



# Keeping the patient at the center of healthcare with interoperability

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# Introduction

Despite the widespread usage of electronic health records (EHR), more than one-third of clinicians and the care team still struggle with exchanging information<sup>1</sup>. A patient's entire medical journey may be cataloged and recorded—from a routine check-up, to visiting a lab, to undergoing an MRI—yet many clinicians don't have the tools to connect the dots. All that data is a goldmine of information, but its value remains untapped because it's siloed across disparate systems that cannot effectively exchange data.

Interoperability unites data across various sites, enabling healthcare providers to make more informed decisions and deliver better care to patients no matter where they originally received care. Every organization is different, requiring a custom interoperability solution to fit their specific needs, instead of a blanket approach. While data standards have been available in the past, they have not been sufficient to achieve full interoperability. For interoperability to be successful, healthcare organizations need a more granular focus that encompasses syntactic interoperability, where a common standard and language are used to interpret the data, and semantic interoperability, where the meaning of the data is also transferred.

Amazon Web Services (AWS), together with [AWS Partner Network \(APN\)](#) partners, makes the promise of interoperability a more achievable reality. The speed, scale, and capabilities of AWS architecture can facilitate uniting and prepping data, while enabling customers to be compliant with HIPAA and other regulations. Many leading APN Partners use AWS as the foundation for their interoperability solutions, allowing healthcare providers to streamline operations and improving access to patient data.

In this eBook, you'll discover how AWS supports the building blocks for tailored interoperability solutions, how APN Partners are equipping companies to tackle interoperability challenges, and how industry standards like Health Level Seven® International (HL7®) Fast Healthcare Interoperability Resources (FHIR®) are shaping the future of interoperability.

<sup>1</sup> [Black Book 2018 Survey of Inpatient EHR Client Satisfaction](#)

# AWS building blocks support interoperability to fit your needs

Each healthcare organization is different and may take a unique approach to interoperability. Rather than providing a one-size-fits-all service, AWS offers the building blocks, together with FHIR and controlled terminologies, for healthcare organizations to customize and implement an interoperability solution that is right for them. AWS delivers the compute, storage, analytics, data transformation, and compliance solutions to serve as a foundation for interoperability or to augment an existing setup.



## Scalable compute plus flexible storage transform data

The cloud has made life easier for healthcare IT departments. Transforming healthcare messages, such as HL7 Version 2, into a single data model is crucial to successful interoperability. Historically, organizations would need to provision their own infrastructure to manage the influx of messages into their system. With AWS, healthcare organizations can remove themselves from this task by using the serverless compute capabilities of AWS Lambda and AWS Glue to transform health data and store the resulting information in a data lake backed by Amazon S3. By building their healthcare API on Amazon API Gateway, organizations get a scalable, secure API to ingest FHIR messages.





## Secure cloud infrastructure helps ensure compliance and privacy

Regardless of format, healthcare data that is shared and stored by covered entities is governed by HIPAA or other global regulations to ensure patient privacy. That is why AWS adheres to HIPAA standards, enabling HIPAA-compliant solutions that can process, maintain, and store protected health information. Choose from more than 100 AWS services that are HIPAA-eligible, and apply the necessary technical controls to ensure compliance. AWS also offers a wide range of certifications and attestations, covering international compliance programs. Leverage these certifications to meet additional compliance standards, such as the Federal Risk and Authorization Management Program, ISO 27001, ISO 27002, and the HITRUST Common Security Framework.



## AI and machine learning help clinicians deliver better results faster

AI and machine learning get to the crux of interoperability issues by reducing manual processes prone to errors, and automating time-consuming activities, like scheduling, paperwork to free up clinicians and standardize processes. For instance, one application may code a file entry as “HTN” while the next system can only interpret “hypertension.” Instead of letting this entry go untapped, [Amazon Comprehend Medical](#) acts as the go-between translator, enabling a meaningful data exchange. As a natural language processing service, Amazon Comprehend Medical makes it easy to use machine learning to extract relevant medical information from unstructured text. Organizations can also use AI capabilities to learn from the combined patient data and flag potential issues for care providers, such as adverse medication interactions.

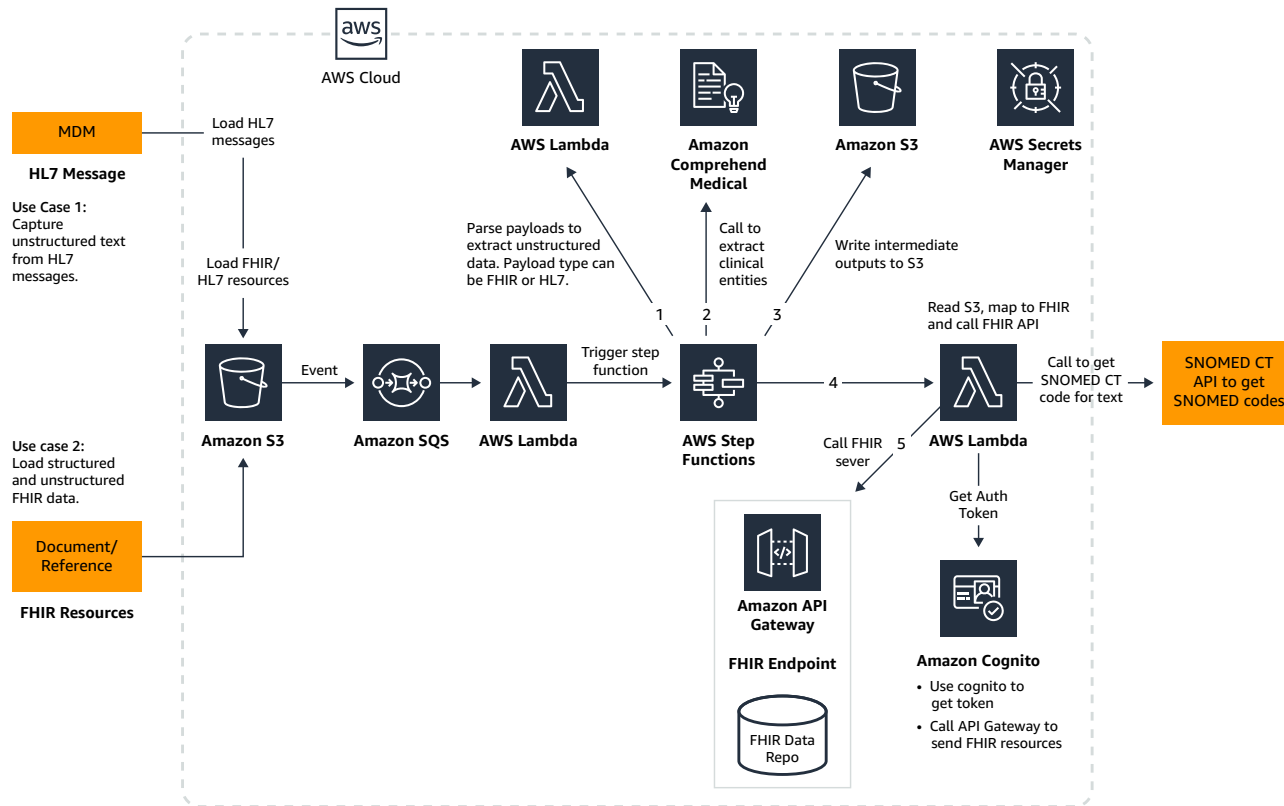




## See interoperability with AWS in action

This reference architecture shows an example of an interoperability solution on AWS. It leverages FHIR as the common standard to achieve syntactic interoperability, and uses Amazon Comprehend Medical to extract clinical clinically significant information from free text and send them to existing FHIR endpoints. Because most major EHRs do support FHIR endpoints, this architecture can be used as a blueprint to achieve interoperability across sources of free text data such as scanning systems, transcription systems, and email.

The architecture also demonstrates the use of OAuth2.0 tokens for FHIR-based communication, where Amazon Cognito serves as the user pool to enforce the security around API-based communication. All data is encrypted both at rest and in transit to ensure that your information stays safe. This example uses serverless components that can scale automatically without the need to provision resources, enabling healthcare companies to focus on their core business.



# AWS partners help customers solve their interoperability challenges

Using AWS as a foundation, APN Partners provide both flexibility and customization for organizations to enhance their existing systems or tailor their interoperability. These partners have developed a broad range of interoperability solutions for providers, payers, and software vendors to securely store, process, transmit, and analyze clinical information.

## **Change Healthcare develops free interoperability service using AWS**

Change Healthcare, which provides software, analytics, and network solutions to companies throughout the industry, has developed a free interoperability service that runs on AWS infrastructure. Change Healthcare is working with its customer CommonWell Health Alliance® to migrate to AWS to enable a more scalable solution given CommonWell's significant growth and need to support additional use cases. Change Healthcare provides patient identification, record locator services, and document retrieval services to CommonWell. The scalable, secure, and agile nature of AWS helps ensure Change Healthcare can deliver critical and accurate medical data, paving the way for interoperability that improves patient care and decreases costs across the board.



AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## Datica delivers compliance assurance and HL7 integration for virtual care solution

Virtual care options are steadily becoming mainstream throughout the healthcare sector because they deliver patient care faster and cheaper than traditional visits. In real time, from virtually any location, a patient can confer with a clinician to set up a treatment plan or receive a referral for myriad conditions.

### Challenge

Founded in 2009, Zipnosis set out to deliver a virtual care solution that healthcare organizations could easily integrate into their existing EHR platform to provide virtual care to patients—without sacrificing data capture and analysis. When virtual care isn't fully connected to a healthcare provider's IT, the patient experience can feel disjointed, and clinicians may miss key pieces of information that are siloed across systems. Actions like handing off a patient to another provider may be slow and difficult if the virtual visit isn't synched with the patient's records.





AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## Datica delivers compliance assurance and HL7 integration for virtual care solution

### AWS Partner solution

Zipnosis needed a flexible, compliant platform where it could build its virtual care solution, as well as support for integrating its virtual visit record with customers' HL7 data. Zipnosis found the right APN Partner with Datica, who supports Zipnosis by augmenting its integrations team with interoperability expertise and thought leadership. Datica also provides Compliant Managed Integration with Electronic Health Records via Amazon EC2 and a secure VPN connection. Datica's Cloud Compliance Management System (CCMS) provides continuous management and monitoring of a customer's compliant state. Continuous security and compliance are provided via a Management Virtual Private Cloud (VPC) leveraging Amazon EC2, AWS Lambda, Amazon CloudWatch, and AWS CloudTrail. This assures Zipnosis of the security, compliance, scalability, affordability, and reliability of its critical infrastructure. Zipnosis leveraged Datica's [compliance software](#) to build its HIPAA-compliant solution that could scale with each new customer, and Datica's [compliant EHR integration platform](#) to facilitate HL7 integration. Since the beginning, Datica has worked behind the scenes to help Zipnosis execute HL7 integrations for its customers.

**"We needed both a solution that could scale up but also a partner that could creatively solve virtual care interoperability problems. Datica met both of those needs and, along the way, we discovered they shared our views about the next generation of virtual care."**

—Derek Rockwell  
Sr. Director Product & Engineering  
Zipnosis





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## Datica delivers compliance assurance and HL7 integration for virtual care solution

### Results

- Having Datica configure VPNs and map virtual care visit data into customers' HL7 messages saved Zipnosis the cost of 4-5 FTEs, saving hundreds of thousands of dollars
- Working with Datica cut overhead costs for Zipnosis that would have been passed on to future clients
- 100% uptime of Zipnosis interfaces with zero security incidents
- Since partnering with Datica five years ago, Zipnosis has sent and received hundreds of thousands of messages representing nine message types across over half of their health system partners

### Looking ahead

With Datica handling the infrastructure and interoperability, Zipnosis was able to focus on the business side of things, expanding its solution to serve more use cases and service lines.

ZipPlus is a new offering that extends the Zipnosis virtual care solution to areas like occupational and behavioral health.





AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## Redox speeds data integration with custom solution for long-term post-acute care (LTPAC) EHR

True interoperability goes beyond the movement of data. Data transmitted from point A to point B is not necessarily structured or valuable to the system and staff on the receiving end. PointClickCare, an EHR vendor for LTPAC and senior living sectors, recognized the disconnect between hospital and LTPAC facilities, and developed a software solution ([Harmony by PointClickCare](#)) that enables more structured communication and open data access to all pertinent care providers.

### Challenge

When a patient is discharged from a hospital, and admitted into a LTPAC facility, such as a nursing home or rehabilitation facility, the patient's information will be faxed or manually provided to the receiving facility. As a result, staff on the receiving end are often required to manually review patient information, often hundreds of pages of documents, to determine and reconcile a patient's medication and post-acute care needs. Manual and unstructured communication systems and processes can delay care and increase the likelihood of an adverse event and the need to readmit a patient to the hospital. In fact, 27 percent of hospital readmissions—which cost \$11,000 on average—are preventable. As value-based care models that link payment to clinical outcomes are becoming more prevalent, blind handoffs of patient information are no longer viable, as they drastically increase healthcare providers' financial risks.

Harmony by PointClickCare connects into a healthcare organization's existing EHR to coordinate care and enable data sharing as a patient transitions into an LTPAC facility. Initially, PointClickCare handled the setup of its point-to-point connections in-house, but the process was time and resource intensive.





AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## Redox speeds data integration with custom solution for long-term post-acute care (LTPAC) EHR

### AWS Partner solution

Once PointClickCare started working with APN Partner Redox, it was able to pass off the configuration and management of its customers' connections. Using AWS infrastructure to remove the complexity of managing a compute environment allows Redox to deliver interoperability for the PointClickCare solution five times faster while remaining in a fully HIPAA compliance eligible, HITRUST-certified environment within the AWS ecosystem. Redox provides a full-service integration platform that enables real-time data exchange across software vendors and healthcare data sources, such as EHRs, HIEs, and CRMs. The integration platform allows organizations to use a single connection and the same integration design by providing a normalized data exchange experience and reusable connections. This makes integrating easy to do and easy to scale. Redox has been able to speed traditional integration times by conforming to a customer's existing use of data standards, as opposed to changing specifications that are already established. Redox connects with healthcare data sources via VPN or webhook and uses their specified integration method, such as HL7, FHIR, or a vendor API, as it's already configured. Software vendors use a single connection via webhook to send and receive data using Redox's API or a FHIR API, R^FHIR. This results in consistent and predictable integrations regardless of the data source.

This approach has significantly reduced interface testing time, allowing Redox to cut integration time by 80 percent. In addition, Redox is able to rapidly scale for PointClickCare and several other hundred customers by using the auto-scaling technology provided by AWS Elastic Computing Cloud (Amazon EC2) to grow its customers' workflows without manually building new servers. This is supported by Redox as it manages its infrastructure exclusively as code, allowing Redox engineers to quickly and effectively build customized solutions.

**"If your goal is to improve patient care and reduce rehospitalization, then you need Redox. They're doing more than just connecting you to an API—they're delivering data that's actionable and consumable."**

— Sean Vanderweerd  
Sr. Product Manager  
PointClickCare

**REDOX^** | **PointClickCare**®



AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## Redox speeds data integration with custom solution for long-term post-acute care (LTPAC) EHR

### Results

- Working with Redox enabled PointClickCare to speed its data integration process 4X and reduce the workload on its in-house resources by 75 percent
- PointClickCare delivered a fully integrated post-acute care solution to a health information exchange in 1.5 weeks with the help of Redox
- Redox cuts integration time for customers by 80 percent—where the traditional point-to-point method takes about 100 hours, Redox can accomplish it in 20 hours

### Looking ahead

Redox plans to continue expanding its network of providers for a wider pool of systems that communicate together. Redox's work to promote meaningful interoperability will improve the coordination of care between acute care and skilled nursing facilities across the care continuum.



AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## InterSystems central to modular, scalable architecture for California's health data network

With information for 17 million patients, size is just one dimension of California's largest nonprofit health data network, Manifest MedEx (MX). Millions more data points are layered on to facilitate interoperability across combined clinical and claims data. MX recognized early on how crucial it was that its platform could scale to handle the state's growing population and constantly evolving integrations.

### Challenge

MX formed in 2017 when two health information exchanges (HIEs) merged. As a new entity with a new vision for putting information to work in California, MX sought a technology partner that could deliver a flexible, modular platform that would unite its existing data assets and leave room to scale for new patients and integrations. Specifically, MX wanted a highly scalable clinical data repository and data warehouse, an enterprise master patient index solution, and an integration engine. The health network also wanted to retain its existing IP around HL7 interfaces.





AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## InterSystems central to modular, scalable architecture for California's health data network

### AWS Partner solution

MX found its modular match with InterSystems. The core of the MX platform runs on [InterSystems HealthShare](#), a suite of connected care solutions that creates a unified patient care record from a number of different sources. The result is a scalable solution that handles the data architecture, storage, management, and workflows, as well as data replication and warehousing for analytics. HealthShare runs on Amazon EC2 instances established to host the MX platform.

As a result, MX is able to deliver its 400+ participating providers both clinical and claims data—in real time. Without both data sets, a clinician might increase the dosage for a patient who isn't responding to a particular medication. With access to claims data such as pharmacy visits, however, the clinician would notice that the prescription had not been filled, and would realize that increasing the dosage was not the right care plan.

The HealthShare solution for MX was built for flexible deployment and scale so MX can quickly incorporate new functionality. MX hosted its InterSystems application leveraging Amazon EC2 instances for compute and elastic storage for production and backup storage. For authentication and access control the platform uses Cognito, and InterSystems manages additional security configurations through Amazon Virtual Private Cloud features.

**“InterSystems HealthShare will help connect the dots on every patient record, delivering the information California payers and providers need as they move toward value-based care.”**

—David Kates, CTO  
Manifest MedEx





AWS PARTNERS HELP CUSTOMERS SOLVE THEIR INTEROPERABILITY CHALLENGES

## InterSystems central to modular, scalable architecture for California's health data network

### Results

- Utilizing information delivered by MX has led to a 39 percent decrease in patients not seen within seven days of discharge for participant Inland Empire Foundation for Medical Care.
- ER visits have decreased 3 percent, and ER visits leading to hospitalization fell by 5 percent for the patient population managed by this organization.

### Looking ahead

For patients, value-based care has the potential to lower healthcare costs while also improving health outcomes. With a solution built to scale, MX has its sights set on uniting more datasets and deriving useful insights from the vast amounts of data it aggregates. This will support a full transition to value-based care from the industry's current fee-for-service approach. Additional data can provide a more comprehensive picture of patient health, lowering the overall risk of a value-based model as providers move to that model.



# HL7 FHIR standards speed interoperability adoption

The future of interoperability depends on a common language that enables communication across different healthcare systems. Leading the charge in developing these communication standards is the not-for-profit organization Health Level Seven® International (HL7®). Since 1987, HL7 has developed and released information modeling standards applicable to EHRs and applications to enable meaningful healthcare data exchanges. Its latest framework, FHIR, includes both a data model for healthcare information and a technology stack for application development. As an open source standard that's widely accessible, FHIR has helped speed the development of interoperability solutions and bridge fundamental gaps in data exchanges.

In 2018, the U.S. Office of the National Coordinator for Health Information Technology launched a testing program called [Inferno](#) to support the adoption of FHIR. Inferno allows developers to verify that their FHIR standards are consistently implemented across systems. This will help ensure that developers adhere to FHIR standards and that communication remains consistent.

Paired with cloud technologies, FHIR is turning real-time interoperability into a reality. Before, clinicians relied on manual processes that connected across various systems to deliver patient information. The datacenters holding key medical data were difficult to scale, maintain, secure, and slower to access. Now, with FHIR operating as a common language on fast, accessible, cloud-hosted systems, crucial information can be delivered exactly when it's needed.

The logo for HL7, consisting of the letters 'HL7' in a bold, red, sans-serif font, with a registered trademark symbol (®) to the upper right of the '7'.

**“FHIR provides a common language for all EHRs to talk to each other. But more than that, FHIR allows you to build apps quickly—what used to take months or years is now much faster. You get a solid foundation of infrastructure and content resources plus the ability to adapt and extend on demand.”**

**“Cloud computing is so much better than what we could possibly do ourselves a decade or two ago...solutions such as AWS can typically provide much more security, redundancy, scalability than most on-premises type solutions.”**

—Wayne Kubick  
CTO, HL7



# Take on interoperability and deliver better patient care

The cloud makes it easier to embrace interoperability and initiates a shift from a system-centric view to a patient-centric view. Put the patient back in the center of healthcare with cloud-powered solutions that get systems connected. Discover the right interoperability solution for your company using building blocks from AWS and expertise from an [APN Partner](#).





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