Diagu Fire
API HL7 FHIR

Diagu FHIR API for disease prediction

Overview

The Diagu FHIR API interface will be the collection point of diagnostic results and AI predictions of a disease based on these results. The Diagu FHIR API has three entry points where hospitals and clinics, and pathology labs can order diagnostic predictions of diseases based on the lab results supplied. Ordering can be done either via a direct FHIR Interface between the hospital, clinic or lab, or through the Diagu Ordering website and API.

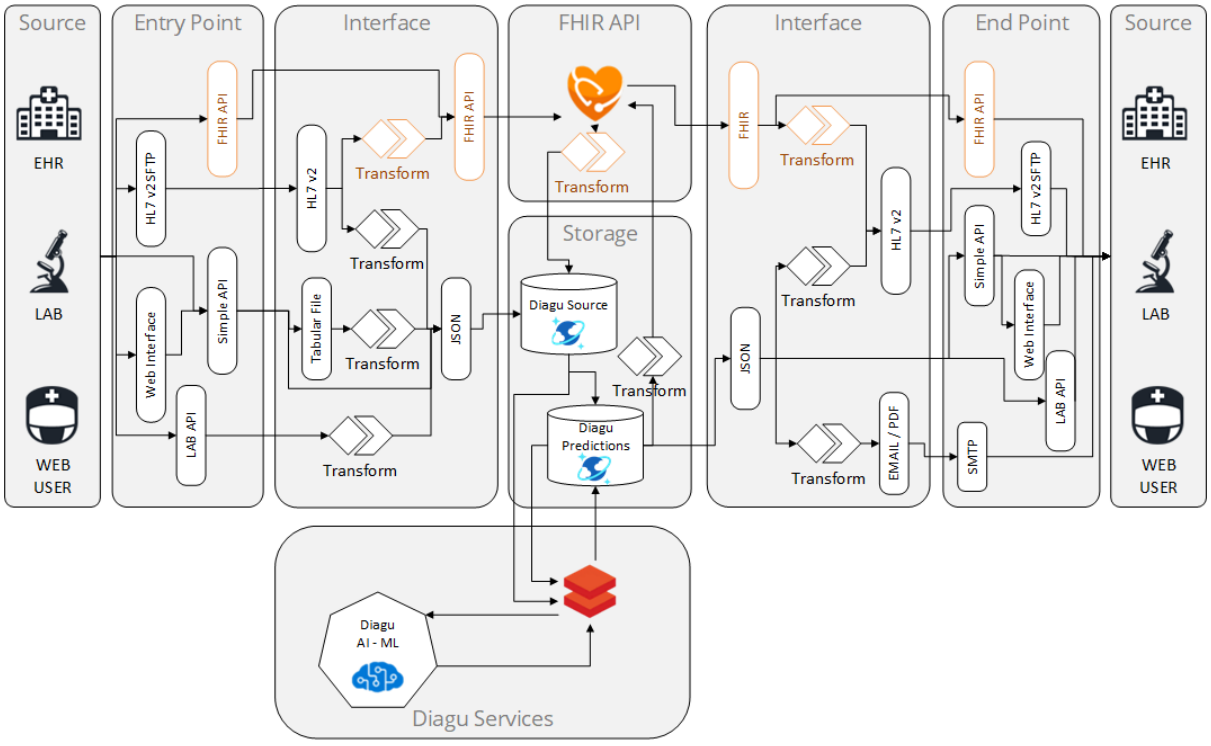


Figure 1 - Conceptual Process Map

About the Diagu FHIR API

FHIR as a standard

The healthcare industry is rapidly transforming health data to the emerging standard of FHIR® (Fast Healthcare Interoperability Resources). FHIR enables a robust, extensible data model with standardized semantics and data exchange that enables all systems using FHIR to work together. Transforming your data to FHIR allows you to quickly connect existing data sources such as the electronic health record systems or research databases. FHIR also enables the rapid exchange of data in modern implementations of mobile and web development. Most importantly, FHIR can simplify data ingestion and accelerate development with analytics and machine learning tools. [1]

Azure API for FHIR

Azure API for FHIR enables rapid exchange of data through Fast Healthcare Interoperability Resources (FHIR®) APIs, backed by a managed Platform-as-a Service (PaaS) offering in the cloud. It makes it easier for anyone working with health data to ingest, manage, and persist Protected Health Information PHI in the cloud. The FHIR API and compliant data store enable you to securely connect and interact with any system that utilizes FHIR APIs.

Security and access control

Role-based access control (RBAC) enables the management of how data is stored and accessed. Providing increased security and reducing administrative workload, by determining who has access to the datasets, based on role definitions created. Access, creation, modification, and reads of records are tracked with built-in audit logs. The Azure API for FHIR implements a layered, in-depth defence and advanced threat protection for Protected Health Information (PHI) data with unparalleled security intelligence. [1]

Available Interfaces

Standard FHIR API Interface

Clients can order disease predictions by and transfer diagnostics results directly through their own standard FHIR API Interface.

HL7 v2 Interface

Diagu has also made provision for older data standards catering for HL7 v2 files to be transferred through a secure SSH / SFTP transfer mechanism for clients that still rely on older data transfer standards.

Custom API Interface

A custom Diagu cloud-based ordering API has been made available to allow clients to order and transfer results if they do not have a FHIR API available. These transfers are through a secure (HTTPS) encrypted link to hosted cloud servers.

Custom Lab API Interface

Custom cloud-based ordering API's can be made available to allow Labs to order and transfer results if they do not have a HL7 v2 interface or FHIR API available. The API transfers data through a secure (HTTPS) encrypted link to hosted cloud servers.

Manual Web orders

A Web interface for manual orders is also available to allow clients to manually upload the diagnostic results via a web page where a large-scale automated interface implementation is not required. Clients can also upload files containing tabular data for bulk processing. Prediction results are packaged in a password protected PDF and emailed back to the client.

Development Roadmap

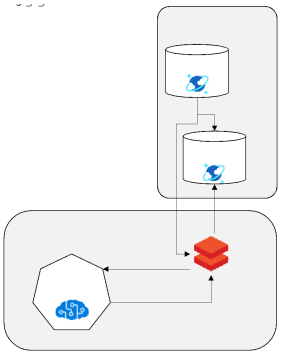
The overall implementation can be broken down into various components and pathways based on priority and incremental expansion where the following component and pathway builds on the previous to add entry points and functionality. This architecture also allows for separation of services and would allow for additional components like DICOM image processing to be added at a later stage.

Components and Pathways

Below is a list of the various components and pathways. These will be in order from a core process framework to complete process framework.

Core Components

The core components consist of the Diagu Storage, AI – ML Services and the Simple API entry point and end point. The sub-components of the storage and AI – ML Services could consist of Azure Cosmos DB Containers, and a Data Bricks Interface.



Core Pathway

The core pathway would follow the route from a basic API entry point to end point allowing for real-time and also batched data processing. The pathway also allows for a simple bulk data ingestion into the Storage and from there the AI - ML Services.

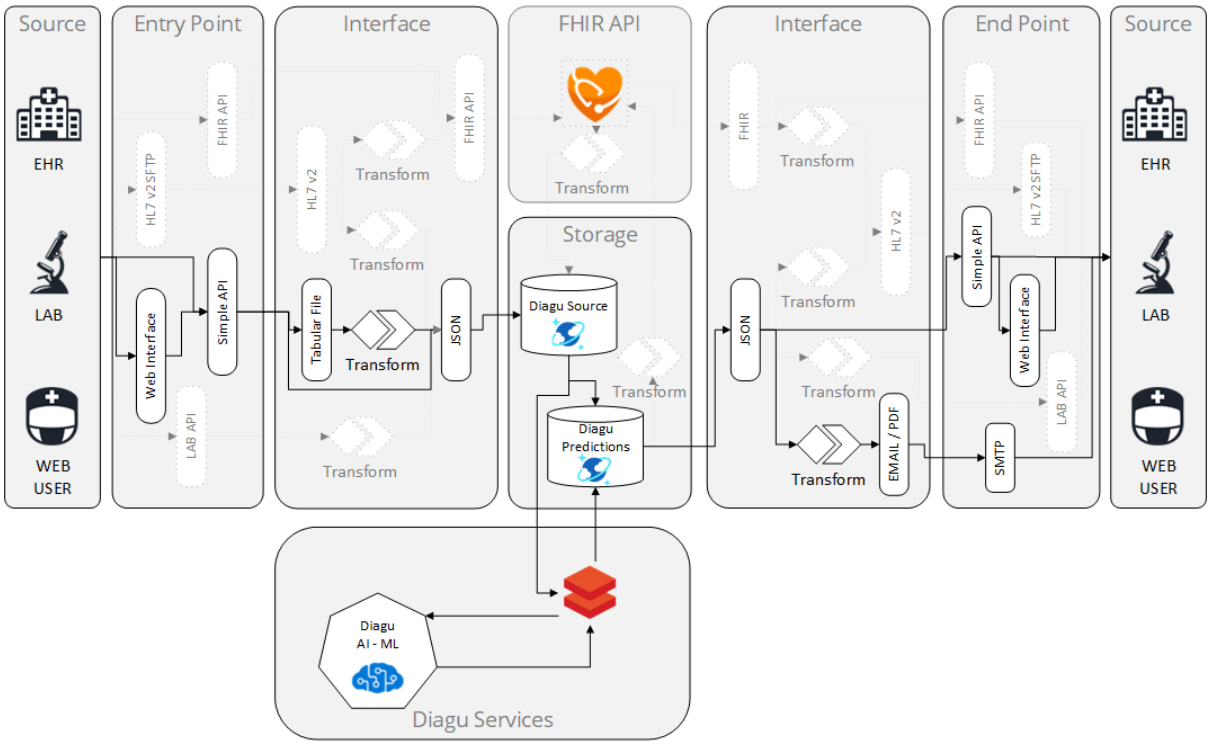


Figure 2 - Base Pathway

Additional entry points and pathways

The second stage of the implementation roadmap would be to expand the entry and end points to allow for more complex data submission. These would include the custom Lab API developed for a large Lab Partner and HL7 v2 data services. The requirements for the HL7 v2 interface will have its own implementation plan that will consist of the architectural components like Virtual Servers, Firewalls, SSH Tunnelling and SFTP. HL7 v2 is an event-based service and will require the EHR or Lab Client to configure their EHR or LIM Systems (e.g. Epic, Cerner, Labware, Starlims, etc.) to send requested data and receive results to and from the Diagu end points.

Note: Although the FHIR API allows for the ingestion of HL7 v2 data and transform it into a FHIR compatible structure, the simple services and transformations required for processing a limited number of HL7 v2 data structures can be achieved much faster than a full FHIR implementation.

HL7 v2 and Lab API Pathways

The HL7 v2 workflow process will require the standard HL7 ORM – HL7 ORU event-based process with some customizations in the type of data that is sent. In addition to the HL7 v2 Pathway the custom Lab API can also be added to allow larger Lab Partners to effortlessly send and receive large amounts of prediction requests.

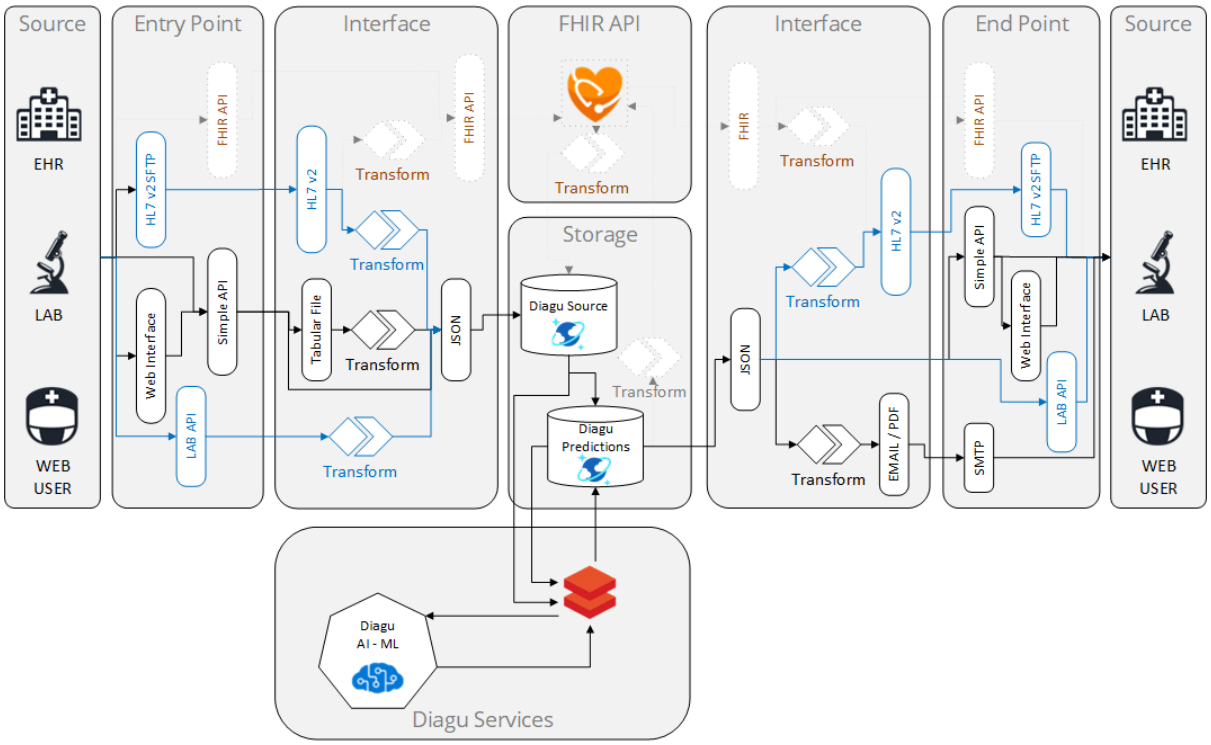


Figure 3 - HL7 vs and Lab API Pathway

FHIR API / Complete Pathway

The FHIR workflow process will require the standard FHIR workflows and resources to be used in an async receipt-response fashion. The FHIR Resources used will include but is not limited to the Service-Request[2] and Diagnostic-Report[3] resources. The hospital or lab client / partner will create a workflow to send the required Service-Request including the diagnostic reports of the lab tests to the Diagu FHIR API endpoint and receive a Diagnostic Report in return containing the prediction results for the various diseases. The Source data may or may not include the patient specific data but should at minimum include the required gender and age data along with the client and patient ids. The implementation of the FHIR API allows for the HL7 v2 Pathway to be changed to use built in HL7 v2 or HL7 v3 data transformation pipelines.

Core Pathway Process

The Core Pathway offers a real-time request-response process for predictions. It also allows for data ingestion in various formats without a result being returned. Below is a high-level process map.

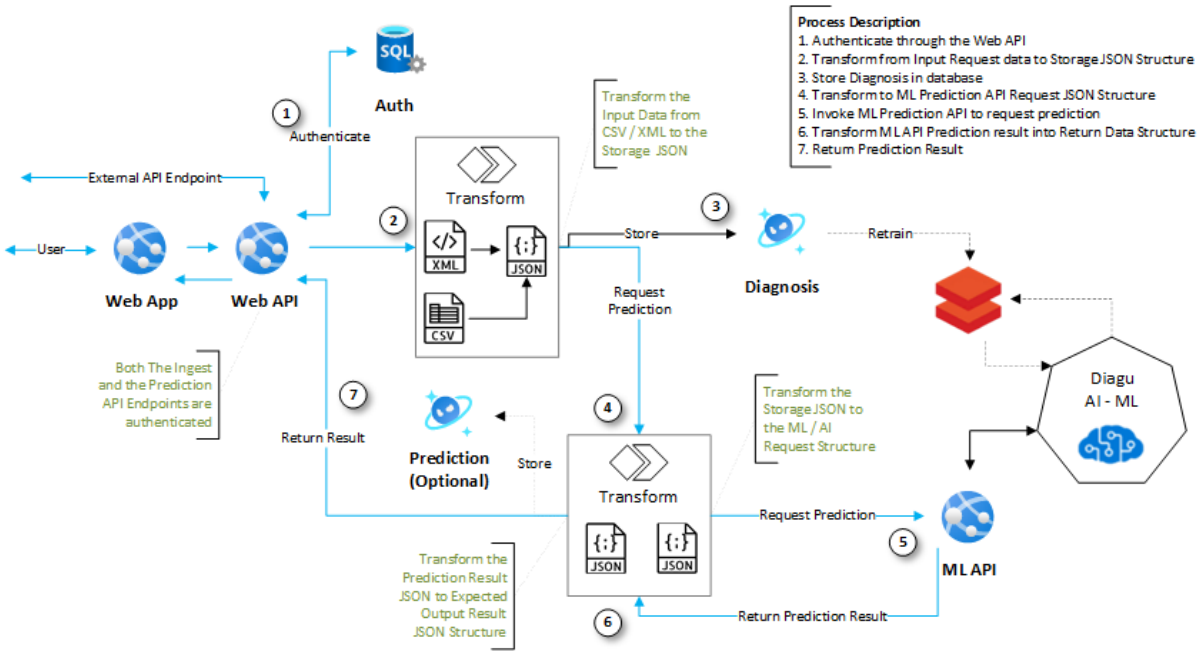


Figure **4 - Core Process Map**

References:

(1) Source: https://docs.microsoft.com/en-gb/azure/healthcare-apis/overview
(2) http://hl7.org/fhir/STU3/referralrequest.html
(3) https://www.hl7.org/fhir/diagnosticreport.html