LOADBALANCER

WHITE PAPER

Fast Healthcare Interoperability Resources (FHIR)

Driving interoperability to build a patient-centered smart healthcare ecosystem

Introduction

Earlier, health care used to be much easier. Growth, changes and regulations have made it complex today. While digital transformation in health care has proven to bring in a positive impact in the industry, it comes with its own challenges.

This paper talks about leveraging the benefits of Fast Healthcare Interoperability Resources (FHIR) to address the needs of the complicated health IT system and build an interconnected health care platform that aids both providers and patients alike. The paper also emphasizes the role of load balancers in facilitating interoperability within the healthcare setup.

Mariam is the Chief Information Officer (CIO) of a leading healthcare research center in California. Part of her job is to ensure health information is securely accessible to clinical stakeholders and patients alike in order to power processes, clinical decisions, and improved health care outcomes. Currently, a good deal of vital clinical information at their center is hidden across departments and systems unconnected to patient records, and inaccessible to the clinical stakeholders that need it the most. With massive amounts of patient data being generated and multiplied every single day, how does Mariam consolidate the information and link it to key enterprise systems?

A connected healthcare platform is the answer. It aids clinicians in making more informed and accurate diagnoses and treatment decisions, enhancing the overall healthcare user experience.

As the concept of connected data becomes one of the key new indicators for better health outcomes, most industry leaders in healthcare (like Mariam) have realized the need to harness data like never before – with healthcare interoperability.

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Interoperability – the solution for a complex health IT ecosystem?

The Healthcare Information and Management Systems Society (HIMMS) determines that for two systems to be interoperable, they must be able to exchange data and subsequently present that data in such a way that it can be understood by a user. Simply put, interoperability is the ability for a device from one manufacturer to work with one from another. Healthcare interoperability enables applications, databases, and other computer systems to connect, communicate, and exchange information with one another readily, even if they're built on different platforms by different vendors – such as an ultrasound device from GE that can seamlessly communicate and exchange information with a Philips picture archiving and communication system (PACS).

With healthcare interoperability, medical test results, drug prescriptions, specialist visits, and diagnoses no longer have to sit siloed in paper files and computer systems owned by physician offices, laboratories, clinics, pharmacies, hospitals, and medical practices. Instead, the technology enables disparate IT systems across multiple environments to exchange and share data. It doesn't just display a patient's information but also enables healthcare providers to quickly and efficiently access relevant patient data and use it to provide better care. The integration of a patient's health-related records helps clinicians have easy access to his or her medical information on time and reduce medical delays and errors.

FHIR: the underlying standard in healthcare interoperability

Healthcare interoperability provides two major benefits:

- Health practitioners get a complete view of patients' health information spread over multiple electronic health record (EHR) platforms
- Patients get full access to their health information located across providers, specialists, insurers, pharmacists, and more

The question is, how? Thanks to FHIR (pronounced 'fire'), a standard for seamless healthcare data exchange, published by Health Level Seven International (HL7), the non-profit developer of electronic health information standards. Based on previous HL7 clinical and administrative data standards[1] — v2, v3, and clinical document architecture (CDA), FHIR is a standard describing data formats and elements (known as 'resources') and an application programming interface (API) for exchanging EHRs.

Most health data is stored in proprietary databases that use their own formats, sometimes many at once, so it's as if the sending entity speaks one language while the receiving entity speaks another. Without translation, they can't understand each other, which makes the shared data useless. FHIR serves as the common language for the sender and receiver, making semantic interoperability[2] possible.

1 https://hl7.org/FHIR/
2 https://www.darenasolutions.com/blog/2020-the-decade-of-semantic-interoperability-and-compliance

> *FHIR ensures a standard data set that enables systems and applications to send, receive, and share data easily.*

FHIR ensures a standard data set that enables systems and applications to send, receive, and share data easily. Patient data repositories built on FHIR servers aggregate and store all the data available from different entities including primary care physicians, specialists, hospitals, surgeries, pharmacies, and other health setups in a standardized format in one place.

This standardized format allows FHIR servers and other FHIR-enabled applications to send and receive data across multiple locations. To facilitate a better health care environment for patients and providers, FHIR can also be used in a variety of applications, including mobile apps, cloud communications, EHRs, and more.

Benefits of FHIR for digital health

Now in its fourth release, FHIR can be used as a stand-alone data exchange standard or in conjunction with existing standards. It focuses on addressing the need for patient records to be readily:

- Available
- Discoverable
- Understandable
- Exchangeable

FHIR enables data to be connected to, and easily accessed from, core clinical applications allowing providers all-round visibility into a wealth of actionable information about their patients. This information helps streamline processes and workflows while aiding clinicians to make accurate diagnoses and well-informed treatment decisions. For example, a FHIR-based interface can automatically generate a patient-specific document that outlines a particular patient's potential medication interactions and side effects based on his or her medical history. Such actionable information helps in making crucial clinical decisions and preventing potential adverse drug interactions. FHIR APIs benefit providers on multiple levels – right from managing efficient clinical workflows, better patient outcomes, and regulatory compliance. It has the power to simplify or eliminate many administrative work and care-coordination tasks allowing providers to shift their focus from non-value generating activities to patient's clinical needs. By making the right data available at the right time, FHIR enables providers to:

> *FHIR-supported interoperability enables patients to take an active role in their health care.*

- Deliver timely and better-coordinated care to their patients
- Eliminate medical errors and enable increased patient safety
- Cut down unnecessary or duplicate diagnostic tests
- Improve patient engagement and satisfaction
- Attain regulatory compliance with ease, and reduce medical liability

From a patient perspective, FHIR-supported interoperability enables patients to take an active role in their health care. As individuals, if we can readily access banking information to make decisions about our money, why shouldn't we be able to access our medical data to make decisions about our health as well? By controlling individual health care data, patients can look for new health insurance schemes that best meet their requirements, find research organizations that understand their health conditions better, or even share medical data with other organizations to help other patients down the road. Patients will, of course, have control over exactly what data and with whom they want to share.

Another great benefit is the patient's ability to implement connectivity between third party app developers. Apple has already included FHIR in iOS 11 and is leveraging this new standard as part of its Health app[3] that allows users to download and view their health care data from connected healthcare organizations on their iPhone. While Apple made the first big move, other tech giants like Microsoft, Google, and Amazon are also moving ahead with FHIR[4], working on tools, technologies and software that use the standard and facilitate the integration of patient-generated health data from millions of fitness trackers, smartwatches and blood pressure monitors with clinical health records located in doctors' offices, hospitals, and medical labs. With this, patients who track their sleep, calorie intake, or log their exercise can quickly and easily transmit that data to their healthcare provider in the same way that their providers can transmit data back to them.

A secondary benefit that patients enjoy is administrative efficiencies. For instance, imagine the ability to instantly provide a complete medical history when visiting an emergency room while on vacation. With FHIR, that can be a reality – and filling out the same information on 10 different forms, or doing redundant lab tests should become a distant memory with FHIR. Improved data portability and interoperability makes it easy for data collected one day to be in another doctor's hands the next day, or perhaps, the next moment – resulting in more timely and safer patient care.

3 https://www.apple.com/healthcare/health-records/
4 https://www.darenasolutions.com/blog/how-microsoft-google-apple-and-amazon-are-fueling-fhir

How load balancers fuel FHIR

Due to the advancements in medical imaging, big data analytics tools, and the increasing use of real-time data in clinical decision-making, researchers have found that health care data is projected to grow fast[5], experiencing a compound annual growth rate (CAGR) of 36 percent to 2025. Also, according to statistics compiled by Dell EMC[6], healthcare organizations have already seen an explosion in health data – growing almost 900% from 2016, to 8.41 petabytes (PB) on average in 2018. Considering the substantial volumen of health data that's floating around already (and ever-increasing), it's not advisable for healthcare organizations to store their valuable data in just one location. As the healthcare industry marches forward with FHIR adoption and implementations, organizations need to shift their data load from one single server to multiple servers or move it up to the cloud. Because, for two or more systems to be interoperable, data must be available and accessible when one system tries to talk to another. But, for instance, if all the data generated in a particular hospital were going to one single server, the chances are that the server could soon be overwhelmed, like one doctor handling all the patient inflow in a hospital would be. Server overload can cause network failure and press storage systems to eventually break.

Deploying multiple storage nodes and a load balancer across your health IT environment ensures guaranteed uptime. The concept of load balancing is to route network traffic intelligently across multiple servers. While layer 4 load balancing is a super fast and highly scalable method, layer 7 is more feature-rich but often, somewhat less scalable. Whether it's layer 4 or layer 7, all load balancers help achieve scalability and high availability, while delivering zero downtime – crucial for your mission-critical health systems.

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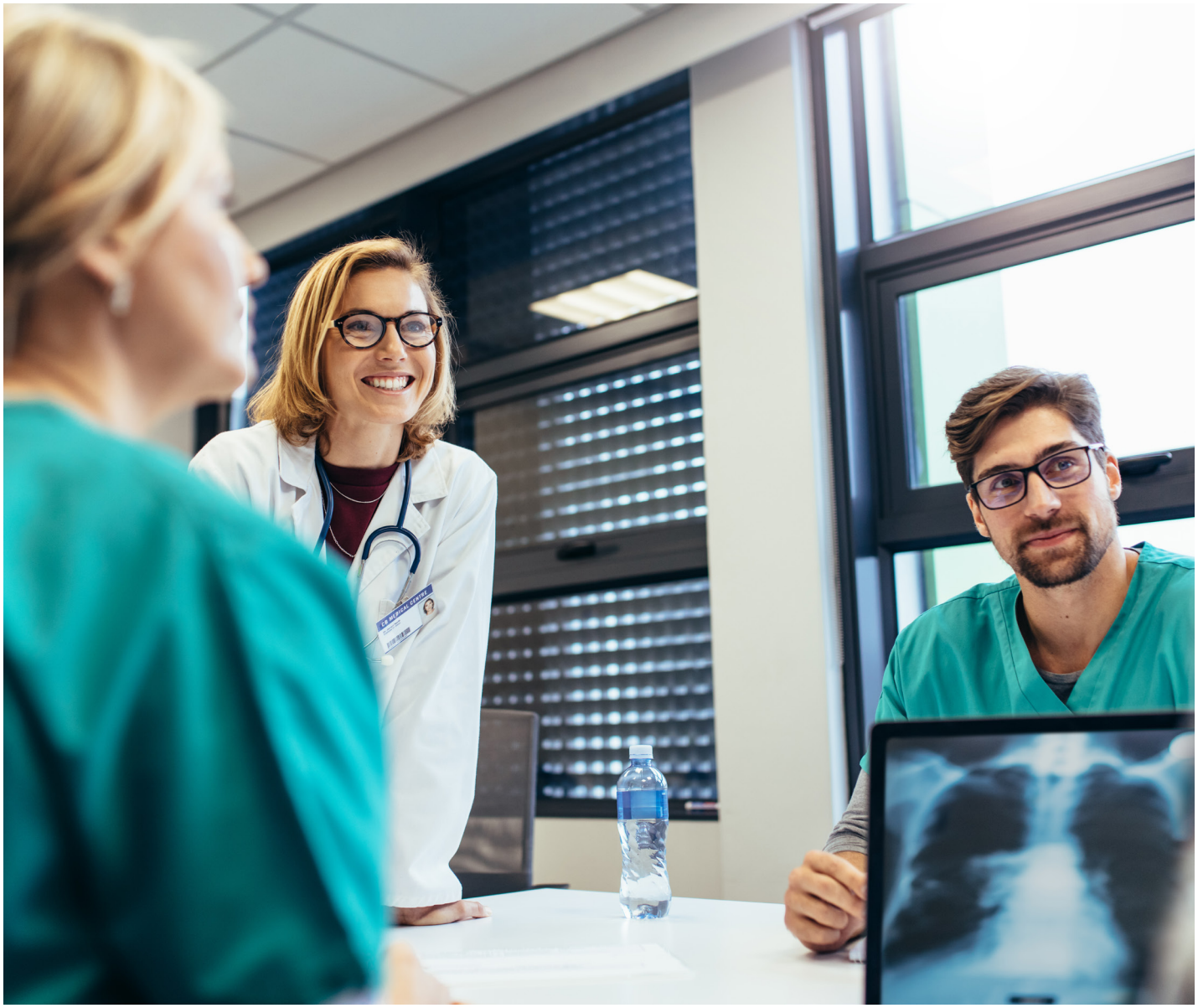
Load balancing is critical to facilitating data exchange and accessibility between, and among multiple health IT systems, because it enables data to be distributed among multiple servers – helping IT systems scale up to handle larger workloads. By scaling up data from single to multiple servers, a load balancer routes network traffic in a way that it becomes sustainable – with no one server having to manage all requests. 'Least connections' load-balancing algorithm enables a load balancer to send traffic to the servers with the lowest number of active connections and not just to one single server, to balance the traffic inflow and prevent a particular server from getting overloaded.

5 https://healthitanalytics.com/news/big-data-to-see-explosive-growth-challenging-healthcare-organizations
6 https://blog.dellemc.com/en-us/exploring-global-data-protection-index/

> *Load balancers can detect if a server breaks or stops functioning, to ensure high availability for your health IT systems*

While having a scalable storage system is certainly important, equally important for healthcare organizations is to make sure that their systems are unbreakable – giving patients and providers easy access to critical health information all the time at the click of a button. Load balancers can detect if a server breaks or stops functioning, to ensure high availability for your health IT systems. The appliances identify the failure and rebalance and reroute the users affected by that failure to a different location across the remaining healthy servers – helping users enjoy uninterrupted data access.

Moreover, load balancers encrypt the transfer of data from one location to another allowing users to access the data via a secure connection handle. For establishing interoperability and data sharing between multiple health systems – secure and insecure – a load balancer supports data exchange in both HTTP and HTTPS formats. While sending data from a system (A) that supports secure communication channel such as HTTPS to a system (B) which doesn't, a load balancer can decrypt or remove the security layer in the traffic by using SSL/ TLS termination and send it to the receiving system as plain HTTP. Likewise, it can also do the reverse. If an older system sends traffic as plain HTTP, a load balancer can re-encrypt it in SSL and send the traffic to a newer system wrapped with the security layer, facilitating the communication between older and newer health IT systems.



Loadbalancer.org – helping you rise to every challenge

At Loadbalancer.org we know how to design and create innovative systems based around your goals. Our in-depth knowledge of the healthcare IT industry and the experience of working together with the world's top 10 health IT vendors, has helped us become the leading load balancer provider for the medical sector.

> *We help customers achieve scalability, high availability, security, and zero downtime with our range of powerful, cost-effective products and services.*

Our team of specialist engineers are able to provide strong support from project inception, through deployment and beyond. Whatever the challenge, we can help you rise to it. Collaborating with healthcare vendors and providing them with bespoke load balancers, has helped us understand customer pain points better than other providers. For example, we know how terrible it would be for a hospital's imaging system to experience downtime, even just for a couple of minutes. We understand the seriousness of the situation, and we help customers achieve scalability, high availability, security, and zero downtime with our range of powerful, cost-effective products and services.

We have decades of expertise working with web-based protocols like FHIR – handling HTTP and HTTPS traffic is one of our biggest strengths, because we understand exactly how it works. In order to support such an array of different applications, we use a variety of load balancing methods including Layer 4 DR, Layer 4 NAT and Layer 7 SNAT modes[7]. As FHIR evolves to become an important health IT standard, we're able to scale-out current deployments for customers, and include the latest standards across existing PACS, EHR or VNA (vendor neutral archive) systems.

7 https://www.loadbalancer.org/applications/load-balancing-medical-imaging-systems-pacs-dicom-xds-hl7/

> *FHIR is designed to do great things for health care and the foundation has already been laid.*

Transforming the future of health care with FHIR

According to a Deloitte report[8], as FHIR emerges as the common language for medical data sharing, consumer demand, government regulations, competition and the need for value-based care are creating immense pressure on the healthcare sector to embrace interoperability. Looking forward, if healthcare organizations are to provide the best patient care, they should be able to consume, access, and share information rapidly and securely. Agreeing to this, more and more organizations are already underway with installing software and implementing tools and technologies that support FHIR – Microsoft Cloud for Healthcare is one such example. Microsoft's newest FHIR-integrated, industry-specific cloud offering delivers automation and efficiency on high-value workflows and deep-dive analytics for both structured and unstructured data, empowering customers to turn insights into actions. Recently, the software enabled the Chicago Department of Public Health and Rush Hospital to achieve an end-to-end solution that brought together clinical, lab, and capacity data analysis in just a few days to support the COVID-19 crisis.

FHIR is designed to do great things for health care and the foundation has already been laid. However, while the FHIR API is now available for most major EHR systems and equipped for exchanging medical data such as laboratory results and medications, it's not yet ready for exchanging specialized information, for instance if an oncologist wanted specific information on a gene or biomarker. Given time, FHIR is sure to become more deeply ingrained into the health IT space, delivering better experiences, insights, and overall patient care.

8 https://www2.deloitte.com/us/en/insights/industry/health-care/radical-data-interoperability-survey.html#endnote-8

Source links

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About Loadbalancer.org

Loadbalancer.org's mission is to ensure that its clients' businesses are never interrupted. The load balancer experts ask the right questions to get to the heart of what matters, bringing a depth of understanding to each deployment. Experience enables Loadbalancer.org engineers to design less complex, unbreakable solutions - and to provide exceptional personalized support.

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