Laboratory Integrated Schema

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Abstract: - The IHE initiative for clinical laboratories defines an architecture that promotes understanding, usability and reusability among the laboratories. The primary goal is to ensure that medical information is correct and on time to the healthcare professionals. The IHE attempt does not define new standards but uses well established existing standards like HL7, ASTM, DICOM, ISO, IETF, OASIS, CLSI in a strict framework and defines specific implementations of the standards to achieve integration goals of clinical laboratories. The functional components of a healthcare system are called Actors. Actors interact through transactions. The schema produced by IHE is based on the notion of Integration Profile and is comprised of Actors. The goal of this paper is to present the clinical laboratories integration profiles as a sequence of transactions between actors. The set of Workflow Integration Profiles involving clinical laboratories, clinical wards and other teams within healthcare institutions to fully integrate diagnostic testing on in vitro specimens are presented together with a Content Integration Profile; the Content Integration Profile enables clinical laboratories (local, regional or national) as well as standalone laboratories to share their result reports.

Key-Words:: LTW, LDA, LPOCT, LCSD

1 Introduction

Within a given healthcare setting there are typically dozens of information systems that each perform specific functions using different standards like HL7, IETF, ISO, CLSI, OASIS, DICOM and W3C standards. Sometimes the situation is like the “tower of Babel” whereby each information system utilizes a number of standards in a wide variety of ways that precludes medical information flow from one to another. The purpose of IHE is to integrate the heterogeneous information systems among and within the different departments. For each department, IHE provides a detailed schema of Integration Profiles, Actors and Transactions with specific implementation of the existing standards and a strict framework of how these standards can be used. Actors are components that produce, manage, and act on categories of information required by healthcare operational activities. Transactions are interactions between actors that communicate the required information through standards-based messages. Actors and Transactions are abstractions of the real-world healthcare environment and form integration profiles creating representations of real-world capabilities. The IHE effort for the clinical laboratories has resulted to a set of Workflow Integration Profiles and a Content Integration Profile which will be presented at this paper.

2 Laboratory Activities

A clinical laboratory receives test orders from clinical departments or from physicians. The tests are performed on in vitro specimens collected from the patients. Depending upon the organization the specimen collection may be performed by laboratory staff, ward staff, sample collection room staff or third party. The identification of specimen containers is essential. The specimen identifier is usually carried by a barcode label stuck on the specimen container. The laboratory has the ability to accept, modify, or reject an order, with appropriate notification to the ordering organization. The testing produces observations of various types: simple numeric value (e.g. a serum glucose level), rich textual observation (e.g. a bone marrow biopsy), simple coded result (e.g. a HIV serology negative), graphical observation (e.g. a serum protein electrophoresis). Results are sent to the ordering ward and/or physician; copies may be sent to other physicians or departments, and/or stored in an electronic record. Observation results may be generated for both ordered and unordered tests (aka reflex tests). Observation results progress through

different steps of validation (non-validated results, technically validated results, clinically validated results) [1]. The laboratory usually delivers results after clinical validation (aka medical validation). Under some conditions (e.g. emergency, permanent disposition with some wards), it may also deliver technically validated results, which will be confirmed or corrected later on, after clinical validation has occurred.

To describe all the activities within the Laboratory department, IHE uses the notions of integration profile, actor, and transaction [2].

- An integration profile is a representation of a real-world capability that is supported by a set of actors that interact through transactions.
- Actors are information systems or components of information systems that produce, manage, or act on categories of information required by operational activities in healthcare.
- Transactions are interactions between actors that communicate the required information through standards-based messages.

The diagrams we will show are intended to provide an overview so the transactions can be seen in the context of a healthcare institution and community workflow. We will describe the set of Workflow Integration Profiles and the Content Integration Profile which enables laboratories within healthcare institutions as well as standalone laboratories to share their results reports within a broad healthcare community [1], [3], [4].

4. Laboratory Integration Profiles

The following section identifies the workflow and content integration profiles of a clinical laboratory.

4.1 Lab Workflow Integration Profiles

The Workflow Integration Profiles for the Laboratory Department are the following (figure 1):

- The **Laboratory Testing Workflow (LTW)** profile which covers the workflow related to tests performed by a clinical laboratory inside a healthcare institution, for both identified orders and unknown orders, related to both identified patients and unidentified or misidentified patients.
- The **Laboratory Point Of Care Testing (LPOCT)** profile which covers the workflow related to clinical laboratory tests performed on the point of care or on patient's bedside, by ward staff, under supervision of a laboratory of the healthcare institution.

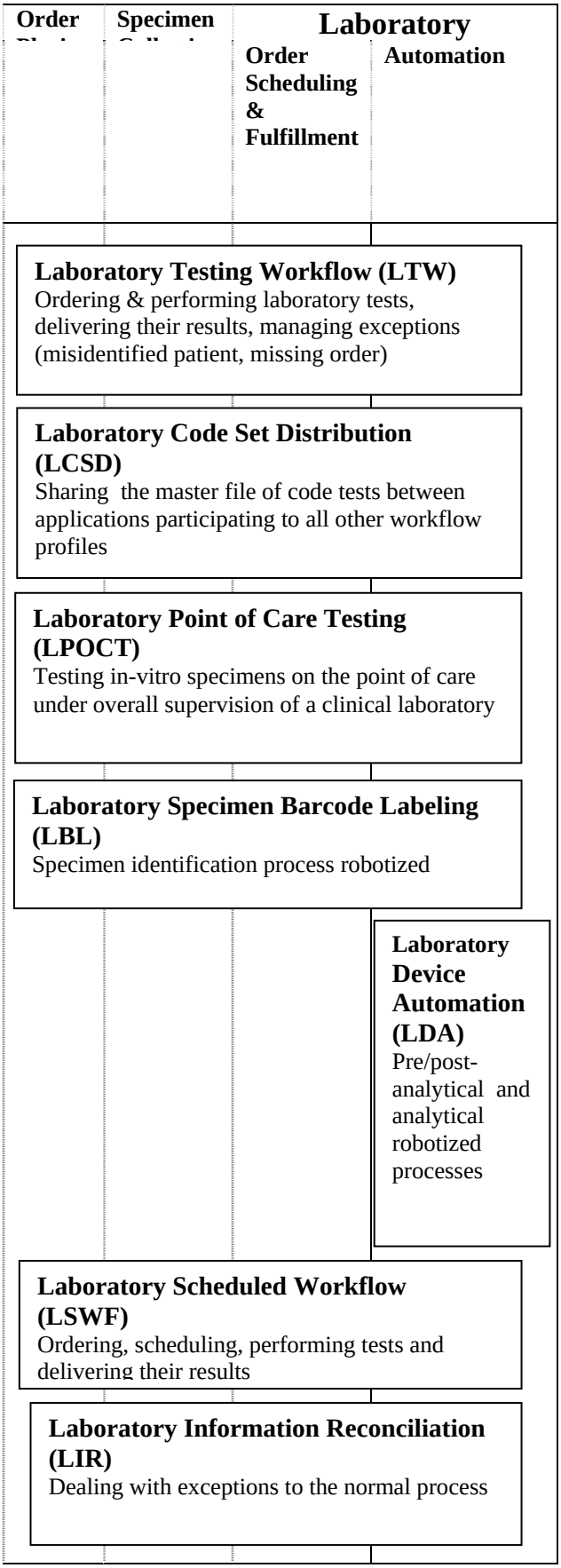

Figure 1. Workflow Integration Profiles

- The **Laboratory Device Automation (LDA)** profile which describes the workflow between the Automation Manager and a set of laboratory equipment (pre-analytical devices, analyzers, post-analytical devices) involved in the testing process.
- The **Laboratory Code Set Distribution (LCSD)** profile which provides a way for an application owning a code set in the domain of clinical laboratory (battery, test and observation codes) to share it with other applications to further support data exchange between these applications.
- The **Laboratory Specimen Barcode Labeling (LBL)** profile which covers the robotized process of container labeling and delivery for specimen collection related to an existing order or order group for a patient.
- The **Laboratory Scheduled Workflow (LSWF)** – (deprecated, retained for backward compatibility) which covers the scheduled workflow related to tests performed by a clinical laboratory, fulfilling an existing order related to a well-identified patient.
- The **Laboratory Information Reconciliation (LIR)** – (deprecated, retained for backward compatibility) which covers the workflow related to tests performed by a clinical laboratory under exceptional situation (patient unidentified or misidentified, order not available etc.).

4.2 Content Integration Profile

A Content Integration Profile defines a structured content to be used in the transactions of a document sharing integration profile. Each of these transactions is viewed as having two components, a payload, which is the bulk of the information being carried, and metadata that describes that payload. The binding of the Content to a transaction specifies how this payload influences the metadata of the transaction.

Figure 2 shows the only Content Integration Profile of the Laboratory environment the XD-LAB and its dependencies towards integration profiles from the Information Technology (IT) Infrastructure [7]. The "Sharing Laboratory Reports" (XD-LAB) profile enables the sharing of laboratory results reports with a document sharing resource; this profile defines the content of a laboratory report as an electronic document [1].

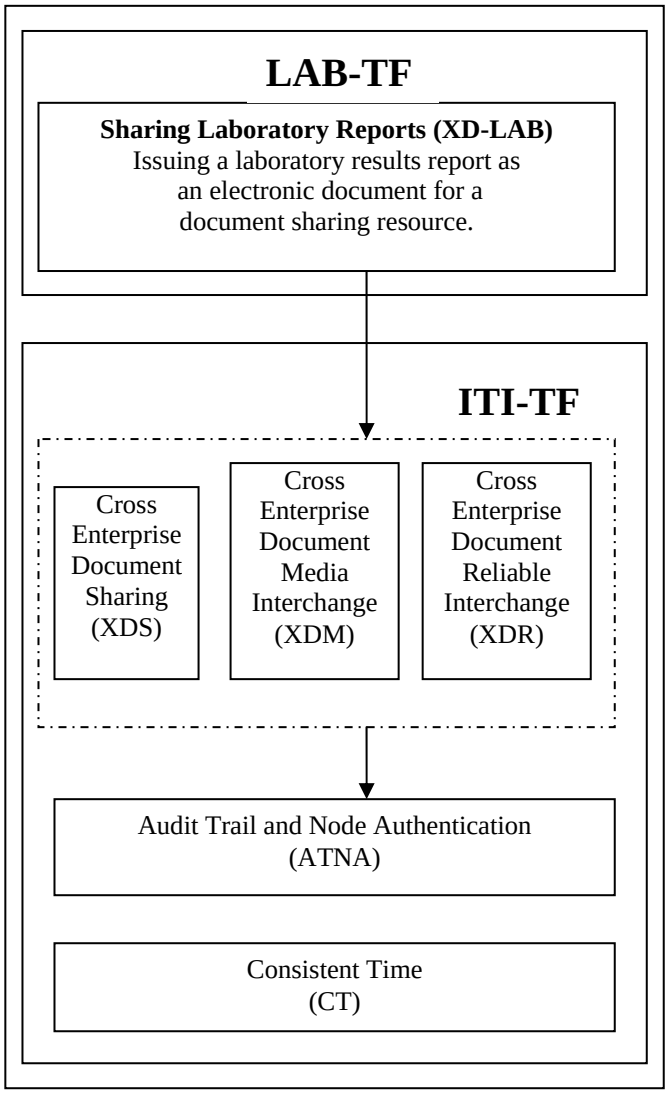

Figure 2. The Content Integration Profile

5. Laboratory Integration Profiles Detailed Presentation

The following section provides a detailed presentation of every identified Lab Integration profile. For each integration profile the corresponding set of actors and transactions are defined.

5.1 Laboratory Testing Workflow (LTW)

The Laboratory Testing Workflow integration profile establishes the continuity and integrity of clinical laboratory testing and observation data inside a healthcare institution. It covers the workflow related to tests performed by the clinical laboratories of the institution, for both identified orders and unknown orders, related to both identified patients and unidentified or misidentified

patients. The profile involves a set of transactions, to maintain the consistency of ordering and patient information, to track the specimen collection and specimen acceptance and to deliver the laboratory results at various steps of validation.

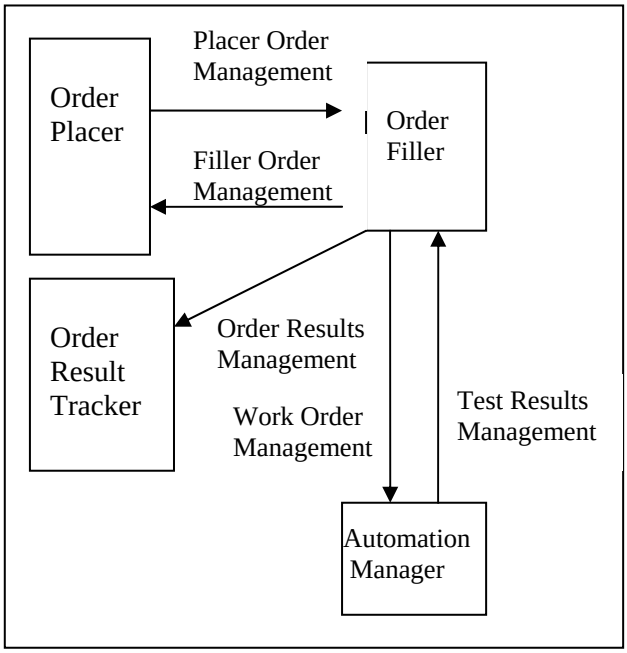

Figure 3. LTW Actor Diagram

Figure 3 shows the actors directly involved in the Laboratory Testing Workflow Integration profile and the relevant transactions between them. Other actors that may be indirectly involved due to their participation in other related profiles are not shown [1], [5], [6].

Table 1 lists the transactions for each actor directly involved in the Laboratory Testing Workflow Integration Profile and the relevant transactions between them.

Actors	**Transactions**
Order Placer	Placer Order Management
	Filler Order Management
Order Filler	Placer Order Management
	Filler Order Management
	Order Results Management
	Work Order Management
	Test Results Management
Automation Manager	Work Order Management
	Test Results Management
Order Result Tracker	Order Results Management

Table 1. LTW-Actors and Transactions

5.2 Laboratory Device Automation (LDA)

The LDA integration profile (figure 4) supports the workflow for the automated technical section of the clinical laboratory: The Laboratory Device Automation integration profile covers the workflow between an Automation Manager application (e.g. a LAS or a LIS) and a set of automated Laboratory Devices (LD) to process a Work Order, perform the tests on the related specimens and retrieve their results. This processing includes the pre-analytical process of the specimen and the analytical process itself (run of the ordered tests on the specimen) and the post-analytical process (recapping, transportation, rerun, dilution, storage and retrieval). The LDA profile strictly addresses the workflow between Automation Managers and Laboratory Devices (LD) operated by the clinical laboratory staff. Devices operated by the clinical ward staff, are supported by another profile: LPOCT, and are therefore out of scope of LDA. The Automation Manager receives a Work Order from the Order Filler, splits it into a sequence of one or more Work Order Steps (WOS), each of which is entrusted to an automated device implementing an actor (Pre/Post-processor, Analyzer) [1], [5], [6].

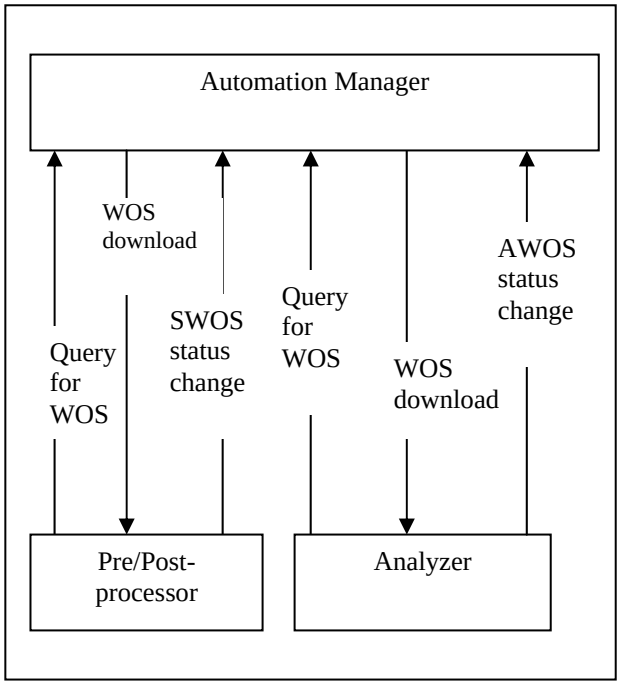

Figure 4: LDA Actor Diagram

Table 2 lists the transactions for each actor involved in the LDA profile. To claim support of this Integration Profile, an implementation of an actor must perform the required transactions (labeled "R"). Transactions labeled "O" are optional.

Actors	Transactions
Automation Manager	WOS Download (“R”)
	WOS Query (“R”)
	AWOS Status Change (“R”)
	SWOS Status Change (“O”)
Analyzer	WOS Download (“O”)
	WOS Query (“O”)
	AWOS Status Change (“R”)
Pre/Post Processor	WOS Download (“O”)
	WOS Query (“O”)
	SWOS Status Change (“R”)

Table 2. LDA - Actors and Transactions

5.3 Laboratory Point Of Care Testing (LPOCT)

There are situations where clinical laboratory testing can be performed straightforwardly on the point of care device or the patient’s bedside by the ward staff, and even by patients themselves. These organizations enable the ward staff immediate access to common tests, whose specimen does not need any pre-analytic preparation. The results are used immediately in clinical decisions. The point of care analyzers located in the wards send their observations to a central Point Of Care Data Manager, using a connection that can be persistent or intermittent [1], [5], [6].

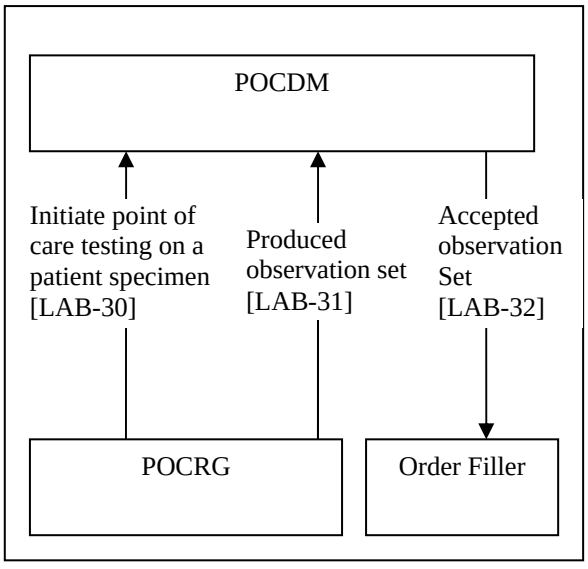

Figure 5: LPOCT Actor Diagram

This profile addresses organizations, where point of care testing is placed under the overall supervision of a clinical laboratory of the healthcare enterprise. This supervision includes clinical validation of POCT results, Quality Control (QC) surveillance, reagent delivery, and education on good testing practices delivered to the ward staff. This profile can also support organizations that leave point of care testing under the responsibility of the ward medical staff using the point of care analyzers, and do not involve any laboratory in this process. To fulfill the laboratory led need, the POCDM (figure 5) must be able to forward point of care patient results to the Order Filler application of the clinical laboratory supervising the POCT process. The workflows covered by this LPOCT profile depend upon the kind of organization chosen, and upon the type of connection (persistent or intermittent) used by point of care devices. LPOCT profile uses the Order Filler actor defined in LTW profile, and introduces two new actors: Point Of Care Result Generator (POCRG), Point of Care Data Manager (POCDM).

Table 3 lists transactions for each actor directly involved in the LPOCT profile. In order to claim support of this integration profile, an implementation must perform the required transactions (labeled “R”). Transactions labeled “O” are optional.

Actors	Transactions
Order Filler	Transaction LAB-32 (“R”)
Point of Care Data Manager	Transaction LAB-30 (“O”)
	Transaction LAB-31 (“R”)
	Transaction LAB-32 (“R”)
Point of Care Result Generator	Transaction LAB-30 (“O”)
	TransactionLAB-31 (“R”)

Table 3. LPOCT – Actors and Transactions

5.4 Laboratory Specimen Barcode Labeling (LBL)

The Laboratory Barcode Labeling integration profile (figure 6) supports the workflow of a robotic system which delivers specimen containers pre-identified with a bar coded label, for the specimen collection related to a laboratory test order. This robotic system receives patient, test order and specimen data from another system (HIS, CIS, LIS), and issues a label for each (specimen, container) needed, with the specimen identifier bar coded on the label, and possibly other information printed on this label. This workflow is supported by two new actors, Label Information Provider (LIP) and Label Broker (LB). The Label Broker receives label information, and delivers these labels in appropriate operations, and may notify the status of this process. The Label Information Provider is usually grouped with the

Order Filler or the Order Placer from the Laboratory Testing Workflow Integration Profile. The Label Broker may be notified passively with the labeling instructions or may query the Label Information Provider to get these instructions. This profile addresses only specimen container labeling within the scope of the Laboratory Domain. It does not address labeling workflows in other domains [1].

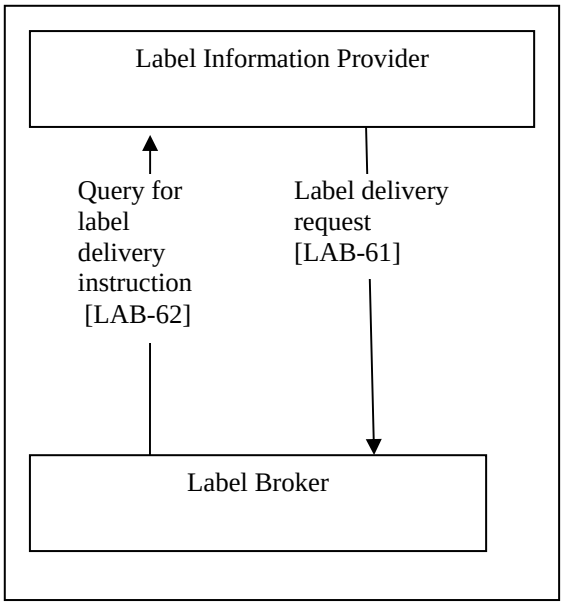

Figure 6: LBL Actor Diagram

Table 4 lists transactions for each actor directly involved in the LBL profile. Transactions labeled "R" are required transactions. Transactions labeled "O" are optional.

Actors	Transactions
Label Information Provider	Transaction LAB-61 ("R")
	Transaction LAB-62 ("R")
Label Broker	Transaction LAB-61 ("R")
	Transaction LAB-62 ("O")

Table 4. LBL – Actors and Transactions

5.5 Laboratory Code Set Distribution (LCSD)

A set of common codes is generally used by multiple application systems in a laboratory workflow environment. These common codes need to be synchronized across the various applications at a given site. In many implementations, one application system will be the author (the "owner") of the code set. The responsibility for managing a code set may also be distributed among different systems. This profile provides a way for the owner of a code set (battery, test and observation codes) to send the code set to other applications. Figure 7 shows the actors directly involved in the Laboratory Code Set Distribution integration profile and the transaction between them [1], [5].

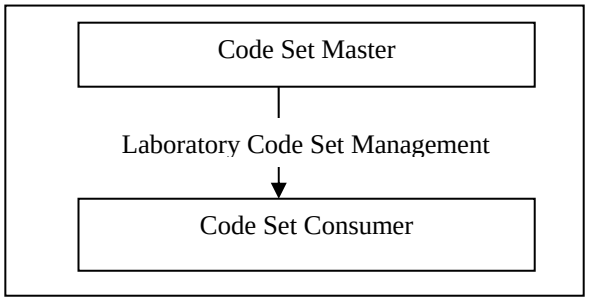

Figure 7: LCSD Actor Diagram

Table 5 lists the transactions for each actor directly involved in the Laboratory Code Set Distribution Profile. In order to claim support of this Integration Profile, an implementation must perform the required transaction (labeled "R").

Actors	Transactions
Code Set Master	Laboratory Code Set Management ("R")
Code Set Consumer	Laboratory Code Set Management ("R")

Table 5. LCSD – Actors and Transactions

5.6 Laboratory Scheduled Workflow (LSWF)

The Laboratory Scheduled Workflow Integration Profile (figure 8) establishes the continuity and integrity of clinical laboratory testing and observation data throughout the healthcare enterprise. It involves a set of transactions, to maintain the consistency of ordering and patient information, to control the conformity of specimens, and to deliver the results at various steps of validation. Some of these transactions are already defined in the IHE Radiology Technical Framework. This profile also enables automation of pre-analytical, analytical and post-analytical processes within the laboratory. LSWF profile is deprecated but it is retained for backward compatibility; the new version of LTW profile will cover all the characteristics of LSWF.

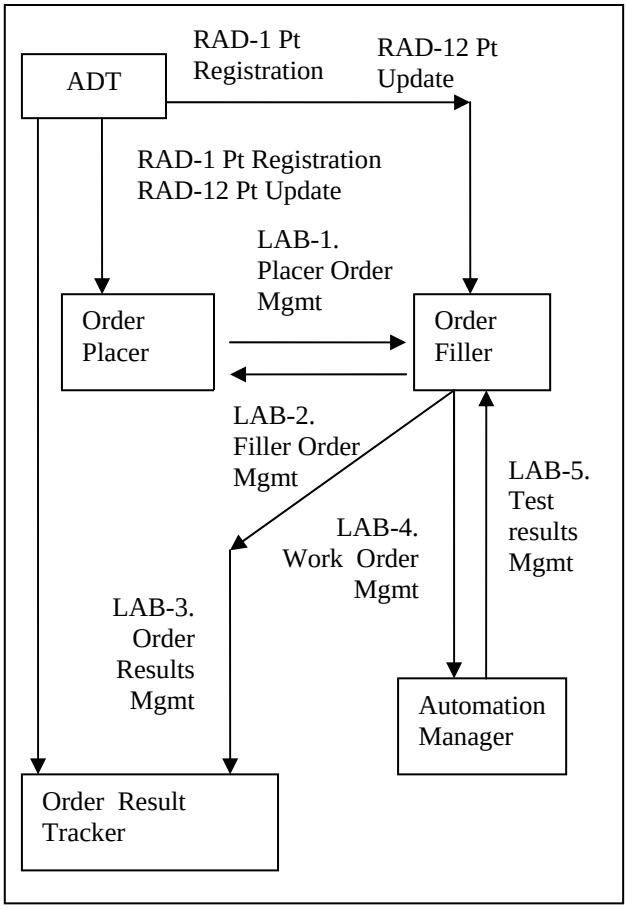

Figure 8. Laboratory Scheduled Workflow Diagram

Table 6 lists the transactions for each actor involved in the Laboratory Scheduled Workflow Profile.

Actors	**Transactions**
ADT	Patient Registration
	Patient Update
Order Placer	Patient Registration
	Patient Update
	Placer Order Management
	Filler Order Management
Order Filler	Patient Registration
	Patient Update
	Placer Order Management
	Filler Order Management
	Order result management
	Work order management
	Test result management
Automation Manager	Work order management
	Test result management
Order Result Tracker	Patient registration
	Patient Update
	Order result management

Table 6. LSWF Actors and Transactions

5.6 Laboratory Information Reconciliation (LIR)

The LIR profile has been deprecated and retained for backward compatibility only (its characteristics will be included to the new LTW profile in conjunction with LDA profile). It supports the following exceptional cases

1. *Unidentified Patient registered at ADT:* This use case gives a simple but concrete solution to the very common case of the misidentified or unidentified Patient in a healthcare center. As the patient information is an important part of an Order, this use case can impact into two different scenarios which involve either the Placer Order or the Filler Order.
2. *Patient not registered at ADT:* This use case considers the situation of a ward staff or user of an order entry system that needs to create a laboratory request to have urgent analyses performed, but where the patient is not yet registered. Neither the patient Id nor details are available and consequently no order can be entered.
3. *Tests performed on laboratory devices before creation of the order:* Typical case of a very urgent specimen examination. The examination request can arise when the lab systems are not in an active state and so the process should start from the Laboratory Devices or if possible from the Automation Manager.

5.7 Sharing Laboratory Reports (XD-LAB)

The Sharing Laboratory Reports profile (figure 7) describes a clinical laboratory report as an electronic document to be published towards a document sharing resource such as an Electronic Health Record (EHR) or in Personal Health Record (PHR) shared by a community of care providers, using one of the document sharing profiles defined in ITI-TF [7]. Such an electronic document contains the set of releasable results produced by a clinical laboratory in fulfillment of one or more test Orders for a patient. The report is shared in a human-readable format. There are two actors in this profile, the Content Creator (A Content Creator Actor is responsible for the creation of content and transmission to a Content Consumer) and the Content Consumer (A Content Consumer Actor is responsible for viewing, import, or other processing of content created by a Content Creator Actor) [1], [5], [6].

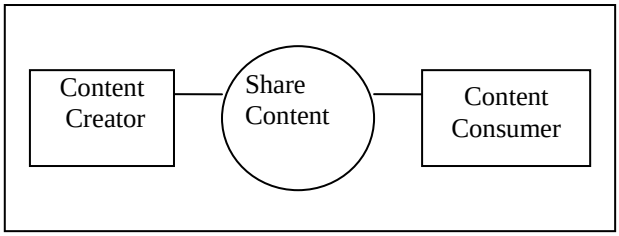

Figure 9: XD-LAB Actors

6. Actor Descriptions

The following section provides a description for each actor met on the previous diagrams [1], [5], [6].

ADT (Admission Discharge and Transfer): A system responsible for adding and/or updating patient demographic and encounter information, and delivering this information to Order Placer, Order Filler, Order Result Tracker. This Actor inherited from the Radiology Technical Framework, only appears in the deprecated profiles LSWF and LIR.

Analyzer: An automated instrument that performs testing on biological specimens upon request from the Automation Manager managing this instrument. Each request for testing on a specimen sent by the Automation Manager to the Analyzer is called an Analytical Work Order Step (AWOS). The instrument sends back to the Automation Manager the observations produced and any related conditions or events. In addition, the Analyzer may perform QC testing for its own surveillance, and also sends its QC results to the Automation Manager. This actor is involved in the LDA profile.

Automation Manager: A system or component that manages the automation in the laboratory or a part of it. Automation involves the integration or interfacing of automated or robotic transport systems, analytical instruments, and pre- or post-analytical process equipment such as automated centrifuges and aliquoters, decappers, recappers, sorters, and specimen storage and retrieval systems. This actor receives work orders from the Order Filler. It manages the processing of the ordered tests on the appropriate devices, and sends technically validated results back to the Order Filler. This actor must be considered even if it manages a small part of the analytical process; e.g. if it manages one single analytical instrument. Multiple Automation Managers can be related to one Order Filler. This actor is involved in the LTW and LDA profiles as well as in the deprecated profiles LSWF and LIR.

Code Set Master: A system which owns (is responsible for the maintenance of) one or several code sets. This system may be a LIS, a CIS, a HIS, a LAS or an Enterprise Common Repository. Code sets can be sent on a routine basis (e.g. every week) or every time the code set changes. A code set may contain battery, test and observation codes. This actor is involved in the LCSD profile.

Code Set Consumer: A system which receives code sets from Code Set Master(s) and updates its internal tables to reflect the code set as maintained by the Code Set Master. This actor is involved in the LCSD profile.

Content Consumer: An application responsible for viewing, importing, or other processing of content created by a Content Creator Actor. This actor is involved in the XD-LAB profile to 2310 consume laboratory reports.

Content Creator: An application responsible for the creation of content and transmission to a Content Consumer. This actor is involved in the XD-LAB profile to issue laboratory reports for sharing purpose.

Label Broker: A robotic system delivering and identifying the containers required for the specimens collection related to an Order or an Order Group for a patient. This system receives its instructions from another system called the Label Information Provider. This actor is involved in the LBL profile.

Label Information Provider: An information system owning the specimen labeling instructions related to an Order or an Order Group, and sending these instructions to a Label Broker. This actor is involved in the LBL profile.

Order Filler: A system used by a laboratory, that receives test orders from Order Placer actors, collects or controls the related specimens, accepts or rejects the order, schedules work orders, and sends them to one or more Automation Managers, receives the results from each Automation Manager, performs the clinical validation, appropriately manages all state changes of the order and sends the results to the Order Result Tracker(s). In some cases, the Order Filler will create test orders itself (e.g. a paper order received by lab from a department not connected to an Order Placer, or a paper order was received from a physician external to the organization, or a reflex order generated by the laboratory). In some cases the Order Filler is responsible for collecting and identifying the specimens. An Order Filler may receive test orders from more than one Order Placer in the institution and may send the order results to more than one Order Result Tracker. In

organizations supporting point of care testing, this actor is also involved in the LPOCT profile to upload the point of care observations to the designated laboratory in charge with the supervision of the process. This actor is involved in the LTW and LPOCT profiles as well as in the deprecated profiles LSWF and LIR. In the LPOCT Integration Profile this actor receives the point of care observation sets from the POCDM, and stores them within orders, either matched or generated for the occasion. These POCT orders are also submitted to clinical validation, and are archived for quality assurance and responsibility purposes only, since they have already been used by the medical staff in its care decisions. The clinical validation process triggers the sending of these results to the Order Result Tracker, using transaction LAB-3 of profile LSWF. POCT orders are associated to orders on the Order Placer side by means of transactions LAB-1 or LAB-2 of profile LTW.

Order Placer: A system that generates test Orders and Order Groups for various clinical laboratories, places each of these to the correct laboratory, and appropriately manages all state changes. In some cases the Order Placer is responsible for identifying the specimens. Therefore, the transaction between Order Placer and Order Filler may carry specimen related information. There may be more than one Order Placer actor in a healthcare institution. In organizations supporting point of care testing, this actor is also identifying the point of care test orders, either before testing or after it is done, upon request from the Order Filler. This actor is involved in the LTW new profile as well as in the deprecated profiles LSWF and LIR.

Order Result Tracker: A system that stores laboratory observations obtained for the patients of the healthcare institution, registers all state changes in the results notified by Order Fillers. This actor stores observations the context of their Order or Order Group. This actor is involved in the LTW new profile as well as in the deprecated profiles LSWF and LIR.

Point Of Care Data Manager (POCDM): A system managing a set of POCRG and centralizing their results. The POCDM is ready to react to any conversation from a POCRG. The POCDM receives point of care observations from POCRG actors. It controls these observations within their context, stores them and forwards them to the Order Filler. The POCDM is supporting the technical review (technical validation) of the results. The POCDM offers features to control the activity of its set of POCRG.It stores the quality control results of each POCRG and supervises this QC on all POCRG.

The POCDM lets the authorized staff configure its application, and its related set of POCRGs.

Point Of Care Results Generator (POCRG): A system that produces results by automatic measure, manual entry or calculation. It identifies the results with the related patient or QC specimen ID, the operator who performs the tests, the ordering provider and the care unit. It sends this information to the POCDM. In addition, the POCRG is able to send its internal process control information to the POCDM.

Pre/Post-Processor: An automated device that performs some elementary steps on biological specimens upon request from the Automation Manager managing this device. Each request for a step on a specimen sent by the Automation Manager to the Pre/Post-Processor is called a Specimen Work Order Step (SWOS). The instrument sends back to the Automation Manager the status of the operation. Examples of Pre/Post-Processors are sorters, aliquoters, decappers, recappers, specimen conveyors, specimen storage systems. This actor is involved in the LDA profile.

7. Transaction Descriptions

The following section provides a description for each transaction met on the previous diagrams [1], [5], [6].

Placer Order Management: This transaction provides all the messages needed between the Order Placer and the Order Filler Actors for the management of the life cycle of an Order (standalone or within an Order Group). Its main goal is to keep a consistent vision of the Order, (content and status), between these two Actors.

Filler Order Management: This transaction provides the messages needed between the Order Filler and the Order Placer to allocate a new Placer Order Number to an Order created on the laboratory side by the Order Filler application.

Order Results Management: This transaction carries the results of an Order, as well as status changes, modifications, cancellations of these results, from the Order Filler to the Order Result Tracker.

Work Order Management: This transaction provides the messages needed between Order Filler and Automation Manager Actors for the execution of a Work Order by the latter. The goal of this transaction is to distribute the work to the

Automation Manager, and to keep this Actor informed of all updates happening to the patient related to that Work Order.

Test Results Management: This transaction carries the technically validated test results obtained for a Work Order, as well as status changes, modifications, cancellations of these results, from the Automation Manager to the Order Filler.

WOS Download: This transaction contains the messages used to download a Work Order Step (WOS) from the Automation Manager to the Analyzer or Pre/Post-processor, according to a "push method". It includes "new WOS", "update WOS", "cancel WOS" and the related applicative acknowledgements. This transaction is used with Analyzers and Pre/Post-processor which work in download mode.

WOS Query: This transaction contains the message used by the Analyzer or Pre/Postprocessor to query the Automation Manager with one or more specimen (or location) identifiers, and the reply message from the Automation Manager delivering one or more WOS dedicated to each of these specimen. This transaction implements the "pull method" for requesting WOS.

AWOS Status Change: This transaction contains the messages used by the Analyzer to report the status of an AWOS (such as "specimen arrived", "first run failed", "second run started", "AWOS complete"…) and to send the tests results when the AWOS is complete. It also includes the related applicative acknowledgements from the Automation Manager.

SWOS Status Change: This transaction contains the messages used by the Pre or Post- Processor to report all the status changes of the SWOS, and the related applicative acknowledgements. Status changes include: "specimen arrived", "SWOS complete", "SWOS failed"…

Initiates point of care testing for a patient specimen. This transaction is used on a persistently connected POCRG: A POCRG sends to the POCDM a message containing its own ID, the care unit ID, the ordering provider ID, the operator ID, the patient/visit ID (or QC ID) and other information related to the test to start. The POCDM identifies the operator, and checks the patient identification (not in case of QC). It then sends the answer back to the POCRG. The answer may be positive and carry the patient's identity (unless in case of QC), or negative and carry the reject reason.

POCT observations produced. The POCRG sends an observation set to the POCDM. The POCDM checks the content of this observation set, stores it and acknowledges it to the POCRG.

POCT observations accepted. The POCDM sends an observation set completed with the patient information, to the Order Filler. The Order Filler acknowledges it. The acknowledgement carries the filler order number attributed to this observation set.

Laboratory Code Set Management: Code set distribution (battery, test, observation).

Label delivery request: This transaction contains the messages for label delivery sent by the Label Information Provider to the Label Broker. These messages include the Label information, patient information and specimen information.

Query for label delivery instruction: This transaction contains the message used by the Label Broker to query the Label Information Provider with a patient identification, and the response message sent back by the Label Information Provider, including the label information, patient information and specimen information.

6. Conclusion

The IHE framework for the Laboratory Department identifies functional components called IHE actors, and specifies their interactions in terms of a set of coordinated, standards-based transactions organized into Integration Profiles. The Integrating the Healthcare Enterprise approach for the Laboratory Department provides a set of Workflow Integration Profiles and a Content Integration Profile. The set of the Workflow Integration Profiles fully integrate diagnostic testing on in vitro specimens; the Content Integration Profile enables laboratories within a healthcare institution as well as standalone laboratories to share their results reports within a broad healthcare community.

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