Attachment G: Response to SOW

1. Approach to Business Operations

1.1 Governance

Effective communication with existing and potential participants is essential for the success of the HIE. Abartys Health has already well-established interactions with virtually all major healthcare stakeholders in PR, as a part of its commercial activities during the past 6-7 years. In particular, Abartys has integrations with the two major lab information systems (LISs) in PR – ███████████████████ Some of the major insurance companies, such as ███████ ██████,[4] are also Abartys clients. As well as some major pharmaceutical companies based in PR, such as ████████ Abartys has also excellent relationships with non-profit and government institutions such as the PR Diabetes Association[6] and the PR Department of Health (DOH). Additionally, Abartys has very strong collaborations with the PR research community such as the University of Puerto Rico and the PR Science and Technology Trust.[7]

Thus, Abartys is fully committed to actively participate in the HIE Advisory council to hear and understand the participants' needs as well as to inform and educate on new technologies and solutions that can advance the HIE and the participants' individual goals. Abartys will dedicate a staff member to serve as a liaison between the HIE community and the company, in particular, by participating in the HIE governance activities.

Of special interest to Abartys is the opportunity to get all the PR healthcare stakeholders together in order to understand better the interactions between them and the type of data that is available to them. This would allow to identify potential synergies such are new connections and/or exchange of data that could improve the quality of care or reduce expenses; or data enrichment using two or more participants' datasets to yield new insights. Such synergies could benefit the participants in particular by monetizing their data and/or reducing their expenses, as well as the PR community in general that would benefit by better healthcare products and improved efficiency.

1.2 Data Governance

Abartys is prepared and fully committed to protect the patient Protected Health Information (PHI). Due to its line of work, Abartys is used to managing PHI. The Abartys Health Warehouse and Datalake currently contain clinical lab results for about 40% of the PR population. For the purposes of information security Abartys leverages the most up-to-date technologies on the AWS cloud, and it is ISO 27001 certified.[8]

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[6] Asociación Puertorriqueña de Diabetes, https://www.diabetespr.org/
[7] PR Science, Technology and Research Trust, https://prsciencetrust.org/
[8] ISO/IEC 27001: Information security, cybersecurity and privacy protection, https://www.iso.org/standard/27001

Abartys has a suite of web portals and mobile applications as a part of its software-as-a-service (SAAS) offering. In particular, *PatientLynk* and its white-labelled versions[9] is the Abartys portal for patients, developed in response of the Affordable Care Act [10] to provide access to patients to their current and historical health data and facilitate the interaction with providers and payers. As a part of the patient portals Abartys can manage and track the patients' consent.

As a part of this project, Abartys will develop and HIE portal where all the documentation related to the HIE's policies and operation will be provided, such as but not limited to:

- *Information about HIE*
  e.g. mission and goals, structure, scope, news and announcement.
- *Information about participants*
  e.g. services provided, type of involvement.
- *Policies*
  e.g. data sharing and management policies, information security policies, etc. as described in section 1.3.
- *Service information*
  e.g. available services information, in particular public APIs.
- *Contact information*
  e.g. leadership contacts, participants, and support information and contacts.
- *Patient consent information*
  e.g. information about legislation governing the rights of patients such as HIPPA, ACA, etc.
- *Forms*

In addition to static information, the portal will display dynamic statuses of the different systems and connections as well as the data volumes stored and exchanged during particular time periods. This functionality is outlined in section 1.5 on operational reporting. Access to reports on performance measures such traffic volumes, data quality, notification volume, etc. will also be provided via the portal.

1.3 Policy

Abartys Health has significant experience in developing and working with information security policies as a part of the ISO 27001 certification.[8] Abartys will is prepared to leverage this experience and the experience of partners such as A-LIGN[11] to help with the establishment of the HIE policies. Abartys will also assume and further develop the policies developed by previous vendors. The available and approved by PR-MP and PR-DOH, policies will be made available to the HIE participants directly and via the HIE portal.

1.4 Technical Assistance

Abartys Health is aware of the difficulties involved in participants' onboarding, especially when this involves legacy infrastructure and software and lack of technical ability on the participants' side. Abartys already has substantial experience in onboarding clients with different levels of

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[9] PatientLynk Portal, https://patientlynk.com/; Labinfo Portal, https://portal.labinfopr.com/; Misresultados Portal (new), https://misresultados.com/nuevoportal/
[10] Affordable Care Act, https://www.healthcare.gov/glossary/affordable-care-act/
[11] A-LIGN, https://www.a-lign.com/

technical sophistication. Also, a large part of Abartys' partnership with AWS involves connection to clients' infrastructure and migrating legacy workloads to the cloud, including migrating data in a variety of formats.

Therefore, Abartys is prepared to offer technical assistance to the HIE participants to connect, transition, and maintain their connections by:

- Providing necessary documentation on connections and standards. For example, white papers and tutorials.
- Customize the HIE pipelines to accommodate participants' specifics. For example, implement HL7 jargons to accommodate the participants' use of the standard. This way the technical requirements to the participants are reduced to a minimum.
- Provide consulting services to help with the implementation of certain processes on the participants' side.
- Provide hands on help with the participants' explicit permission and responsibility waver.

Abartys will maintain, improve, and communicate the connection and data standards and will help participants implement any changes.

During operations Abartys will maintain a helpdesk based on a ticketing system, which will be attended in the order of priority by the Abartys developers. Abartys will dedicate the necessary personnel to communicate with the HIE participants and serve as a liaison between the participants and the Abartys developers.

In terms of employee training, Abartys will offer:

- In person training sessions in order to introduce the participant's employees to the HIE capabilities and usage. These sessions can be scheduled periodically, e.g. once a year, or by request.
- Online tutorials and guides which will be available on the HIE portal.

All training and educational events as well as the development of new educational and training materials or updates will be reported in the operational reporting.

1.5 Operational Reporting

Abartys understands that accountability and transparency are of paramount importance for the HIE adoption and success. Therefore, from the onset Abartys will strive to provide all necessary information about the HIE operation in an easily accessible and timely manner.

Therefore, instead of or in addition to monthly and/or annual reports Abartys' goal will be to provide real time and historical status reports via dashboards on the HIE portal. Since these would be developed from scratch, they would undergo continuous improvement with the goal to capture all the necessary operational information including, but not limited to:

- *Participants information*
  This would include a list of the participants, status of their connection, amount of data ingested or exchanged during various periods, and number of exceptions or errors occurred.
- *Connections status*
  Depending on the participant's capability, periodic connection checks will be established, and the connection status will be displayed on the HIE portal. Notification will be sent to the responsible persons to remediate any issues.
- *Infrastructure status*

Internal checks will be implemented for the pipelines on the HIE side to test the availability of the core systems and these statuses will be displayed on the HIE portal. Notification will be sent to the responsible persons to remediate any issues.

- *Data quality status*
  Based on data ingestion logs, statistics will be displayed showing the overall traffic by participant, system, and data type. In particular, the number of errors and exceptions will be shown. The errors will be investigated by the responsible staff.

For some types of measures real time reporting is not appropriate or necessary. These will be reported in the appropriate way for each type of measure. For example:

- *News section*
  Participant activities, partnerships, etc. will be appropriate for the news section of the portal.
- *Announcements*
  Events such as training or outreach, as well as technical or standard changes will be specifically announced.
- *Periodic reporting*
  Other pre-agreed performance measures, such as the amount of traffic, amount of data, number of notifications, etc. will be reported in a predefined frequency in a predefined format to the appropriate entity.

1.6 Technology Architecture and Partnerships

The Abartys Health infrastructure is 100% virtual on the AWS cloud. Abartys is one of the pioneers of AWS in PR and it is currently a member of the AWS Partner Network.[12]

The Abartys infrastructure and data pipeline is illustrated in Figure 1. Data is ingested from a number of sources using REST API and SFTP protocols. Then the data is transformed, cleaned, and standardized before it is stored in the Abartys Health Warehouse. The warehouse is based on AWS Dynamo DB which is used for online transaction processing (OLTP) workloads, in particular to support the Abartys Health Portals and mobile applications. The data is incrementally added to the Abartys Health Datalake which is then used for extract, transform, and load (ETL) and online analytical processing (OLAP) workloads (via AWS Athena), to support the Abartys Health Analytics such as the ClinicLynk portal and Data-as-a-Service (DAAS) pipelines. The AWS Simple Notification Service (SNS) and Simple Email Service (SES) are leveraged for notifications, as well as in-app and push notifications on the mobile clients. The AWS Simple Storage Service (S3) is used for long term data storage.

Unlike other vendors Abartys is not burdened with legacy infrastructure. Instead, it has implemented almost everywhere cloud-native solutions based on microservice architecture. Because of that, most of its services are serverless and highly scalable. Thus, the Abartys infrastructure can accommodate variable workloads without the necessity of a large upfront investment and can scale seamlessly with the load.

Since the underlying services are managed by AWS, Abartys can rely on the highest level of security and dependability for its underlying infrastructure. The AWS cloud offers the highest level of security, redundancy, and availability on the infrastructure side. Abartys on the other

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[12] AWS Partner Network, https://aws.amazon.com/partners/

hand strives to implement the highest information security standards. It has been ISO 27001 certified since 2021.[8]
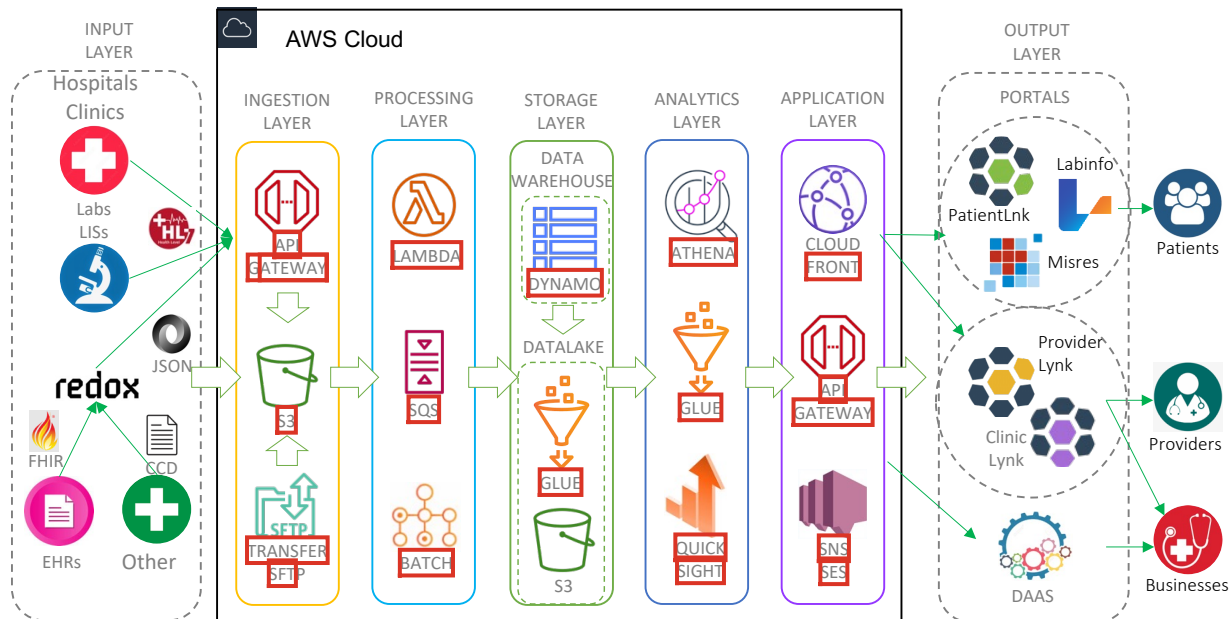

Figure 1: Abartys Health data workflow with indicated logical parts and major technologies employed.

This infrastructure can support the needs of the PR HIE, not only in theory but in practice. Abartys has been processing clinical health data from the largest LISs in PR and supplying analytical and DAAS services to some of the largest healthcare stakeholders in PR for years. In Section 2, we describe in more detail how the Abartys know-how would be used to support the HIE requirements.

In the cases where Abartys does not have internal know-how, such as connections to electronic health record systems (EHRs) and direct messaging service, Abartys will leverage the services of partners such as Redox.[13]

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[13] Redox Engine, https://www.redoxengine.com/

2. Approach to Technical Services

2.1 Background

2.1.1 Company

Abartys Health is an innovative startup specializing in big-data clinical laboratory results warehousing and analytics. Headquartered in San Juan, Puerto Rico, Abartys boasts an extensive clinical data repository with tens of millions of lab test results spanning more than five years and covering half of PR population. Abartys enables individual electronic access to lab results, while at the same time leveraging de-identified and aggregated data to power their diverse range of data-driven products. These offerings encompass DAAS delivery, interactive health analytics dashboards, as well as large-scale, data-driven population health and risk-forecasting models. Abartys' data analytics capabilities cater to various stakeholders in the PR healthcare landscape, including government entities, insurance companies, pharmaceuticals, and academic research institutions. Technologically, Abartys has developed a cutting-edge, cloud-native infrastructure on the AWS platform. Abartys is one of pioneers in cloud adoption in Puerto Rico, utilizing 100% virtual infrastructure on the AWS cloud since 2016. More recently Abartys is part of the AWS Partner Network with a Select Partner status.[12]
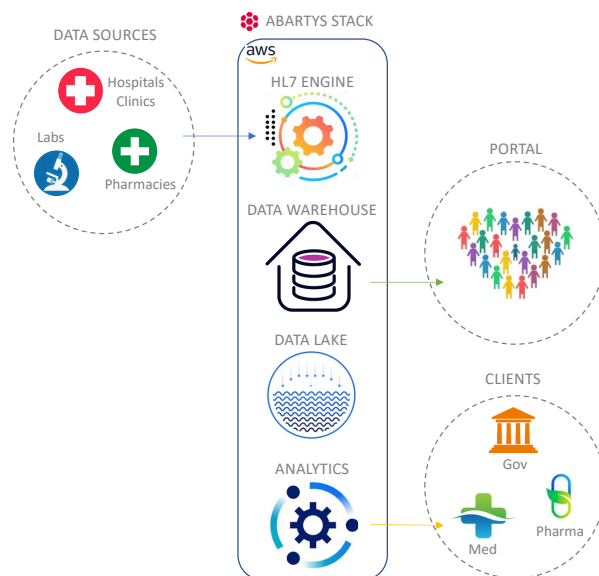

Figure 2: Abartys Health functional diagram.

2.1.2 Data and integrations

Abartys is currently integrated and receiving clinical laboratory data from the two major Laboratory Information Systems (LISs) in PR – Misresultdos[1] and Labinfo.[2] It processes approximately one million lab results per month using its infrastructure on AWS. The infrastructure showcases exceptional scalability, facilitating the ingestion, processing, and storage of millions of laboratory results. A functional diagram of the Abartys pipeline is shown in Figure 2.

Utilizing proprietary technologies, Abartys has implemented standardized data practices to aggregate and normalize data from multiple sources, ensuring its readiness for analytics purposes. The clinical data is continually updated and consolidated within a datalake, serving as the bedrock for Abartys' wide-ranging portfolio of data-driven solutions and offerings.

2.1.3 Products and services
(a) Data-driven applications [14]

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[14] Abartys Health, "Abartys Apps & Services (AAS): Data-Driven Apps", White paper (2024)

Abarty has developed a set of applications leveraging the Abartys Health Warehousing system to deliver data-driven content to end users – patients and providers. This umbrella project consists of the following subprojects:

- *PatientLynk*
  Access to clinical health data for patients anytime, anywhere, from any electronic device via a web portal and mobile apps.
- *ProviderLynk*
  Access to patients' clinical data for diagnostic and treatment purposes. Sharing of credentialing documents with the insurance companies for healthcare providers.

(b) Data-as-a-service [15]

Delivery of near-real-time data streams in custom formats for clients such as insurance companies, such as TripleS and Humana, and government entities, PR-DOH. Also providing data for research purposes in collaboration with the University of Puerto Rico.

(c) Data analytics [15]

Advance analytics, predictive modeling, and data visualization services:

- *ClinicLynk*
  Leveraging the Abartys Health datalake to deliver actionable insights for improved decision making for life science, medical insurers, and government entities.

(d) AWS consulting

Abartys has recently joined the AWS Partner Network with the purpose to use its expertise in building and utilizing advanced cloud infrastructure to aid clients' migrations to the cloud. Abartys has reached a Select partnership status.

2.2 Deliverables

Abartys will leverage its big-data and advance-analytics expertise, as well as its know-how in building scalable, cloud-native infrastructure, to build and operate the necessary HIE services.

2.2.1 Enterprise Identity services (Master Patient ID)

A major problem with data aggregation from a variety of sources is the lack of universal and reliable identifiers that allows to link the profiles and data of patients across sources. Typically, entities only have local identifiers to distinguish their clients internally. Also, they collect the minimum amount of data necessary to provide their services. On top of that, there are errors in names, dates, and contact information which are due to poor quality control. The amount of data poses yet another challenge because brute force profile comparison across multiple multimillion-record sources is prohibitively time consuming and expensive.

Abartys has already encountered this issue in joining the clinical data of patients across laboratories. It has developed a master patient ID (MPI) to match patient records on a set of identifier fields which allows to gather the patients' historical (longitudinal) lab records.

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[15] Abartys Health, "Abartys Data (AD): Data Pipelines and Data Analytics", White paper (2022)
[16] Abartys Health, "Abartys Data (AD): Master Patient Identifier", White paper (2024)

Abartys already uses this technology to match person profiles across clinical laboratories and label all records with the universal person id in the Abartys Health datalake. This methodology will be extended to include other sources that are part of the HIE such as hospitals and clearinghouses. This technology will satisfy all the HIE requirements:

- It is implemented as a stand-alone service that can be deployed in any AWS cloud platform.
- Accurately identifies a patient's records across all disparate data sources.
- Translates local patient identifiers to unique patient id, and vice versa.
- Consolidates the multitude of profiles into a single view of the patient.

The MPI implementation enables the querying capabilities:

- *Demographic query* - Return consolidated demographic information, including names, date of birth, addresses, phone numbers, etc.
- *Identifier cross-reference* - Return mappings between the provided identifier and all associated identifiers across various systems or sources.
- *Patient discovery* – Based on partial patient information such as first name, date of birth, or other relevant identifiers, return a ranked list of patients matching the information.
- *Patient history* - Retrieve the complete list of longitudinal records associated with the patient.

2.2.2 Interface specifications

Another problem with data aggregation from a variety of sources is the lack of data exchange mechanisms or formats and the non-standard nature of the available export formats. Many entities use third-party vendor tools that only store data internally without means of export. If exporting is available, it is often either in a non-digital format (e.g. PDF file) or in a vendor proprietary format which is only intended to communicate with another copy of the vendor's software.

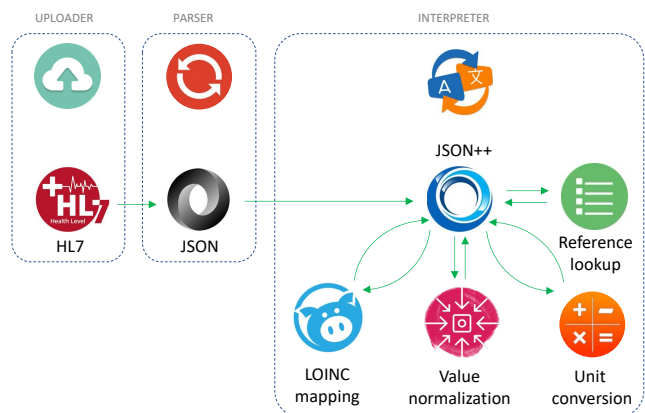Fortunately, in the PR healthcare space the use of the HL7 v2 standard was agreed

Figure 3: Diagrammatic representation of the Abartys HL7 v2 processing engine.

between a number of the stakeholders,[17] which has resulted in a partial standardization of the field. Although the conventions in using the standard vary somewhat between entities in addition to containing a variety of non-standard labels and data entry errors. For the purpose of LIS integrations, Abartys Health has implemented system to ingest, parse, interpret, and standardize health data in the HL7 v2 format.[18] A schematic illustration of the Abartys HL7 processing pipeline is given Figure 3. Abartys uses this standard to receive data daily form around 800 laboratories in PR as illustrated in Figure 4. The Abartys Health Warehouse currently holds more than 42 million lab test results for about 40% of the PR population and dating back more than 5 years.

The Abartys HL7 v2 standard is described in a white paper and will be communicated to the HIE participants.[19]

In addition, Abartys performs *customizations of the standard upon onboarding of new participants to accommodate their respective dialects,* which is a particular advantage of developing an in-house parser/interpreter as opposed to using third-party tools. In particular, Abartys will incorporate and support the dialects developed by the previous vendors (also based on HL7 v2) and do that seamlessly, with the least amount of interruption for the HIE participants. Based on this experience, Abartys will maintain HL7 v2 connectivity with existing participants who support this format. It will extend its format support to all the applicable cases in accordance with the HL7 standard, but it will also perform customizations to support participant dialects. Additionally, Abartys will offer its own JSON format and will help with the format implementation to participants that are yet to develop export formats. Abartys will also accept and develop translators for non-standard and legacy formats that are native to the participants.

In the particular case of connections third-party EHR software, Abartys will leverage the experience of its partner Redox,[13] simply because the variety of such software is too broad to be accommodated in timely and efficient manner. In this partnership Redox will be responsible for the connection and data exchange with the various participants' EHR systems and subsequently it will transfer the data to Abartys using a single, JSON-based data format agreed between them.

Figure 4: Abartys data ingestion and processing diagram.

2.2.3 Care Coordination Services

Abartys Health already provides access to longitudinal health records to individual through its patient portal *PatientLynk* and to providers through the provider portal *ProviderLynk*. The portals are available both as websites and mobile applications for Android and iPhone. The data for the apps is provided through and
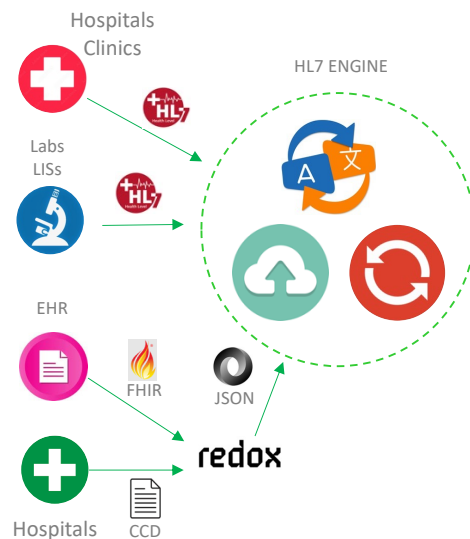
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[17] Health Level Seven International (HL7), https://www.hl7.org/
[18] Abartys Health, "Abartys Data Exchange (AEX): HL7 Parsing, Interpretation, and Normalization", White paper (2022)
[19] Abartys Health, "Abartys Data Exchange (AEX): HL7 Interface Specification", White paper (2021)

API which in turn utilizes the Abartys Health Warehousing. Additionally, Abartys provides aggregated data in the form of business intelligence-like dashboards through its portal *ClinicLynk* and customized real-time or periodic data streams through its DaaS services. This functionality is powered by ETL jobs implemented for big-data processing in Apache Spark and operating on top of the Abartys Health Datalake.

Here is a summary of the Abartys services and capabilities:

o **Data Core**

The data core system implements the clinical data ingestion, warehousing, processing, analysis, and security of the clinical health data. As such, it is at the base of all data-centered services such as the data analytics and data-driven apps. It consists of the following:

- *Cloud infrastructure and information security*
  Cloud-based, highly scalable, highly available infrastructure compliant with industry security standards (ISO 27001 certified).
- *Data ingestion pipeline and data warehousing*
  Robust, scalable data ingestion implementing the HL7 v2 and LOINC standards.
- *Clinical data datalake and services*
  Repository of clinical and auxiliary data making it available for query and data analytics.

o **Data Analytics**

Advance analytics, predictive modeling, and data visualization services, leveraging the Data Core clinical data datalake to deliver actionable insights for improved decision making for life science, medical insurers, and government entities. Consists of the following portals:

- *ClinicLynk*
  Web portal to deliver analytic reports and visualizations of population health data.

It leverages ETL backend to prepare the displays:

- *Abartys ETL*
  Battery of ETL tools made for big data (Spark) to fetch, aggregate, and analyze population reports. Visualizations are made as dashboards using a cloud-native BI tools (Quicksight) and delivered via the web portal ClinicLynk as illustrated in Figure 5.

Figure 5: Abartys data analytics diagram.

o **Data-driven Applications**

Applications leveraging the Data Core data warehousing system to deliver data-driven content to end users as shown in Figure 6. It consists of the following portals/apps:

- *PatienLynk and white labeled portals* [9]
  Access to clinical health data for patients anytime, anywhere, from any electronic device via native apps and web interfaces.
- *ProviderLynk* [20]
  Access to patient clinical data for and sharing of credentialing documents with the insurance companies for healthcare providers.
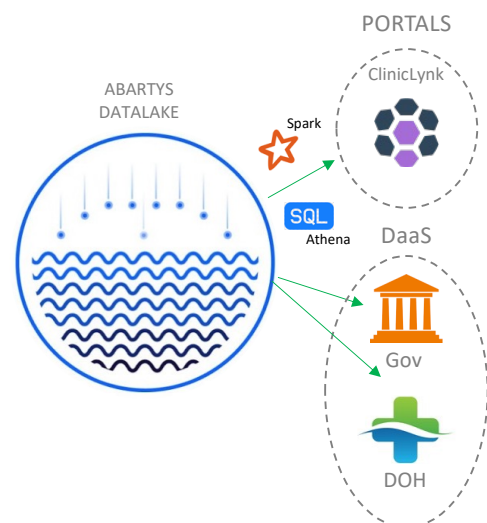
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[20] ProviderLynk Portal, https://providerlynk.com/

These applications rely on scalable REST API to fetch clinical data from the Abartys Health Warehousing:

- **Abartys API**
  REST API to access patient and providers demographic and clinical data on the Abartys Health Wearhouse.

These tools already cover a large portion of the HIE needs and Abartys already processes a significant portion of the HIE participant data (LISs). Moreover, the Abartys experience is specific for the PR market. The missing portions, such as EHR integrations, will be added during the course of the project or will be obtained through partners (e.g. Redox).
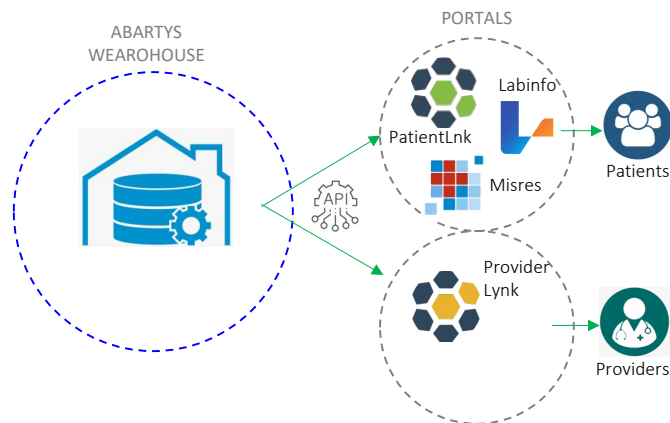

Figure 6: Abartys health data warehousing and data-driven apps.

2.2.4 Data Quality and Reporting Services

One of the strongest sides of Abartys Health is the value added to raw clinical data by its proprietary standardization and normalization protocols. It could be argued that on the PR market Abartys provides the cleanest and most standardized clinical data sets which are analysis ready. In particular, Abartys value-added services include:

- **Health Level 7 (HL7) v2 standard** [21]
  Abartys has a robust HL7 v2 standard implementation to support data exchange between interested parties.

- **LOINC standard** [21]
  Abartys has implemented proprietary methodology to assign LOINC codes to local coding systems to allow for data consolidation from different sources. Abartys is likely the *only entity in PR that can provide comprehensive and high-fidelity LOINC assignment*. Abartys has been providing this service to clients, such as TripleS insurance. Additionally, it has a service to correct the CPT codes on lab tests.

- **Data cleaning and normalization**[21]
  Additional services include the standardization of addresses, results values (in particular categorical values), units including unit conversion to standard units, abnormal flag recalculation (often missing), etc.

- **Master Patient Identifier** [16]
  A service as described in section 2.2.1 to join person profiles from a variety of sources without a single robust identifier.

- **Clinical health data datalake** [22]
  The data is available in partitioned, incrementally updated datalake which makes the data available for analytical and data science services.

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[21] Abartys Health, "Abartys Data (AD): HL7 Engine", White paper (2020)
[22] Abartys Health, "Abartys Data (AD): Health Data Datalake", White paper (2022)

2.2.5 API Services

Due to standardization efforts in the past among the PR healthcare stakeholders, the PR health data exchange is organized around the HL7 v2 standard. Therefore, this is the standard implemented by Abartys to receive data from its clients such as the PR LISs Misresultados and Labinfo. Nevertheless, Abartys had developed limited capabilities to import data in HL7 FHIR, e.g. from EHR systems, and export data in HL7 FHIR, e.g. for the PR-DOH Covid 19 reporting. Thus, Abartys will use FHIR as needed for the purposes of the HIE and full support of HL7 FHIR is in the Abartys' long-term strategy. Meanwhile, Abartys will also leverage partners, such as Redox, to communicate with EHR systems using FHIR.

The Abartys infrastructure is largely based on microservices, and therefore it frequently leverages APIs for communication between different parts of its services. Currently two main REST APIs are in use:

o **File upload API** [23]

   This API is a part of the Abartys HL7 ingestion pipeline and allows clients to upload HL7, PDF and JSON files to the system.

o **Data-driven apps backend API** [24]

   This is a very comprehensive API system that supports the data-driven apps such as PatienLynk and ProviderLynk. The apps' front- and back-end are completely decoupled and all the data access to the Abartys Warehouse, such as fetching patient's new results and longitudinal health data, is achieved via API calls.

   A subsystem of this API is implemented between Misresultados and Abartys for the purpose of the validation and creation of new users and the synchronization of their data between the systems.

   All Abartys services support activity logging and notifications. The various services produce internal and external (client) reports with daily, weekly, and monthly frequencies. Therefore, monthly HIE activity reporting will not be an issue. In fact, Abartys will endeavor to provide *real-time activity reporting via BI-style dashboards*, access to which will be provided for the respective stakeholders.

2.2.6 Public Health Reporting

DaaS is a large part of Abartys' product offerings. Abartys currently supplied data with *predefined frequency (daily, weekly, monthly) and custom delivery method and formatting* to large clients such as TripleS and Humana insurance companies. Previously, Abartys had developed a similar functionality to report Covid 19 cases to the PR DOH in the HL7 FHIR format.

Thus, Abartys has the necessary experience to:

o Ingest data from the healthcare providers and meet their reporting requirements.
o Assume and maintain the existing data feed from ELR to the existing and new stakeholders.
o Leverage the Abartys expertise to onboard new sources of data.

Based on past experiences, Abartys has no technical or know-how limitations on ingesting, transforming, and delivering data.

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[23] Abartys Heath, "Abartys Exchange (AEX): File upload API", White paper (2021)
[24] Abartys Heath, "Abartys Apps & Services (AAS): Backend API", White paper (2024)

2.2.7 Medicaid Data Services

As described in section 2.2.6 a major part of the Abartys revenue comes from DaaS products to ingest, transform, and deliver data with predefined frequency and custom formats. Currently, the highest delivery frequency is daily, however, there are no technical limitations to delivering data as-it-is-received. Thus, Abartys is prepared to submit structured data to PRMP in any frequency as long as the structured data specifications and the transport mechanism specifications are provided.

As already mentioned in sections 2.2.3 and 2.3.5 Abartys already provides these capabilities for the clinical health data it received form the LISs. In particular, Abartys provides:

- o **Individual level reporting**
  Through its patient portal *PatientLynk*, Abartys provides access to current and historical (longitudinal) data for individuals including in a graphic format. The data is fetched via the Abartys API, which in principle can be consumed by other clients with the necessary authentication.
- o **Provider/Facility level reporting**
  Through its provider portal *ProviderLynk*, Abartys provides access to current and historical data to the providers for their pool of patients. The option exists to group provides by organizations/facilities. The API endpoint can be used to provide provider-level access to other clients.
- o **Payer level reporting**
  Similarly, the Abartys API has the capability for payer (e.g. Medicaid) reporting.
- o **Public level reporting**
  Described in section 2.2.6.

2.2.8 Medicaid Services

The MPI described in section 2.2.1 allows for joining patient profiles from a variety of sources. Using this technology Abartys already supports some insurance companies, such as TripleS and Humana, by providing them lab result data for their members, including for Medicaid and Medicare patents. The same technology can be used to support other MCOs.

This procedure can be enhanced if claims data is available. Ingestion, warehousing, and analysis of claims data, for the purposes of combining it with clinical lab data has been one of the goals of the company. Abartys will incorporate, possibly migrate to AWS, and further develop already existing claims workloads, if such has been developed by previous vendors. not, Abartys commits to a pilot:

- o Work with the clearinghouses to develop protocols for data ingestion, and subsequently process, warehouse, and link this data to the clinical data using the Abartys MPI.
- o Provide consistent access to the data via API to the MCO partners.
- o Offload the data to the Abartys Health Datalake and implement the necessary ETL processes to deliver the data to the Medicaid data warehouse.
- o Develop the necessary analytics ETL pipelines to support the MCO partners reporting and provide payer support.

2.2.8 Direct Secure Messaging (DSM)

Abartys Health does not at this moment support encrypted email service between providers, because email is an inherently insecure protocol which is approaching obsolescence. However, it does support in-application (*ProviderLynk*) messaging and push notifications, as well as chat. In case, some of the HIE participants use DSM we will leverage the expertise of our partners to provide this service. Abartys is also ready to incorporate and possibly migrate to AWS am already existing DMS service, if such has been developed by previous vendors.

2.2.9 Electronic Notification Services (ENS)
Abartys currently uses a service to notify patients for new result. The notifications are triggered by the receipt and processing of test results for a patient. Such a notification system can easily be setup to handle ADT type HL7 messages. The notification mechanism, powered by the AWS SNS, is subscription base and scalable to any number of recipients. Abartys will provide an interface through which the participants can subscribe to different types of messages. This HIE message subscription model woold allow that all the participants receive notification for events with interest although they do not directly have access to the data.

2.2.10 Emergency Response Services
As described in section 2.2.9 the HIE subscription-based service would allow any of the HIE participants to receive notifications for events triggered by any other participant and not only during emergencies. In particular, notifications can be sent to the eHealth Exchange and the PR-DOH. There are no limitations to the transport protocol or the formatting of the notification as long as clear specifications are provided.

2.2.11 Interoperability Compliance
Abartys will provide the necessary documentation to and actively train the HIE participants in the use of the HIE services. Abartys acknowledges that many existing and potential HIE participants do not have the technical capacity to implement the necessary step for data exchange with the HIE, so Abartys will offer hands on technical help to enable the participants' HIE integrations.
Aabrtys is determined to comply all the necessary regulatory requirements including providing automated rules for data sharing when allowed by the data blocking rules. Abartys will also provide a mechanism to collect complaints and use them to revise the rules and report cases of data blocking to the necessary instances.

2.3 Conclusions

Abartys Health is a PR company that has been actively participating in the PR health market for more than six years. During this time, Abartys has developed integrations with the jurisdiction's largest LIS systems, to the extent that it currently processes about half of the laboratory test results in PR. In the process, Abartys has developed a state-of-the-art, cloud-native architecture on AWS to ingest and process any amount of data. It has also developed proprietary methods, some of them unique, to standardize and normalize data (e.g. LOINC and CPT codes). It has developed big-data-capable ETL pipelines to deliver results on up to real-time frequency in custom formats to healthcare stakeholders (e.g. large insurance companies). And provide

advanced analytics and visualization of the health data. The Abartys is one of the pioneers of cloud infrastructure in the jurisdiction, and recently has joined the AWS Partner Network.

All these capabilities, which Abartys has developed at its own expense, can be leveraged for the purposes of the HIE. Moreover, these capabilities are developed in PR, specifically for the PR healthcare stakeholders. Abartys estimates that the overlap between HIE needs, and Abartys' offerings and capabilities is higher than 75%. Missing capabilities will initially be subcontracted to our partners, and later developed internally if expedient. Abartys will also incorporate all the standards, interfaces, and connections developed under by the previous contractors and make an utmost effort to make the transition as seamless as possible. As a PR company and long-term player in the PR healthcare market Abartys has the incentive to succeed in this project way beyond the continuation of this contract.