



Healthcare Product Modernization

White Paper 2021





Abstract

Modernization is a business imperative if one wants to stay relevant in today's healthcare industry.

Especially so in the wake of accelerated adoption of technology mandated by the pandemic of 2020. Legacy modernization powered by new-age technology has become a top priority not only to meet the current-day expectations of the healthcare consumers but also to ready oneself for future possibilities. Technological disruptions, if adopted in a timely-manner, eventually result in enhanced capabilities, optimization of investments, better compliance, improved time-to-market, immense cost savings, and better customer stickiness.

Agreed that modernization projects are time, cost and effort-intensive; but with proper planning, well-thought strategies, and a comprehensive outlook, it is possible to make the transition efficiently.

This white paper recommends modernization through a comprehensive strategy comprising the following four technical aspects:

- ✓ Infrastructure modernization
- ✓ User Experience modernization
- ✓ Data Strategy modernization
- ✓ Compliance modernization

The bottom-line: "Modernization is not a single, point-in-time event but it's a journey consisting of a series of carefully planned, incremental steps".

Let us explore.

| Situation Overview

Despite ongoing investments and improvements in Health IT, the healthcare industry continues to be saddled by legacy applications that limit their ability to stay efficient, competitive and adopt quickly to the current needs of their consumers. Traditional healthcare ecosystem is bound by a complex compliance framework, set operative mindset of consumers, trained clinicians, and fragmented systems. As a result, healthcare is not only becoming costly and complex but also missing a lot of innovations that can add significant value to care quality.

Modernization often remains a much-stated intent but under implemented goal. Many of the organizations still take a reactionary, fragmented approach and have often focused on quick-fixes and incremental technology upgrades. Modernization should be addressed as a well-planned and comprehensively thought-out strategy with an integrated approach. It is a business imperative that must be dealt as a top priority. A piecemeal program, which often is the approach, defeats the very purpose of a complete overhaul.

Companies cannot escape modernization and that's a fact. Age-old legacy infrastructure drains the system through the following inefficiencies that creep into the operations:

- Maintenance and Support: This becomes costly with time. Infrastructure begins to lag, maintenance needs old or specific skill set or talent that becomes increasingly difficult to get.
- Compliance: Non-compliance penalties are very high. An old architecture may not support all the new compliance enhancement needs.
- Security: Legacy systems are less resistant to cyberattacks, harmful programs, and malware.
- Competitiveness: Shrinking market share and profitability impact your ability to remain relevant and profitable.

To address these challenges, the providers must develop a strategy that will enable them to move beyond the current status quo and implement next-generation healthcare information technology.

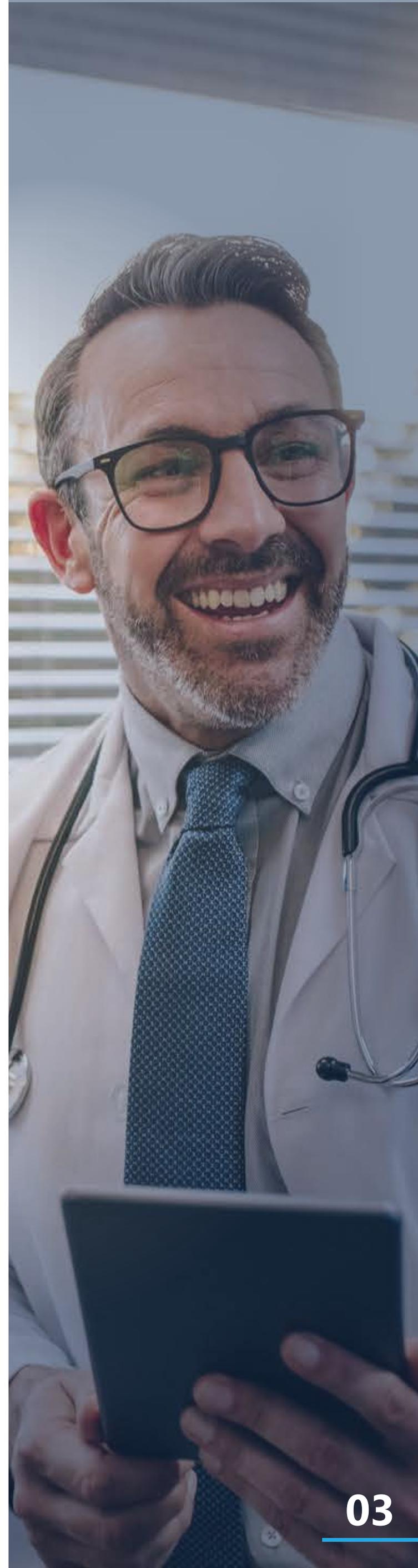
| A new outlook

The good news is that emerging behavior and technology revolutions are increasingly being adopted to disrupt the ecosystem and make it more efficient and customer-centric. Healthcare stakeholders have started accepting the new way of doing things and are understanding the value that the latest technology innovations are bringing. There is a visible acknowledgment of how technology is helping improve the quality of care, thus reducing healthcare costs by making the system more intelligent. Other factors leading to this change are the massive shift in generation, storage, consumption, and sharing of data/information.

The latest advancements in Health IT like adoption of AI/ML, Data Science or even the new models of healthcare like Telehealth and Remote Patient Management need a strong technology backbone. And, this may not blend well with old architecture.

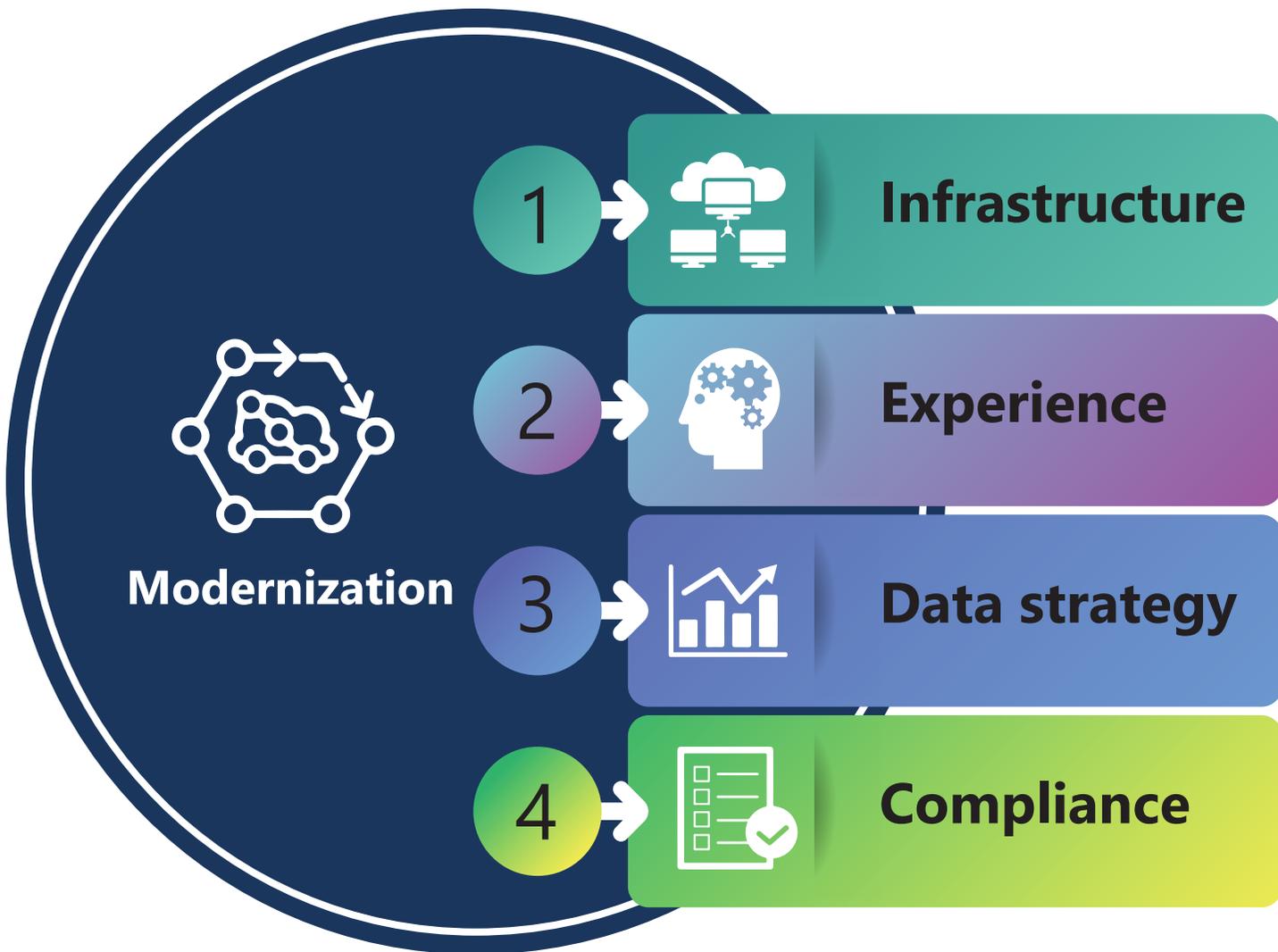
While the pace and penetration of such disruptions are yet to be determined, one thing is for sure that coming years are going to see a compelling modernization drive in healthcare.

"Modernization is not a single, point-in-time event but it's a journey consisting of a series of carefully planned, incremental steps".



Modernization projects are complex and carry significant risk. They entail managing dual systems during the transitions. The platform migration needs to be planned and executed carefully to avoid cost overruns, data loss and gaps in security, performance and compliance. This needs a thorough **risk analysis, due diligence, education and project management**. Unlike regular development, a **phased, integrated approach works better** to lower risks and avoid unnecessary costs.

Based on Harbinger's experience of helping organizations with the planning and execution of their modernization strategies, this discourse primarily focuses on four technology aspects relevant for modernization of the overall system - Infrastructure, Experience, Data Strategy and Compliance modernization





Infrastructure Modernization

Cloud migration

Infrastructure modernization in the form of Cloud migration is one of the first few things that a company needs when planning for application modernization.

Examine the following facts:

- The global healthcare cloud computing market size is expected to grow by USD 25.54 billion during 2020-2024 with a CAGR of 23%.
- According to the West Monroe Partner's report, 35 percent of healthcare organizations surveyed held more than 50 percent of data or infrastructure in the cloud.

Cloud platforms now have a dedicated focus on healthcare use cases with inherent support for all healthcare standards (HL7, FHIR, EDI, and so on), and compliances. All major cloud providers offer support for almost all aspect of healthcare, for instance, Health IoT (Internet of Things) (e.g., Azure IoT Hub, AWS IoT, Salesforce IoT Cloud, and others), integration/interoperability (e.g., Azure API for FHIR), AI (Artificial Intelligence) and Machine Learning offerings or even the latest one like Microsoft HoloLens.

The good part: For Remote Patient Monitoring, all major Cloud providers have a specific offering that makes the process quite easy for everyone to read:

<https://harbinger-systems.com/blog/2021/04/cloud-platform-providers-making-remote-patient-monitoring-easy/>

While the cloud migration trend has huge benefits, yet one has to be careful while planning the activity. This is because migrating to cloud can be a highly intrusive and destructive process for the existing platform/ application structure. Here are a couple of recommended strategies that could be adopted based on the business needs and readiness:

Re-Host

Here an application or system is hosted on a cloud platform without making any change. This IAAS based approach is minimally intrusive. However, as the application architecture is not changed in any significant way, the characteristic benefits of the cloud platform can be missed. As a result, Re-Hosting is many times followed by restructuring in later years.

Re-Platform

Here the core framework for an application is not modified while taking advantage of the cloud platform's PaaS capabilities. Many times, for legacy systems, this involves some code changes. For example, the application data is stored on cloud storage for easier management.

Restructure

In this case, the application code and framework are modified to take advantage of the underlying cloud platform. For example, the application code is provided with an API wrapper, using which the application can connect with multiple cloud services.

Rebuild

Rebuild includes rearchitecting the application from the ground up to take advantage of the PaaS provider's features. This approach provides the application access to all new features from the PaaS platform. Such changes also help in answering a specific need such as performance improvement, the addition of features, scalability, and more. For example, re-architecting monolithic applications to take advantage of SOA (service-oriented architecture) can be one such step.

Replace

Businesses can opt to replace their entire application to take advantage of SaaS-based platforms and features building a new system.

As is evident from the above approaches, cloud migration is not a simple task. It needs an informed decision and a clear strategy. Challenges can include unanticipated interoperability issues, changes in an existing application, and additional security and compliance considerations, including proper business associate agreements.

| Multiple Benefits

Cloud migrations have multifold benefits as outlined below:

- Efficient data security (HITRUST certified)
- Ease of integration
- Scalability and high availability
- Quick disaster recovery

A move to cloud also helps with operational efficiency and cost benefits. This is due to the following features of cloud:

- No setup costs for hardware
- Optimum utilization of hardware
- Reduction in IT infrastructure management team cost
- In-built support for all healthcare standard and compliance regulations
- Several plug and play components for healthcare use cases.

Migration to cloud results in cost saving.

- According to a CDW survey, companies can save up to 20% of IT costs with cloud migration.
- Major cloud providers claim to reduce the overall costs by 30% if the infrastructure is moved to cloud.



Mobile

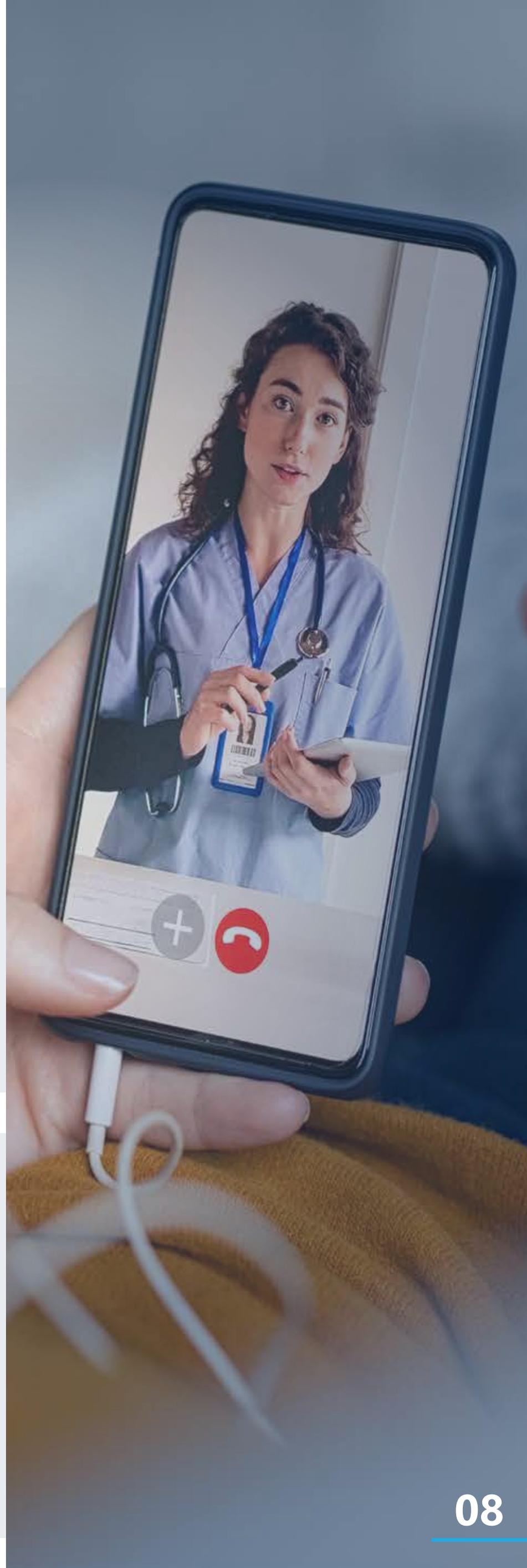
Enabling Mobile Availability can be another modernization feature majorly sought after by the healthcare systems. With mobile devices like phones, PDAs, monitoring devices dominating the landscape, mobile applications are rapidly becoming an integral part of patient care. Grand View Research predicts the global mHealth apps market size will reach USD 236.0 billion by 2026, which is evident by the increase in physicians recommending patients to use mHealth applications, and patients' interest in managing self-care through self-management of disease, chronic care, and overall health monitoring.

Digital interactions enabled by mobile applications can be in the form of apps for:

- Telemedicine
- Remote Patient Monitoring
- Benefits and Coverage information and Claim status.
- Healthcare Provider information
- Determining high-level Cost of Procedures

Mobile enablement provides benefits as described below:

- Ease of chronic patient care monitoring
- Increased patient interaction
- Ease of scheduling appointments, viewing results and many other patient related tasks, resulting in increased patient satisfaction.
- Reduced in-person visits.



Mobile enablement demonstrates promising costs benefits:

- A study shows that the use of healthcare apps can reduce the overall US healthcare cost by 7 billion dollars annually.
- Another study talks about people living with diabetes who use an mHealth platform for care management, saving roughly \$88 a month in medical costs during their first year.

Advanced Features

In addition to the cloud enablement and mobile availability, healthcare platforms and systems are gearing towards secured interoperability with the use of APIs. Blockchain frameworks are increasingly used for secured information exchange between different stakeholders. Further information about the use of API and blockchain in the overall remote patient care can be found here.

White Paper <https://harbinger-systems.com/remote-patient-engagement/>





Experience Modernization

The profile of healthcare application users, be it providers or even patients, has now changed. Today, they are more alert, tech-Savvy, have shorter attention spans, like participating in their health decisions, and are more aware of healthcare processes and options. In addition, the users are now more mature and demanding. Everyone expects an intelligent system that also gives them a great user experience.

One of the main reasons for poor patient engagement or low HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) score is not the lack of information, but poor patient experience. If we talk about providers, there is a good amount of productivity loss because most of the poorly designed applications are built to deliver information but not the experience.

Healthcare applications often lag customer expectations of accessible and easy-to-use digital services. The ramifications of this apparent gap are:

- Product training cost
- Employee training cost. The average training cost per employee is \$1,252, according to the Association for Talent Development's 2016 State of the Industry Report.
- Support cost - \$243 lost per customer due to bad user experiences.
- Opportunity Cost - Good UX (user experience) is estimated to add earnings to your product/service.
- According to the ATD report, employers use an average of 33.5 training hours per employee.

Data also confirms that,

- 45% of users give up if registration is hard.
- The ROI of a good UX ranges from \$2 to \$100 for every \$1 invested.

Considering these changes in the user profiles, it is imperative to give a new age application experience to the users.

There are several ways of modernizing experience. One approach for improving experience is Design Thinking

<https://harbinger-systems.com/blog/2021/02/patient-engagement-an-imperative-in-healthcare/>

Using this methodology, we can modernize the application with a patient-centric and provider-centric approach.

Here are some examples on how we can provide an improved user experience to end users:

Chatbot or conversational agent

- Answer all basic questions for patients, 24*7.
- Patient-physician matchmaker after initial assessment
- Appointment scheduling

Application user interface design (UI/UX)

- Personalized UI (UX Improvements)
- Easy and customizable information flow

Medical education – lightweight and personalized learning experience

- Most of the patients do not understand their reports properly and do not understand the treatment options available to them.
- Won't it be a good idea to send your patients very customized and personalized learning content before and after every procedure? This will not only reduce the physician's burden but will also improve the patient satisfaction score.
- Anytime – anywhere – through mobile
- Nudge learning

IoT

- Instead of a patients visiting the healthcare facility and recording their vitals or patients recording their vitals and sending them to physicians, why not have a system where the patients' vitals will get shared with the physician automatically.
- Instead of the patients reporting any risk, the physicians, equipped with data, can see the risk coming and take coreective action. Wouldn't that be super efficient for the patients?



Data Architecture Modernization

Before we get into the details of the 'how' and 'why' of data, here are some points to ponder over:

- Healthcare data is experiencing a 48 percent annual growth rate and has reached 2.314 exabytes in 2020, according to IDC.
- The healthcare data has grown from 500 petabytes in 2012 to 25,000 petabytes in 2020, according to Orion Health.
- If all digital data in healthcare were loaded onto the memory in a stack of tablets, it would reach 82,000 miles high, one-third of the way to the moon by 2020 – up from just 5,500 miles high, three percent of the way to the moon in 2013, according to IDC.
- Between electronic medical records (EMRs), digitized diagnostics, and wearable medical devices, the average person will leave a trail of more than 1 million gigabytes of health-related data in their lifetime, according to IBM estimates.

But the mere existence of data, however, does not complete the story. Instead, healthcare organizations need to leverage modern healthcare technology to transform this proliferation of unwieldy information into actionable information or insights to make more informed decisions.

Remote patient care, EMR/EHR, and wearable devices are generating a vast magnitude of data in the healthcare ecosystem, where stakeholders are trying to leverage a large amount of data influx for garnering insights. This calls for data management solutions that need to satisfy affordability, quality, and access challenges. These challenges can be addressed through Data Storage and Data Analysis.

Data Storage

Healthcare data is a mix of structured and unstructured data types. Data related to patient, treatment, provider, and payment is mostly structured. But the ecosystem generates a large magnitude of unstructured data like Radiology images or genome sequence information which is large in magnitude.

Move to a cloud platform that provides scalable and cost-effective data storage is the first step towards managing data. In addition, data management can also be helped by modernization techniques like building data lakes/data warehouses. Considering the Export, Load, and Transform (ELT) paradigm of data storage and management, Data Lake provides a central data storage with a flexible architecture to accept all kinds of data, from multiple channels (EL). Such architecture provides for rapid data collection, metadata gathering for audits as also repeatability, and the ability to analyze structured and unstructured data.

Data Analysis

The data stored in warehouses can be analyzed using various ML/AI tools to gain relevant insights. Techniques like Natural Language Processing (NLP), Optical Character Recognition (OCR) help data processing immensely. With wearable IoT devices, data can be analyzed closer to its source using mobile computing. Complex algorithms can be created for predictive analysis using AI/ML. For example, a predictive model generated after processing thousands of radiology images can help in the diagnostic of radiology images enabling automated decision making. Analyzing the 'omics' data is another challenge tackled by bio-informatics. For example, quantitative data like laboratory data, treatment data, and genomics data can be combined and analyzed for digitized healthcare.

Platforms like IBM Watson enable healthcare data warehousing, analysis, and visualization. All major cloud providers have also come up with offerings to support data analysis.



The benefits of data analytics can thus be outlined as below:

- Better understanding of patient longitudinal care data resulting in improvement in outcomes
- Predictive analysis of patient behavior as well as population health for infrastructure forecasts
- Eliminating unnecessary tests
- Predicting propensity to pay (p2p)
- Enhancing medical knowledge – For example, projects like genome analysis help in the overall understanding of human genetics

Data analysis contributes to measurable cost savings:

- Using data analytics could contribute to reducing hospital supply chain costs by \$23 billion annually, based on analysis of more than 2,300 hospitals by consulting firm Navigant.
- Allina Health implemented a P2P strategy to eliminate/minimize bad debt and generated revenue through overall patient collections by \$2 million in one year.





Compliance / Programs / Certification

Healthcare is one of the most regulated industries in the United States and this makes healthcare compliance a crucial and growing field within the industry. The Bureau of Labor and Statistics projects the overall need for compliance officers to grow by over 8% from 2016 through 2026.

These ever-growing government regulations are critical because they set privacy and usage standards for patient information, ensure quality patient care, prevent fraud, and protect healthcare staff. CMS (Center for Medicare & Medicaid Services) or Government healthcare bodies keep releasing new or updated versions of the major laws, acts, and regulations that healthcare organizations are mandated to remain compliant with. Compliance professionals therefore have to not only closely monitor the existing regulations but also keep a close eye on any amendments that are made from time to time.

Health systems, hospitals, and PAC (post-acute care) providers need to comply with 629 (341 hospital-related and 288 PAC-related) discrete regulatory requirements. As the AHA (American Hospital Association) outlines in the report, the financial cost of Healthcare Regulatory Compliance is very high.

- The healthcare providers segment spends about \$39 billion annually on the administrative facets of regulatory compliance.
- An average-sized community hospital spends nearly \$7.6 million and around 49 FTEs (over one-quarter of which are doctors and nurses) annually to support compliance with the reviewed federal regulations.
- The regulatory burden costs \$1,200 every time a patient is admitted to a hospital.



Not only the cost of compliance but the timing and pace of compliance also make a significant difference. As new or updated regulations are issued, a provider must quickly mobilize clinical and non-clinical resources to decipher the regulations and then redesign, test, and implement the new processes.

A lot of this can be handled by enhancing the software product that you are using. The healthcare software product companies, as well as healthcare organizations, need to ensure that the applications they are using are compliant with the new or updated regulations.

This brings a new type of **healthcare application modernization need** that has to cater to the compliance requirements. This helps healthcare organizations to not only stay ahead of the competition but also save penalties from CMS and other governing bodies.

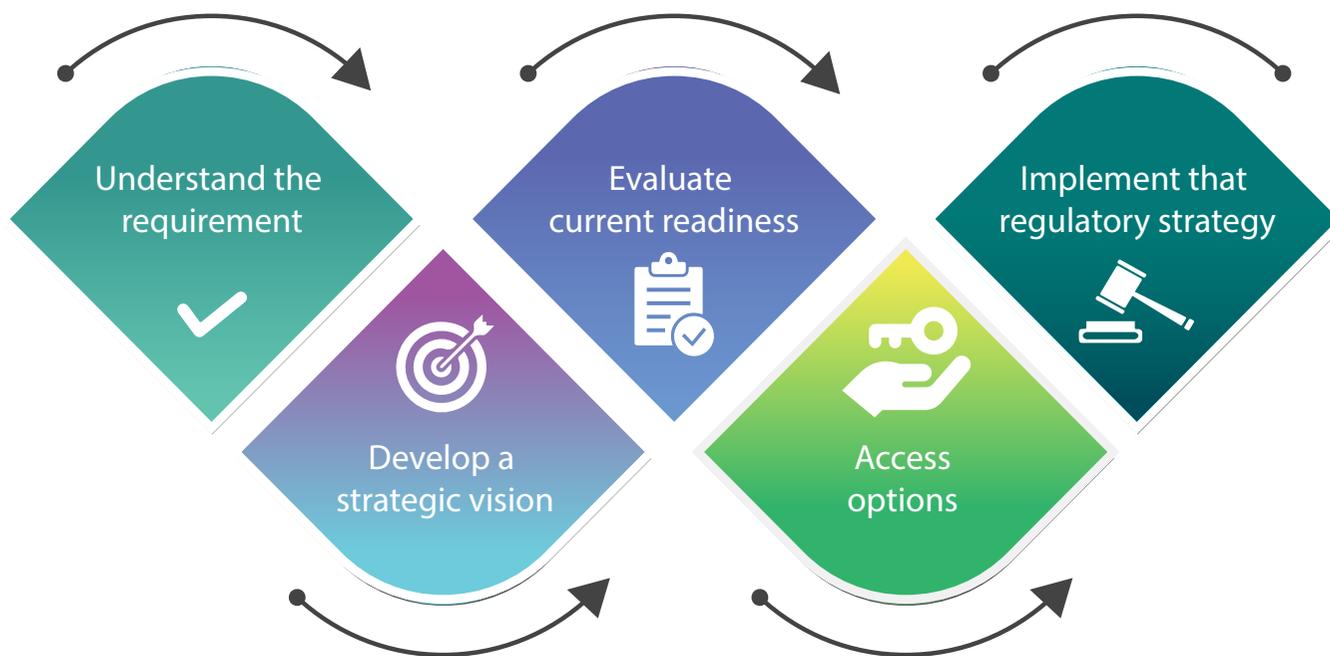
Examples of a few regulatory compliances (laws, acts, and programs) that are applicable to healthcare organizations are HIPAA (Health Insurance Portability and Accountability Act), HITECH (Health Information Technology for Economic and Clinical Health), MACRA (Medicare Access and CHIP Reauthorization Act of 2015), Medical Necessity, and Chain of Custody.

So, if you are developing a healthcare application from scratch, it is assumed that you will design the application as per the most updated regulatory compliance. But in most cases, the applications are already in place, and they **need modernization to meet the new regulatory compliance requirements.**

Let us understand this with the example of MACRA and QPP (Quality Payment Program). If we talk about MIPS (Merit-based Incentive Payment System), it stresses on four aspects i.e., Quality, Advancing Care Information, Improvement Activities and Cost by which physicians are scored.

The degree to which physicians are incentivized or penalized in terms of reimbursement will be based on these performance metrics. Now, to meet all these new criteria, you need to modernize your existing application. This needs to be planned and executed very carefully as regulations keep changing and hence your modernized application also needs to have the provision to accommodate even the future changes with minimum changes in the existing application.

At a high-level, the application modernization process to meet new regulatory compliance requirements includes: understanding the requirement, developing a strategic vision, evaluating the current readiness, accessing options, and implementing regulatory strategy.



Healthcare product modernization best practices

Businesses hesitate to go down the modernization path due to various perceived barriers. Some of these are:

- Security Concerns for the overall setup and data
- Fear of losing control of data
- Inability of end users to quickly adapt to dynamic technologies such as IoT devices, mHealth and so on
- Need of major investment necessary for infrastructure enablement

It could be easily observed that the overall security, availability and durability promised by the cloud setup can more than match any existing on-premise setup. The operational cost of procuring, maintaining and refreshing the on-premise setup also offsets the initial cost of the cloud setup. The cloud providers have healthcare-specific compliance certifications for the setup they offer, reducing the need of maintaining compliant infrastructure. End-user education can also help in changing the end-user mindset. The pandemic days have forced many of the healthcare end-users to embrace new technology enabling remote patient management.

The following best practices can be incorporated in the modernization strategy to overcome such barriers:

- Ongoing training and education for all members so that they are not only clear on requirements but also the big picture with respect to the healthcare product compliance requirements.
- Maintaining compliance and accreditation with the increased use of cloud providers per HIPAA.
- Using proper identity and access management and other techniques.
- Checking all 3rd party libraries, cloud providers, devices, and tools and ensure they meet all the healthcare compliance requirements.
- Ensuring that integration with other systems complies with prescribed standards like HL7, FHIR, EDI, and so on.
- Keeping up with changes in technology and the associated regulations.
- A detailed audit log for every transaction.
- Agility in planning and delivery.

Conclusion

Healthcare systems will encounter a lot of challenges if they continue to operate on legacy infrastructure. Aging existing systems not only stop you from leveraging modern technology but they also lag in many aspects such as operational efficiency, optimum utilization of investment, up-to-date compliance, seamless integration with modern equipment/devices and of course end-user experience. Beyond doubt, modernization is the need of the hour for healthcare systems. Several problems may arise if healthcare portals do not take the necessary step to modernize. Some of these include:

1. Non cohesive patient experience
2. Gaps in System integrations
3. Regulatory compliance risks
4. Higher Costs
5. Lack of Efficiency
6. Loss of future revenue

Comprehensive planning and a complete inside-out modernization strategy including aspects such as infrastructure, experience, data strategy and compliance is what is recommended.

Key Takeaways

- Modernization is a business imperative. It is a journey comprising series of carefully planned incremental steps.
- The four technology aspects relevant to the modernization of the overall system are: infrastructure modernization, user experience modernization, data strategy modernization, and compliance modernization.
- Cloud migration, mobile availability, carefully crafted user experience, efficient data processing, and the ability to meet up with new regulatory compliance requirements are some of the integral aspects of modernization.
- An integrated approach and not quick fixes is the call of the hour.

About Harbinger Systems

Harbinger Systems is a global company providing software technology services for independent software vendors and enterprises. Since its inception in 1990, Harbinger has developed a strong customer base of organizations worldwide that includes high-tech startups in Silicon Valley, multi-national product companies, and in-house IT teams of large organizations.

Harbinger Systems leverages the latest digital technologies to build software solutions in HRTech, HealthTech, WorkTech, and Learning Tech domains, and helps solve complex business problems in these areas for organizations across industries.

For over ten years, Harbinger has enabled many Health Tech companies in delivering quality care, meeting government compliance requirements, and improving patient engagement. Our Health Tech team has extensive knowledge of healthcare regulations and standards combined with deep expertise in connected healthcare and healthcare intelligence.

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