IHE EUROPE Integrating the Healthcare Enterprise

IHE SERVICES | Building trust in eHealth interoperability

A Practical introduction of selected IHE Profiles

ISHEP IHE Bootcamp 27 November 2015

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ISO Technical Report
Compares three different strategies

1. Profile Based
   Set the functional requirements (use cases) and draw upon IHE Profiles to set an interoperability framework for projects. Tender infrastructure and separately edge system connections/upgrades

2. Customized Standards
   Develop project specific interoperability specifications. Tender in one or more projects.

3. Infrastructure Vendors
   Set the functional objectives for the project, tender and let the infrastructure vendor set the Interoperability Specifications

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Comparing Interoperability Strategies

Implementation Strategies	1 Profile Based		2 Customized Standards	3 - infra-structure vendor
Areas of Impact associated with the interoperability pathway to adoption	Initial Cost	Life Cycle Cost	Initial Cost => Life Cycle Costs	Initial Cost => Life Cycle Costs
Technology				
Determine and Document Interoperability Use Cases				
Development of Interoperability Specification				
Maintenance of Interoperability Specification				
Connect new IT systems and devices to Infrastructure				
Connect existing IT systems/devices to Infrastructure				
Compliance Testing				
Build eHealth Infrastructure				
Change eHealth infrastructure				

Implementation Strategies	1 Profile Based		2 Customized Standards	3 - infra-structure vendor
Areas of Impact associated with the interoperability pathway to adoption	Initial Cost	Life Cycle Cost	Initial Cost => Life Cycle Costs	Initial Cost => Life Cycle Costs
Process				
Engage/educate key stakeholders				
Interoperability Specification Development Schedule Risks		N/A		
Develop implementation and testing schedule				
Change management				
Policy development				
Opportunities for change				
Environmental analysis				
People				
Recruitment of skilled staff - Domain knowledge				
Cost of adding support for new Interoperability use cases				
Awareness and education training				

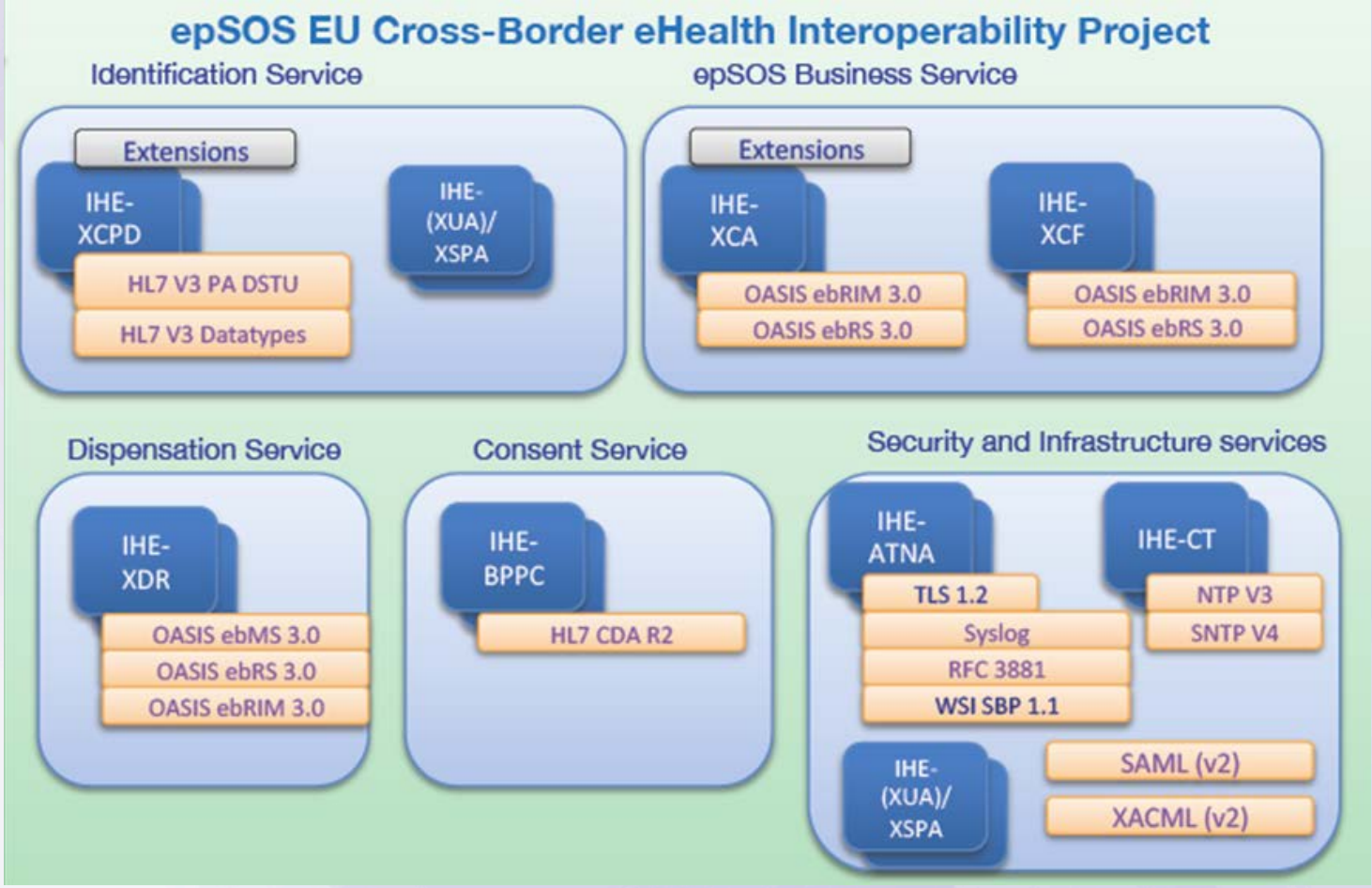
IHE Profiles under EU regulation 1025/2012 (EU MSP)

XCPD	XCF	XCA
XDR	XDM	XDS.b
CT	ATNA	PIX
PDQ	PAM	BPPC
SVS	XUA	PRE
DIS	XPHR	MS
XD LAB	SWF	PIR
XDS-I.b	SWF.b	LTW
LCSD	LAW	XD-SD

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2015_199_R_0011

IHE Profiles prioritisation

- 1. Start Safe: Built on epSOS specification



IHE Profiles prioritisation

- 2. Expand the National Infrastructure (ITI Profiles)

[ATNA] Audit Trail and Node Authentication Basic security through (a) functional access controls, (b) defined security audit logging and (c) secure network communications	**[BPPC]** Basic Patient Privacy Consents method for recording a patient's privacy consent acknowledgement to be used for enforcing basic privacy appropriate to the use.	**[XCA]** Cross-Community Access allows to query and retrieve patient electronic health records held by other communities.
[XDW] Cross Enterprise Workflow coordinates human and applications mediated workflows across multiple organizations.	**[XDS]** Cross Enterprise Document Sharing share and discover electronic health record documents between healthcare enterprises, physician offices, clinics, acute care in-patient facilities and personal health records.	**[XDS-SD]** Cross-enterprise Sharing of Scanned Documents enables electronic records to be made from legacy paper, film, and other unstructured electronic documents.
[XUA] Cross-Enterprise User Assertion communicates claims about the identity of an authenticated principal (user, application, system...) across enterprise boundaries - Federated Identity.	**[EUA]** Enterprise User Authentication enables single sign-on inside an enterprise by facilitating one name per user for participating devices and software.	**[PAM]** Patient Administration Management establishes the continuity and integrity of patient data in and across acute care settings, as well as among ambulatory caregivers.

Listed Profiles are indicatives, please review IHE profiles at http://wiki.ihe.net/index.php?title=Profiles

IHE Profiles prioritisation

- 3. Restructure old systems (i.e LAB, RAD Profiles)

[LTW] Laboratory Testing Workflow integrates ordering and performance of in-vitro diagnostic tests by a clinical laboratory inside a healthcare institution.	**[XD-LAB]** Sharing Laboratory Reports describes the content (human and machine readable) of an electronic clinical laboratory report.	**[LBL]** Laboratory Barcode Labeling integrates robotic specimen container labeling systems with sources of order-related labelling information.
[SWF] Scheduled Workflow integrates ordering, scheduling, imaging acquisition, storage and viewing for Radiology exams.	**[MAMMO]** Mammography Image specifies how Mammography images and evidence objects are created, exchanged, used and displayed.	**[BIR]** Basic Image Review defines baseline features and user interface relevant to simple review of DICOM images.
[XCA-I] Cross-Community Access for Imaging extends XCA to share images, diagnostic reports and related information across communities.	**[BRTO]** Basic Radiation Therapy Objects integrate the flow of treatment planning data from CT to Dose Review for basic treatments	**[MS]** Medical Summaries describes the content and format of Discharge Summaries and Referral Notes.

Listed Profiles are indicatives, please review IHE profiles at
http://wiki.ihe.net/index.php?title=Profiles

IHE Profiles Prioritisation

- 4. See the future (ePrescription, mHealth, etc)

[CMPD] Community Medication Prescription and Dispense integrates prescription, validation and dispensation of medication in the ambulatory sector.	**[PRE]** Pharmacy Prescription Document records a prescription.	**[PADV]** Pharmacy Pharmaceutical Advice Document records pharmaceutical advice in response to a prescription.
[DIS] Pharmacy Dispense Document records the dispensation of medication to a patient.	**[HMW]** Hospital Medication Workflow integrates prescription, validation, dispensation, distribution and administration of medication inside healthcare institutions.	**[PML]** Pharmacy Medication List
[MHD] Mobile access to Health Documents provides a RESTful interface to Document Sharing including XDS.	**[IUA]** Internet User Authorization provides user authorization for RESTful interface.	**[DEC]** Device Enterprise Communication transmits information from medical devices at the point of care to enterprise applications.

Listed Profiles are indicatives, please review IHE profiles at
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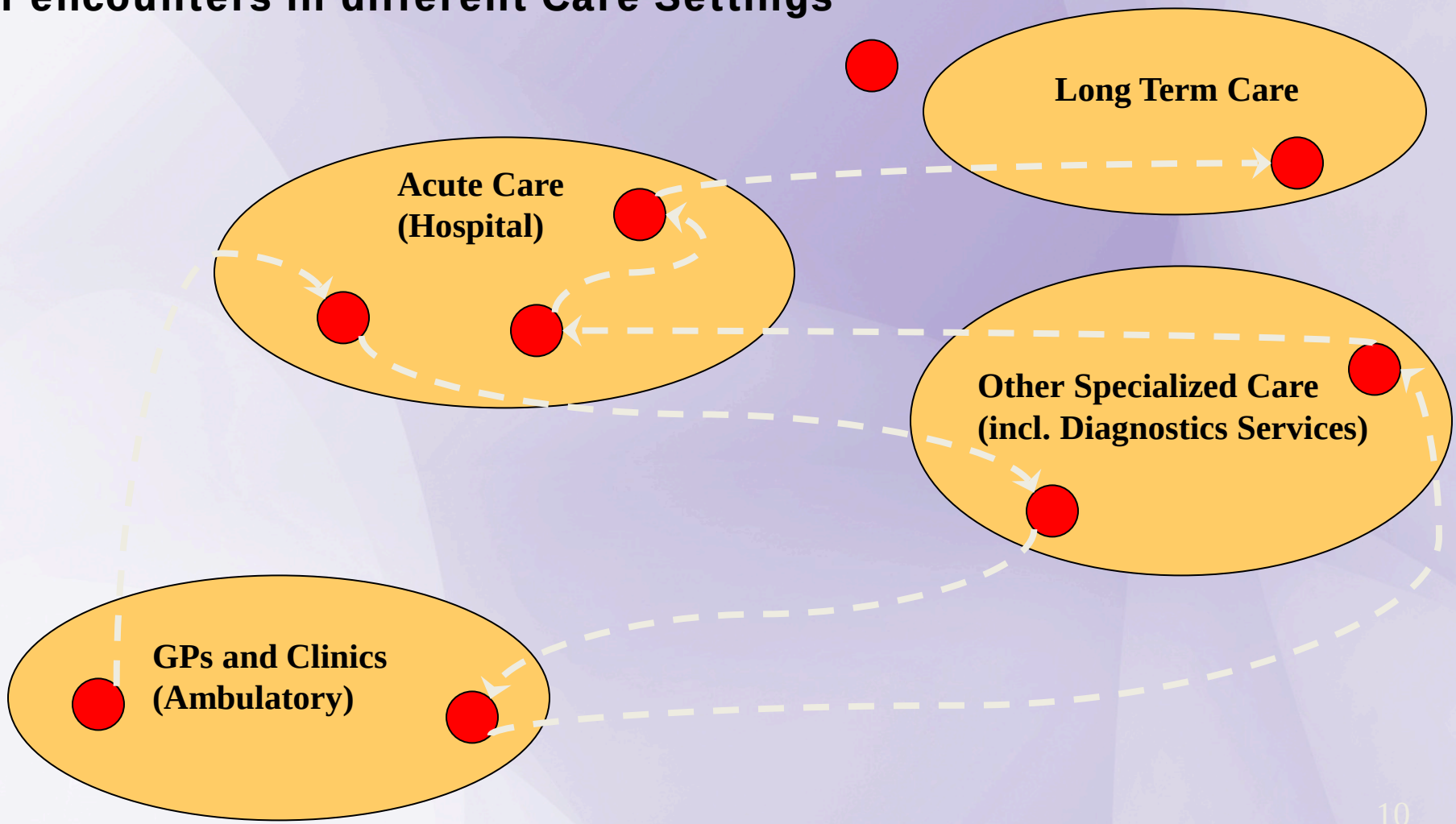
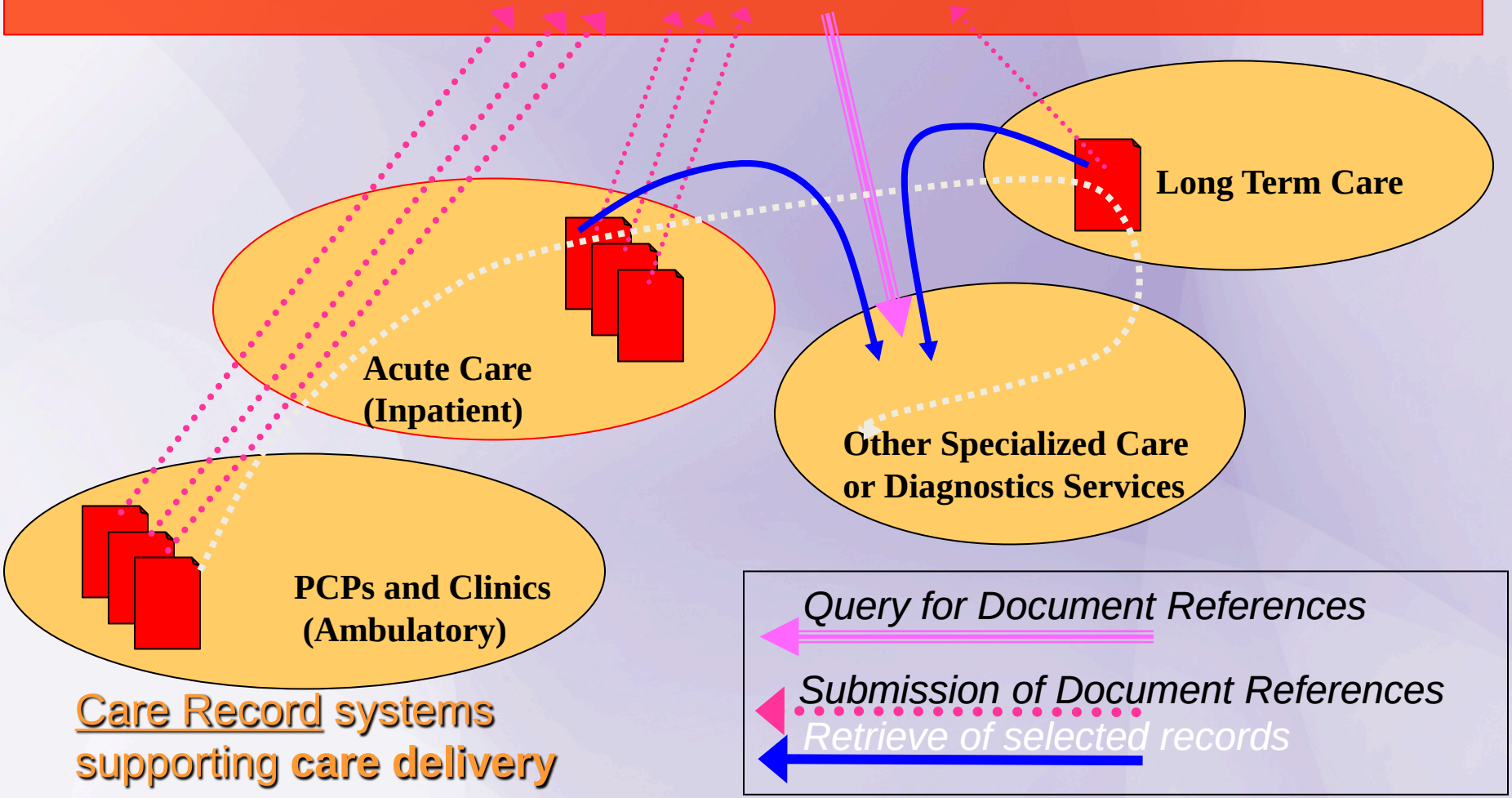
Lets start from an example: Use Case
Publish, share and access health records

Typically, a patient goes through a sequence of encounters in different Care Settings



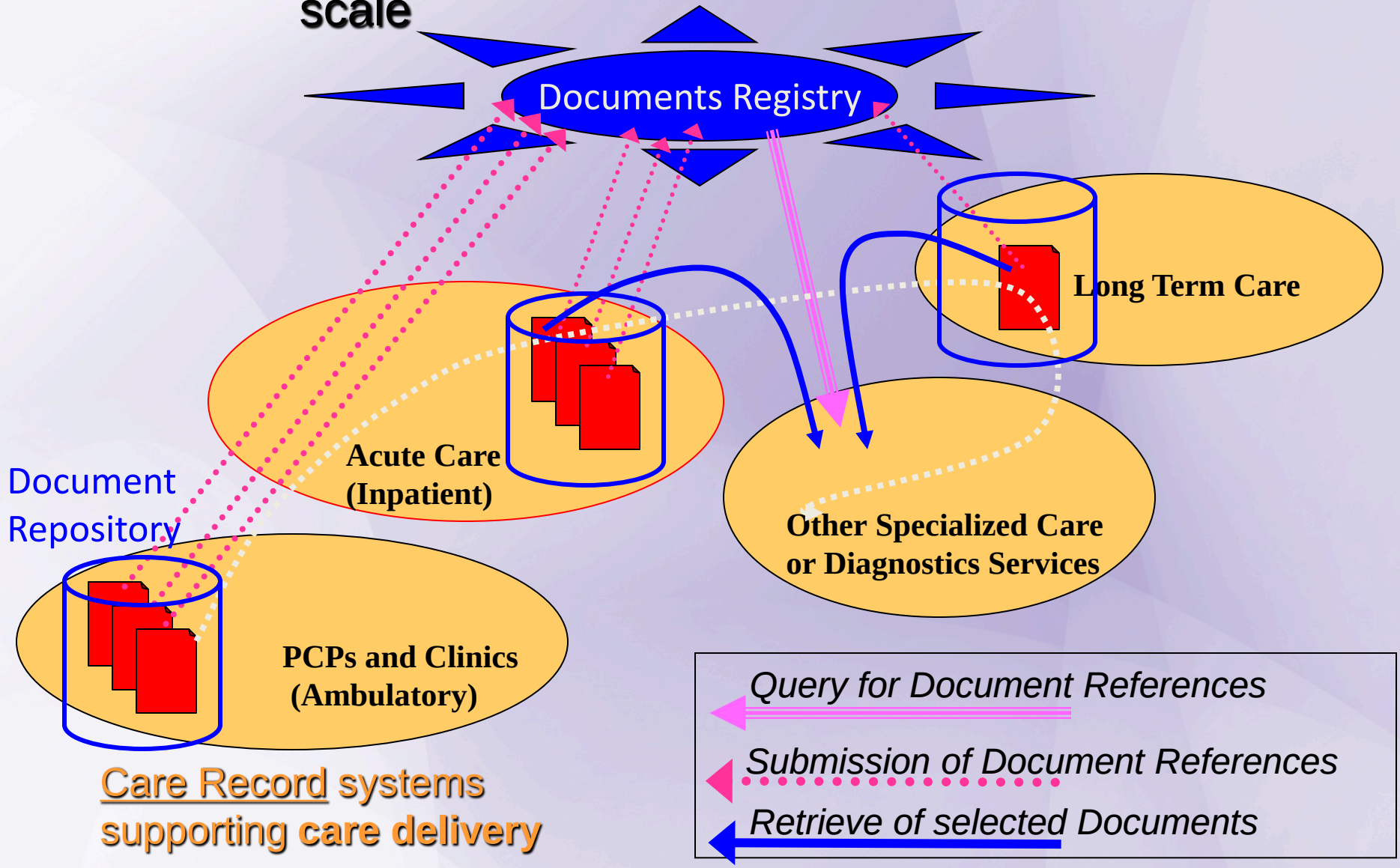
Assembling and accessing health records for integrated care

Document Index: Longitudinal Record as used **across-encounters**



Care Record systems supporting care delivery

XDS Profile: Sharing Health Records at a large scale



Use Cases

- Patient Care Summary (e.g. within a region)
  - Publishing of Care Summaries by providers
  - Access to patient's Care Summary in an emergency
- eReferral between primary and secondary care providers
- Sharing of radiology reports and images between facilities
- Sharing of laboratory reports by clinical laboratories with ordering physicians and other care providers
- ePharmacy between community pharmacy and ambulatory physicians

Main Systems and Responsibilities

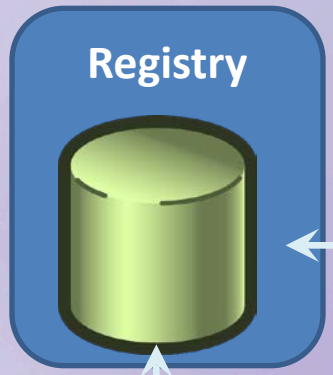
- A document **Repository** is responsible for storing documents in a transparent, secure, reliable and persistent manner and responding to document retrieval requests.
- A document **Registry** is responsible for storing information or metadata about those documents so that the documents of interest for the care of a patient may be easily found, selected and retrieved irrespective of the repository where they are actually stored.
- Any IT system (e.g. point of care) may act as a Document Sources or Document Consumers submitting documents for registration, or querying/retrieving relevant documents.

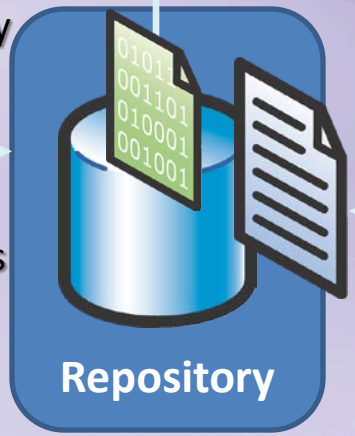
Notes:

- Analogous to a library (book repository) and catalog/index
- The Registry does not have access to the documents – an important separation from security and privacy perspective
- Multiple Repositories can be linked to one Registry

XDS Flow and Interactions

XDS Document (Metadata):
- Class
- Patient Id
- Author
- Facility
- Date of Service
- …





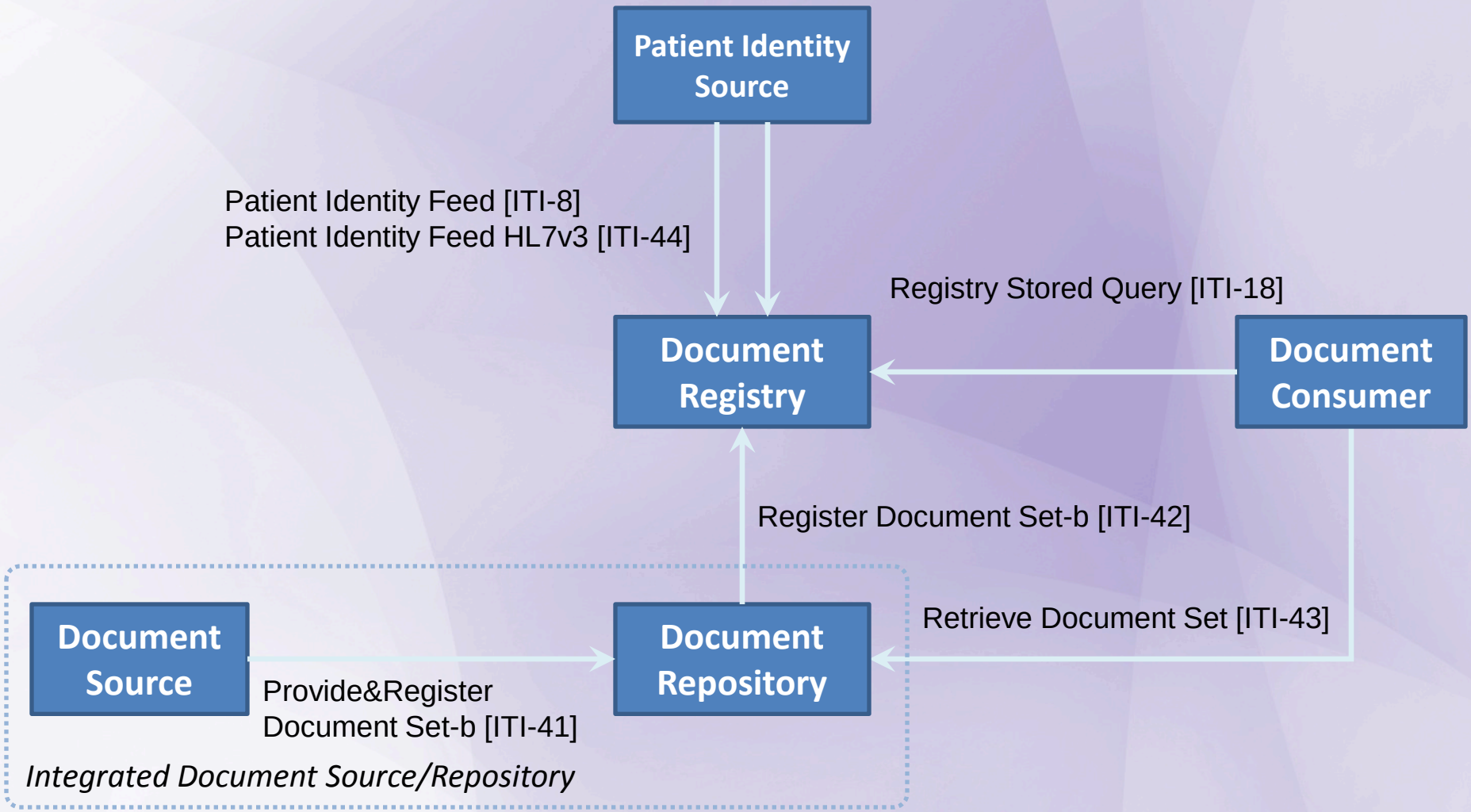
1. Sources post document packages to the Repository

2. Repository registers the documents metadata and pointer with the Registry

3. Consumers search for documents with specific information

4. Consumers retrieve selected documents from Repository (-ies)

XDS Transaction Diagram



XDS Actors

- **Document Source** – producer and publisher of documents, responsible for sending documents and their metadata to a *Document Repository* actor
- **Document Repository** is responsible for both the persistent storage of these documents as well as for their registration with the appropriate *Document Registry*
- **Document Registry** maintains metadata about each registered document and a link to the Document in the *Repository* where it is stored. Responds to queries from *Document Consumer* actors about documents meeting specific criteria.
- **Document Consumer** queries a *Document Registry* for documents meeting certain criteria, and retrieves selected documents from one or more Document Repository actors
- **Patient Identity Source** provides unique identifier for each patient and maintaining a collection of identity traits. This facilitates the validation of patient identifiers by the *Registry Actor* in its interactions with other actors
- **Integrated Document Source/Repository** combines the functionality of the *Document Source* and *Document Repository* actors into a single actor that does not expose the *Provide and Register Document Set* transaction

XDS Transactions (1)

- **Provide and Register Document Set** – For each document in the submitted set, the *Document Source Actor* provides both the documents as an opaque octet stream and the corresponding metadata to the *Document Repository*. The Document Repository is responsible to persistently store these documents, and to register them in the *Document Registry* using the *Register Documents* transaction.
- **Register Document Set** allows a *Document Repository Actor* to register one or more documents with a *Document Registry*, by supplying metadata about each document to be registered. This document metadata will be used to create an XDS Document Entry in the registry.

XDS Transactions (2)

- **Patient Identity Feed** conveys the patient identifier and corroborating demographic data, in order to populate the *Document Registry* with patient identifiers that have been registered for the XDS Affinity Domain. (At least one of the options [ITI-8] or [ITI-44] must be supported.)
- **Registry Stored Query** is issued by the *Document Consumer Actor* to a *Document Registry*. It will return registry metadata containing a list of document entries found to meet the specified criteria including the locations and identifier of each corresponding document in one or more *Document Repositories*.
- **Retrieve Document Set** – initiated by a *Document Consumer*. The *Document Repository* shall return the document set that was specified by the Document Consumer.

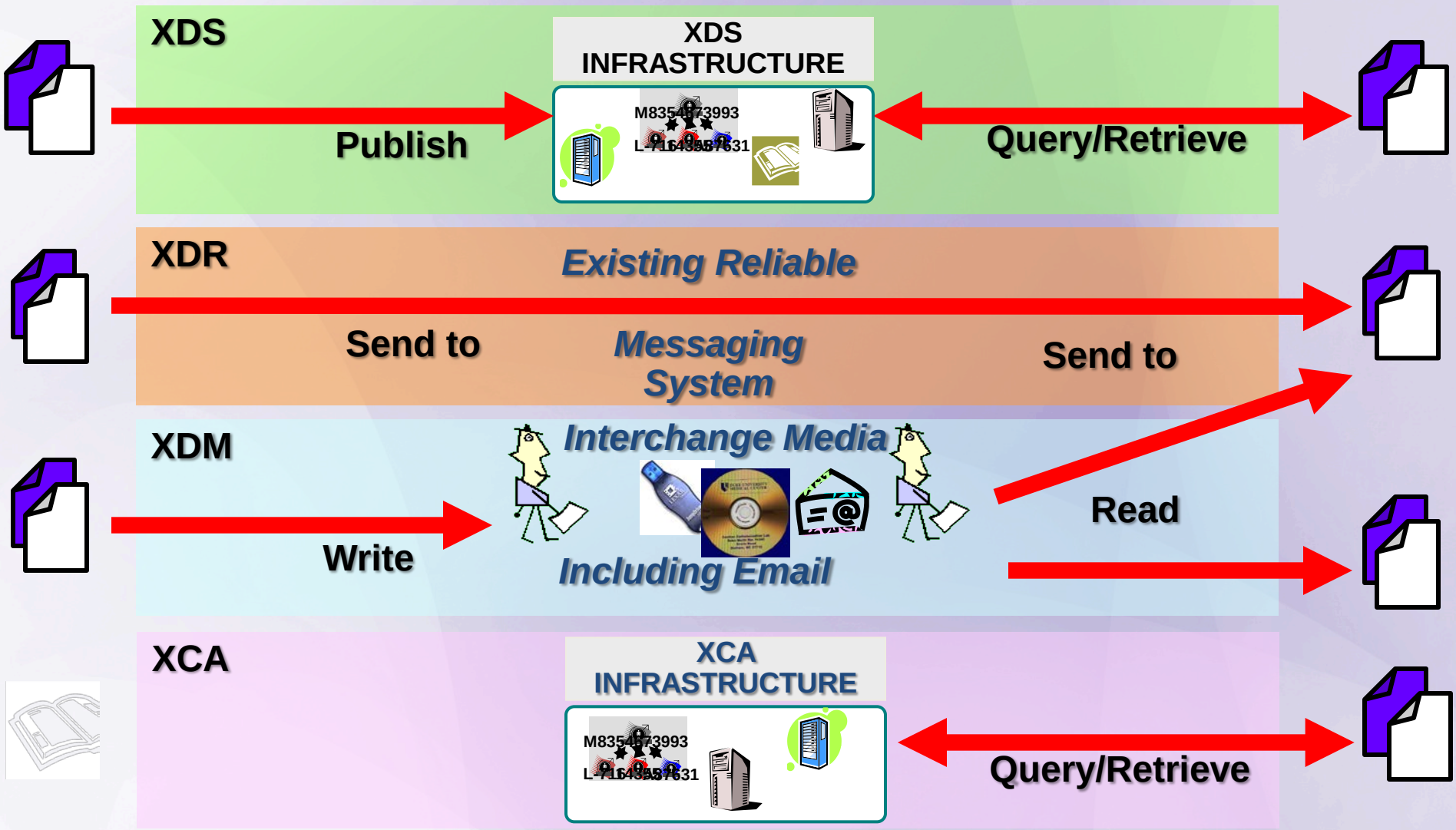
XDS Document Content Types

XDS profile is content agnostic – it can be used with a variety of document types, including:

- XDS-SD: Scanned document, plain text or PDF/A, in HL7 CDA R2 format
- XDS-MS: Medical summary in HL7 CDA format
- XDS-I: Radiology report in plain text of PDF format, or reference to a collection of DICOM SOP Instances in a manifest document in the DICOM Key Object Selection format

Also supported are many other document content profiles specified by the IHE Patient Care Coordination, Laboratory, Cardiology, Pharmacy Technical Frameworks

Health document exchange Profiles



Other profiles to be combined with XDS

- PIX: Patient Identifier Cross-referencing
  - managing multiple local Patient IDs per patient
  - look-up service for cross references
  - support for Master Patient Index (MPI)
- PDQ: Patient Demographics Query
  - find Patient ID based on name, birthdate, sex etc.
- XCPD: Cross-Community Patient Discovery
  - locate communities which hold a patient's relevant health data

Patient Identity Cross-Referencing (PIX)

What Problem is Being Solved?

Problem:

- The industry needs a standards-based method to provide distributed applications with a method to query a patient information server for a list of patients, based on user-defined search criteria, and retrieve a patient's demographic (and, optionally, visit or visit-related) information.

PIX Introduction

- The PIX profile supports the cross-referencing of patient identifiers from multiple Patient Identifier Domains. These cross-referenced patient identifiers can then be used by “identity consumer” systems to correlate information about a single patient from sources that “know” the patient by different identifiers. This allows a clinician to have more complete view of the patient information.
- This integration profile does not define any specific enterprise policies or cross-referencing algorithms

PIX Introduction

The Patient Identifier Cross-referencing Integration Profile (PIX) is targeted at healthcare enterprises of a broad range of sizes (hospital, a clinic, a physician office, etc.). It supports the cross-referencing of patient identifiers from multiple Patient Identifier Domains via the following interactions:

1. The transmission of patient identity information from an identity source to the Patient Identifier Cross-reference Manager.
2. The ability to access the list(s) of cross-referenced patient identifiers either via a query / response or via update notification.

PIX Introduction

The Patient Identifier Cross Referencing Integration Profile supports two domains:

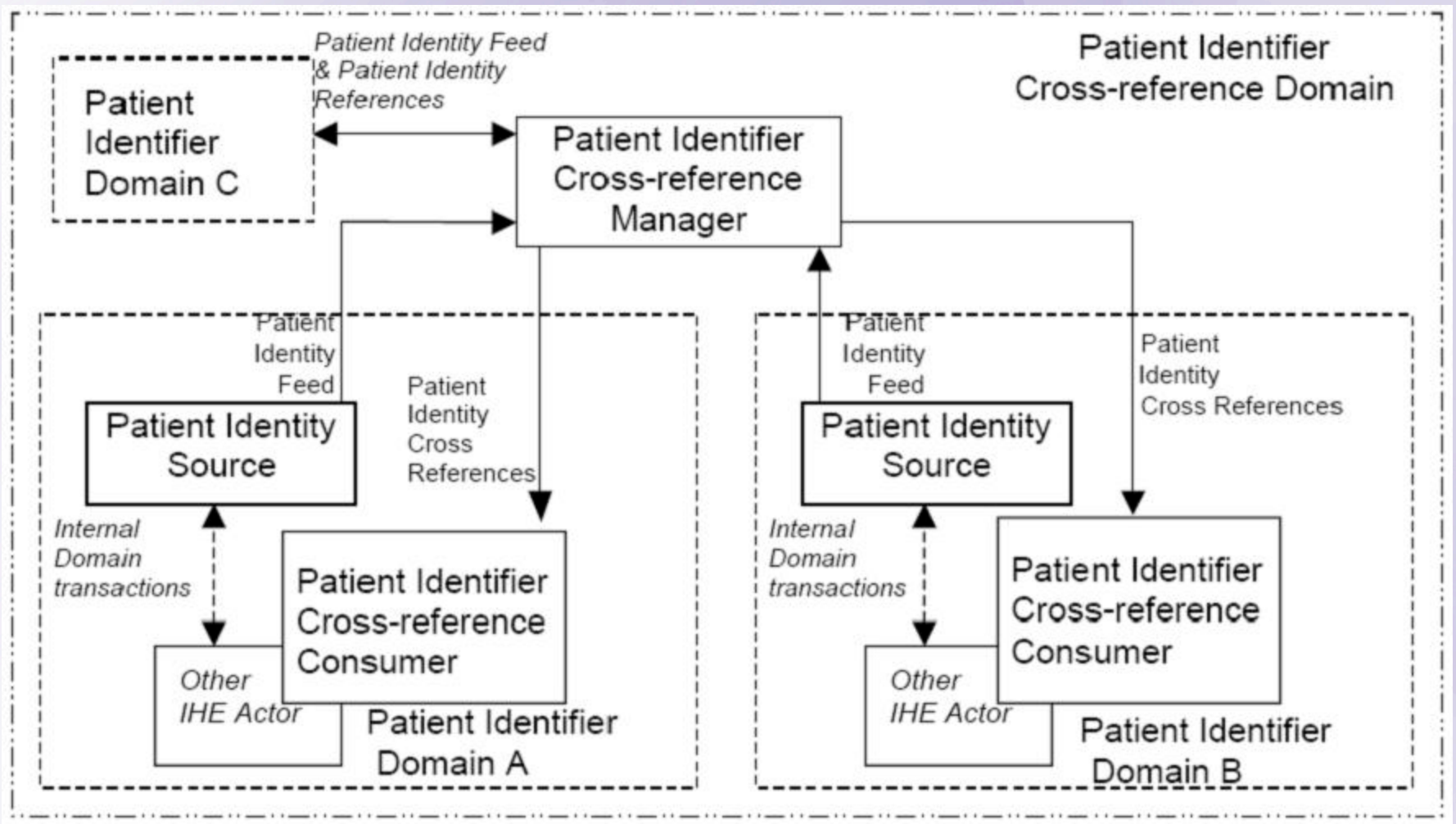
1. A Patient Identifier Domain is defined as a single system or a set of interconnected systems that all share a common identification scheme (an identifier and an assignment process to a patient) and issuing authority for patient identifiers.
2. The Patient Identifier Cross-reference Domain embodies the following assumptions about agreement within the group of individual Patient Identifier Domains:
   - They have agreed to a set of policies that describe how patient identities will be cross-referenced across participating domains;
   - They have agreed to a set of processes for administering these policies;
   - They have agreed to an administration authority for managing these processes and policies.

PIX Use Case

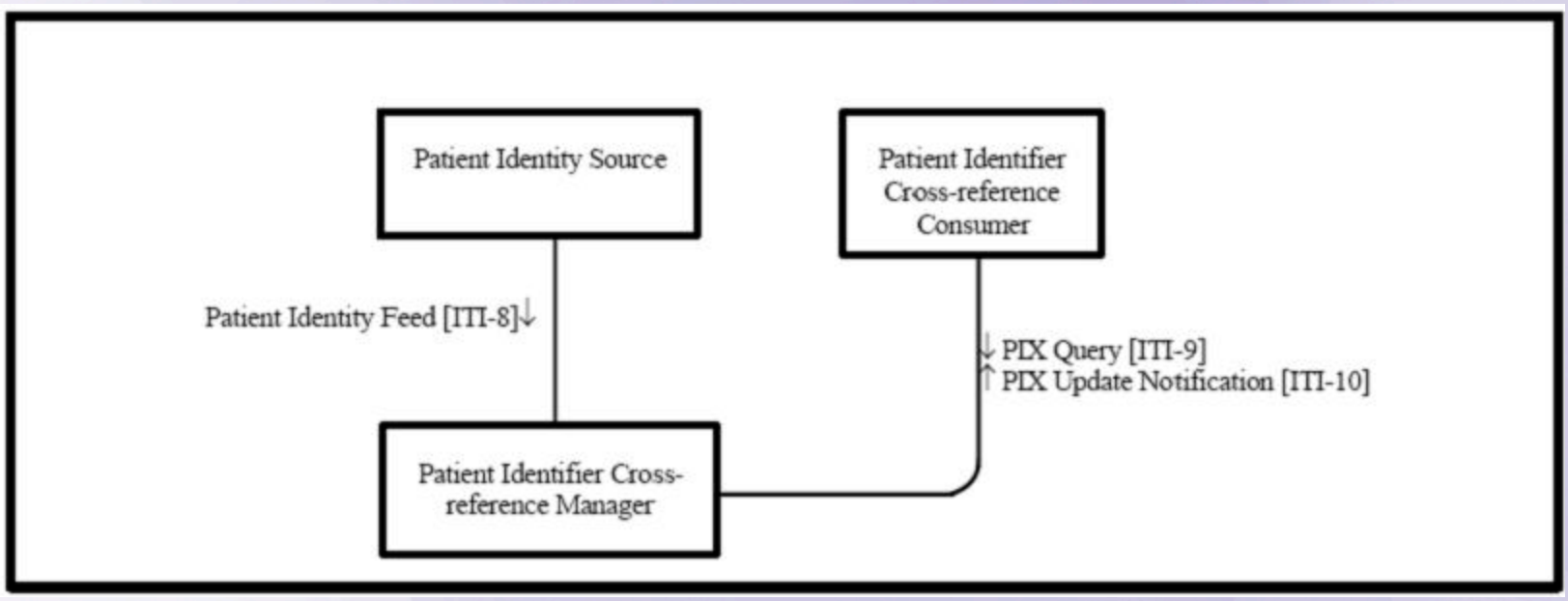
Multiple Identifier Domains within an Enterprise.

- Clinician seeks to monitor data across Intensive Care and hospital's laboratory system
- Essentially two different patient identifier domains
- Hospital ADT system (acts as the Patient Identity Source) provides Patient Identity Feed to the PIX Manager
- Intensive Care system would also send a PIX Feed to the PIX Manager
- Subsequently any authorized system could use the PIX Manager to determine alternate identifiers

PIX Process Flow Diagram



PIX Transaction Diagram



PIX Actors

- Actors
  - **Patient Identity Source** – Provides notification to the Patient Identifier Cross-reference Manager and Document Registry for any patient identification related events including: creation, updates, merges, etc.
  - **Patient Identifier Cross-reference Consumer** – Uses patient identifiers provided by Patient Identity Source to ensure that XDS Documents metadata registered is associated with a known patient and updates patient identity in document metadata by tracking identity change operations (e.g., merge).
  - **Patient Identifier Cross-reference Manager** – Serves a well-defined set of Patient Identification Domains. Based on information provided in each Patient Identification Domain by a Patient Identification Source Actor, it manages the cross-referencing of patient identifiers across Patient Identification Domains.

PIX Transactions and Options

- Transactions
  - **Patient Identity Feed [ITI-8]** – Communicates patient information, including corroborating demographic data, after a patient's identity is established, modified or merged or after the key corroborating demographic data has been modified.
  - **PIX Query [ITI-9]** – Request by the Patient Identifier Cross-reference Consumer Actor for a list of patient identifiers that correspond to a patient identifier known by the consumer.
  - **PIX Update Notification [ITI-10]** – The Patient Identifier Cross-reference Manager Actor provides notification of updates to patient identifier cross-reference associations to Patient Identifier Cross-reference Consumers that have registered their interest in receiving such notifications.
- Options
  - **PIX Update Notification**

XDS "Family" of Integration Profiles

- CT: Consistent Time
  - synchronize all systems to common time
  - needed for audit trail, access rights etc.

- ATNA: Audit Trail and Node Authentication
  - Basic security functions: centralized audit trail, authentication of systems (not users), optional encryption for transport connections
  - Required by IHE for all XDS implementations

XDS Support Profiles

- XUA: Cross-enterprise User Assertion
  - user authentication in a distributed system
- HPD: Healthcare Provider Directory
  - Details of registered healthcare professionals
- XDW : Cross Enterprise Document Workflow
  - Handles sharing a workflow across different enterprises.

XDS Support Profiles

- DSUB : Document Submission and Notification
  - Send notification that documents are available
- DSG : Digital Signature
  - Signing of documents in repository/registry

XDS Content Profiles

- Outside scope of XDS; layer on top of XDS
- Content Profiles
  - Document use cases and translation of document content into registry metadata
  - Publishable separately
  - Generated (mostly) by other committees (PCC, Radiology, Lab etc)
- Of concern only to Document Source and Document Consumer actors
- Base standards for Content Profiles include: HL7 CDA, DICOM, etc.

XDS Content Profiles

- Content Profiles define document formats and XDS extensions for specific applications:
  - XDS-MS: Medical Summaries
  - XPHR: Exchange of Personal Health Record Content
  - PRE/DIS/PADV: Prescription/Dispensation/Advice
  - EDR: Emergency Department Referral
  - XDS-SD: Scanned Documents
  - XDS-Lab: Lab Reports
  - XDS-I: DICOM Images
  - …

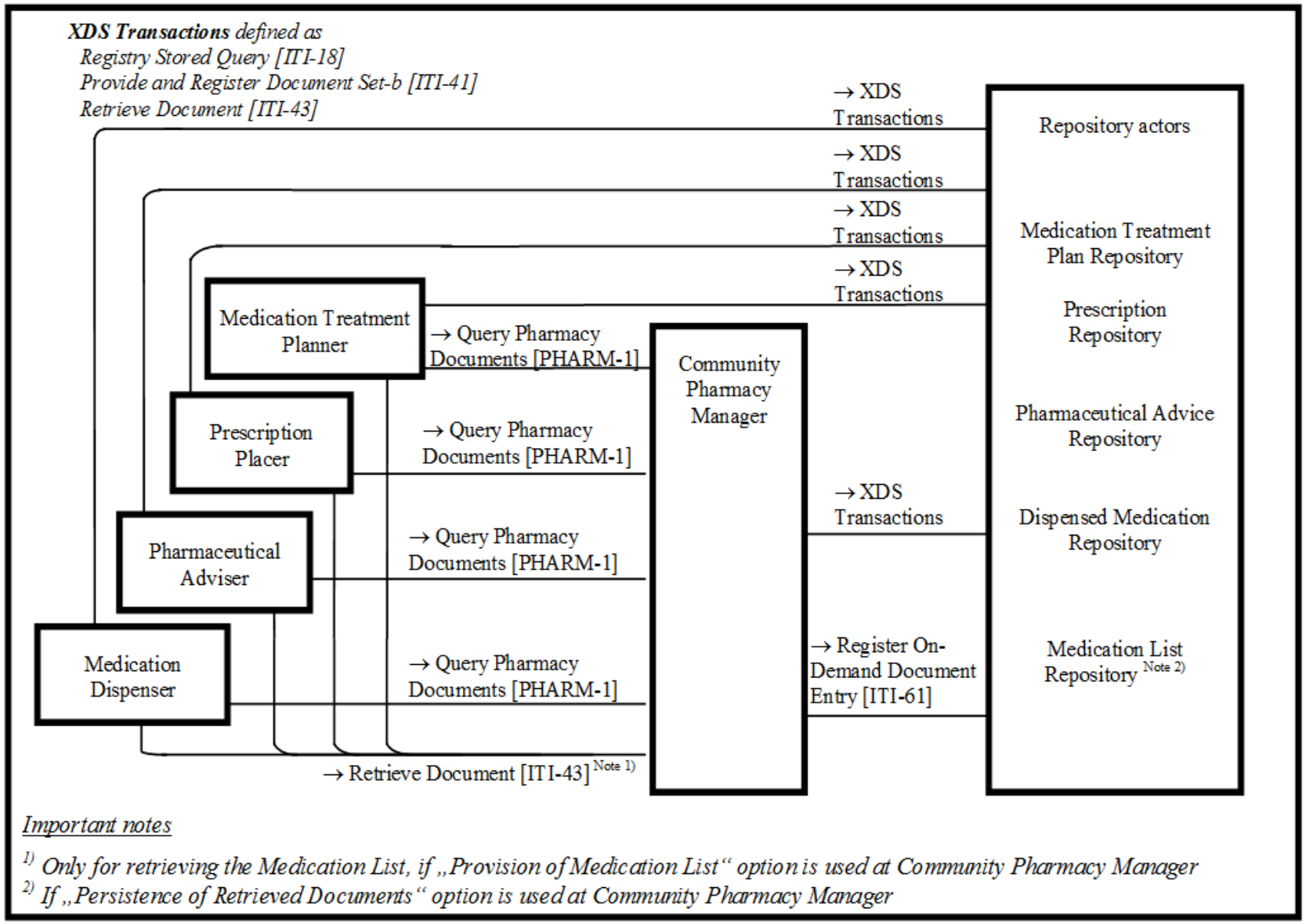
Pharmacy Profiles

Pharmacy Profiles

Currently 2 sets of profiles:

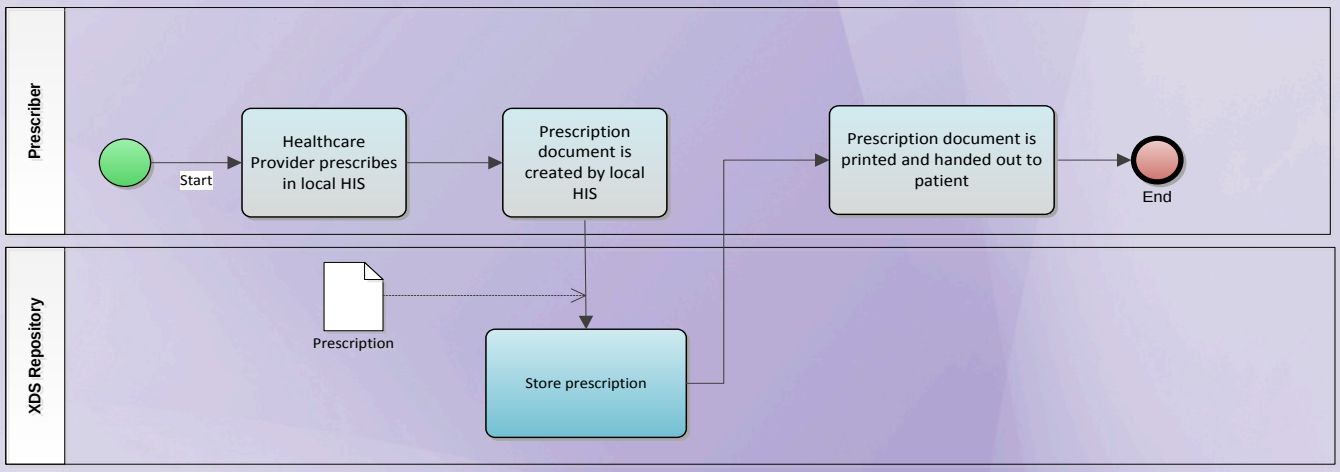
- Community Pharmacy
  - Document-based (XDS), Query-Retrieve model
- Hospital
  - Message-based (HL7 v2), “push” model

Community Pharmacy

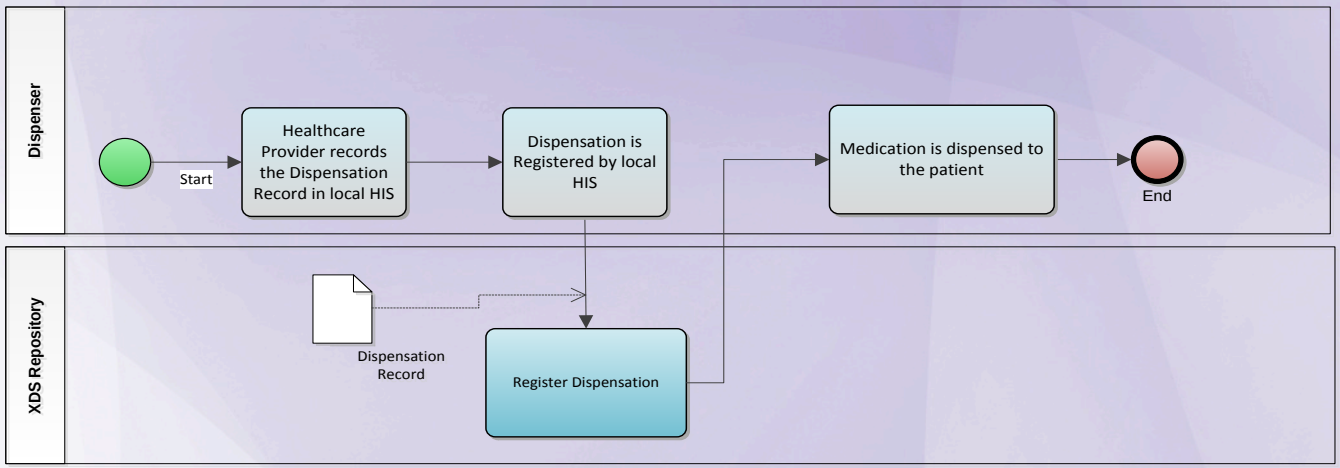


Create Prescriptions & Dispense Records

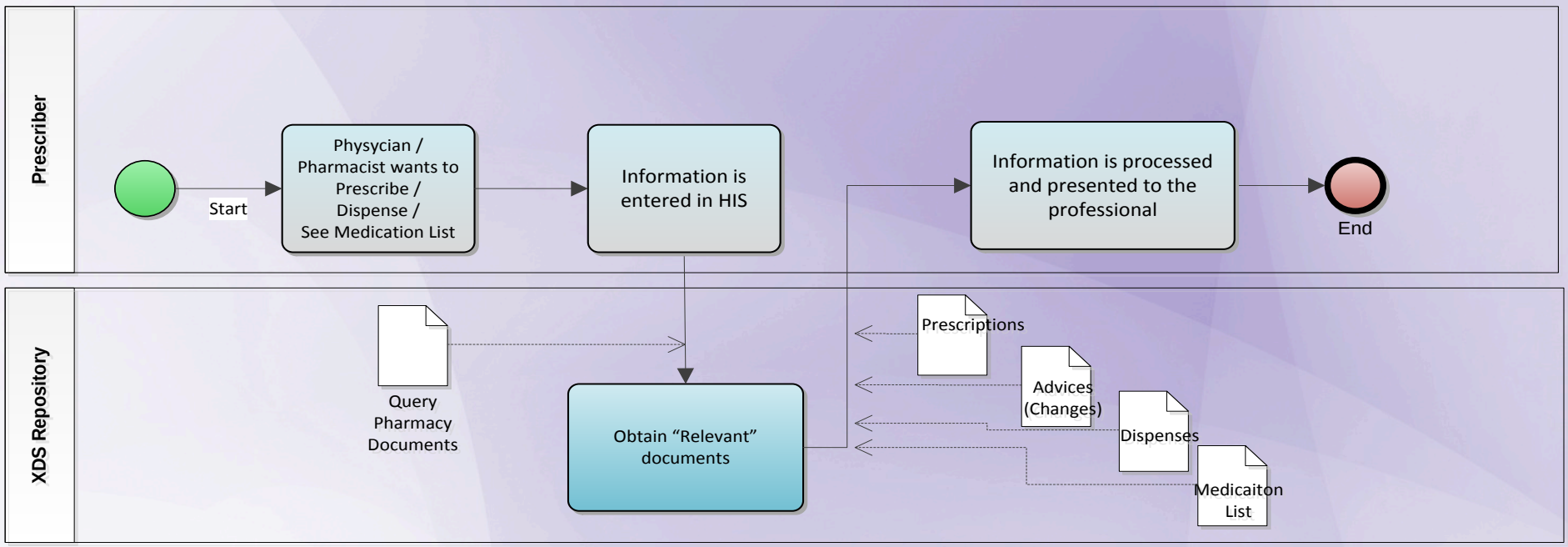
Create Prescription



Register Dispense



Query Pharmacy documents



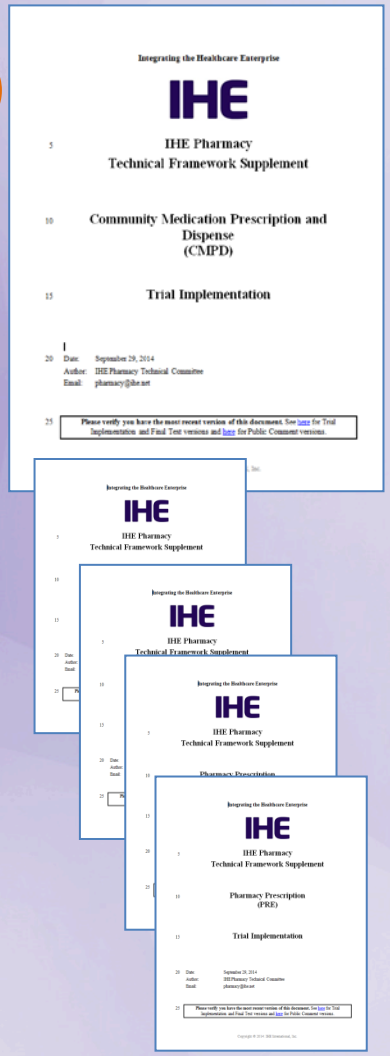
Community Pharmacy profiles

Workflow

- **Community Medication Prescription and Dispense (CMPD)**
  - Technical Integration, Actors, Transactions, based on IHE ITI XDS

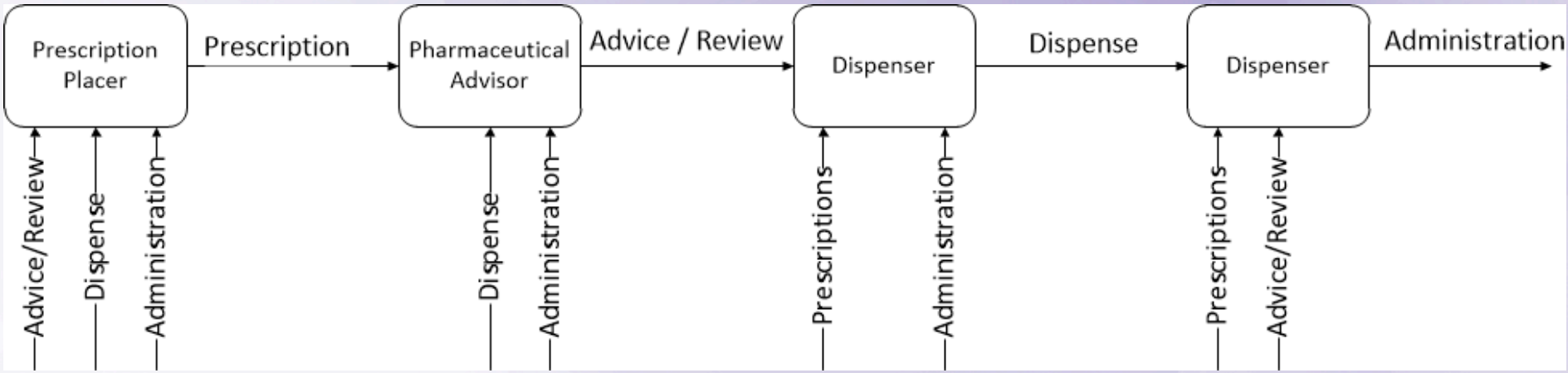
Content (based on HL7v3 CDA extended with HL7 Medication CMETs)

- **Prescription (PRE)**
  - Order / authorization to dispense
- **Dispense (DIS)**
  - Dispense record
- **Pharmaceutical Advice (PADV)**
  - Order changes, pharmaceutical validation
- **Treatment Plan (MTP)**
  - Medication treatment
- **Pharmacy Medication List (PML)**
  - List of medications planned, prescribed, taken

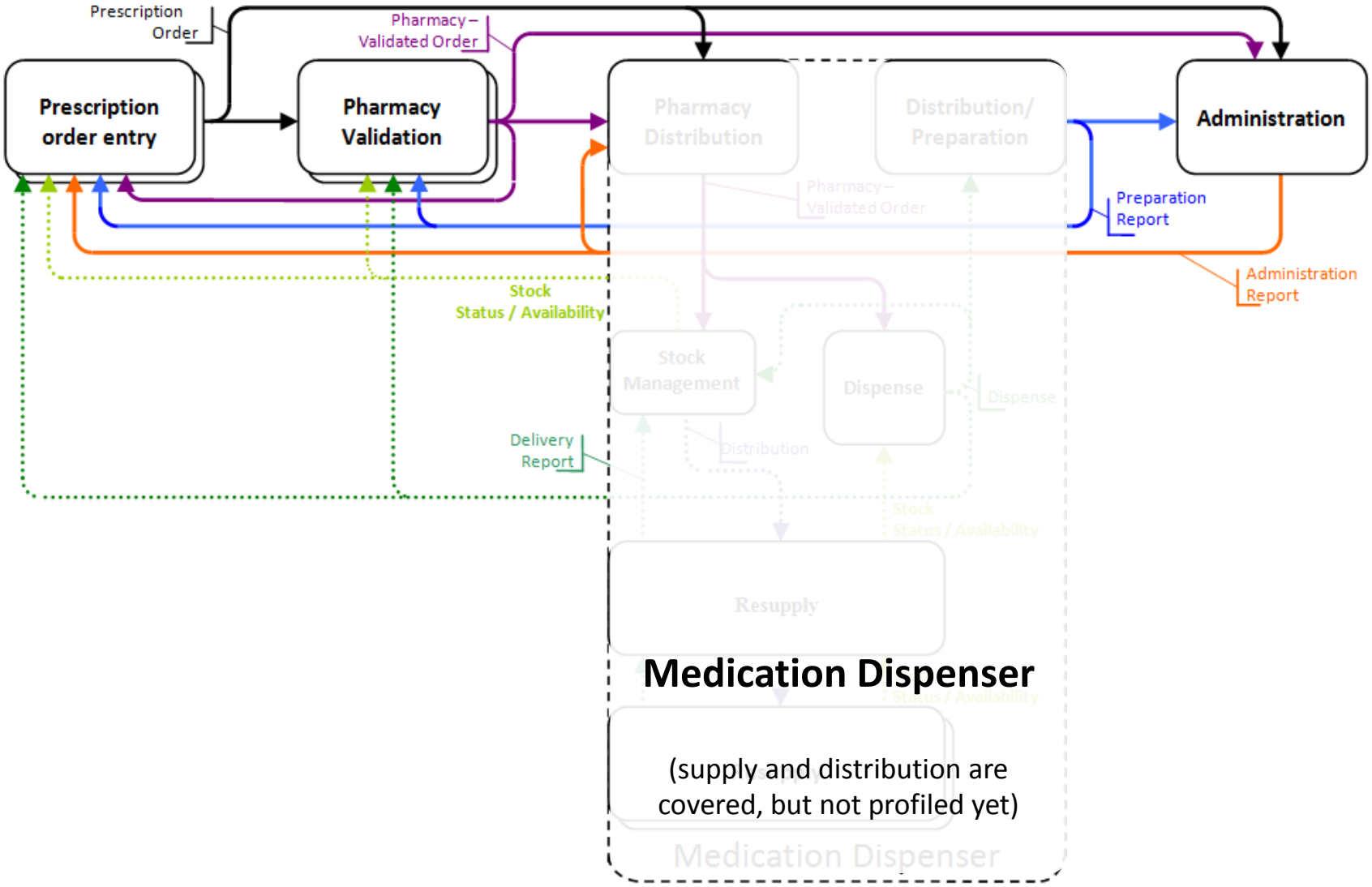


Hospital Pharmacy

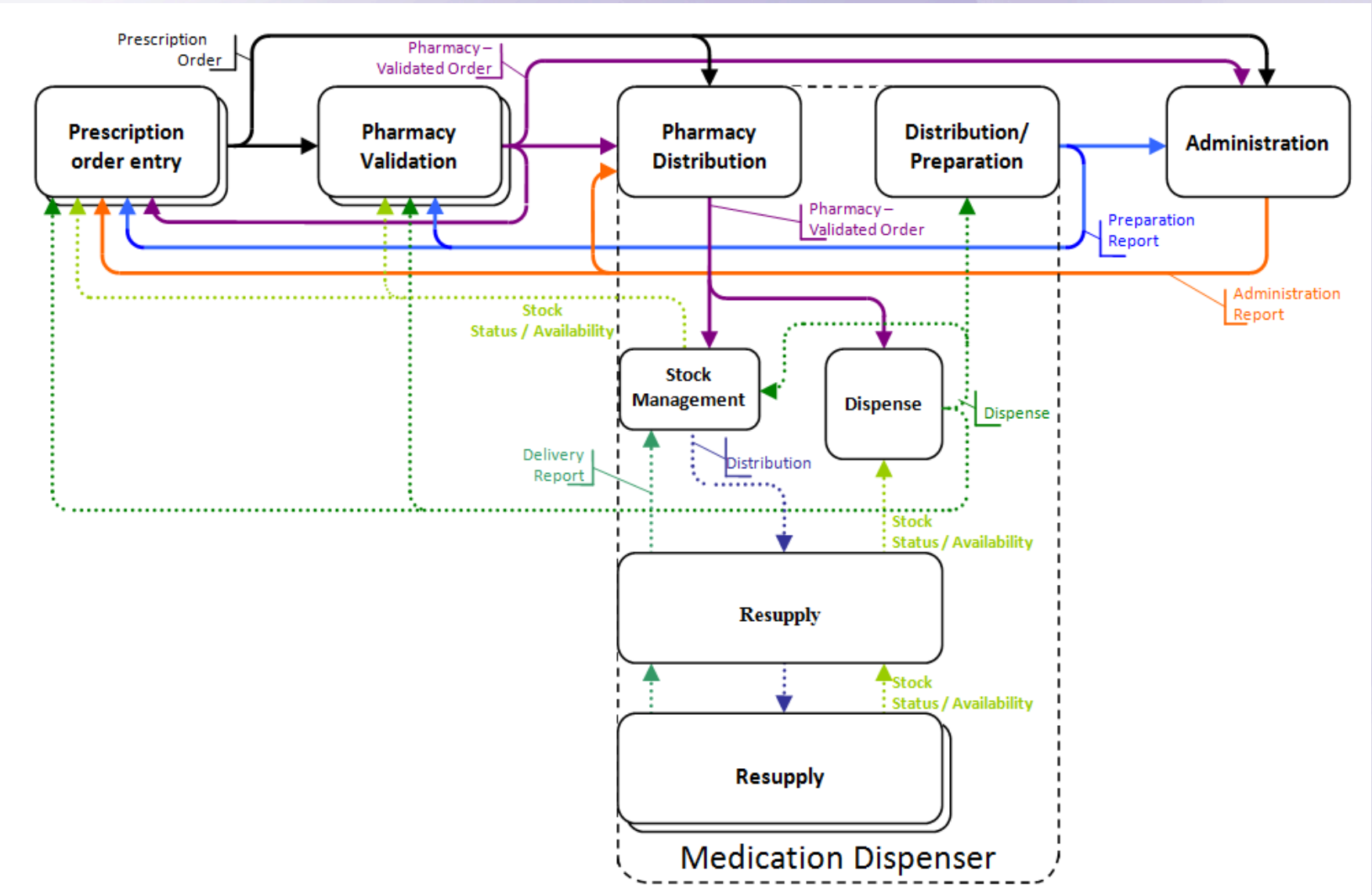
- Same principles
- Several systems with different functionalities
- “Real-time” communication
- Also includes administration
- Message-based (point-to-point)



Point-to-point communication



Point-to-point communication



Challenges being solved

- “We need a central repository of prescriptions and related data”
- We need an e-Prescription programme
- We need to keep track of dispensing
- We need a medication record for ICA checks

- We need to integrate all systems in a hospital concerning medication – from prescription to nurses, including automated dispensers

Interoperability practice

- "We need to integrate with our automated dispenser but the system cannot send prescriptions to it"

- "Need to integrate our dispensing systems but
  - some are manual, other automatic
  - some are nominative, others are for ward medication
  - some are unitdose, others are multidose

- "Need to integrate with chemotherapy ordering system, to have one list of medications per patient"..
  - ...but that cannot trigger double dispensation

IHE EUROPE Integrating the Healthcare Enterprise

"The best way to predict the future is to invent it."
Alan Kay

Thank You!

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