Bring the power of AWS services to healthcare and life sciences organizations

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Healthcare and life sciences (HCLS) organizations are reinventing how they collaborate, make data-driven clinical and operational decisions, enable precision medicine, and decrease the cost of care. The cloud can empower organizations to achieve these goals, and Amazon Web Services (AWS) is addressing challenges HCLS organizations face when moving their workloads to the cloud.

By offering flexible cloud models wherever a hospital, research facility, or even pharma or medical device manufacturer needs them, organizations can benefit from reduced costs and faster time to results and ultimately help health professionals make better decisions. Cloud services can now be brought into a variety of on-premises locations, including data centers, smaller and more remote sites, as well as to the edge—where there's a need to process data close to where it originates. AWS hybrid and edge solutions overcome common challenges around where patient data is stored and accessed, the need to keep some large datasets local for processing, and how to achieve low enough latencies to support applications such as real-time processing of radiology image scans.

By bringing cloud infrastructure and services closer to where patients and practitioners need it, organizations can also leverage an ever-growing suite of cloud services from AWS to help them do more. Applications utilizing analytics, machine learning (ML), and artificial intelligence (AI) are all having a big impact on life sciences research and personalized care for patients.

In this solution brief, we discuss how AWS hybrid and edge solutions enable healthcare and life sciences organizations (including ISVs and managed service providers) to create hybrid environments that blend on premises, edge, 5G, and cloud-based services, using the same modern cloud technologies, services, and APIs. This gives HCLS organizations access to the benefits of AWS wherever they need it to drive innovation and reduce costs and IT overhead. Hybrid and edge solutions such as AWS Outposts, AWS Local Zones, and AWS Wavelength bring data storage, compute power, advanced technologies, and more—while meeting low-latency, local data processing, and data residency requirements.

Common cloud challenges in healthcare and life sciences

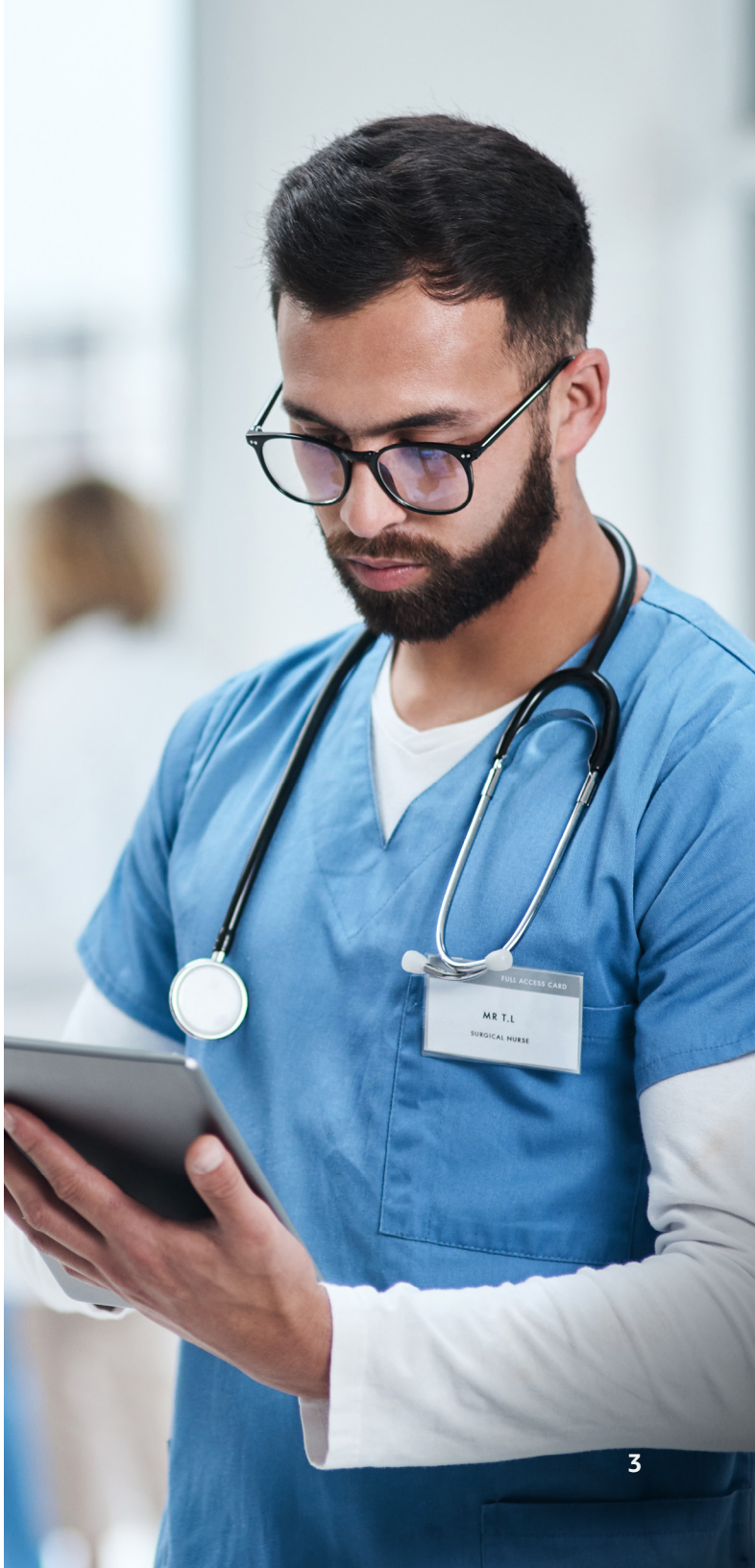
Healthcare providers

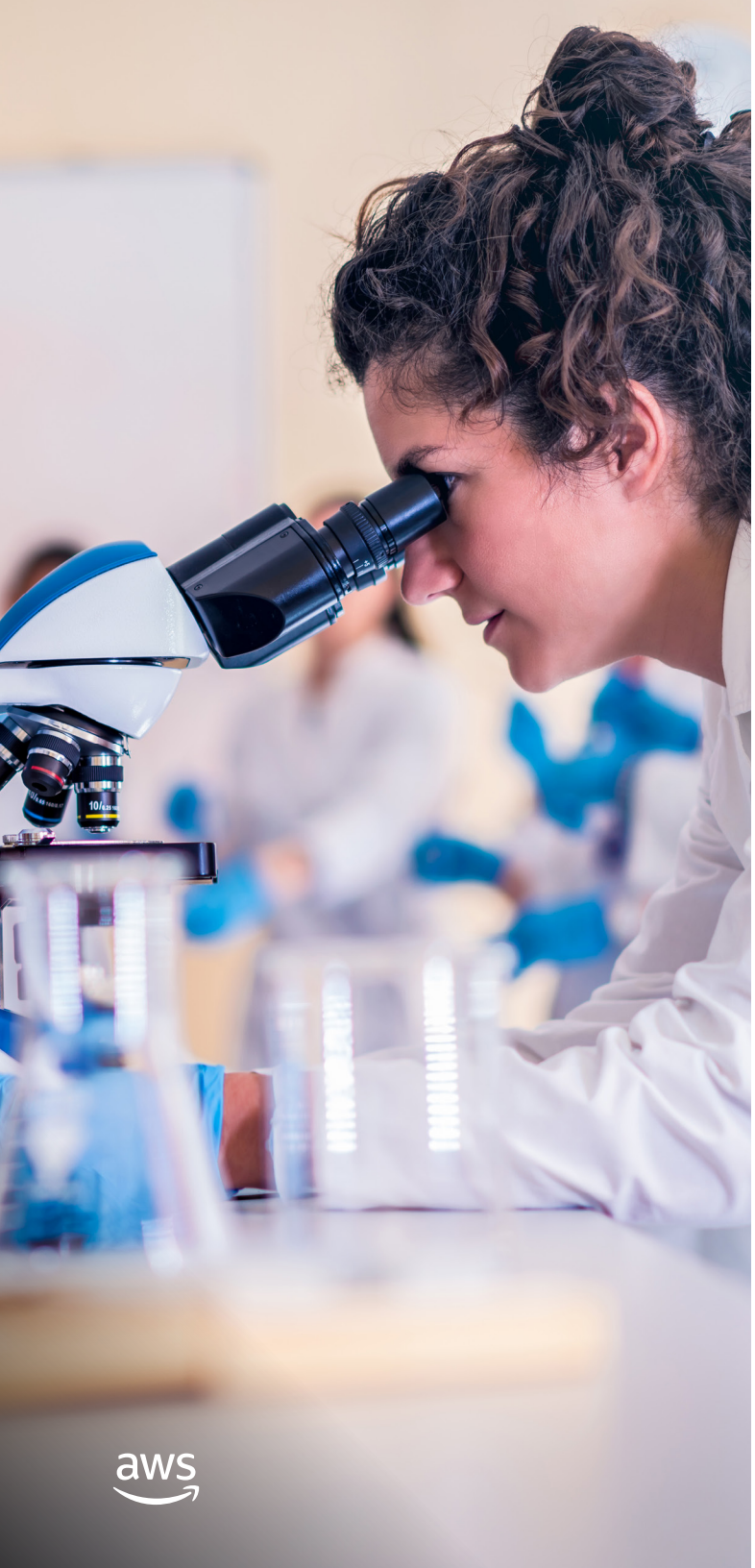
Doctors and other healthcare practitioners need rapid access to data, medical images like radiology/CT scans, and diagnostic test results. When on-premises equipment accesses the cloud for data processing, the delay between a request for information and the resulting response—latency—can at times be unacceptable. High-end surgical devices and patient monitoring systems also require low-latency connections.

In addition, patient medical records that need to be accessed on a timely basis often reside in on-site electronic health record (EHR) systems and electronic medical record (EMR) systems. To make medical imaging and PACS (picture archiving and communication systems) useful for healthcare providers and their patients, the data files produced by radiology, scans, mammography, ultrasound, cardiology, and other diagnostic technologies have significant capacity requirements and must be processed and analyzed quickly and available anywhere.

There may be regulatory issues surrounding where personal healthcare information (PHI) is kept. Moving all that data to the cloud might not be possible due to data residency requirements.

Healthcare providers are focused on better patient experiences and improved care delivery. By modernizing health organizations, cloud benefits such as flexibility, scale, and lower costs can be achieved. While organizational leadership recognizes the value of application modernization and cloud migration, custom-built legacy applications that have monolithic, traditional architectures cannot be moved to the cloud in one go. Additionally, many of these applications have low-latency dependency on data stores that must (for now) remain on premises in research facilities and clinics to be able to operate.





Life sciences organizations

In life sciences, organizations are looking to do more and faster, with huge sets of data being generated by research. Some of the challenges in research areas include ensuring that latency between lab instruments is low and that visualizing images and training deep learning models can operate seamlessly, often in small or more remote locations.

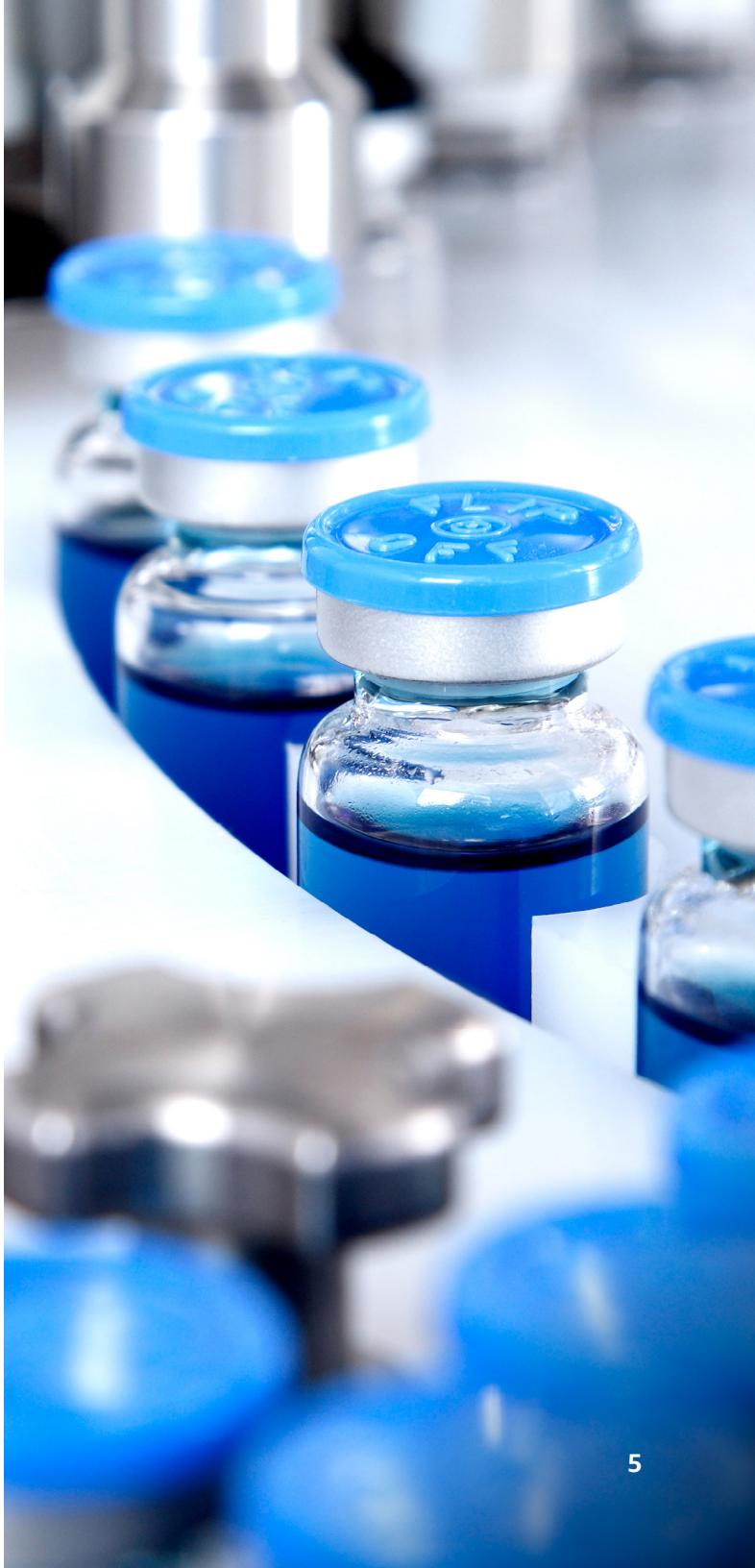
Cryo-EM devices produce petabytes of data, so there remains a need to process the data locally to save time for scientists and achieve higher utilization of devices. In genomics sequencing, where the data may be used in the cloud as a high-performance computing workload, there is still a need for some local processing before data is sent to an AWS Region.

Drug manufacturers and medical device makers

In manufacturing sectors (pharma and medical devices), there is a particular need for low-latency operations and to bring AWS services to manufacturing locations. Consider a business that manufactures medical devices with multiple sites running very latency-sensitive applications to support factory floor operations (including robotics). The overhead of maintaining both on-premises and cloud models is not desirable.

Maintaining or improving upon low latencies can help such factories make faster decisions and achieve real-time feedback on manufacturing operations to improve plant efficiency. That means medical devices can be developed quicker and get into healthcare settings faster—ultimately improving the patient experience.

Likewise, pharmaceutical manufacturing organizations can modernize every stage of the value chain, from R&D through commercialization, to bring advanced and differentiated therapeutics to market faster. For example, AWS is helping Pfizer create innovative cloud-based solutions with the potential to improve how new medicines are developed, manufactured, and distributed for testing in clinical trials.



OTHER CONSIDERATIONS

Challenges in maintaining cloud and on-premises environments

Infrastructure teams

- Complex procurement and provisioning cycles across multiple vendors and typical wait times of 3–6 months to get servers installed on premises
- Significant overhead to patch and upgrade on-premises infrastructure against a complex "compatibility matrix" across various hardware and software components
- Business continuity and operational impact caused by the downtime needed for maintenance

Developers

- The services and APIs used to build applications on premises may not be the same as those used in the cloud
- The tools used for on-premises automation, deployment, and security controls may not be the same as those used in the cloud
- Having different code and processes for on-premises and cloud applications creates friction and operational risk, impacting developer efficiency

Legacy Systems

- The pace of on-premises innovation lags behind the pace achieved in the cloud as a result of the legacy systems and complex architectures in use on premises
- Businesses would like to leverage the latest cloud infrastructure and services, such as AI, ML, analytics, and container orchestration, to build new and innovative applications on premises

AWS hybrid and edge solutions meeting demands in healthcare and life sciences organizations

To meet workload challenges and support these diverse applications, providers typically run and maintain on-premises data centers that use different infrastructure, tools, and APIs than are used in the cloud. Relying on a mix of hardware and software solutions in this way creates complexity, resulting in increased management costs, greater risk, and decreased innovative potential. IT teams must manage multiple disparate environments, while developers have the added burden of using different development and deployment tools on premises and in the cloud. AWS hybrid and edge computing solutions bring the same APIs, software development kits (SDKs), services, and tools on premises, as are available in the cloud. IT teams have a common set of management tools and can use common skills to manage their cloud and on-premises environments.

AWS is helping diverse HCLS organizations leverage AWS infrastructure, services, APIs, and tools where they are needed most in addressing low-latency, local data processing, and data residency needs. See below for how AWS Outposts, AWS Local Zones, and AWS Wavelength are solving for HCLS organizations today.

AWS Outposts Family

AWS Outposts provide an on-premises solution, with the advantage of being a fully managed service that removes the traditional overhead associated with designing, procuring, and managing infrastructure. This improves IT efficiency and reduces operational risk, as well as enables organizations to focus resources on developing healthcare solutions to improve patient outcomes. AWS Outposts come in different form factors to suit the nature of different locations. An AWS Outposts rack is the full 42U size version, suited to larger HCLS facilities and supports a range of AWS services that can be run locally on Outposts, such as compute, storage, databases, and networking. The smaller AWS Outposts servers (in 1U and 2U form factors) are perfect for branch locations, such as remote labs with less space or more modest demands.

AWS Local Zones

AWS Local Zones provide compute, storage, database, and other select AWS services in locations close to large populations, industries, and IT centers, giving healthcare providers single-digit millisecond latency between applications and end users. AWS Local Zones extend AWS infrastructure and services to where there isn't a near enough AWS Region to meet latency or data residency requirements, and have many of the same services, such as compute, storage, database, and containers. AWS Local Zones allow organizations to get all the benefits of AWS resources closer to end users without needing to own and operate their own data center infrastructure or AWS Outposts when AWS Local Zones can support the need for edge compute.

AWS Wavelength

AWS Wavelength places infrastructure and services within 5G networks, enabling devices connected over mobile networks to access data and applications on AWS with ultra-low latency. AWS Wavelength can support many emerging use cases around remote surgeries, as well as pre-send ambulance data to hospitals.

Taking the next steps with AWS

Put together, AWS Outposts, AWS Local Zones, and AWS Wavelength deliver the scalable, flexible, and robust hybrid cloud infrastructure that HCLS providers and facilities need to provide innovative paths to better research and patient care and drug and device manufacturers.

AWS provides healthcare organizations with the same infrastructure and services across their on-premises, hybrid, and edge environments. This means benefiting from the simplicity of using the same AWS infrastructure, services, APIs, and tools across the entire stack.

Customers can choose from a variety of AWS services, including Amazon Elastic Compute Cloud (Amazon EC2) instance types and Amazon Elastic Block Storage (Amazon EBS) options. Seamlessly extend Amazon Virtual Private Cloud (Amazon VPC) and choose where to run AWS services.

Through the AWS Management Console, hybrid and edge services can be ordered and launched, accelerating your organization's path to faster outcomes and better patient care.

AWS hybrid and edge use cases for HCLS organizations

Migration

Use case: HCLS organizations' modernization strategies may include both cloud transformation and on-premises refreshes. Legacy applications often require the low latency of on-premises infrastructure to maintain performance, such as for accessing medical imaging data. If a business wishes to shift these workloads to the cloud while still requiring them to communicate with the systems of record (running on mainframes), latency can pose challenges.

Solution: AWS Outposts and AWS Local Zones enable organizations to start transitioning legacy applications to benefit from the cloud while keeping them close to users or dependent systems and thereby meeting their low-latency requirements. Both services make modernization easier from an operational and financial perspective. For example, administrators and developers can use the same infrastructure, APIs, tools, and management controls across on premises, at the edge and in the cloud. AWS Outposts also offer a variety of procurement models, including one with no upfront capital outlay, thereby eliminating one of the biggest challenges of conventional on-premises IT.

Data Residency

Use case: For HCLS organizations like Philips that have thousands of customers all around the world, the need to ensure personal data is kept within the boundaries of certain countries is paramount. Regulatory issues surrounding where PHI is kept are stringent, and moving all that data to the cloud might not be possible due to data residency requirements.

Solution: With AWS Outposts and AWS Local Zones, organizations can control where workloads run and where data resides while using local operational tooling for things like monitoring and stability. AWS Outposts also allow low-friction movement of workloads between the cloud and the edge, and vice versa, to keep on top of any regulatory changes for on-premises environments and the cloud while minimizing application changes.

Software licensing

Use case: As customers increasingly adopt cloud services, ISVs are seeking to align by making their applications simpler to price, deploy, and manage while still meeting their customers' needs for data locality. One challenge for ISVs as they transition to a software-as-a-service (SaaS) model is licensing. HCLS customers are seeking usage-based pricing of ISV applications. ISVs must pivot to this model while ensuring they and their HCLS customers remain fully compliant with any license agreements of third-party application components, such as databases.

Solution: With AWS Outposts and AWS Local Zones, ISVs can offer their applications on a SaaS basis while meeting customers' data locality and residency needs. Moreover, AWS Outposts-validated ISVs mitigate risk by ensuring cloud infrastructure is secure, compliant, and cost-optimized.

Medical image access

Use case: Medical imaging is compute-intensive and generates large, high-resolution data files. Clinical care providers, as well as vendors, need fast access to these files to review patient history, consult with colleagues, and create care plans for patients. Organizations are considering the practicality of running PACS workloads on AWS Outposts but have requested low-cost, high-density storage for multiple petabytes of data to consider running their entire PACS in the cloud. Pharma R&D teams need fast access to imagery for 2D microscopic snapshots and 3D molecular behavior modeling, driving the need for low latency.

Solution: AWS Outposts deliver low-latency local compute with options for GPU instances designed for graphics-intensive applications. There are various AWS Outposts partners specializing in PACS and vendor neutral archive (VNA) solutions. Moreover, AWS Outposts work across multiple vendor applications to ensure migration to AWS Regions with minimal application or process changes.

Healthcare data in numbers

Between 100 million and 2 billion

The number of human genomes expected to be sequenced by 2025.[1]

40 exabytes

The amount of storage likely to be required if the number of human genomes sequenced reaches 2 billion.[2]

21.5%

The forecast compound annual growth rate (CAGR) of the global healthcare analytics market between 2022 and 2030.[3]

[1] Stephens, Z., et al., "Big Data: Astronomical or Genomical?" National Library of Medicine, July 2015

[2] Stephens, Z., et al., "Big Data: Astronomical or Genomical?" National Library of Medicine, July 2015

[3] "Healthcare Analytics Market Size, Share & Trends Analysis Report by Type, by Component, by Delivery Mode, by Application, by End-use, and Segment Forecasts, 2022–2030," Grand View Research, April 2022

Summary and recommendation

Healthcare and life sciences organizations, from hospitals and clinics to research and manufacturing facilities, can benefit from the low-latency processing, simplified application development, improved security, and streamlined management delivered through AWS hybrid and edge solutions. An ideal next step for organizations that have already started modernizing using the cloud is to bring familiar AWS infrastructure and services on premises or closer to end users with AWS Outposts, AWS Local Zones, and AWS Wavelength.

AWS Outposts, AWS Local Zones, and AWS Wavelength answer the challenges around local data processing and data residency needs, ensuring organizations can maximize the potential of their data to deliver the high-quality care and products demanded from their sectors.

Learn more about AWS hybrid and edge solutions here.