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Healthcare

The Internet of Things and Blockchain: Unique Opportunities for Healthcare

Leading healthcare organizations are leveraging the game-changing power of the Internet of Things and blockchain to improve patient outcomes and optimize internal operations.

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INTRODUCTION

If you think about technology innovation in healthcare, what likely comes to mind are cutting-edge advances for saving lives. These attention-grabbing developments include breakthroughs in gene therapies and the use of high-resolution, 3D visualization for microsurgeries. However, that's only part of the innovation story. An equally significant wave of technological disruption, fueled by **the Internet of Things (IoT)** and **blockchain**, is impacting all aspects of the healthcare value chain in game-changing ways.

Individually, and more importantly when combined, IoT and blockchain—especially when paired with artificial intelligence (AI) and machine learning—provide even more possibilities for healthcare. Fundamentally, IoT and blockchain provide a way to exchange value-embedded data without friction. AI then puts the data into action to create value without human effort. Data sources from multiple stakeholders provide AI with a rich data source to study patterns and behaviors—to gain deeper insights—as well as recognize scenarios and how best to respond.

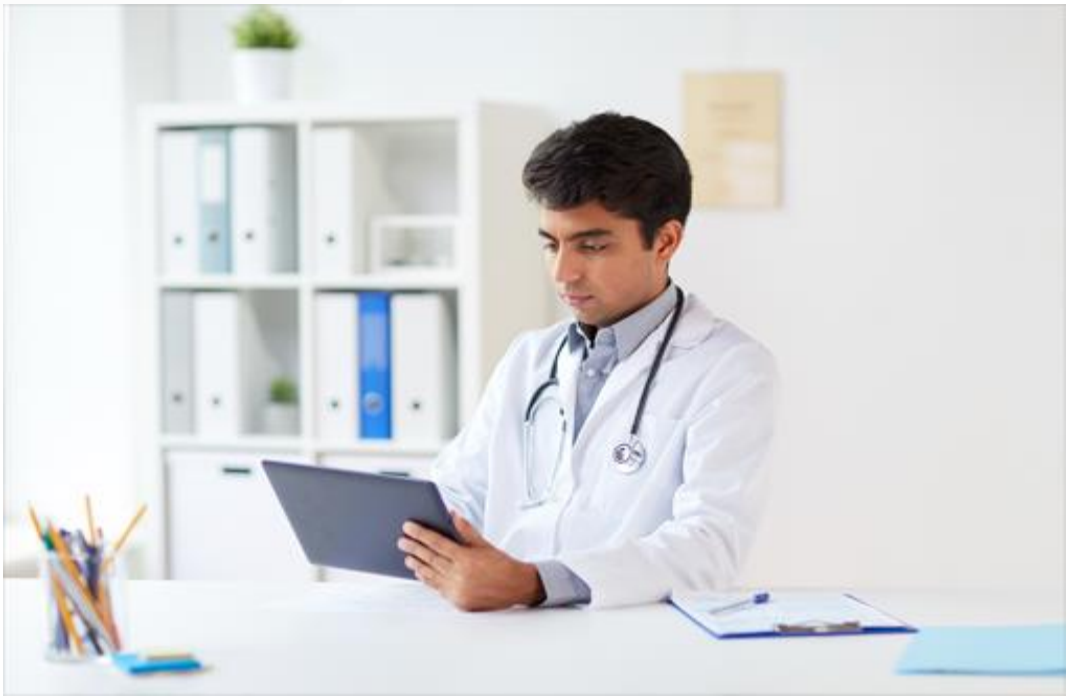
With IoT and blockchain, as with any new technology, healthcare professionals must separate market hype and aspiration from current reality and long-term potential to determine how best to use them for quick wins and ongoing benefits. Considering the fast-paced developments surrounding these technologies, it's not an easy thing to do. But one thing is clear, now is the time to get started.

There's no question that IoT and blockchain are generating intense interest these days. But to accurately assess their potential, healthcare executives must understand where each technology stands in its maturity curve.

This white paper explains what healthcare professionals can realistically expect from IoT and blockchain today and in the future, and provides real-world examples of how healthcare organizations are already benefiting from these innovations.

IoT ENTERS MAINSTREAM HEALTHCARE

The maturity level of IoT is well ahead of blockchain. Variations of the IoT model—using numerous data-collecting sensors to gather real-time information—have been used for years in the manufacturing and utility industries. What's new for healthcare is the term **Internet of Healthcare Things (IoHT),** which refers to a connected infrastructure of devices and software applications that can communicate with various healthcare IT systems. Many healthcare organizations are already using IoHT, from monitoring newborns to tracking inventory and maintaining assets, though most believe we are just scratching the surface of the potential for innovation. Reflecting this interest, a report by management consulting firm Frost & Sullivan predicts that the number of IoHT devices will rise from about 4.5 billion in 2015 to as many as 30 billion by 2020 [1].



Frost & Sullivan predicts that as many as 30 billion IoHT will be used by 2020

Where Does IoHT Fit in Healthcare?

The answer is that there are two distinct categories of use cases—one for **clinical services** and the other for **support operations**. In clinical settings, IoHT is improving patient-centric activities with remote patient monitoring (RPM). For example, doctors and nurses can use IoT sensors to closely monitor the vital signs of recently discharged postop patients for early warnings about potential complications. IoHT also aids clinical trials by closely tracking vital signs and any other indicators important to the studies, such as blood-sugar levels and weight trends.

Other patient-centric IoHT applications include medication adherence and supporting wellness and prevention programs. Healthy patients can closely track their exercise and fitness goals designed to keep them in top form. Similarly, these programs give chronically ill patients tools for self-managing their conditions and ultimately reducing the severity of their diseases. For patients taking medications, studies show that nearly 75 percent of adults are non-adherent in one or more ways, such as not filling a new prescription or taking less than the dose recommended by the physician [2].

IoHT benefits support operations with equipment-centric sensors and data-collection capabilities that can reduce costs through better utilization of mobile medical assets. Sensors give the facilities staff real-time information about the usage rates and location of digital x-ray equipment, ventilators, and other movable resources so that they can be assigned more effectively and quickly located when needed. These capabilities are sorely needed by hospitals. Studies have found that the average utilization rate for mobile devices is as little as 42 percent, and that nurses typically waste more than 20 minutes of their shift trying to locate equipment, leaving them less time to care for patients [3].

In addition, IoHT sensory inputs can show technicians the real-time performance status of expensive machines such as MRI equipment. This helps technicians to plan maintenance according to actual usage rates, not generic schedules advised by manufacturers. The detailed data can also flag a problem component before damage or failure occurs. This is especially important for large health systems where equipment is dispersed across various physical locations and an equipment failure would have a widespread impact.

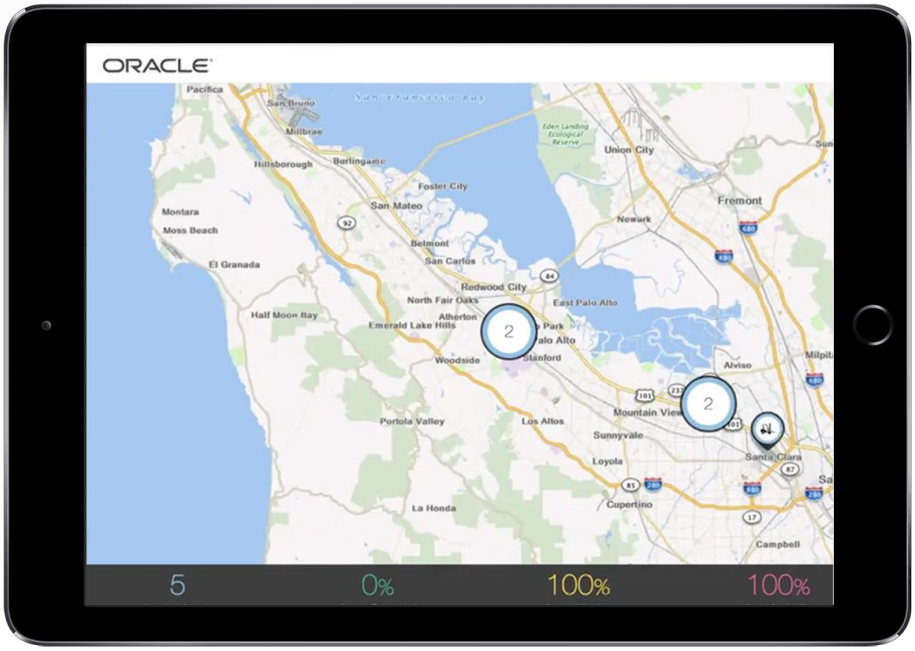


Figure 1. IoT Augmented Reality View Visualizing Locations/Status of Dispersed Assets

Healthcare decision-makers are also evaluating the combination of IoHT and augmented-reality (AR) technology to create digital twins. Interactive and highly visual AR interfaces may digitally recreate complex hospital equipment to give technicians and clinicians realistic, hands-on training opportunities. In addition, the facilities staff may test ideas for performance optimizations on the AR proxies before risking any changes to production systems.

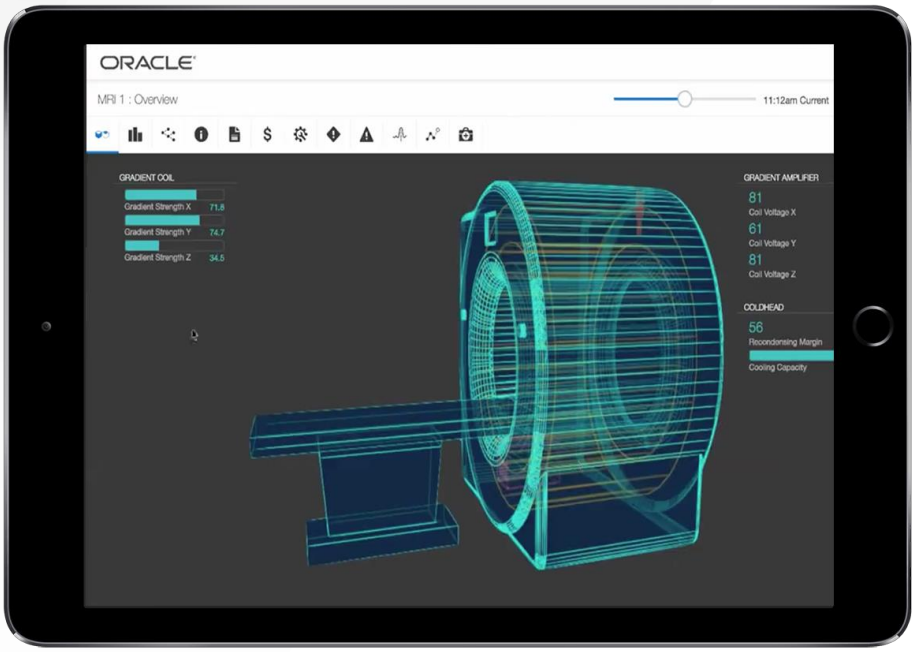


Figure 2. IoT Digital Twin Representation of MRI Machine

BLOCKCHAIN SOURCE OF TRUTH

Newer than IoHT, blockchain is gaining attention because of its ability to generate and securely distribute permanent, unalterable records of transactions. The recent fervor around bitcoin may be fueling interest among the general public in blockchain, which is the underlying technology that makes bitcoin possible. But blockchain, also known as digital-ledger technology, isn't itself a cryptocurrency. It creates sequences of transactions, known as blocks, and records them in an ongoing chain of events that can be shared among members of a network. Because the blocks are protected using advanced cryptographic technology, the records are virtually impossible to change, according to blockchain advocates.

In the blockchain, every transaction that occurs between nodes is logged and verified to make sure all nodes in a network agree about the current state of the ledger and every transaction in it. This means that thousands of nodes all agree that a transaction has occurred on a specific date at a specific time. This way, everyone has access to a shared, single source of truth.

This has ramifications for all types of industries and business processes. For example, in financial services, more than $US1.4 billion has been invested in the last three years to evaluate blockchain applications [4].

Healthcare professionals are also taking notice. Research by the management consulting firm Deloitte determined that 35 percent of executives at health and life sciences companies are planning to implement blockchain within the next 12 months [5]. This is on top of the 28 percent of organizations in those industries with current investments of $US5 million or more and the 10 percent of companies that have already earmarked $US10 million or more.

Where Does Blockchain Fit in Healthcare?

Blockchain has broad implications for the industry, including the ability to simplify and improve security and accuracy for cumbersome, inefficient processes. Examples include streamlining claims adjudication, faster medical insurance enrollment, and augmenting B2B activity across the healthcare value chain.

When blockchain is combined with IoHT, secure, unalterable blockchains can also reduce risks by charting the chain of possession of medical devices and pharmaceuticals. Healthcare organizations can trace products through supply chains to ensure authenticity or flag potentially damaging in-transit events, such as signs of tampering, extreme environmental conditions, or careless handling. This data provides a valuable forensic trail if quality issues arise after delivery of an item.

Similarly, if a manufacturer identifies a problem with a device or pharmaceutical, the blockchain can help vendors expedite recalls by quickly determining the location of inventory across the supply chain to keep it out of circulation.

Other blockchain opportunities include faster and more-efficient credentialing of employees, thanks to the ability to verify unalterable records of caregivers, as well as the use of smart contracts to automatically perform actions established with contracts, such as pre-authorizations between payer and providers.

Healthcare executives planning IoHT and blockchain implementations should consider two supplemental technologies that can speed adoption and time to value. The first is the use of AI, a subset of advanced analytics that offers decision-makers new ways to analyze efficacy and improve outcomes. AI aggregates and then extracts insights by recognizing patterns and correlations across large volumes of data. In short, AI goes beyond traditional analytics and can unlock the value of all of that information associated with IoHT and blockchain platforms.

Hybrid clouds are the second key to a strong IoHT and blockchain foundation. These new hybrid cloud-at-customer models provide highly scalable public-cloud applications and services, while keeping clinical data behind enterprise firewalls to conform to organizational and regulatory requirements. Cloud-at-customer models also help by consolidating sprawling legacy IT environments as organizations begin their cloud journey. For example, one large US health system is projecting that it will save more than $US7 million over five years as it replaces or consolidates legacy hardware by shifting to a cloud-at-customer approach.

THE POWER OF DATA DRIVEN HEALTHCARE

IoHT and blockchain are still maturing, and while their use in healthcare is in early stages, leading organizations throughout the world are already seeing significant benefits from the technologies.

For example, VINCI is a Watford, UK, company that uses IoT cloud capabilities as part of the maintenance services it provides for St. Helens and Whiston Hospitals in the Merseyside region of the country. The National Health Service's Patient-Led Assessments of the Care Environment (PLACE) evaluations assess key factors of hospital care environments, including maintenance performance. The hospitals served by VINCI received a 99 percent rating from the PLACE assessment. What's more, the IoT-supported maintenance services found opportunities for reaping energy savings of US$560,000 per year.

Blockchain, with its immutable ledger, and ability to authenticate users and create trusted networks of participants, is also making an impact on healthcare's ongoing drive for data interoperability. The goal: support the smooth flow of patient information among various software applications and hospital IT systems. In fact, one industry survey found that 90 percent of medical group managers and IT specialists believe blockchain could significantly improve connectivity, privacy, and patient record-sharing among providers. In the same survey, 68 percent of payers said blockchain could be added to their data management systems by the end of 2018 [6].

TIME TO ACT

The latest digital innovations are creating opportunities for reshaping how healthcare organizations deliver patient services, improve outcomes, enhance clinician satisfaction, and manage costs more effectively. But doing so requires a clear understanding of what IoHT and blockchain can deliver in the immediate future, and as they continue to mature over time. To do that, executives should assess the current state of these technologies and how they can be combined with the help of cloud services for even greater impact.

Real-world use cases show now is the time to expand these assessments

IoHT	BLOCKCHAIN
Chronic Condition Management	Supply Chain Traceability & Recall
Medication Adherence	Credentialing
Remote Patient Monitoring	Claims Adjudication
Asset Monitoring	Health Plan Enrollment
Clinical Research	Payer/Provider B2B Collaboration

Table 1: IoHT and Blockchain Use Cases for Healthcare

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Oracle has a long and growing presence in the healthcare market worldwide, —including providers, academic medical centers, specialty care organizations, and payers. The Oracle Cloud is the most powerful, unified cloud solution suite available today, redefining how healthcare can transform and innovate in a digital world.

LINKS FOR MORE INFORMATION

- Oracle IoT Cloud Service
  https://cloud.oracle.com/iot
- Oracle IoT Asset Monitoring Cloud
  https://cloud.oracle.com/en_US/iot-asset-monitoring-cloud/features
- Oracle Blockchain Cloud Service
  https://cloud.oracle.com/en_US/blockchain
- Oracle Cloud at Customer
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