OSP

INTEROPERABILITY

POWERING THE IDEA OF INTEGRATED CARE

Index

1. Introduction

Imagine a patient is admitted in the ICU anywhere in the country. Multiple devices are connected to that single patient, and each device is generating a vast amount of data every few seconds. This healthcare data is locked in data silos, controlled by different stakeholders. The reality is many of them are reluctant to share this information with others.

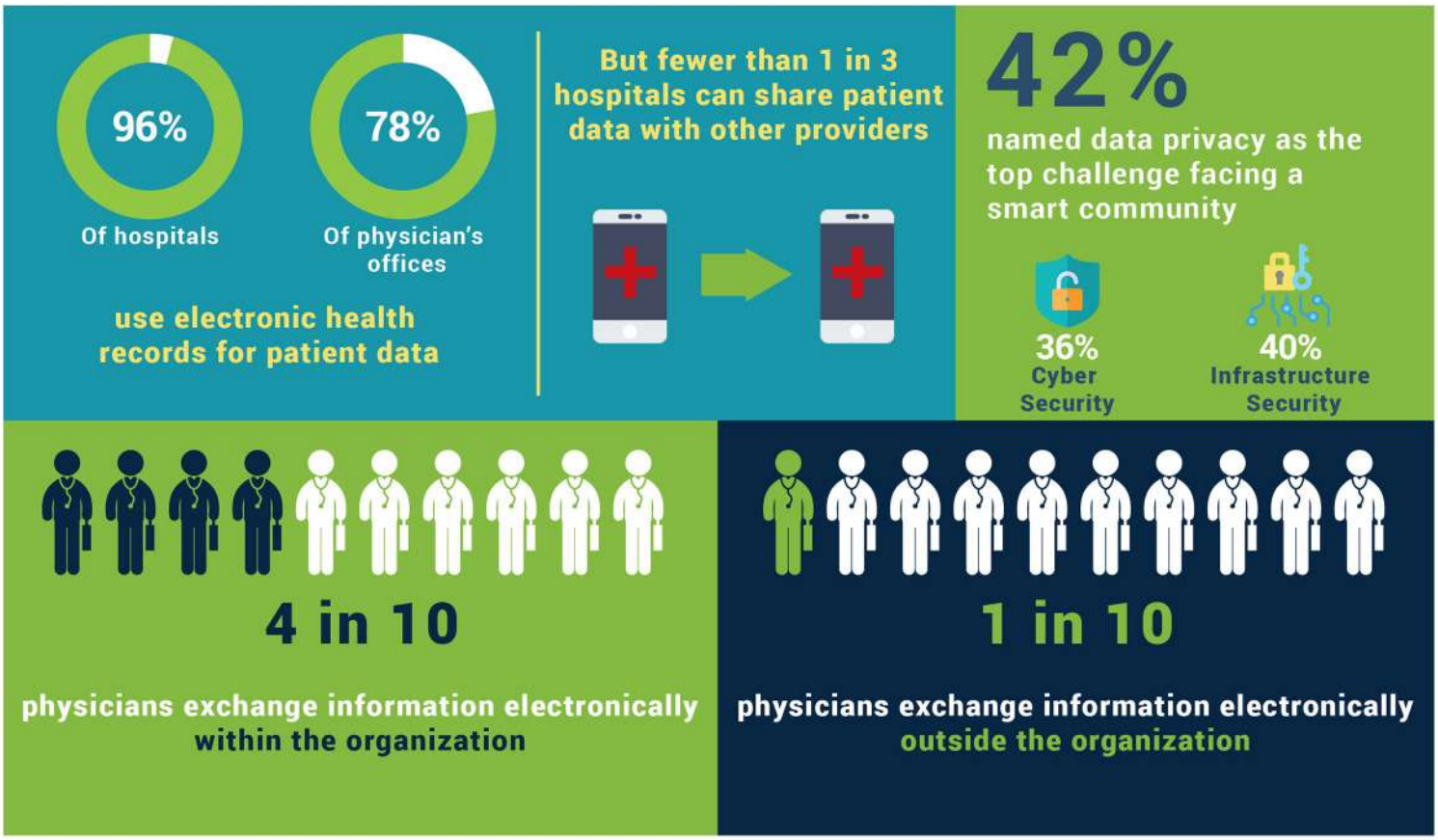
2. Understanding Interoperability

The lack of data interoperability has plagued healthcare for many years; it is responsible for driving up health care costs and negatively affecting your health until now.

To understand interoperability, we must find answers to the following questions:

- **What happens to the collected health data?**
- **How does it travel from one system to another in the enterprise?**
- **Who can access the data and how easily it can be accessed?**
- **How well is the data linked to other data of a single patient?**
- **How well is this data linked to other data of similar patients in the same healthcare facility?**
- **Can data of a single patient be leveraged for a full-scale population health management system?**

Millions of patients in healthcare settings across the US generate a vast amount of health data. Patients served by radiology, oncology, cardiology, and other departments, all connected to multiple devices generating sheer volumes of data.

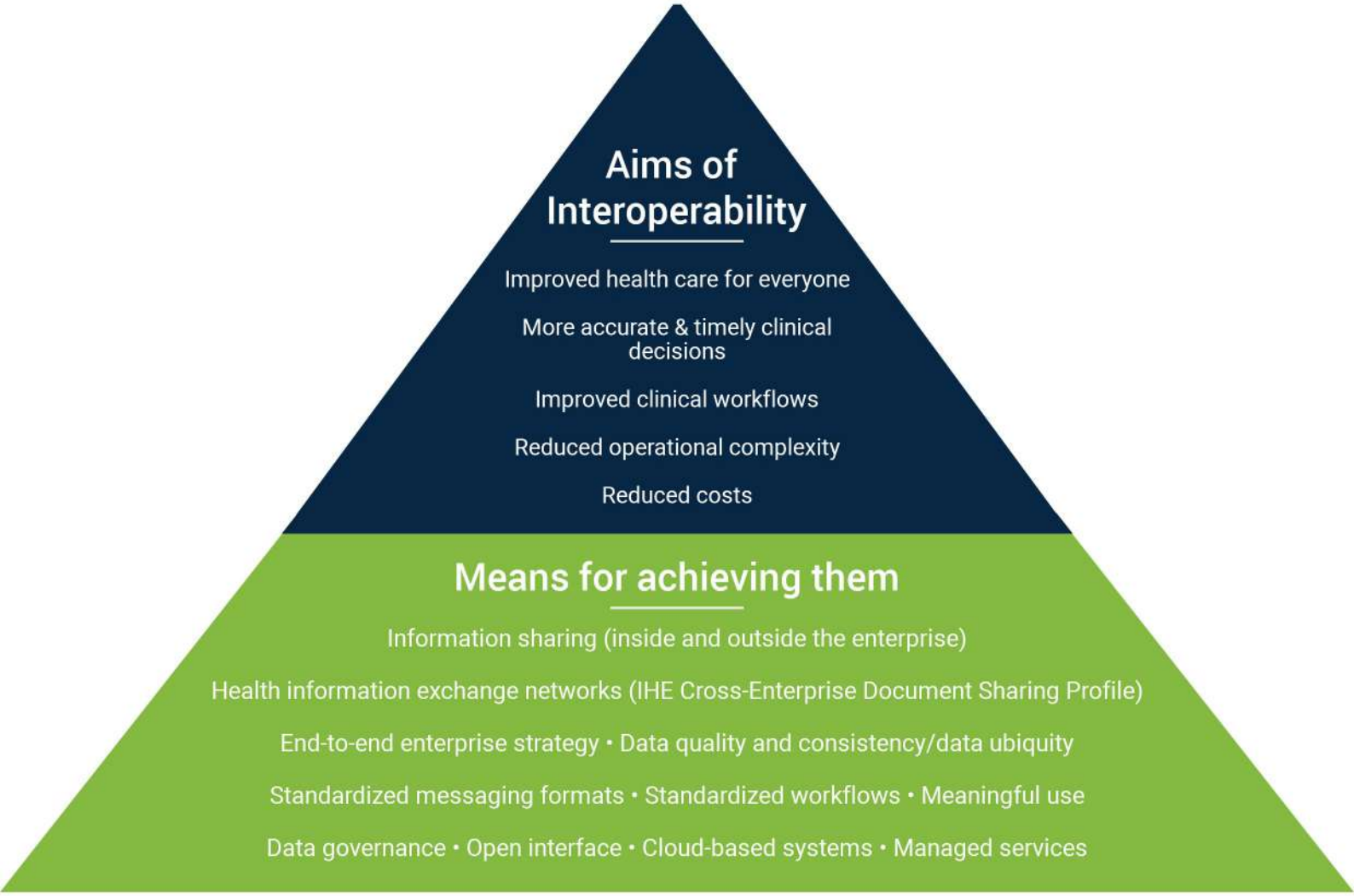


Today's health IT challenges not only affect the providers but all healthcare stakeholders. Here are some challenges that we are facing today,

- 31% of surveyed health centers report data security breaches.
- Care teams are not able to collaborate with patients and their families because they cannot view the same EHR.
- Major amount of data remains missing, inaccurate, and non-standardized.
- The needless duplication of tests, medications, and treatments adds to rising healthcare costs.
- Systems cannot integrate data from different sources—even those from within the same organization.
- Health information analysis and related research are obstructed by lack of clinical data warehouses; only clinical data "silos" exist.

The pressure of these major challenges on healthcare systems has never been higher. This is due to rising expectations, aging populations, and especially in emerging economies, the combined challenges of infectious disease and the rising incidence of chronic illness.

3. The Aims and Means of Interoperability



> *In San Diego, where I live, we have health systems that have no business case for exchanging data, but more than that, we have big healthcare systems where data from the emergency room can't be shared with acute care unit in the hospital. That's not an interoperability problem, that's a problem of the way systems evolve and the business needs of our respective stakeholders. There's not the will to overcome the challenges, nor apparently the capabilities to do so.*
>
> — Charles Jaffe, CEO, HL7

We Are Here

94% of non-federal acute care hospitals use a certified EHR to collect electronic health data about patients

78% of office-based physicians use an EHR system to collect electronic patient data

62% of hospitals electronically exchanged health information with providers outside of their system

Many US states have diverse laws and regulations making interoperability challenging across state lines

A typical care provider has to coordinate with **229 other physicians** working 117 care practices

51% of hospitals can electronically search for critical health information of a patient from various outside sources

14% of office-based providers electronically share patient information with other providers

5 Years

The Future

SPEED BUMPS TO INTEROPERABILITY

- Health information is not sufficiently standardized
- Aligning payment incentives
- Misinterpretation and differences in existing privacy
- Lack of trust

Advances in the use and sharing of patient-generated health data through the use of mHealth and wearables

2020

Increased (& scalable) Automation

Granular Inforamtion Access

Expanded Sources & Users of Information

Improved Quality & Reduce Cost

Finely-tuned algorithms and advanced technologies like AI and ML helping to enhance interoperability

IN 10 YEARS

2024

Longitidinal Information

Ubiquitous Precision Medicine

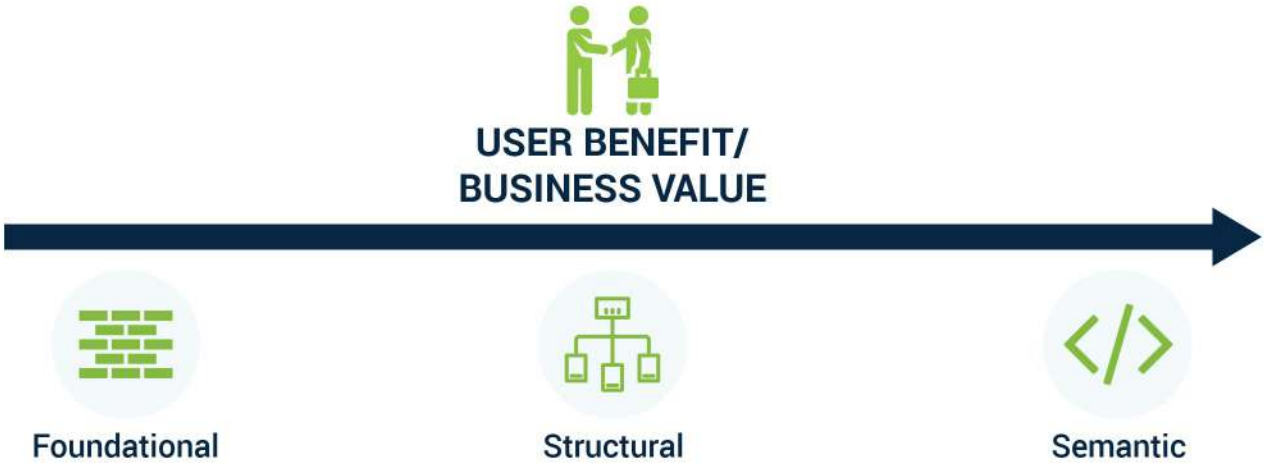
Reduced time from evidence to practice

A Learning Health System reduces the time from evidence to practice. This enables ubiquitous connectivity, improves population health and helps researchers analyze data from a variety of sources

4. Types of Interoperability

Interoperability helps to make the right data available to the right people at the right time across the organization. The interoperable health IT ecosystem can be relied upon and meaningfully used by recipients.

An enterprise-wide healthcare interoperability strategy is needed to ensure the meaningful and appropriate use of insight-rich data, helping to transform healthcare delivery for everyone.



Existing Interoperability Standards and Organizations

Standards

DICOM – Digital Imaging and Communications in Medicine

LOINC – from Regenstrief

IEEE – Advancing Technology for Humanity

SNOMED International – Leading healthcare terminology, worldwide

HL7 FHIR

HL7 International

Organisations

IHE International – Integrating the Healthcare Enterprise

Personal Connected Health Alliance

5. Mapping of Interoperability Standards

In summary, there is no single organization that covers all the standards needed for Digital Health. However, standards can be combined to provide a fully interoperable Digital Health service.

6. How Can Clinical Data Be Made Meaningful and Usable?

Information technology is rapidly advancing with immense growth in the Health IT marketplace in the background. It has brought a rush of health IT organizations into the field, adding to the sheer volume and a wide variety of clinical information originating with different systems. The onslaught of structured and unstructured data adds to the challenge of delivering a comprehensive and integrated view of patient care through enterprise-wide interoperability.

Clinical information should be easy to search, retrieve, and interpret for any given user's needs. It is made possible by adding metadata tags in DICOM to provide a context. Our primary goal is to make interoperability an ongoing journey with many routes by which it can be easily reached.

What are the Major Technical Challenges & Solutions for Delivering Meaningful Information?

Seamless delivery of meaningful clinical information across the enterprise is essential. It requires advanced analogous methods and tools for effective image capture, process workflow management, image data management, centralized storage system, and the ability to access and share data throughout the enterprise.

Several challenges must be solved to build a fully integrated enterprise ecosystem, including:

Disparate Images

Acquisition

Acquisition Devices

Data Formats & Protocols

Metadata

Storage

Solutions:

Acquisition and Capture

Data Formats & Protocols

Enterprise Data Recovery

Cross-enterprise Data Discovery

Patient Demographic Data Discovery

EHR Integration

7. The Curious Case of Health Data Exchange

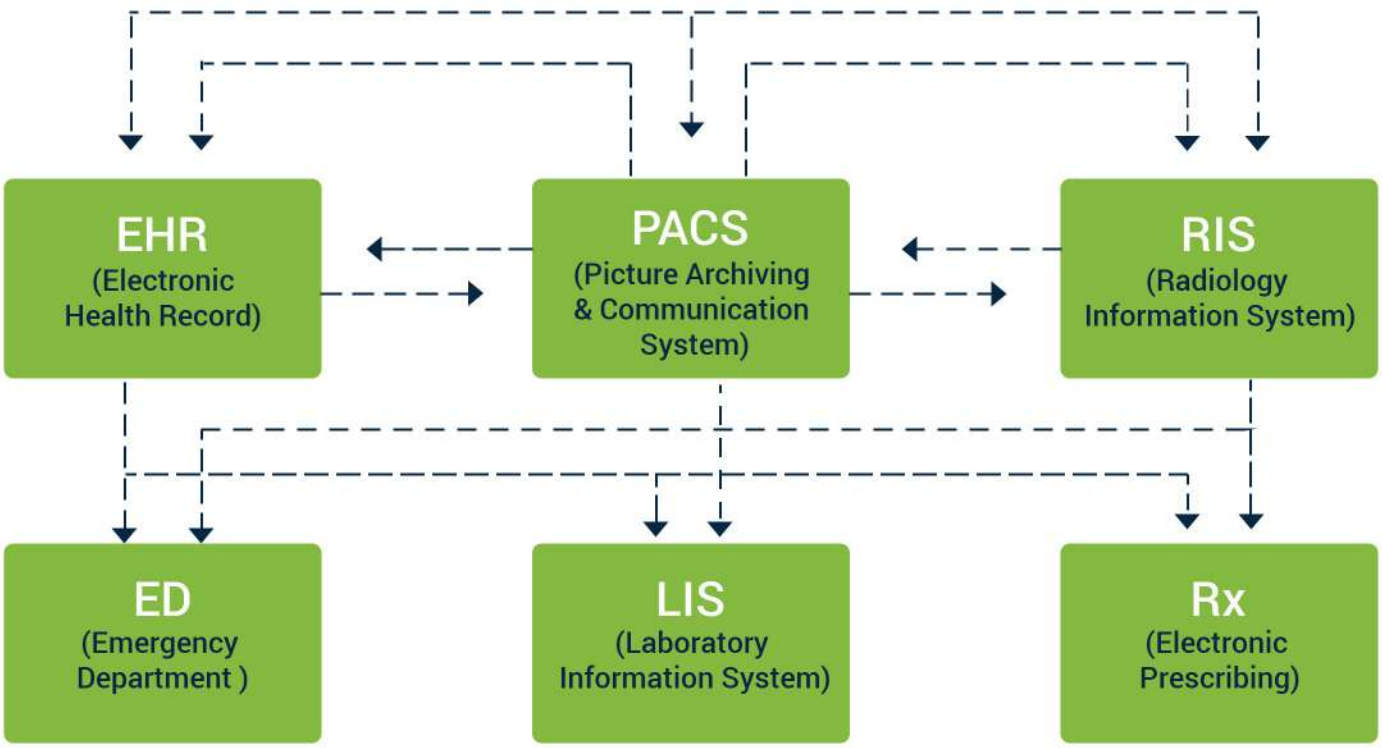
Since 1987, HL7 International has been working on healthcare data standards to create and improve the standards in use throughout the healthcare industry. HL7 standards are essential for providers to integrate data from different vendors.

Different systems have varied workflows which are supposed to work well in a patient facility or an ambulatory environment. The technology leveraged should be flexible and easily configurable. Let's understand the traditional health data exchange pattern using HL7 V2.

1. Traditional Data Exchange

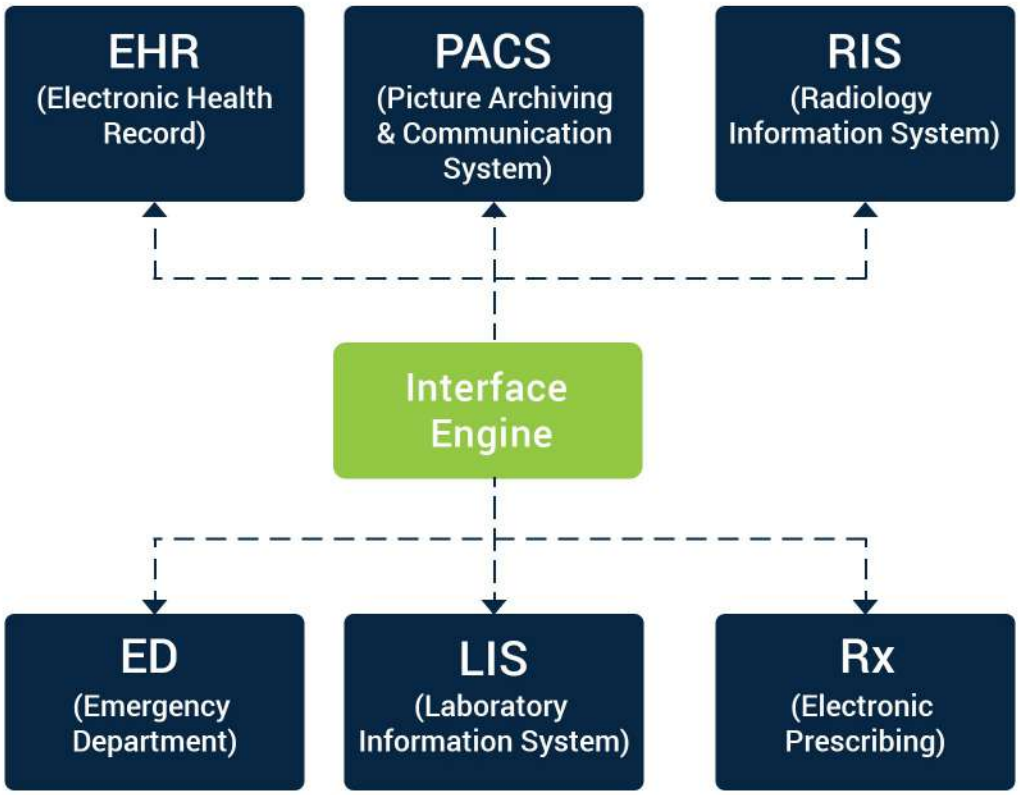
- A doctor types data into the EHR.
- Data leaves the EHR in an HL7 v2 or CDA format document.
- The data is sent over an interface to the receiving health system.
- The receiving health system parses the data and imports it into their database.

Typical Point to Point



2. Data Exchange with an Integration Engine

Today, most providers prefer an integration engine at the core of all their interfaces. Integration engines are quick and simplify the workflow for central monitoring, flow control, alerting, data mapping, and more, to organize data flow within these applications.



> *"Interoperability means the ability of health information systems to work together within and across organizational boundaries in order to advance the health status of, and the effective delivery of healthcare for, individuals and communities."*
>
> **- Interoperability Definition by HIMSS**

8. Web APIs

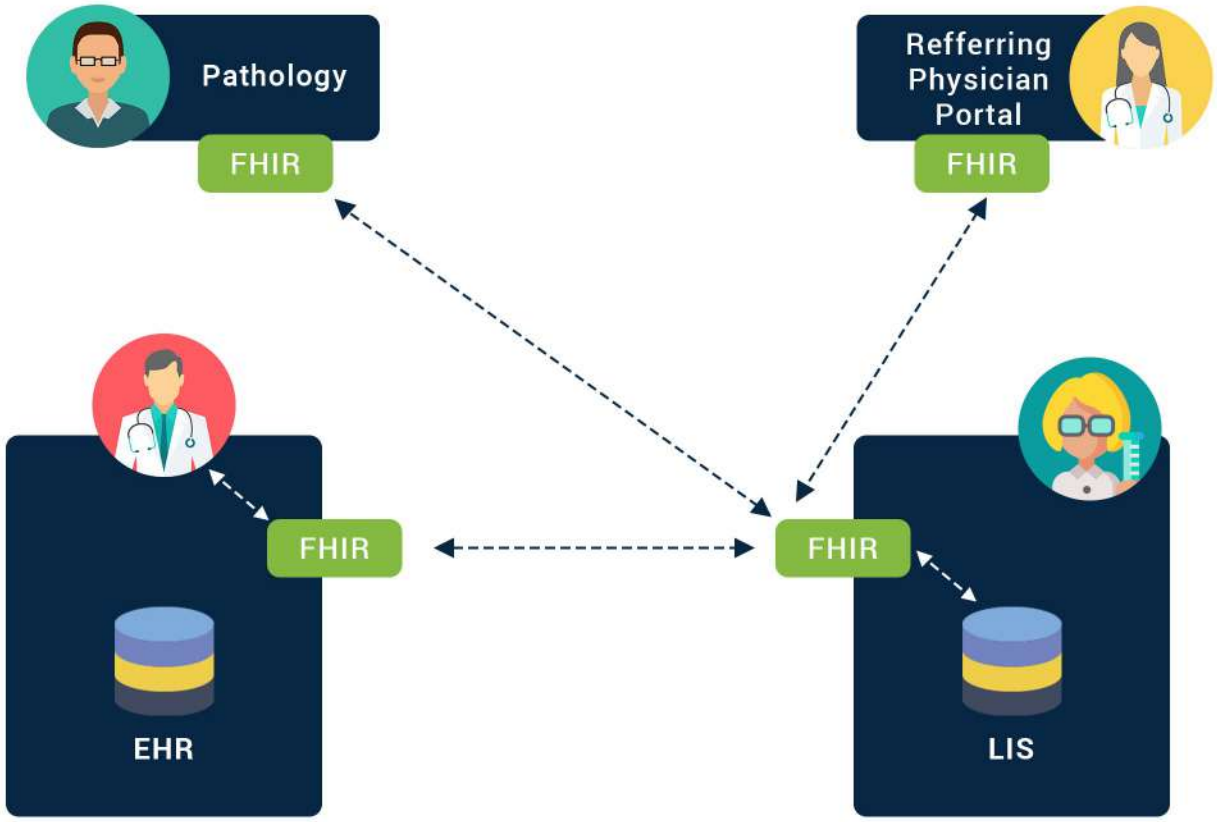
An API, or application programming interface to enable communication between multiple health systems such as EHRs, mobile apps, IoT devices, etc. APIs play a vital role for any authorized application to receive and/or send data with stringent security authentication.

Major API Usage Categories:

1. APIs for the traditional provider integration strategy
2. Open API for clinical data sharing

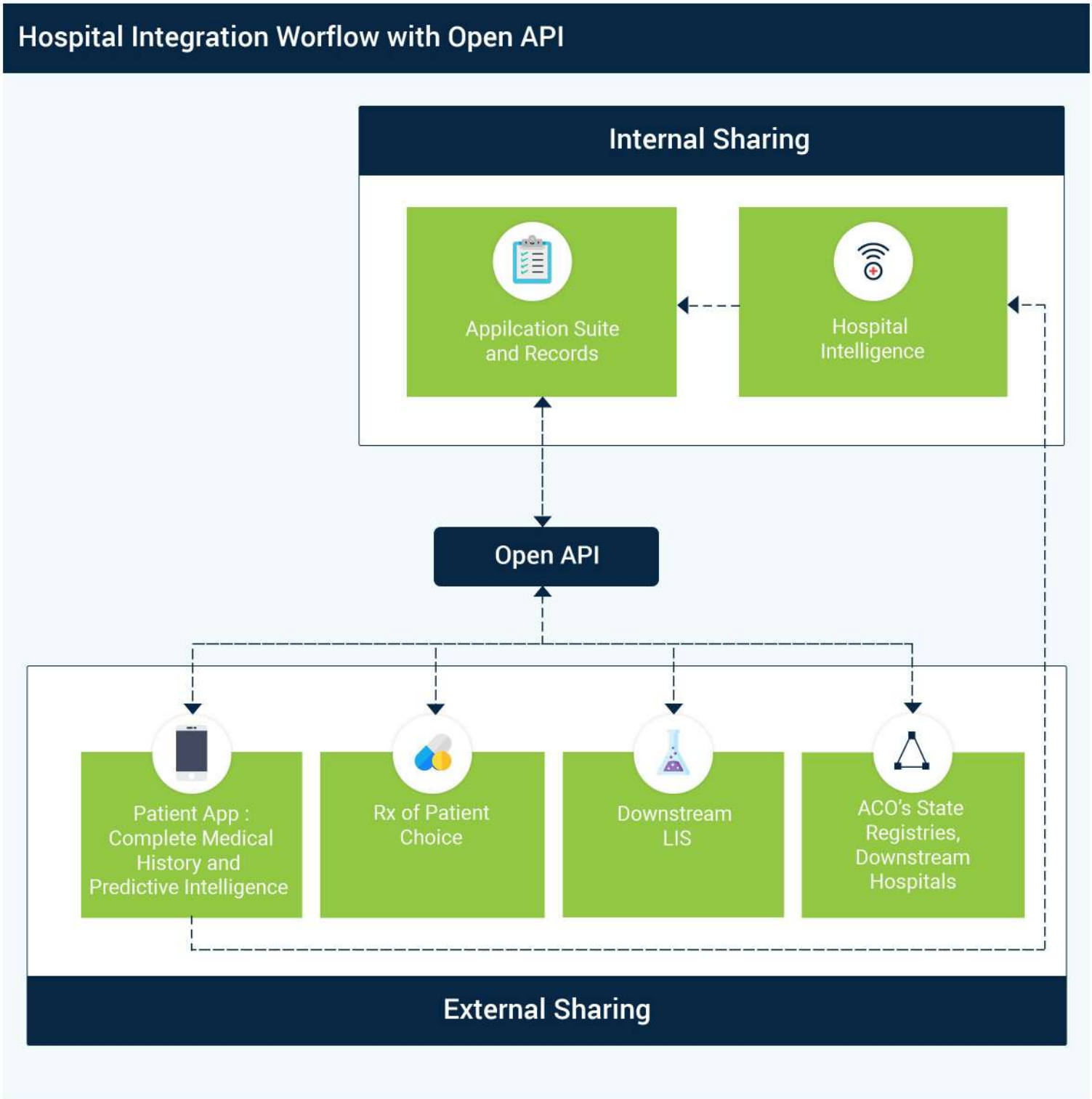
1. APIs for Provider Integration

APIs can supplement the current methods of HL7 v2 exchange by offering a cheaper, lighter, and easier format of interoperability. Providers can create a robust API to facilitate external data-sharing requests by simply sharing their approved API standards.



2. Open API for Sharing Clinical Data

Aggregation of medical history of a single patient is possible with easy access to data via an API. To provide a patient's complete clinical information via API, providers must combine data and return it to the requesting application via API. The integration layer can help health organizations to break free from EHR data silos and gain total control of patient's medical data.

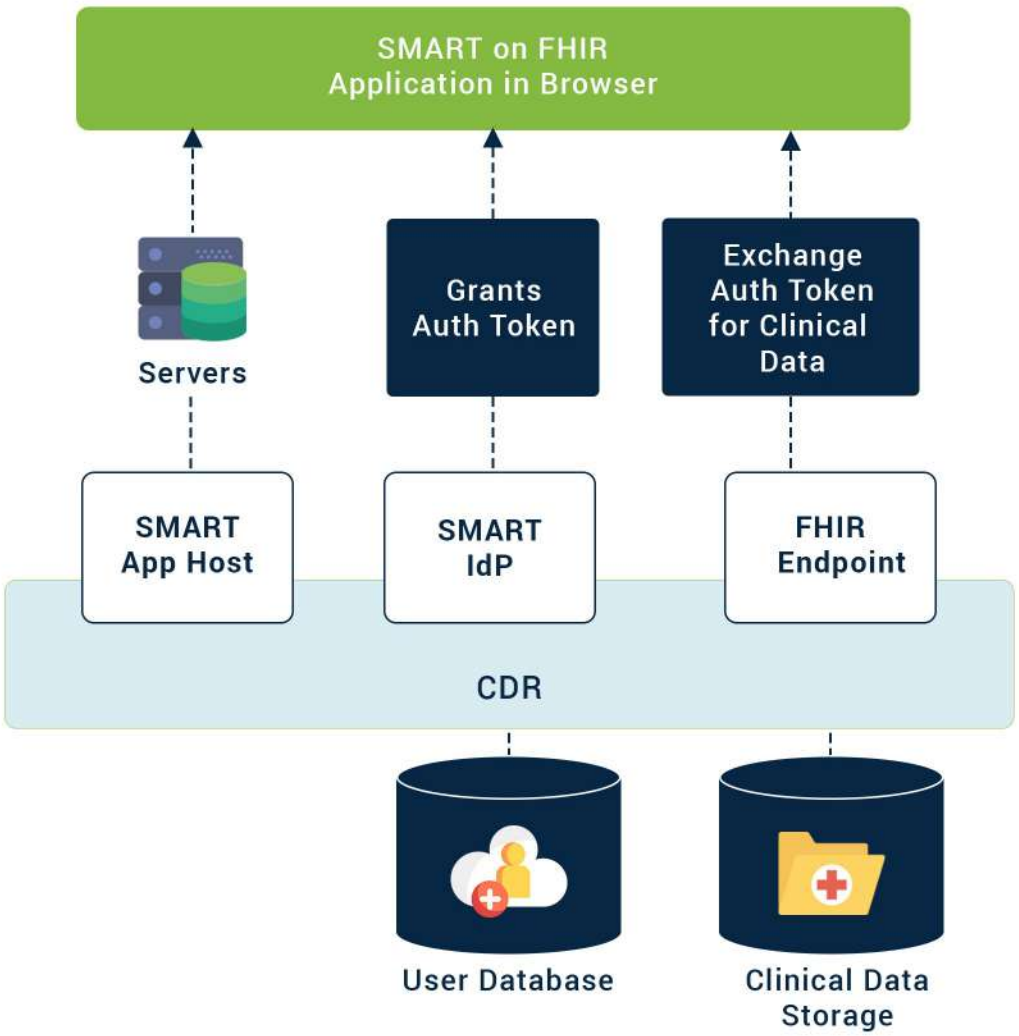


9. HL7 FHIR

As we have learnt above, HL7 v2 is a well-established standard that helps to connect enterprise applications. Leveraging HL7 V2 also has many challenges. It's limited to modern devices and apps which are trying to leverage available clinical information of a patient. Implementing data privacy and security are also among the pressing challenges.

The FHIR standard has an API designed with a more flexible and lightweight method of clinical data exchange. FHIR utilizes RESTful web services along with SOAP web services, making security easier to maintain.

Web services have readily defined security protocols (HTTPS) and commonly used authentication techniques like OAuth 2.0. Security measures implementation becomes easier with FHIR with flexibility to leverage widely used security standards. Combining the FHIR API with multiple advanced web services is the future of technology.



10. SMART on FHIR

SMART is an acronym for 'Substitutable Medical Applications and Reusable Technologies'. It was created in 2010 and implemented at the Harvard Medical School Department of Biomedical Informatics and Boston Children's Hospital Computational Health Informatics Program.

'SMART on FHIR' is a set of open specifications to integrate apps with EHRs, health portals, HIE (Health Information Exchange), and other Health IT systems.

SMART was started with an objective to define a data standard which would make a "build once, go anywhere" model possible. SMART is a standard that works in association with and on top of FHIR. This is why healthtech industry commonly refer to it as 'SMART on FHIR'.

SMART focuses on formalizing the method for interacting with FHIR interfaces, outlining how the mobile apps will be 'launched' from the EHR. SMART also focuses on standardizing the security protocols used by third-parties to exchange data into EHR systems.

SMART follows a dedicated approach to produce 'how-to documentation' designed to help developers to understand what FHIR makes available and how to build alongside SMART for future rollouts to a live healthcare setting.

> *"The goal of SMART is audacious and can be expressed concisely : an innovative app developer can write an app once, and expect that it will run anywhere in the healthcare system. Further, that app should be readily substitutable for another."*
>
> **- Kenneth Mandl,** MD, MPH
> Chair, SMART Advisory Committee

How to implement a SMART on FHIR app?

The process of implementation happens in the following steps:

1. The required specification is developed.
2. EHR vendors implement the standards as well as specifications.
3. The health systems EHR consumers install, update, and configure their systems to consolidate the standards.
4. Applications are developed on top of the health system's specifications.

SMART strived to produce specifications that work for modern-day healthcare app developers and are implementable within today's evolving technology landscape. SMART on FHIR addresses the needs of end-users and app developers while providing an open-standards-based platform that aligns with the needs of clinical system vendors. To build upon the momentum, we recommend a strong push toward early platform adoption in service of business cases that provide value today.

11. Push vs. Pull Models of Exchange

APIs allow applications to pull the information it needs from when it is needed. With each update in the application, the traditional V2 interfaces continually push the patient data. Rather, a specific piece of clinical data such as order status, current blood pressure, location, etc. should be received in real-time. Real-time approach is not possible with v2.

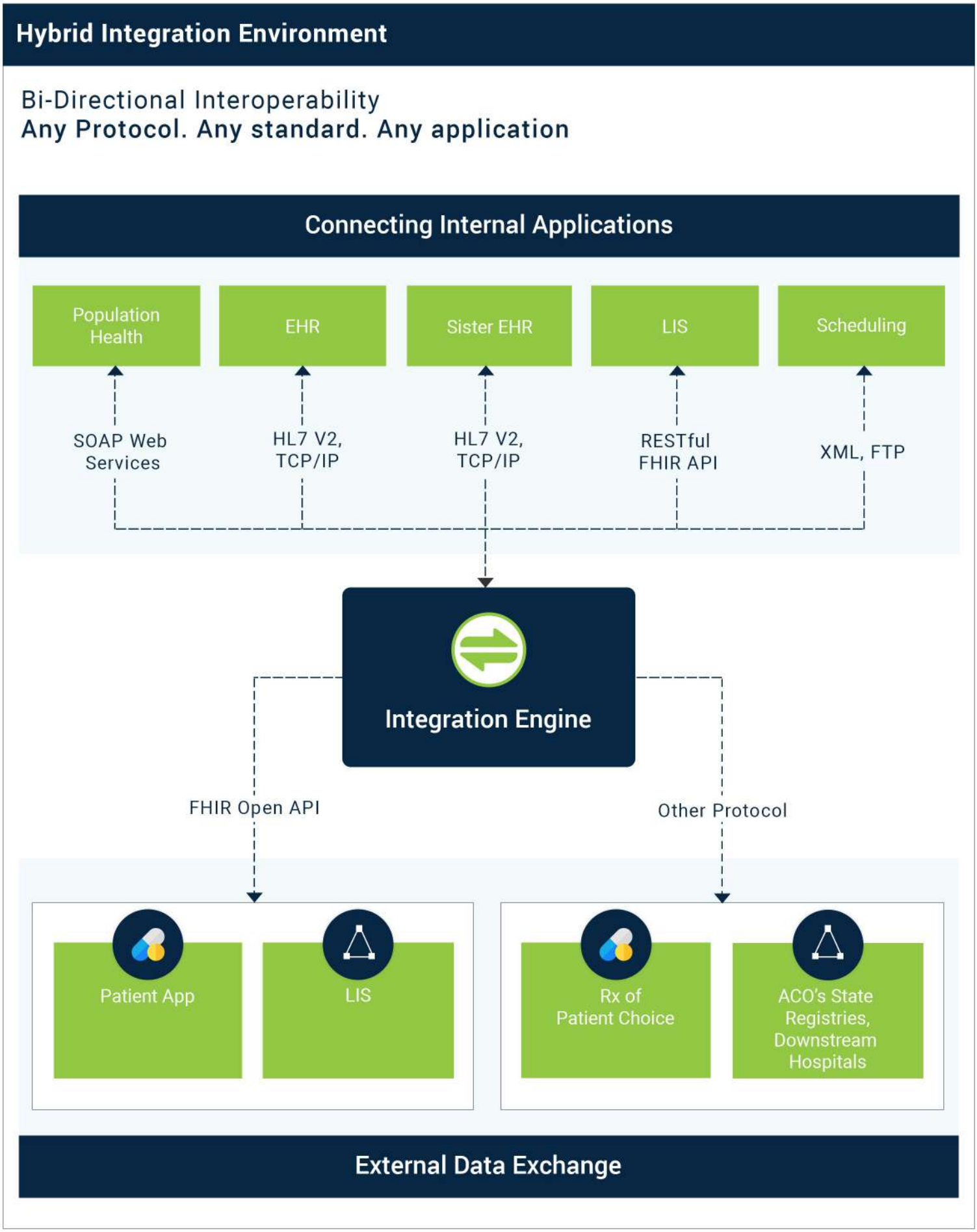
A Hybrid Approach to Data Exchange

83% of healthcare providers use some cloud service or application within their IT architecture - according to the HIMSS Analytics Cloud Survey.

If we decide to follow the groundbreaking FHIR API approach to data exchange, we require an extremely flexible approach to manage health data. Modern health IT departments need a central command to help guide the flow of data between systems to ensure that each application and healthcare provider has the right patient data, at the right time, with the right insights.

As FHIR API connectivity becomes common, the transparency of EHR databases will surely increase. External applications for patients and providers will have the ability to import and export clinical data more easily without the need for providers to directly give access to the EHR database. This change will likely cause a fundamental shift away from dependence on EHR functionality.

Hybrid Integration Dataflow using Integration Engine:

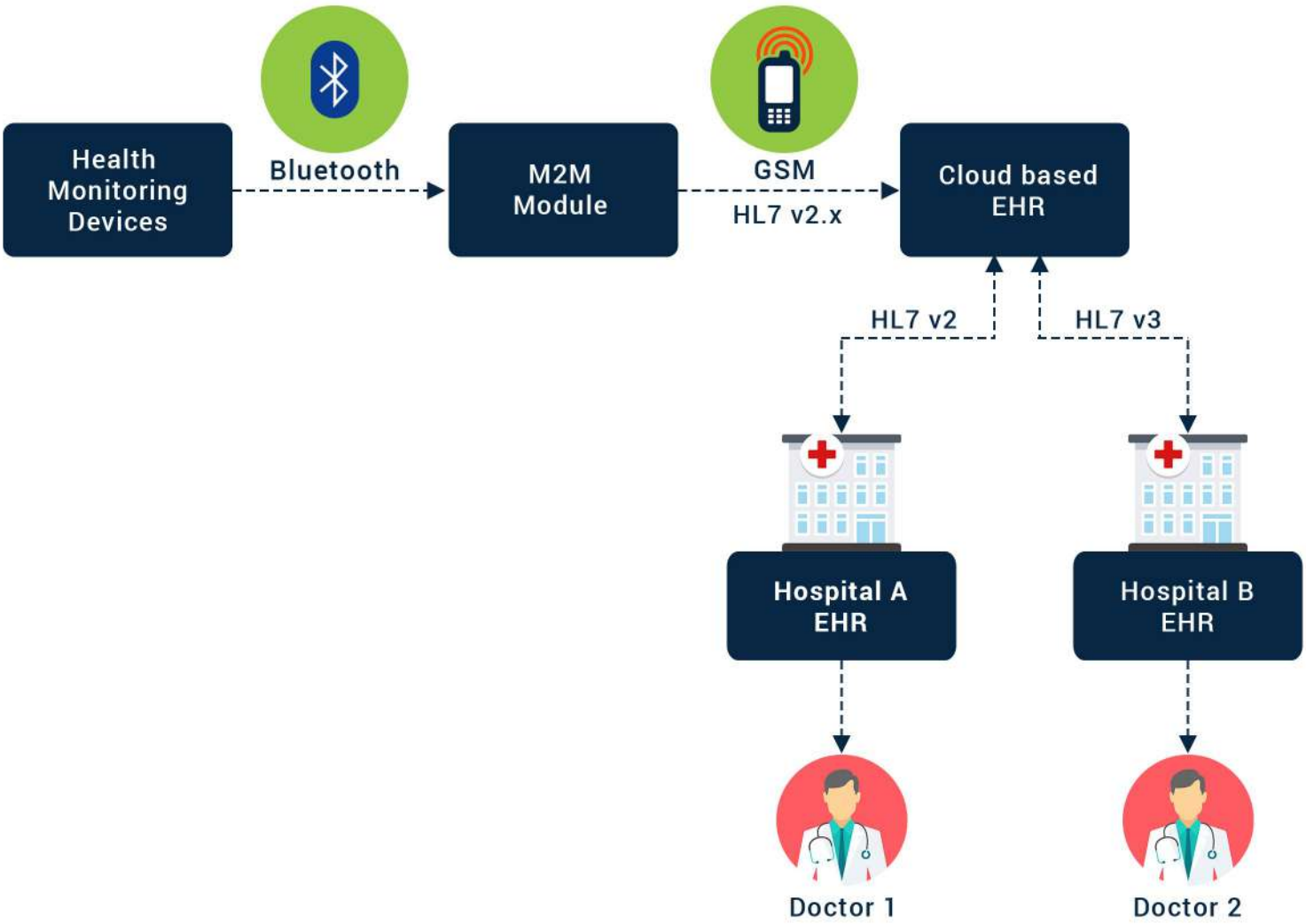


12. Semantic Interoperability

To move towards a more holistic multi-platform, multi-network approach Semantic Interoperability can play a vital role. Today's mobile operators are working with healthcare partners to deliver value-added Digital Health services in five main areas:

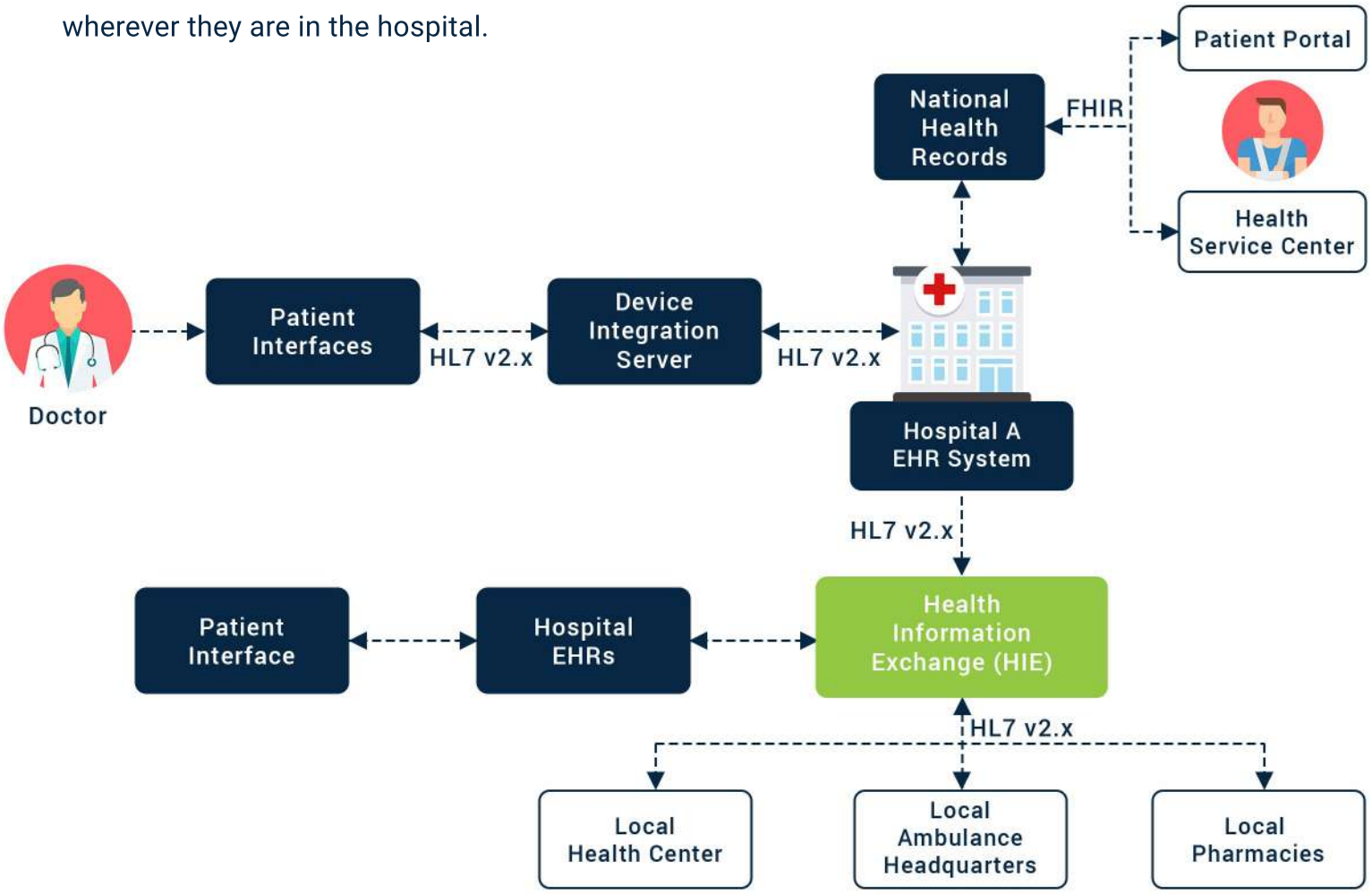
- **Data Hosting, Management and Support/Cloud Services**

Multiple health devices taking key readings with a centralized data storage, usually in a cloud-based EHR require a powerful interoperable system. The data also needs to be presented back to create insight for patients and healthcare professionals.



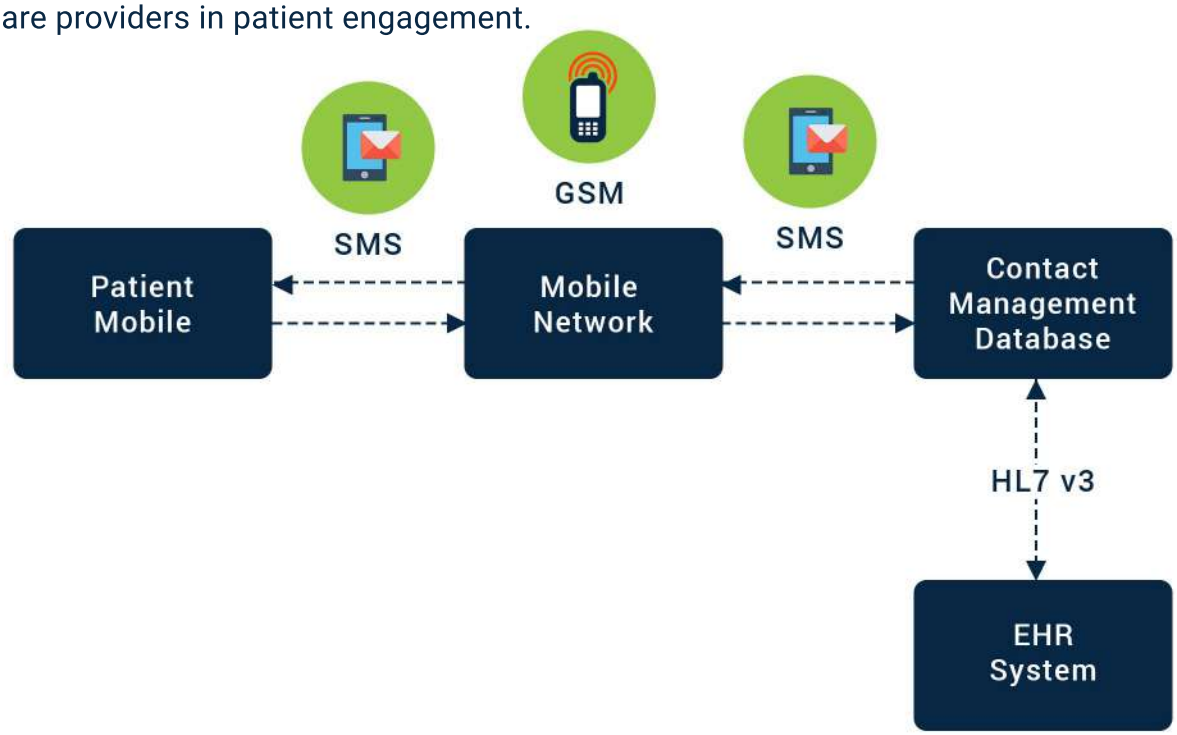
• Hospital Information & Communication Systems

Systems that help healthcare professionals to access their patients Digital Health records wherever they are in the hospital.



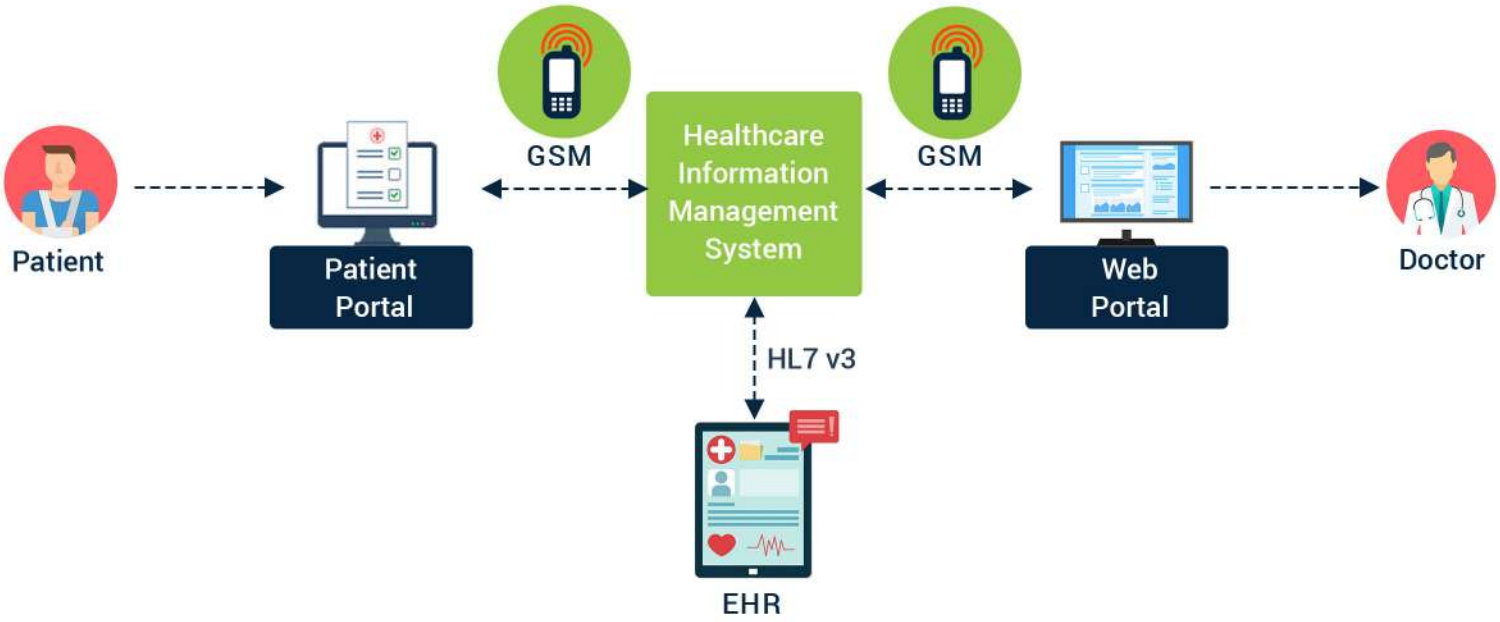
• Patient Relationship Management & Customer Care

Services can range from medical appointment reminders through SMS to call centers, to assist healthcare providers in patient engagement.



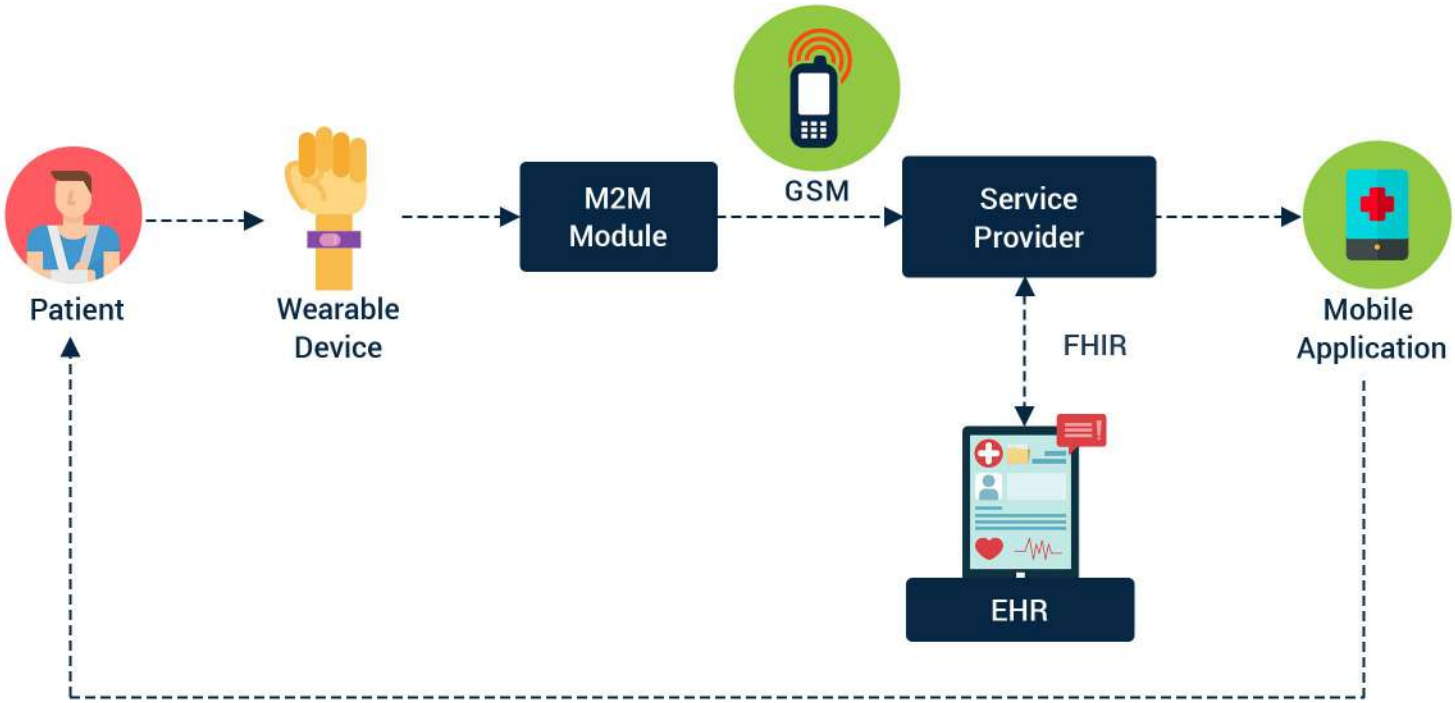
- ## Content Services, Health Access, and Monitoring Solutions

Providing necessary guidance to individuals for the self-management and prevention of their health conditions.



- ## Consumer Device Management & Supply

Fitness devices or smartwatches, enabling individuals to manage their own health and wellness.



13. Conclusion

Lack of interoperability is one of the greatest challenges to achieving improvements to healthcare and cost efficiency promised by emerging e-health systems. On the other hand, implementing the current standards for interoperability is also hard. But an interoperable healthcare ecosystem offers great opportunities to positively influence patients and providers through highly integrated care delivery models.

Healthcare organizations should look holistically at advanced and secure data sharing strategies that span the entire patient care continuum. Healthcare technology developers should seek input and collaboration with federal agencies to inform governance implementation and ensure broad participation across existing operating health information networks, including those focused at the vendor, enterprise, regional, and state levels.

The future of healthcare delivery will be about demystifying the concepts, connecting the dots, eliminating disconnects, sharing data along the value chain to understand it as a whole. Interoperability of data to support the fruitful collaboration of all the major healthcare stakeholders will be key.

OSP

We are a leading software development company aiming to empower, and inspire the world with next-gen solutions. We help in simplifing every step of the development process, from system architecture design to quality delivery. Our intelligent processes enable quick deployment of enterprise-grade solutions against the toughest, and most complex challenges.

We are re-imagining how technology can empower Healthcare, AI, Analytics, and Financial organizations to build solutions for every day use in business applications.

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