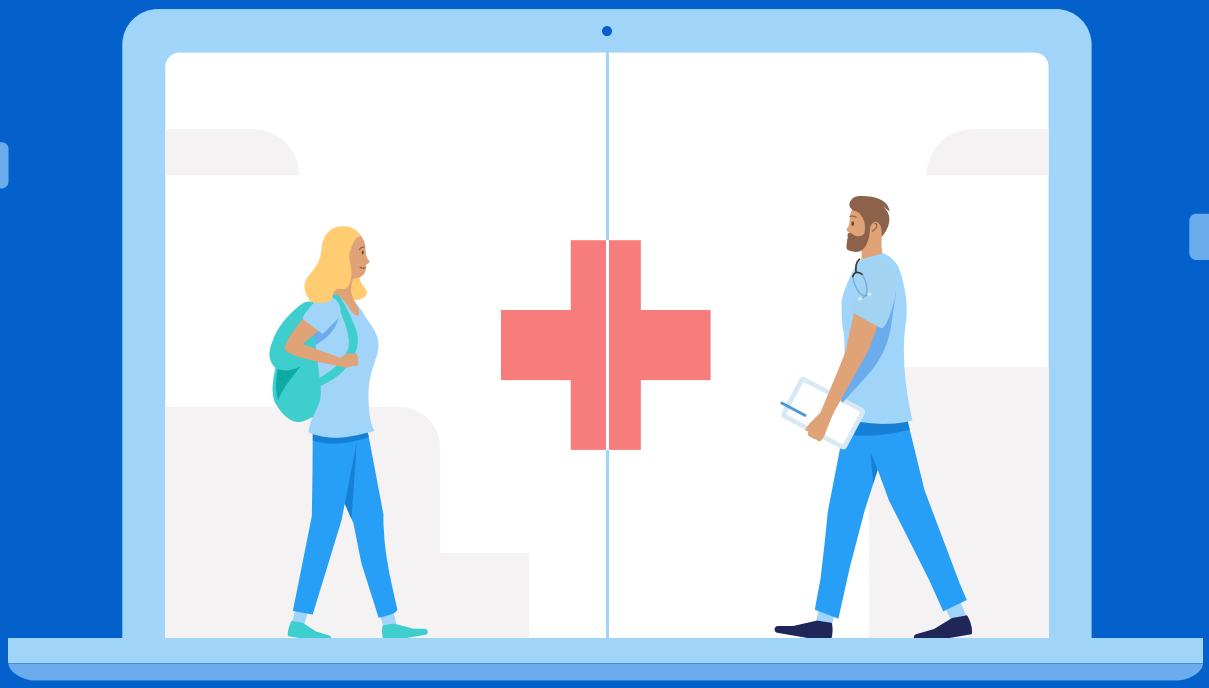
Interoperability and the Modern Healthcare Tech Stack



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Introduction

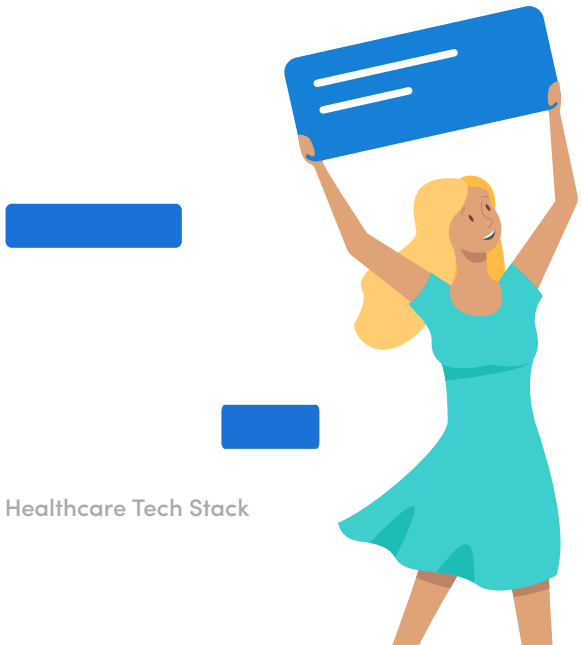
New developments in healthcare technology have ushered in an IT revolution and introduced new approaches to practicing medicine. Telemedicine is an increasingly large part of healthcare, and doctor's office visits are being replaced by remote, on-the-go electronic monitoring devices that transmit real-time data to healthcare providers. By 2024, the global healthcare IT market is expected to reach $382 billion.

The benefits of these new technologies include:

- Reduced treatment costs
- Elimination of unnecessary procedures
- Better patient outcomes
- Faster communication with physicians and nurses
- Earlier diagnosis of medical conditions
- Improved safety and efficiency of healthcare delivery
- Immediate, secure access to a patient's full medical history
- Easier identification of patient cohorts for clinical trials

In the United States, the Health Information Technology for Economic and Clinical Health (HITECH) was signed into law in 2009. The objective is to promote the adoption of electronic health record (EHR) systems and the meaningful use of healthcare IT. By 2015, 86.9% of office-based physicians and four out of five non-federal acute care hospitals had adopted some form of basic EHR.

The problem facing healthcare providers today is how to consolidate and access information in the EHR plus other sources to improve patient care.



What is interoperability in healthcare?

Interoperability is when hardware and software from disparate systems communicate and exchange data without restrictions. It allows data from multiple health information networks to be shared and accessed by a clinician, lab, or hospital—regardless of the system or application being used—at any time for the purpose of providing the best care possible.

Interoperability occurs at three levels: functional, structural, and semantic.

1 Functional level:

The first step is when data is exchanged between various healthcare IT systems.

2 Structural level:

The second step occurs at the structural level, applying schema and standards to make sure all operational data remains constant from one system to another and can be interpreted at the data field level.

3 Semantic level:

The final step is when different IT healthcare networks exchange and interpret data, and are able to use the information that has been exchanged.

A patient's health records and personal medical history are often strewn across various EHR systems in different medical facilities, which presents a number of problems for patients and providers. A patient may have received care for a number of years from one healthcare provider, then moved to a new location and became a patient of a new clinic or hospital. Or, someone may have a medical emergency while away from home, and the family member who is contacted cannot provide the extensive history needed in order to accurately diagnose and treat the condition.

Many challenges stem from patient data stored in different locations, but healthcare providers also face challenges getting their own internal systems to work together. If the records for the emergency room are stored in a different system and format than the records from the home healthcare provider, the data is still effectively in two disconnected systems that do not work together. Providers and administrators are stuck searching databases and running down patient records, wasting valuable time and decreasing the quality of patient care.

If all of the patient's medical records are located in connected, interoperable systems that can be easily accessed, the healthcare team can give the best, most efficient, and safest care possible at the right time.

The healthcare technology stack

To understand interoperability and what its practical application in healthcare means, it is vital to have a clear picture of what technologies are supporting care delivery and how they work together. A "stack" is a group of technologies that are used together—or "stacked" on top of each other—to support a certain function. There are two types of technology stacks: client-side (front end) and server-side (back end).

1 Client-side:

Technology stack installed in a client machine, such as the laptops, tablets, and other devices a healthcare provider and supporting staff may use. Includes the operating system, supporting software, runtime environments, and support for various programming languages.

2 Server-side:

Technology stack installed in a server. Includes all of the client technology stack plus database software and server software, i.e. web server, mail server, FTP server.

A modern healthcare tech stack typically contains the following components:

Programming Languages

Programming languages give a specific set of instructions to a computer to produce different types of output. A computer program is a collection of these instructions that perform a clearly defined task when executed. There are more than 2,000 of these languages, yet only a few are commonly used. Computer programming languages that may be used in the development of a healthcare tech stack include: Java, Python, C#, C++, Scala, Objective-C, JavaScript, PHP, and HTML5.

Operating Systems

An operating system is the software that controls the operation (memory and processes) of a computer and manages all of its software applications and hardware (central processing unit, memory, storage). The type of operating system affects the type of applications that can be run.

Operating systems that may be used in the development of a healthcare tech stack include: Windows, macOS, Linux, and mobile device operating systems like Apple iOS or Google Android.

Databases

A database is a structured set of data contained in a computer. Databases can contain structured (highly organized with clearly defined data types), unstructured (unorganized data with undefined data types), or semi-structured data (a mix of both elements).

Examples of structured healthcare data are unique patient and provider identifiers and record structures linking dates and times of patient care. Unstructured healthcare data may consist of emails between the patient and provider, video chats, or data collected from a wearable medical device.

Databases that may be used in the development of a healthcare tech stack include: MySQL, Oracle, PostgreSQL, Memcached, and MongoDB.

Servers

A server is a computer program that processes requests and serves as the gateway to other programs, either on the same computer or on another machine. Any application or system containing healthcare information must be HIPAA compliant, and that includes the server.

HIPAA, the Health Insurance Portability and Accountability Act of 1996, was created to protect health insurance coverage for persons who lose or change jobs, prohibit group plans from denying coverage for pre-existing conditions, develop national standards for electronic processing of healthcare transactions, and secure access to digital health data.

Servers that may be used in the development of a healthcare tech stack include: Apache server and NGINX.

Web Frameworks

Web frameworks are tools and resources that provide common patterns for building reliable, scalable web applications, services, and websites. They contain a library of pre-existing code that makes software development faster and easier.

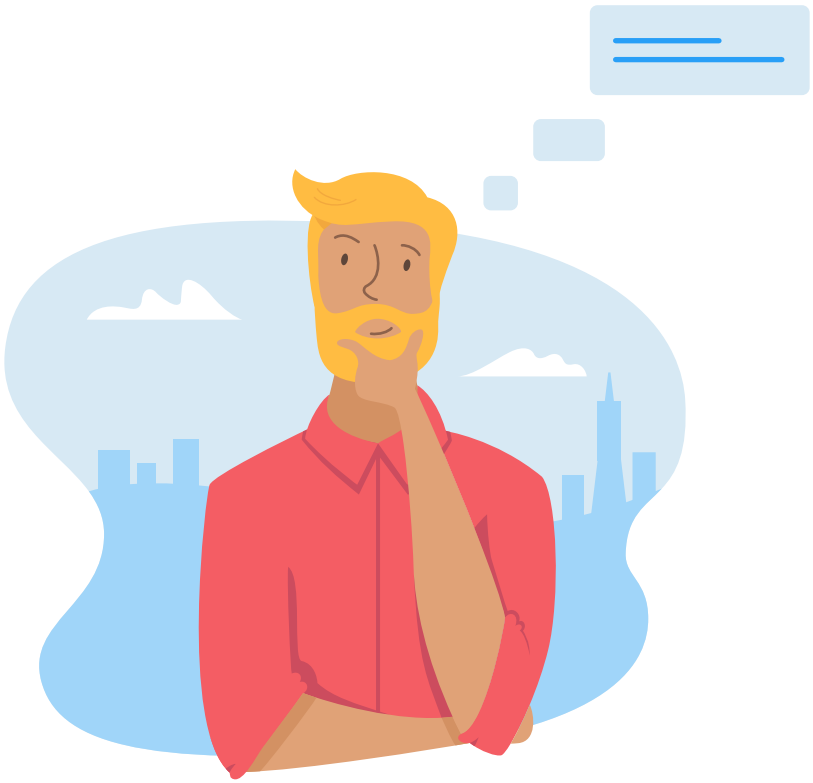
Web frameworks that may be used in the development of a healthcare tech stack include: Bootstrap, Android SDK, Rails, Symfony, Node.js, and Spring.

Other components that may be integrated into a healthcare technology stack are:

- DevOps tools such as GitHub, Jenkins, Selenium, Rollbar, or Bitbucket
- Business tools such as Slack, G Suite, or Desk.com
- Utilities such as Google Analytics, Stripe, or Elasticsearch
- Big Data tools such as Apache Spark
- Cloud storage and hosting providers such as Amazon S3, Amazon EC2, or DigitalOcean

There's no "one size fits all" tech stack for healthcare organizations. Depending on legacy systems and how other related systems are configured, healthcare providers can choose from hundreds of software and hardware combinations to build the right stack. One provider may use Javascript, jQuery, Amazon S3, and Heroku to power a Windows-based system, while another provider just down the street uses Python, MySQL, Amazon EC2, and Elasticsearch for a Linux-based system.

Each tool—whether it's hardware, software, SaaS, or something else—has its own advantages and disadvantages. But at the end of the day, the system and the framework are only as valuable as the data that flows through it. No matter how the system is built, if different programs and EHR systems built on the system cannot communicate with each other, providers and patients feel the strain. When the system is interoperable, providers can give the HIPAA-compliant, role-based access to patient data that keeps patient information secure while moving care forward.



Types of electronic health records systems (EHR)

There are two general categories EHR systems fit into: physician-hosted or remote-hosted. The host refers to the physical location of the servers that store the data. A system may be setup on-premise, where the EHR is located on the physician's servers, or off-premise, where it is hosted through a third-party service provider and accessed remotely.

Regardless of where the EHR system is located, interoperability with other EHR systems and real-time access to a patient's full medical history is becoming increasingly important in order to provide comprehensive services as needed, from any location.

There are three types of remote-hosted, third-party EHR systems:

1. **Subsidized system:**

   EHR is paid for by a hospital or other entity.

2. **Dedicated host system:**

   Data is stored on the EHR vendor servers.

3. **Cloud system:**

   Data is stored in the cloud and accessed remotely.

The healthcare IoT revolution

The term IoT—"Internet of Things"—refers to connected digital devices, objects, and machines that can transfer data over a network independent of human or computer assistance. Each digital thing is assigned a unique identifier and can communicate with each other across different types of public or private networks.

IoT technology is revolutionizing healthcare and how services are rendered. Information collected through a remote medical device or sensor on a wearable device, for example, can transmit critical measurements like vital signs, blood oxygen level, and more over the Internet in real-time to a practitioner located miles away.

Other examples of IoT applications used to provide better health services are:

- Summarized reports of a patient's condition that help identify key areas for a physician to review
- Predictive insights into treatment outcomes by analyzing previous diagnoses and response to treatments over the lifespan of the patient
- Knowledge transfer between different care providers of interpretations of health conditions, diagnoses, and potential causes

In the near future, interoperability of healthcare systems may be achieved using unique patient identifiers to access health records through a national health exchange. The exchange will facilitate transfer of the records to the health care provider, regardless of what EHR houses the data.

How Skedulo enables interoperability

Achieving interoperability in the healthcare tech stack starts with the consolidation of data from EHRs across different private and public networks. When you incorporate mobile workforce management software as a connected system within your tech stack, you can give your mobile healthcare providers the data they need to provide excellent patient care, and you can make informed decisions about employee scheduling and resource allocation.

Skedulo's HIPAA-compliant scheduling platform can connect with leading EHR systems of record. With the Lens API, you can easily integrate Skedulo into your system of record so data flows quickly across users and systems, leveraging your secure, centralized data for better workforce management.

To learn more about our mobile workforce management platform and how it can fit into your existing tech stack, schedule a free demo today!

Skedulo intelligently schedules, dispatches, and tracks your mobile workforce, connecting the office and field in real-time. Traditional field service solutions lack the power and flexibility to fit the new ways people and businesses operate. Skedulo is the mobile workforce management solution built for the future of work.

- For operations and schedulers, Skedulo simplifies matching the needs of complex jobs, worker skills, and customer preferences to create optimal service schedules.
- For teams in the field, Skedulo's mobile app makes delivering a first-class customer experience easier.
- Back office teams—like payroll, invoicing and HR—get the data they need fast while executives get insight to make better business decisions.
- Skedulo's customers win with faster, easier scheduling, reduced costs in the field, improved productivity, plus happier customers and employees.

With Skedulo, your scheduling and operations teams have all the data and functionality they need to effectively manage, schedule, dispatch, and communicate with your mobile workers in one place.

- Manage employees and contractors on one platform
- Maintain your workers' dynamic attributes and skills
- Simplify scheduling to find the right person efficiently
- Automate and optimize against your KPIs
- Optimize travel so workers spend more time with patients
- Provide customized guidance to execute flawless patient care
- Collect and sync critical patient data, even offline
- Communicate in real time

Contact Skedulo to learn more.

Skedulo

Skedulo is the platform for intelligent mobile workforce management. Our solution helps enterprises intelligently manage, schedule, dispatch, and track resources in the field, whether they are full-time, part-time, or contract employees. With native solutions that integrate seamlessly to Salesforce and ServiceNow, and our independent platform that connects to any system of record, Skedulo offers enterprises and mid-market companies a mobile workforce management product that complements any tech stack.

Founded in 2013, headquartered in San Francisco and with offices in Australia, Asia, and the United Kingdom, Skedulo has enabled over 100 companies to seamlessly schedule and service more than 5 million appointments all around the globe. The company secured $9.2 million in Series A funding in 2016, led by Costanoa Ventures. For more information, please visit www.skedulo.com.

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