding method for expressing data of 8 bits binary by ASCII characteristics

Refer to HL7 table 0299

Real Fixed “Base64”

235

Fifth Component: Data (TX)

Definition: Visible ASCII character strings, construct data sent from the source application to the destination application

240

In the case of RP (image referencement is a alternative method tolerated for legacy systems, expected to be deprecated in a future release of the LAB Technical Framework):

Ex. [http://LIS\\_IMAGE\\_SYSTEM/Urinary resident0905060001\\_01.JPG](http://LIS_IMAGE_SYSTEM/Urinary%20resident0905060001_01.JPG)

First Component: Pointer (ST)

245

Definition: unique key allocated by the system holding the image.

Describe URL

Real http or ftp

*The syntax of the URL SHALL be conformant with RFC 1738 and RFC 1808*

250

Second Component: Application ID (HD)

Definition: unique specifier of system that stores data

Third Component: Type of Data (ID)

255

Definition: ID Data Type indicating general type of data

Refer to HL7 table 0191

Real Fixed "AP" (Other application data. The report is not to be interpreted by a HL7 parser), without use of "IM" (Image data).

260

Fourth Component: Subtype (ID)

Definition: ID data type announcing data type of subcomponent (general type)

Refer to HL7 table 0291

Real one of "JPEG", "PNG" or "PDF" (The laboratory report is in jpeg, png or pdf format)

265

### 3.y.1.2 Examples

In the case of ED type

270

```

...
OBX|1|NM|2A160000001930100^blood picture^JC10|1|||||F|...<cr>
OBX|2|NM|2A160000001930151^neutrophil^JC10|1|30|%|||||F|...<cr>
OBX|3|NM|2A160000001930154^acidocyte^JC10|1|40|%|||||F|...<cr>
OBX|4|ED|2A160000001930100^blood
picture^JC10|2|LIS^IM^JPEG^Base64^ABCDE...|||||F|...<cr>
OBX|5|ED|2A160000001930100^blood picture
^JC10|3|LIS^IM^JPEG^Base64^ZXYWV...|||||F|...<cr>
OBX|6|ED|2A160000001930100^blood picture
^JC10|4|LIS^IM^JPEG^Base64^12345...|||||F|...<cr>
    
```

275

280

In the case of RP type(using http)

285

290

```

...
OBX|1|NM|1A105000000166200^Urinary resident^JC10|1|||||F|...<cr>
OBX|2|NM|1A105000000166251^erythrocyte ^JC10|1|1-5|HPF|||||F|...<cr>
OBX|3|NM|1A105000000166252^leukocytes^JC10|1|1-5|HPF|||||F|...<cr>
OBX|4|RP|1A105000000166200^Urinary resident^JC10|2|
      http://LIS_IMAGE_SYSTEM/ Urinary resident0905060001_01.JPG|||||F|...<cr>
OBX|5|RP|1A105000000166200^Urinary resident^JC10|3|
      http://LIS_IMAGE_SYSTEM/ Urinary resident0905060001_02.JPG|||||F|...<cr>
OBX|6|RP|1A105000000166200^Urinary resident^JC10|4|
      http://LIS_IMAGE_SYSTEM/ Urinary resident0905060001_03.JPG|||||F|...<cr>
    
```

In the case of RP type (using ftp)

295

300

305

```

...
OBX|1|NM|1A105000000166200^Urinary resident^JC10|1|||||F|...<cr>
OBX|2|NM|1A105000000166251^erythrocyte ^JC10|1|1-5|HPF|||||F|...<cr>
OBX|3|NM|1A105000000166252^leukocytes^JC10|1|1-5|HPF|||||F|...<cr>
OBX|4|RP|1A105000000166200^Urinary resident^JC10|2|
      ftp://ftp.LIS_IMAGE_SYSTEM/ Urinary
      resident0905060001_01.JPG|||||F|...<cr>
OBX|5|RP|1A105000000166200^Urinary resident^JC10|3|
      ftp://ftp.LIS_IMAGE_SYSTEM/ Urinary
      resident0905060001_02.JPG|||||F|...<cr>
OBX|6|RP|1A105000000166200^Urinary resident^JC10|4|
      ftp://ftp.IMAGE_SYSTEM/ Urinary resident0905060001_03.JPG|||||F|...<cr>
    
```