Azure Queues

Practical Tutorial On Messaging

Lab 08

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Lab08_MessagingHealthcareMisc. slides provide context for Azure messaging services applied to Clinical Scenarios

Messaging Services In Healthcare

Real – World Use Cases?

Interoperability & Information Exchange
- HL7 / CCD, FHIR, HIE EMR Interfaces APIs
- Monolithic Inpatient & Ambulatory Systems
- Notifications, Adverse Events (Meds / Allergies)
- Registration ADT, Lab/Rad, ORM/ORU Orders/Results

Regulatory/ Legal & Compliance
- MIPS/MACRA MU $$ Penalties/Incentives
- Medical Record Retention

Pop Health, Fee-For-Service → Pay-For-Perfomance
- IOT, Sensors, Generic Drugs, Opioid Epidemic
- Precision Med Mgmt. "By 2020, a projected 9 out of 10 top selling drugs by revenue will be specialty meds"

Behavioral Health, Tele-Health, Home Health
- Predictive Analytics (Hospital LOS, Sepsis, ED Readmissions, Claims / Revenue Cycle)
- AI Apps (Skin Cancer, Telemetry /Falls, Fitbit Heart rate/Sleep/Gait)

Why does this matter?

Azure Storage Queue
Azure Service Bus Queue
Azure Service Bus Topic
Azure IoT Hub
Azure Event Hubs
Azure Event Grid
Azure Notification Hubs

Message Brokering:
Service Bus Queues
- Mediates between HL7 clinical applications (1:1 and 1:many)
- Focus on ADT, ORU and ORM messages from HL7 standard
- Supports message validation, sequencing, duplicates, retry's

Healthcare Integration?

Enterprise systems consist of many logical endpoints

- COTS apps, EMR (medical records) services, on-prem / cloud apps, web apps, devices, appliances, highly customized and mostly ancient and/or monolithic software
- Endpoints expose a set of inputs and outputswhichcompromise
- Protocols –e.g. TCP/IP, HTTP, FileSystem, FTP, MQ, SMTP, POP3, MLLP etc…
- Message Standards? * Formats, Binary (C/COBOL), XML, Industry (HL7, EDI), User defined
- Adoption of messaging Standards?* HL7/CCD, FHIR …

  SMART: Substitutable Medical Applications Reusable Technologies

  FHIR: Fast Healthcare Interoperable Resources
  - Uses open standards, oAUTH2, Open ID for authentication
  - HL7 standard for API-based resources
  - Builds on previous standards such as CA and CCDA exchange

Integration is connecting disparate endpoints in meaningful ways to achieve Interoperability

- Route, Transform, Enrich, Filter, Monitor, Distribute, Decompose, Correlate, Pub/Sub, Request/Reply, Aggregate, Complex Event Processing, telemetry, tracking, sensors, IOT …
- Bridges, Gateways, Enterprise Service Bus

Booming business of Interface Engines …

- Corepoint Health/InterSystems, Lawson/Cloverleaf Integration Suite, Orion Health/Rhapsody, Siemens/OPENLink, Mirth/Connect … IBM MQ/IIB *IBM* Watson Health

Health Care Business Challenge

Health care organizations are complex business entities with many distinct, but connected parts. For a hospitals, these departments can include Admission, Labs, Radiology, Pharmacy, Inpatient / Outpatient Services, Medical Imaging, Rev. Cycle

Connectivity

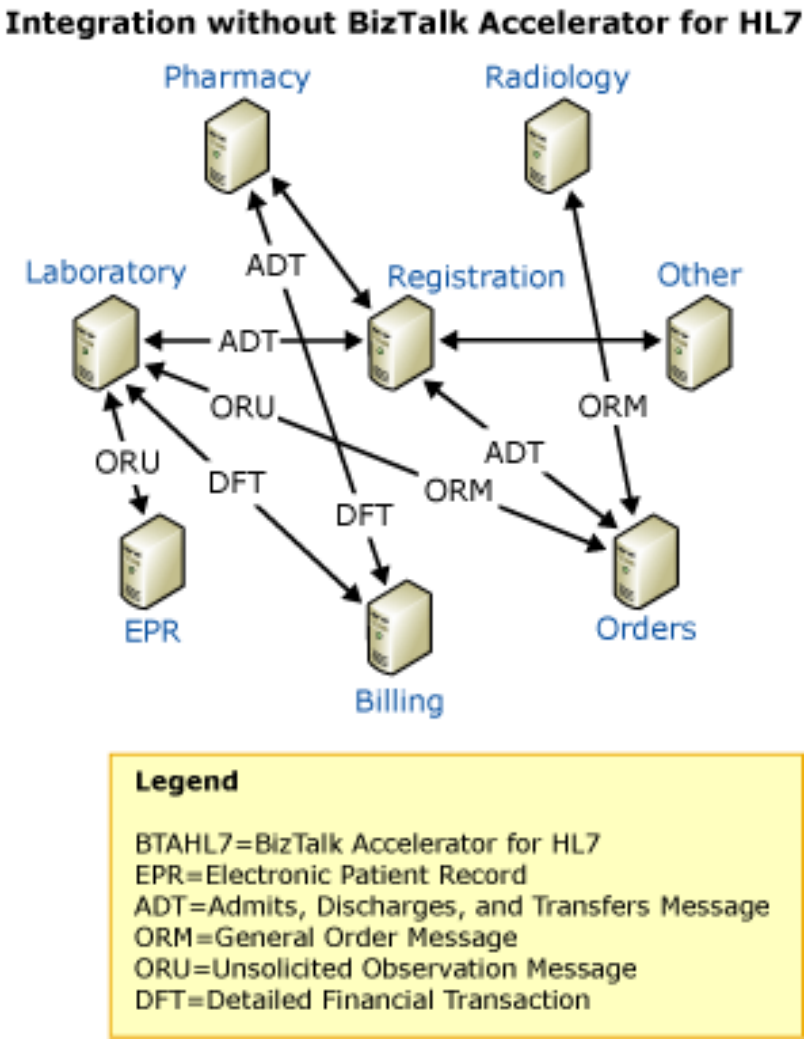
– Need to simplify application connectivity to provide a flexible and dynamic infrastructure

Route and transform messages FROM anywhere, TO anywhere

–Support a wide range of protocols & data formats, Interactions and Operations

Simple programming

–Message Flows to describe application connectivity

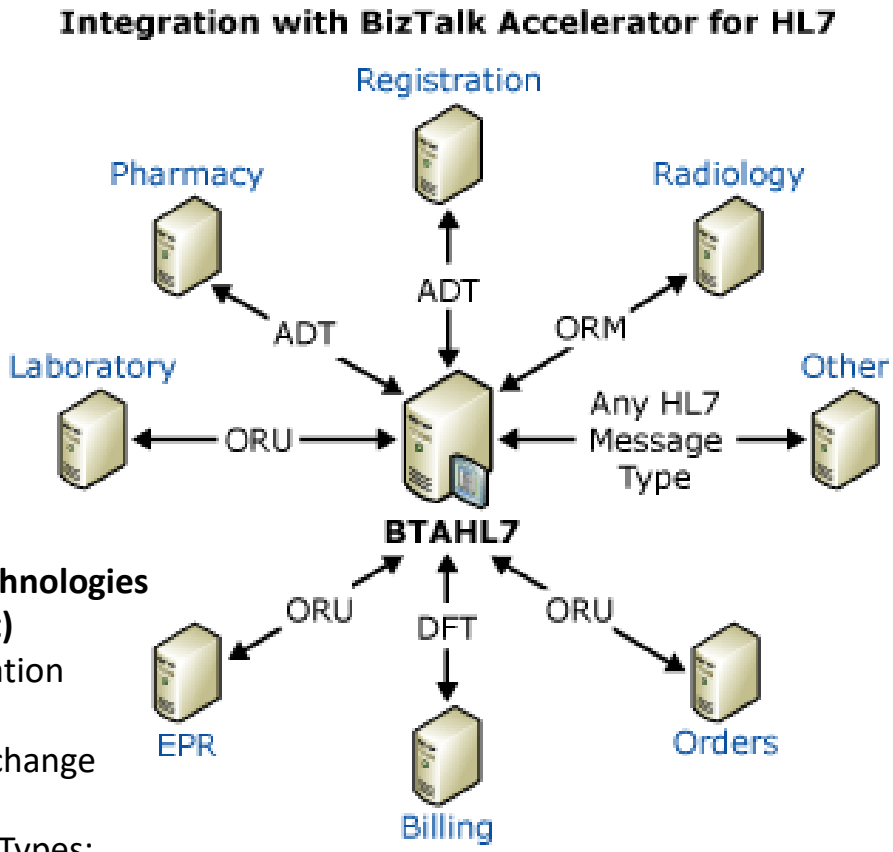


https://docs.microsoft.com/en-us/biztalk/adapters-and-accelerators/accelerator-hl7/sample-business-scenario

Health Care Business Challenge

Standards & Integrated message services specific to the healthcare industry

HL7 / SMART FHIR has created common formats for clinical data, in the form of flat file schemas, and moving away from point-to-point connections to interfaced system models based on a hub-and-spoke arrangement, as shown in the following figure.



SMART: Substitutable Medical Applications Reusable Technologies
FHIR: Fast Healthcare Interoperable Resources (Argonaut)

- Uses open standards, oAUTH2, Open ID for authentication
- HL7 standard for API-based resources
- Builds on previous standards such as CA and CCDA exchange

Clinical Applications Coded and Sample HIPPA Documents Types:

- 837: Claims submission
- 270: Eligibility and Benefits Inquiry Request
- 271: Eligibility and Benefits Response

Legend

BTAHL7=BizTalk Accelerator for HL7
EPR=Electronic Patient Record
ADT=Admits, Discharges, and Transfers Messages
ORM=General Order Messages
ORU=Unsolicited Observation Message
DFT=Detailed Financial Transaction

https://docs.microsoft.com/en-us/biztalk/adapters-and-accelerators/accelerator-hl7/the-need-for-health-care-systems-integration

HL7 Messages

- HL7 |^ pipe and hat format, the MDM-T01 (Original document notification) message would look like this:

MSH|^~\&|MedOne|FACILITY
A|CARECENTER^HL7NOTES|HFH|20060105180000| D61AFEF1-B10E-11D5-8666-0004ACD80749|MDM^T01|20060105180000999999|T|2.3
EVN|T01|20060105180000
PID|1||1112388^BS||ESPARZA^MARIA
PV1|1|O|BS^15^15
TXA|1|GENNOTES|TX|200601051800|50041^SMITH^CHRIS^M|200601051800|200601051800|200601051800|||
SC^ROBINSON^JESSICA^A|1234567890|||FILE0001.TXT|PR

https://docs.microsoft.com/en-us/biztalk/adapters-and-accelerators/accelerator-hl7/hl7-message-structure

L8 DEMOS

Demo1: [10min] Azure Power Shell Messages
- Basic, Queue Storage with AzureRM Modules

Demo2: [20min] Azure Storage Queue Services
- Intermediate, VS Web App C#
- Create/Delete Queue, Add/Peek/Read/Delete Message, Get queue Length

Demo3: [30min] Azure Service Bus Queues
- Advanced, VS Web App C#
- Pub/Sub Message Queues, multi-tier app Customer Orders

Deep Azure Assignment 8

Code samples were collected from various Microsoft & GitHub repositories

https://azure.microsoft.com/en-us/resources/samples/?sort=0

References for HW8 Samples by Anudeep Sharma:

- **Getting Started with Service - Service Bus Queue Basic - in .Net**

Getting started on managing Service Bus Queues with basic features in C#
https://azure.microsoft.com/en-us/resources/samples/service-bus-dotnet-manage-queue-with-basic-features/

- **Getting Started with Service - Service Bus Queue Advance Features - in .Net**

Getting started on managing Service Bus Queues with advanced features in C# - sessions, dead-lettering, de-duplication and auto-deletion of idle entries
https://azure.microsoft.com/en-us/resources/samples/service-bus-dotnet-manage-queue-with-advanced-features/

Misc. / Healthcare Industry-specific Cortana Intelligence solutions

- **Getting Started with Service - Service Bus With Claim Based Authorization - in .Net**

Getting started on managing Service Bus with claims based authorization in C#
https://azure.microsoft.com/en-us/resources/samples/service-bus-dotnet-manage-with-claims-based-authorization/

- **Spark with Kafka (preview) on HDInsight (Event Hubs – See Arch Diagram Below)**

Learn how to use Spark Structured Streaming to read data from Apache Kafka on Azure HDInsight.
https://gallery.cortanaintelligence.com/Tutorial/Spark-with-Kafka-preview-on-HDInsight

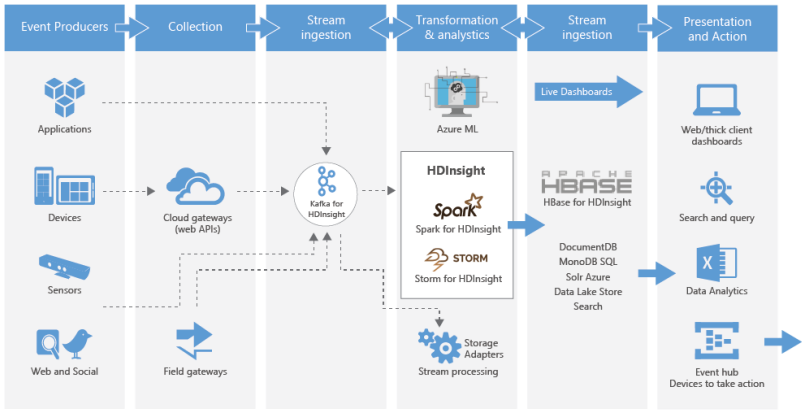
Misc.

Predicting Length of Stay in Hospitals
https://gallery.cortanaintelligence.com/Solution/Predicting-Length-of-Stay-in-Hospitals-1

Population Health Management for Healthcare
https://gallery.cortanaintelligence.com/Solution/Population-Health-Management-for-Healthcare-6

Heart Disease Prediction
https://gallery.cortanaintelligence.com/Experiment/Heart-Disease-Prediction-2

Diagnosing Schizophrenia: A Second Opinion for Doctors
https://gallery.cortanaintelligence.com/Experiment/Diagnosing-Schizophrenia-A-Second-Opinion-for-Doctors



APPENDIX

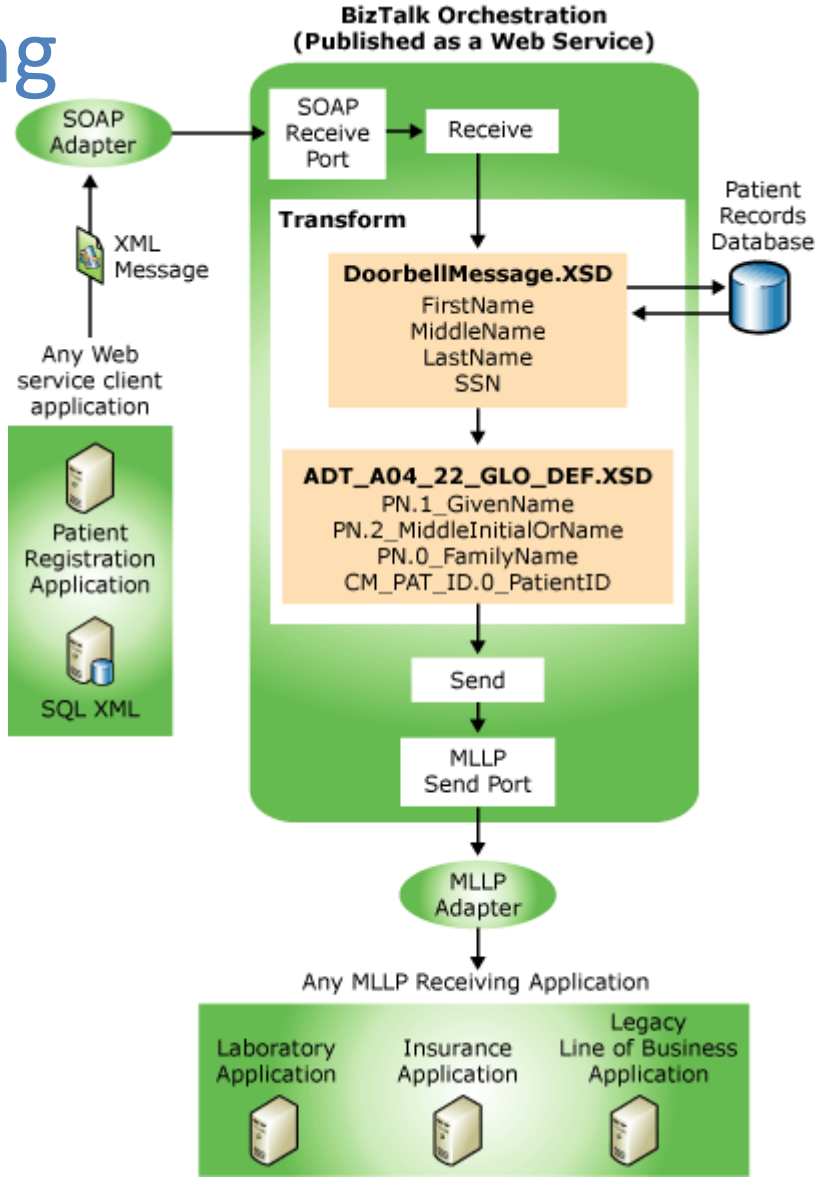
MISC. OPTIONAL FYI SLIDES

HL7 Tutorial – Messaging

HL7 tutorial provides step-by-step procedures for using MicrosoftBizTalk Accelerator for HL7 (BTAHL7) to solve a particular business problem: the message enrichment problem. The message enrichment tutorial describes a situation in which you have to add to, or enrich, a message that is not HL7-compliant and/or is incomplete. This can occur with an application, such as a patient registration application, or it can occur when you are populating a message with XML data from MicrosoftSQL Server.

- capture the messages with BTAHL7, and provide any missing data, for example, from a patient records database. You then convert the message and send it to a laboratory, insurance, or any legacy line-of-business (LOB) application using the MLLP (Minimal Lower Layer Protocol) adapter.

- use a Web service client (WSClient.exe) application to send an XML-formatted message, in this case a "doorbell" Register Patient trigger event, through the SOAP adapter to BizTalk Server with BTAHL7. BizTalk Server receives the message in a SOAP receive port, and routes the message to an orchestration published as a Web service. The XML message contains a patient name and social security number. You augment the message, and use schemas, a map, and a transform to convert the message into HL7 format. You will then send it through an MLLP adapter to the laboratory, insurance, or LOB application.



https://docs.microsoft.com/en-us/biztalk/adapters-and-accelerators/accelerator-hl7/message-enrichment-tutorial

BizTalk vs. Logic Apps

"To simplify the customer experience across our enterprise integration services, we have incorporated the Azure BizTalk Services capabilities into Logic Apps and Azure App Service Hybrid Connections."

–Microsoft Announcement on May 31, 2017

- https://azure.microsoft.com/en-us/updates/azure-biztalk-services-simplifying-our-azure-offerings/
- https://docs.microsoft.com/en-us/azure/logic-apps/logic-apps-enterprise-integration-overview

https://channel9.msdn.com/Events/Ignite/Australia-2017/CLD224
http://www.alliedc.com/azure-logic-apps-vs-biztalk-a-comparison-between-old-and-new-integration-platforms/
https://social.msdn.microsoft.com/Forums/en-US/de98495a-9395-4468-933c-92bedf7d80da/logic-apps-vs-biztalk-server?forum=biztalkgeneral

What is SMART on FHIR?

- SMART on FHIR is creating new opportunities for Healthcare innovation
- SMART: Substitutable Medical Applications Reusable Technologies
- FHIR: Fast Healthcare Interoperable Resources
  - Uses open standards such as oAUTH2, Open ID for authentication
  - HL7 standard for API-based resources
  - Builds on previous standards such as CA and CCDA exchange
- Clinical Document Architecture (CDA) document is a defined and complete information object that can exist outside of a message. In addition to text, it can include images, sounds, and other multimedia content. The CDA is a three-level architecture with each higher level (2, 3) adding an extra section (more specificity to the mark-up) of the document
- CDS Hooks built on SMART on FHIR have potential for dramatic improvement in Specialty prescribing

HL7 ADT–Admit Discharge Transfer

- ADT messages are important in HL7 communications because they provide vital data about the patient and why the message is being sent. Trigger events are instrumental in driving message flow, because they determine when and where messages go based on the type of event that has occurred.

- **For instance, an ADT-A01 (patient admit) message might be sent to an Emergency Department system** while an ADT-A04 (patient registration) message might be sent to an HIS system. The level of urgency and pace at which the message is transmitted might also be different depending on the trigger event.

- There are 51 different types of ADT messages that are used for various trigger events. Some of the most commonly used ADT messages include:
- **ADT-A01** – patient admit
- **ADT-A02** – patient transfer
- **ADT-A03** – patient discharge
- **ADT-A04** – patient registration
- **ADT-A05** – patient pre-admission
- **ADT-A08** – patient information update
- **ADT-A11** – cancel patient admit
- **ADT-A12** – cancel patient transfer
- **ADT-A13** – cancel patient discharge

HL7 ADT–Admit Discharge Transfer

- HL7 ADT messages carry patient demographic information for HL7 communications but also provide important information about **trigger events** (such as patient admit, discharge, transfer, registration, etc.). Some of the most important segments in the ADT message are the PID (Patient Identification) segment, the PV1 (Patient Visit) segment, and occasionally the IN1 (Insurance) segment. ADT messages are extremely common in HL7 processing and are among the most widely used of all message types.

- **HL7 MDM Message–Medical Document Management**
- The HL7 MDM message helps manage medical records by transmitting new or updated documents, or by transmitting important status information and/or updates for the record. Trigger events and messages can be one of two categories: they can either describe the status of the document, or they can describe the status of the document AND contain the document contents. MDM messages can be created in relation to an order or independently of them.

HL7 ADT–Admit Discharge Transfer

- Below is a sample ADT-A01 patient admit message. In the PID segment, you can find the patient's name and contact information. The PV1 segment holds visit information such as the attending physician and the assigned patient location. The IN1 & IN2 segments are where you will find the patient's primary and secondary insurance information.

```
MSH|^~\&|AcmeHIS|StJohn|ADT|StJohn|20050518073622||ADT^A01|MSGID
20050518073622|P|2.3
EVN|A01
PID|||12001||Jones^John^^^Mr.||19670822|M|||123 West
St.^^Denver^CO^80020^USA||(850)555-0809|||||99345|460-99-2928
PV1||I|Main^802^1||||^Quacker^John|||IP|||||||||1|||||||||||||
|||||||||||20050518073622
IN1|1|EPO|80|AETNA US HEALTHCARE|PO BOX 981114^""^EL
PASO^TX^79998^""|||1500004000001|AETNA SERVICES INC|19|AETNA US
HEALTHCARE|""|""||2|SOUTAR^RENEE^D|3|19700722|13324 WHITE
CEMETERY
RD^""^HANNIBAL^NY^130740000^""||||||||||||||||||124705454||||||1|
F|225 GREENFIELD PARKWAY^^LIVERPOOL^NY^13088|185428
IN2|1||124705454||461-1200||||||
```

PID – Patient Info

PV1 – Visit Info

IN1 & IN2 Insurance Info

HL7 Message

An HL7 message is a hierarchical structure associated with a trigger event. The HL7 standard defines trigger event as "an event in the real world of health care (that) creates the need for data to flow among systems".

Each trigger event is associated with an abstract message that defines the type of data that the message needs to support the trigger event.

The abstract message is a collection of segments, and includes the rules of repetition and inclusion for those segments. The following table shows an example of an abstract message associated with the trigger event A04 – Register Patient.

Trigger Event	**Abstract message**
ADT^A04^ADT_A01	Admissions, Discharge, and Transfer
MSH	Message Header
EVN	Event Type
PID	Patient Identification
[PD1]	Additional Demographics
[{ ROL }]	Role
[{ NK1 }]	Next of Kin / Associated Parties
PV1	Patient Visit

HL7 Messages

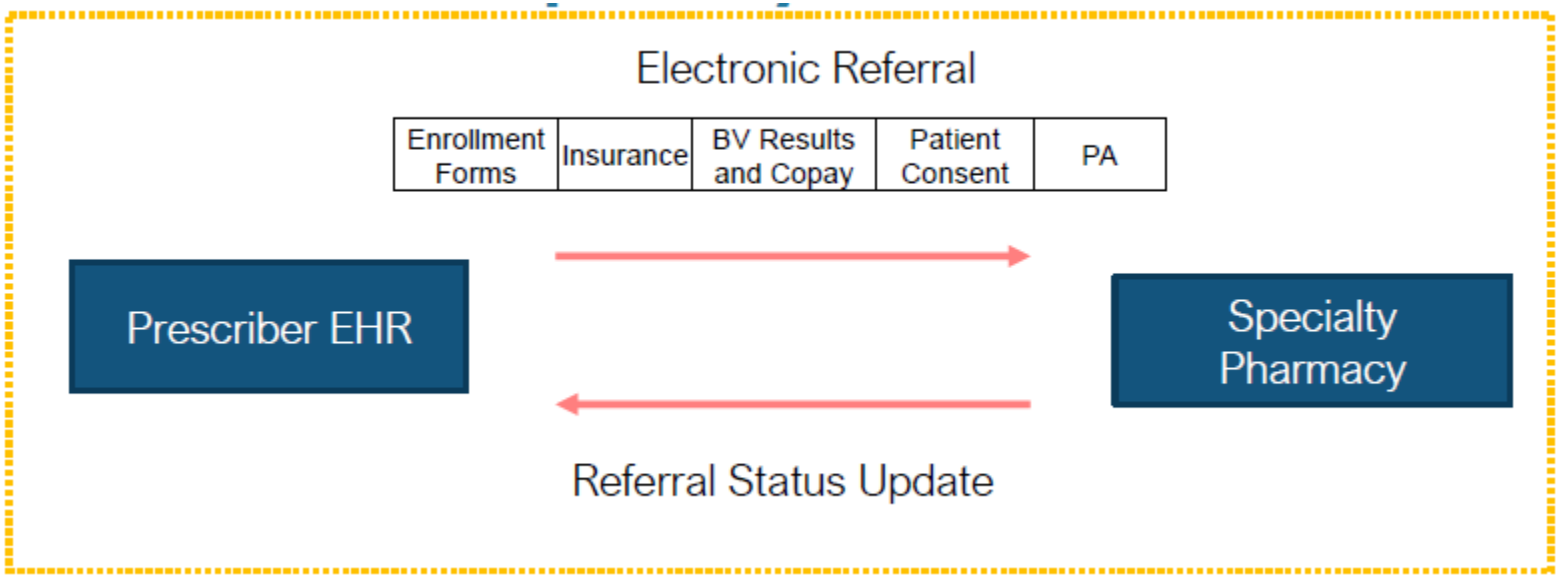
- The OBX segment is an important part of MDM messages that contain document contents, because it is used to separate the body contents along places where headings or other separations might occur. All MDM messages have the same message structure with the exception of the OBX segment. Message types that contain document contents are significantly longer, and may have repeating OBX segments depending on how much data needs to be conveyed.

SEGMENT/ GROUP	NAME	OPTIONAL/REPEATABLE?
MSH	Message header	Required
EVN	Event type	Required
PID	Patient identification	Required
PV1	Patient visit	Required
TXA	Document notification segment	Required

Messaging, ADT, e-Referrals for Specialty Meds

Prescribers receive workflow efficiencies and gain visibility into the patient's status and adherence to medication

Specialty Pharmacies receive increased volume of clean referrals and line of direct communication with the prescriber



Digital Imaging and Communication in Medicine standard (DICOM)