CitiusTech Whitepaper

Fast Healthcare Interoperability Resources (FHIR):

Impact on Healthcare IT and Market Opportunities

FHIR – The springboard for simplifying interoperability

FHIR is a next generation standard framework created by HL7 and successor to HL7 v2.x, v3 and CDA.[1] Given the limitations of previous standards for non-XML segments and esoteric implementations (V2) or complexity of implementation (V3 and CDA), there was a need for a standard which is structured, standardized and human-readable. FHIR is expected to overcome the majority of the complex limitations of current standards.

Accelerating innovation in interoperability

There's a growing interest in the healthcare technology community to use FHIR as the preferred and universal standard for data exchange. FHIR enables faster access to data while keeping the basics of interoperability workflows intact. For example, if a cardiologist wants to access a specific image, it is easier for systems to retrieve that specific piece of information rather than retrieving all the documents related to that image.

Due to a data-centric approach, FHIR can also become a popular exchange standard for patient engagement workflows. Its secured open internet standards will enable developers to innovate patient access to his or her personal health records at a click of a button.

Advantages

RESTful architecture: FHIR is based on RESTful protocols. All FHIR resources can be accessed over HTTP and served in XML or JSON format, similar to web pages, while allowing granular level access to even a single data element. This also allows servers to perform a bulk of calculations which reduces computing required from the client-side and also enables data to be accessed by lightweight clients such as mobiles.

Multiple paradigms: In addition to REST, FHIR also supports messaging (like V2 and V3) and documents (like CDA) paradigms.

Human-readability: Like CDA, FHIR resources have human-readable explanations along with XML/JSON data.

Open-source: FHIR is completely open-source. Authentication is provided by open-source OAuth2 standard. Payload security is handled by HTTPS.

FHIR is a critical technology driver that makes the exchange of healthcare information faster and efficient.

Querying: FHIR resources can be searched using various parameters, similar to a Google search, using REST commands. This saves time and bandwidth as only required and relevant details are fetched instead of the whole message (V2, V3 and CDA).

Support: Extensive documentation and examples are available along with several workgroups and communities. Many open-source FHIR test servers and development platforms are available online.

Relevance to various health IT systems

Electronic health record (EHR) systems

EHRs are the de-facto data storage solution at physician practices and hospitals. The amount of data present in EHRs can be used to accomplish business intelligence (BI) objectives, perform incentive calculations, improve patient experience, etc. Today, most EHR systems function in silos and use proprietary technology making it difficult for interfaces to communicate with other systems, including other EHRs. This defeats the purpose of universal interoperability and restricts patient data to an individual system, whereas a provider may require all possible data, in the least possible time, to make the best health choices for that patient.

FHIR enables EHRs to expose patient data through resources on the web. Other health IT systems can authenticate (OAuth2) and access the data using the URL of those resources. Patients' personal health information (PHI) data is protected through HTTPS. This creates an 'internet' of health IT systems where any data related to a patient can be fetched from any system. Duplication of effort is reduced, faster and better decisions are made, and money is saved.

Furthermore, FHIR APIs can be used to design mobile applications that can help to leverage patient data for health monitoring, BI applications, predictive analytics and much more.

Medical imaging

DICOM is the de-facto standard to store medical images today. However, interoperability among imaging systems is still limited. If a physician wants to send imaging data from a PACS to another one, they have to issue an order and a CD is written, which is then couriered and subsequently written on to another PACS. There are personnel specifically allocated to this task of importing and exporting CDs.

Additionally, each image is stored with its metadata. To access only the image details, the whole image needs to be downloaded. This is a concern for image viewers or any application that may want to access details of the images without downloading them.

While DICOM enables access to images using its standard commands, they are single request/response-based commands. There is no way to access or download 1,000 images without giving 1,000 request commands in succession.

FHIR aims to solve these long standing problems in medical imaging. FHIR has a dedicated resource *ImagingStudy* which maps the parameters from DICOM. The *ImagingStudy* resource, like any other FHIR resource, can be accessed over HTTP from any web-enabled or FHIR device. The metadata is a part of the resource and can be accessed separately. Users can also query the data based on various parameters such as UID, patient name, etc. In addition, multiple images can be accessed in a single command, unlike DICOM. These features help reduce bandwidth, time and enable focused access to imaging data.

Payer systems

The payer market faces many challenges today, such as decreasing margins and outdated processes which often require manual intervention. Payers are looking to move to a patient-centric model which reduces cost, modernizes and simplifies claims processing, and automates processes. FHIR helps payers advance these goals.

FHIR resources help at each stage of the payer workflow-enrolment, claim, eligibility and release of funds. *Appointment* resource can be used to book appointment by both parties (patients and payers), which reduces time lost in synchronization. *EligibilityRequest* and *EligibilityResponse* resources can help to quickly check whether the patient is under coverage. *Coverage* resource stores details of the insurance plan. All orders generated by the physician are linked to the patient through *DiagnosticOrder* resource. This resource can be tracked by all parties (patient, providers and payers) to ensure everything is working smoothly. Having the *DiagnosticOrder* resource available also makes payers aware of the patient's eligibility during an episode of care and the incurring cost before the claim is made. Claims are handled through *Claim* and *ClaimResponse* resources.

All resources and individual data elements are accessible over HTTP, and are kept up-to-date along with change history. This reduces the cycle time at each stage of healthcare workflows, including claims processing.

Laboratory systems

FHIR supports all medical orders: medical imaging, pathology, cardiology, etc., with the help of *DiagnosticReport* resource.

Because labs and other systems are disparate in regards to report format, file structure and communication methods, the variety of data available with different labs is isolated. This makes it difficult to get a holistic picture of the patient unless the C-CDA is generated. Even after C-CDA is generated, the physician would need access to the original report for more details. In addition, EHRs have to build specific interfaces to format all reports from various labs. Since labs may utilize different nomenclatures like LOINC, SNOMED etc., the codes would need to be mapped to what the EHR uses. FHIR-enabled lab systems also exchange their data over HTTP with any system which needs access. *DiagnosticOrder* FHIR resource contains elements which provide links to the lab reports. Hence, the base patient resource contains links to all the diagnostic orders as well as all observations recorded for that patient in the form of links to those resources.

Health information exchanges (HIEs)

HIEs are designed to make data available from disparate sources in a network to all participating systems. Because they enable interoperability, there are some concerns with external devices.

A third party device may have trouble accessing data due to problems including authentication, communication protocols, standards used, etc. To allow any device outside the network to communicate with an HIE, an interface or adapter needs to be built. C-CDA enables a record exchange to happen within the HIE's network of devices. CDAs contain a plethora of information which can be extraneous for simpler tasks, i.e., we don't need to know the demographics while querying for the current medications of a patient.

FHIR-enabled HIEs may expose data to third party devices by dynamic authentication (OAuth2). It also enables any device to query information at a more granular level than C-CDA, e.g., a physician, to gain access to current medications, can access the medication resource and get results on any web-enabled or FHIR device. This reduces cycle time and associated bandwidth for data access.

There is versatile access to data, e.g., a physician can search for medications using patient's name, can follow the link to medications in the patient resource, or they can directly search all patients who have the link to a particular medicine.

How is the market embracing FHIR?

FHIR has seen extensive support from leading vendors who are part of the Argonaut project.[2] The Argonaut project is a private sector initiative (under the aegis of HL7) made up of more than 11 organizations, including Epic, Cerner and McKesson**,** that are working together to drive FHIR development. They provide HL7 with financial resources and are agreeing to adopt FHIR.

The SMART on FHIR (an open platform architecture) is one such project that is developed by the Boston's Children Hospital and supported by Cerner, which has an app development program for SMART on FHIR applications. [3]

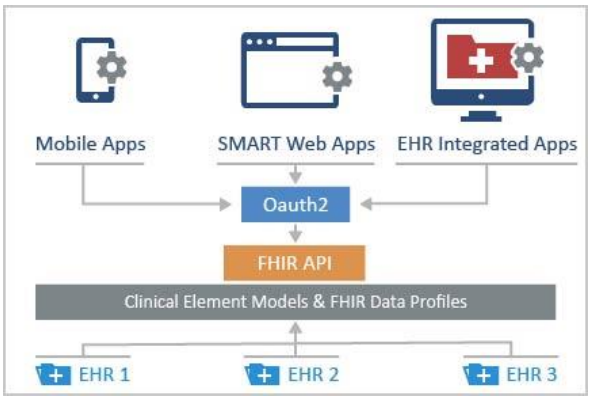

Fig 1: SMART on FHIR

Corepoint Health, Orion Health and Interfaceware have launched their FHIR interface engines. CMS uses FHIR to modernize Blue Button and may include FHIR in future rulemaking. The CDC is working on how FHIR can help improve the accuracy of information collected on death certificates.

FHIR has the potential to be as ubiquitous and useful as the Internet. It can be thought of as the dot com revolution in healthcare.

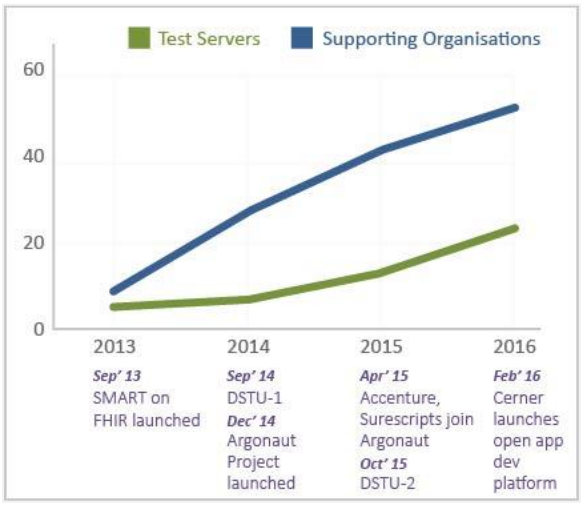

Fig 2: FHIR Adoption Trend

Value to medical technology companies

Future readiness: FHIR has gathered huge support and goodwill from the health IT community, and many market leaders have deployed FHIR-enabled systems.

Federal incentives: The ONC 2015 edition certification mandates the use of an API to help patients access their data. Although no method is currently specified, CMS is inclined towards use of FHIR to achieve this in the near future.

Simplified interoperability: FHIR eliminates the need to build and maintain custom interfaces to communicate with other systems, reducing system complexity.

Reduced cost: FHIR enables focused access to data that saves bandwidth and time. Reduced number of interfaces results in minimal development and operating costs.

Support for app ecosystem: FHIR systems can support a huge ecosystem of apps with a myriad of applications, which can enhance the value proposition for an ISV product, similar to what the App store is for iPhones.

Actionable BI: FHIR enables ISVs to turn data from multiple sources into actionable intelligence and enhance customer experience.

Enhanced scalability: FHIR servers can be easily enhanced like web servers by adding more racks without affecting consuming systems.

Improved reliability: FHIR is built on web protocols and standards that are deployed over millions of systems and have been tested and improved for more than two decades.

Open-source platform: FHIR is completely open-source and uses other open-source standards which eliminates licensing costs.

Readily available support: FHIR is officially supported by HL7 and the healthcare community. Many test FHIR servers are operational.

Minimal skill set required: The skill set required for an implementer is similar to web developers, and anyone with knowledge of HTTP, XML, etc. can deploy a FHIR server without having deep knowledge on healthcare.

Value to providers

Federal incentives: The latest Meaningful Use (MU) and MACRA regulations require a patient to be able to access his or her data from any system using an app. FHIR devices can easily serve this data to the patient through a web-enabled device or REST compatible app.

Enhanced care: FHIR enables a physician to access patient data from all medical devices across practices and hospitals. This helps to eliminate redundancies (duplicate lab tests, etc.) and enables providers to make informed decisions. Also, patient data from their own sources, i.e. fitness bands, mobile phones, etc., can be easily incorporated into FHIR systems if the need arises.

Improved patient engagement: FHIR enables patients to access their own data through an app of their choice and see actionable information (through a BI app) about their health.

Reduced cycle time: With FHIR, a physician can access the data he or she wants and not be overburdened with information. In addition, multiple plug-and-play apps can perform analytics using a patient's data from all systems and can help the provider chart a proper course of action in less time.

Easy data migration: Switching health IT systems becomes easier as all the data is stored in FHIR servers, which are vendor neutral. There is no longer a need for new interfaces and migration tools.

References

[1] FHIR homepage
[2] Argonaut Project
[3] SMART on FHIR

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About CitiusTech

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