





AWS in healthcare

The Amazon Web Services (AWS) healthcare mission is to enable access and delivery of person-centred care in order to improve outcomes and lower costs by accelerating the digitisation and utilisation of healthcare data. Our aim is to help the National Health Service (NHS) and its partners develop cloud strategies to achieve more with less, modernise technology, and digitally transform back office and clinical services.

The AWS cloud

AWS provides on-demand delivery of technology services through the Internet with pay-as-you-go pricing. This is known as cloud computing. The AWS Cloud encompasses a broad set of global cloud-based products that includes compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security, and enterprise applications. The AWS Cloud is on-demand, available in seconds, with pay-as-you-go pricing. With over 200 fully featured services available from data centre's globally, the AWS Cloud has what you need to develop, deploy, and operate your applications, all while lowering costs, becoming more agile, and innovating faster.

With the AWS Cloud, you can spin up a virtual computer, specifying the number of CPU cores, memory, storage, and other characteristics in seconds, and pay for the infrastructure in per-second increments only while it is running. When you are done with the resources, you can simply delete them. With this built-in flexibility and scalability, you can build an application to serve your first patient, and then scale to serve your next million.

How does AWS cloud enhance better patient outcomes for the NHS?



Adopting Amazon Web Services (AWS) can significantly enhance the efficiency, scalability, and effectiveness of healthcare delivery. AWS offers a robust and secure cloud infrastructure that aligns seamlessly with the NHS England's "What Good Looks Like" framework. By migrating critical healthcare systems and data to the AWS cloud, we can help you digitise, connect and transform services safely and securely.

The scalability and elasticity of AWS ensures that healthcare resources are always available to meet demand. This means that during times of crisis, such as pandemics or surges in patient load, the NHS can rapidly scale up its infrastructure to accommodate the increased workload, ensuring that patients receive timely care. Additionally, AWS's strong security measures and compliance certifications can help the NHS maintain data privacy and security, adhering to the highest standards set out in the framework.

AWS aligns with the UK Department of Health and Social Care "<u>Data Saves Lives</u>" strategy, which aims to harness the power of data to improve patient care and outcomes. AWS provides advanced data analytics tools and machine learning capabilities that can help healthcare professionals derive valuable insights from vast amounts of structure and unstructured health and care data. This data-driven approach can lead to more accurate diagnoses, personalised treatment plans, and better predictive healthcare, ultimately saving lives and improving patient experiences.



Step 5

Your NHS cloud adoption plan

In an era marked by technological advancements, cloud computing has emerged as a game-changer, enabling transformation at pace in a safe, affordable and sustainable way. Embracing this paradigm shift since 2013, through the introduction of its cloud-first policy, the UK Government has embarked on a journey to adopt cloud computing across both public and private sectors.

Within this landscape, the NHS stands as a crucial pillar of public service, tasked with the formidable responsibility of safeguarding the health and well-being of millions. The NHS's current technology infrastructure has evolved over decades, resulting in escalating costs and technical debt that makes it difficult to adopt the latest cloud advancements to accelerate change.

Building on over 15 years experience working with healthcare customers in the UK and around the world, AWS has developed a **5-step plan** to help NHS organisations adopt cloud technology. By leveraging the innovations and capabilities of cloud computing, our overarching goal is to modernise the NHS and healthcare technology estate into a nimble, cost-effective, and environmentally sustainable system – responsive to the needs of citizens, patients and NHS employees.

The five step cloud adoption plan

Step 1Learn: Begin your cloud journey by acquiring essential knowledge about cloud computing, its benefits and potential challenges. Understanding the fundamentals of cloud types, security, governance and sustainability which will empower you to make informed decisions as an NHS leader.

Start small: Dip your toes into the cloud by initiating a small-scale pilot project. This hands-on experience will provide valuable insights, data and build confidence in the cloud's capabilities. This will inform any future business cases and show the art of the possible

Step 3 Build a foundation: Establish a solid foundation for your cloud adoption with an AWS Cloud Landing Zone. This structured approach ensures security, compliance and efficiency in your cloud infrastructure from your first workload and others to follow.

Engage: Invest in building a skilled workforce capable of understanding and managing cloud resources effectively. Developing cloud expertise within your team is vital for long-term success.

Scale: Gradually assess and migrate from on-premises IT to the cloud, scaling your operations to leverage the full potential of cloud technology. This step marks a significant transformation in your NHS cloud journey.

Making this vision into a reality will not be quick and will require change in several areas within your NHS organisations – from development to core business operations. As this is a well-trodden path across other industries and the private sector, the NHS can learn from experienced organisations and work with the AWS partner network to accelerate transformation.



NHS on-premises and cloud computing

Before the cloud era, the NHS, like many organisations, invested heavily in maintaining its own data centres, requiring dedicated infrastructure teams to manage these facilities. As the demand for computational power, storage, and networking surged with the growing reliance on the internet, NHS organisations are encountering significant challenges sustaining their extensive physical infrastructure. A cloud-based infrastructure provides a ready alternative to address increasing demands and digitisation requirements.

Consider a scenario where a healthcare technology team aim to deploy new features in their NHS organisations applications. They require a quality assurance (QA) environment mirroring the production configuration for thorough testing. In a traditional onpremises setup, setting up this additional environment involves procuring and installing hardware, managing cabling, provisioning power and configuring operating systems. The overall process is time consuming and expensive. The delay in waiting for the QA environment could hinder the timely release of essential healthcare features for patient care.

In contrast, embracing cloud technology allows the NHS to swiftly replicate entire production environments, on-demand, in a matter of minutes, without the need for physical hardware installation or complex cabling. The cloud solution offers flexibility and efficiency while adhering to stringent healthcare standards and regulations. It also eliminates the need for undifferentiated heavy lifting, enabling healthcare professionals to dedicate more time and resources to patient care and innovation.

Cloud service models

As cloud computing adoption has accelerated, various service models have emerged, catering to the diverse needs of NHS organisations. Each cloud service model offers varying levels of abstraction, control, flexibility, and management. It is imperative that NHS organisations understand the distinctions between Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) in order to make informed decisions about most appropriate model to meet their needs.

Infrastructure as a Service (IaaS)



Infrastructure as a Service (IaaS) contains the basic building blocks for cloud IT, and typically provides access to networking features, computers (virtual or on dedicated hardware), and data storage space. IaaS provides you with the highest level of flexibility and management control over your IT resources and is most like existing IT resources that developers use today.

Platform as a Service (PaaS)



Platform as a Service (PaaS) removes the need for you to manage the underlying infrastructure (usually hardware and operating systems) – allowing you to focus on the deployment and management of your applications. You don't need to worry about resource procurement, capacity planning, software maintenance, patching, or other undifferentiated heavy lifting.

Software as a Service (SaaS)

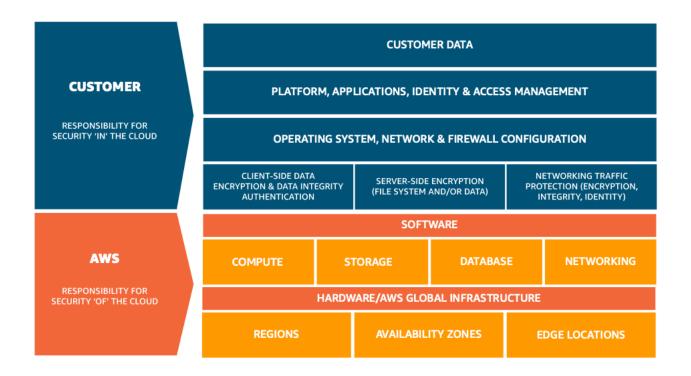


Software as a Service (SaaS) provides you with a completed product that is run and managed by the service provider. In most cases, SaaS refers to end-user applications. With a SaaS offering, you do not have to think about how the service is maintained or how the underlying infrastructure is managed; you only need to think about how you will use it.



AWS security on the cloud

Healthcare is highly regulated, which can mean that rigid security and compliance standards can slow the pace of innovation. At AWS, we recognise that protecting sensitive patient data is 'job zero' and have created a model that supports healthcare customers to meet security standards whilst innovating. Whether you build or consume applications on AWS, managing security and compliance is a shared responsibility between AWS and you, where we manage security "of" the cloud and you manage security "in" the cloud. This allows NHS organisations maintain complete control of their data whilst benefiting from our globally accredited security frameworks, protocols and standards.



AWS Responsibility

Being responsible for security of the cloud means that AWS protects and secures the infrastructure that runs the services offered in the AWS Cloud. AWS is responsible for:

- 1. Protecting and securing AWS Regions, Availability Zones, and data centres, down to the physical security of the buildings
- 2. Managing the hardware, software, and networking components that run AWS services, such as the physical servers, host operating systems, virtualization layers, and AWS networking components.

Customer Responsibility

NHS organisations, or anyone building on the cloud, are responsible for security in the cloud. When using any AWS service, you're responsible for configuring the service and your applications and ensuring that your data is secure.

Your level of responsibility depends on the AWS service. Some services require you to perform all the necessary security configuration and management tasks, while other more abstracted services require you to only manage the data and control access to your resources.

Due to the varying levels of effort, NHS organisations should review the level of responsibility required to secure each service, and how it aligns with security standards and regulations.



AWS Compliance on the cloud

In the evolving realm of healthcare technology, NHS organisations must meet regulatory compliance with cloud adoption. Amazon Web Services (AWS) offers a resilient cloud platform that enables cutting-edge healthcare while upholding stringent security and compliance standards. AWS enables NHS organisations to inherit the most comprehensive global compliance controls, aligned to NHS compliance requirements locally.





















AWS NHS Compliance Summary

ISO9001 – Global Quality Standard for quality management

ISO 27001 – Security Management Controls

ISO 27017 – Cloud specific security controls

ISO 27018 – Code of practice that focuses on protection of personal data in the cloud.

SOC1 – Audit Controls Report

SOC2 – Security Availability & Confidentiality Report

SOC3 - General Controls Report

Cyber Essentials Plus – UK certification focusing on UK Cyber Threat Protection

NCSC (National Cyber Security Centre) – Cloud Security Guidance NHS England – Data Security and Protection Toolkit - Standards Exceeded 2022/23

Environmental sustainability of AWS Cloud

Climate change and human health are inextricably linked. With around 4% of the country's carbon emissions, and over 7% of the economy, the NHS plays an essential role delivering Government sustainability goals, and has set the ambitious target to become the 1st net zero healthcare system in the world.

AWS can directly help the NHS achieve its goals. To build a sustainable business for our NHS customers and for the world we all share, AWS design data centres that provide the efficient, resilient service NHS organisations expect while minimizing our environmental footprint and theirs. Our sustainability work includes enhancing energy efficiency, transitioning to renewable energy, reducing embodied carbon, using water responsibly, driving a circular economy, and enabling sustainability for customers.

Many of our customers have asked us to help measure the carbon footprint of their AWS workloads—both to understand how moving to AWS reduces their carbon footprint and to report their overall footprint.

AWS customer carbon footprint tool uses simple visualisations to show customers their historical carbon emissions, estimate emissions avoided by using AWS instead of an on-premises data centre, and review forecasted emissions based on their current use. The forecast also shows how customers' footprints will change as we stay on the path to powering our operations with 100% renewable energy by 2025.

5X

AWS infrastructure is up to 5 times more energy efficient than typical European data centres

2.4 Billion

Litres of water are returned to communities each year from replenishment projects completed or underway

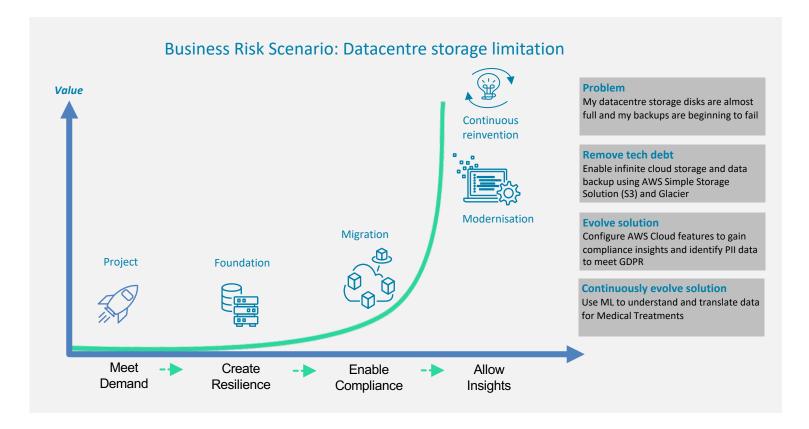
90%

In 2022, 90% of the electricity consumed by Amazon was attributable to renewable energy sources



Trying your first cloud workload

Many NHS organisations struggle with where to start. We always recommend starting with a specific business risk, whether it be improving data backups, optimising storage solutions, or enhancing web application hosting availability. This will allow you to demonstrate tangible business value that cloud adoption can, whilst you are learning. By embracing cloud technologies, you are not only bolstering our IT infrastructure but also fostering a culture of innovation and agility.



Using AWS Free Tier for your first workload

<u>AWS Free Tier</u> offers NHS organisations a valuable opportunity to initiate their cloud adoption journey without incurring initial costs. It provides a risk-free environment for experimentation and learning to a point, allowing NHS staff to understand cloud computing fundamentals and gain hands-on experience. This cost-free period of 12 months enables the gradual transition of workloads to the cloud, with scalability that aligns with the organisation's evolving needs. It also includes essential services for security, compliance, backup, storage, web hosting, and monitoring, addressing critical business risks related to data protection, availability, and performance.

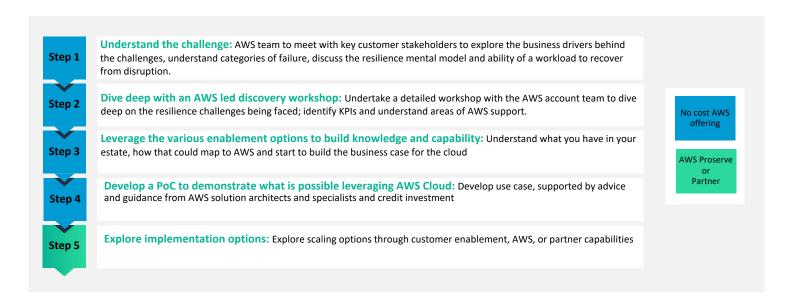
The AWS Free Tier facilitates knowledge acquisition through extensive documentation, training resources, and a supportive user community. It empowers NHS organizations to create proof-of-concept deployments, demonstrating the cloud's business value and feasibility. By leveraging these resources, NHS organisations can build confidence in cloud technology and develop the skills necessary to harness the benefits of cloud computing, such as improved efficiency, scalability, and cost-effectiveness, as they embark on their journey toward a more innovative and agile healthcare infrastructure.





Help Getting Started with AWS Cloud

The "AWS Getting Started" bundle a list of no-cost activities that can be implemented over a short timeframe. These activities are designed to align with NHS organisation resource commitments. The list is not exhaustive and aims to address a key business risk or current concern of the customer (also known as a "quick win"). These activities do not require any commercial agreements to be in place and are aimed to provide NHS organisations with advanced knowledge and understanding on how to define, plan and deliver the right outcome prior to any commercial activity.



AWS NHS Data Egress Waver (NHS DEW)

When you're getting started, it can be difficult to forecast how much moving data in and out of the cloud will cost. We want to make it simple for use to select the AWS cloud, without worrying about unanticipated or hidden costs. That's why we've introduced the NHS Data Egress Waver (DEW) programme.

With the NHS DEW, you can access data egress discounts so that you can adopt or maintain AWS cloud workloads without worrying about network egress charge forecasting. AWS customers may be eligible for waiver of egress charges under this program if you are a:

- NHS Trusts
- Integrated Care Systems (ICSs)
- Arms Length Body (ALBs)



If you use AWS cloud services within your NHS organisation AWS account, we'll give you a discount on the charges when you send data from AWS to the Internet or over the Health and Social Care Network (HSCN) or Scottish Health Protection Network (SHPN). This helps you save time forecasting budgets and can save up to 15% of the total AWS services each month.



Creating a secure and solid foundation (AWS Landing Zone)

As your organisation grows confidence and skills, you should consider setting up an AWS Landing Zone as the foundation for cloud initiatives. AWS Landing Zones offer pre-configured templates and best practices for AWS environments, providing a secure and scalable foundation for cloud adoption.

Automation

Automatically set up a cloud environment suitable for hosting secure workloads. You can deploy this solution in the LHR Region.

Data Security

Deploy the solution in the LHR region based on your data classification and use Amazon services including Macie to provide sensitive data detection in Amazon S3. This solution also helps you deploy, operate, and govern a centrally managed encryption strategy using AWS Key Management Service (KMS).

Compliance

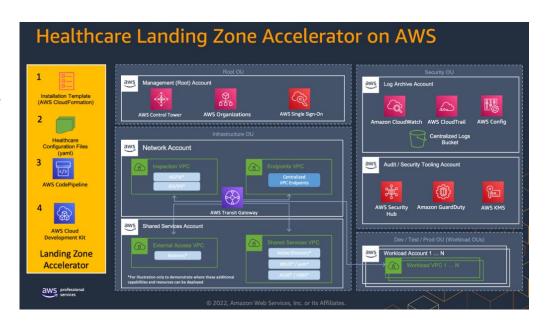
Leverage a foundational infrastructure for deploying mission-critical workloads across a centrally-governed multi-account environment.

The <u>Healthcare Landing Zone Accelerator</u> on AWS solution deploys a cloud foundation that is architected to aligns with NCSC 14 cloud security principles, AWS best practices and multiple global compliance frameworks. With this solution, NHS customers with highly-regulated workloads and complex compliance requirements can better manage and govern their multi-account environments. When used in coordination with other AWS services, it provides a comprehensive low-code solution across 35+ AWS services.

The Landing Zone leverages AWS expertise enabling AWS environments in days instead of weeks in an optimised and secure configuration. By reducing the undifferentiated heavy lifting of establishing a regulated cloud environment, organisations can focus on innovative solutions that provide the greatest value to the customers they serve.

Core components include:

- Default accounts
- Account structure
- Core networking infrastructure
- Security configurations for logging, monitoring, and notification
- Encryption





Cloud Skills

Embarking on a cloud adoption journey is not just about technology change, but also people and culture change. Successfully transitioning NHS organisations to the cloud requires engaging and uplifting staff at all levels. Clinical teams have to be brought on the journey to understand how cloud can transform care delivery. IT teams need upskilling to build, migrate and manage cloud environments. Business roles need to adapt processes for the agility of cloud. Equipping staff with cloud knowledge via training initiatives is key, but engaging them as stakeholders and champions of the cloud adoption journey is equally important.

As the NHS increasingly adopts cloud technologies to improve healthcare services, knowing and developing the right cloud skills within NHS teams has become a strategic priority. However, transitioning to the cloud requires new skillsets that are often in short supply. The AWS Cloud platform require infrastructure teams to become proficient at managing highly automated and programmable environments. Software developers need training on building modern cloud-native applications. Data engineers have to master designing data lakes and analytics pipelines that leverage cloud data services. Even IT management and clinical roles need to adapt to overseeing dynamic cloud infrastructure versus static on-premises systems.

This is why AWS has developed a Digital Skills Programme directly supporting NHS organisations to upskill clinicians, business stakeholders and technology teams — using an integrated curriculum based on real-life challenges to build cloud fluency. Building these critical cloud competencies within NHS teams helps make them more proficient builders and buyers of cloud solutions. Developing cloud skills also aids with recruiting and retaining talent that wants to work with cutting-edge systems.

AWS Learning Needs Analysis (LNA)

The <u>AWS Learning Needs Analysis</u> (LNA) provides a structured way for NHS organisations to evaluate and address cloud skills gaps within their IT teams. The assessment helps compile data on the existing skill levels across staff members as well as identify areas where additional training is required. IT leaders can use the insights to create comprehensive learning paths tailored to the needs of their organisation and staff. The assessment examines competencies across various AWS cloud services and technologies.

It provides visibility into skills proficiency for categories like solution architecture, security, cost optimization, and cloud operations. By taking advantage of the AWS Learning Needs Assessment, NHS IT leaders can diagnose skills deficiencies, prioritise training initiatives, and track progress over time as their teams gain cloud proficiency. Developing these strategic cloud capabilities enables NHS organisations to migrate critical workloads to the cloud and maximize utilization of cloud technologies for advancing healthcare delivery.



Benefits of the LNA include:

Data-Driven Planning

Helps you develop a training and certification plan based on facts and data

Targeted Skills Enablement

Provides guidance on where training investments should be directed

Organisational Alignment

Acts as a self-reporting mechanism to engage employees in training plans



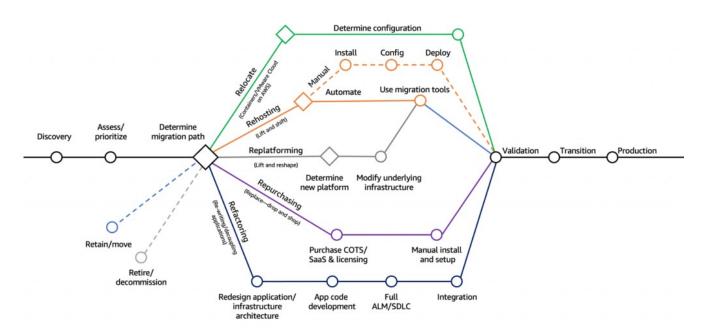
Migration of NHS workloads to the cloud

NHS organisations need to thoughtfully prioritise workloads when migrating to the cloud to maximise benefits while minimising costs and risks. Given the constraints around migration budgets, staff skills and system interdependencies, NHS IT teams should evaluate each workload based on its migration complexity, how much it could benefit from cloud capabilities, its criticality to operations and its cost optimisation potential. This analysis allows NHS organisations to strategically focus first on migrating low-risk, high-value workloads that will deliver quicker outcomes, build organisational experience and pave the way for more complex migrations down the road. Prioritising cloud migrations ultimately allows NHS organisations to balance important factors like dependency management, risk mitigation, optimisation and cost savings.

As NHS organisations migrate workloads to the cloud, it is critical that they evaluate how well their cloud environment aligns to best practices around reliability, resiliency and redundancy. AWS provides a 7R assessment that examines these factors to ensure an organisation's cloud architecture is designed for high availability and fault tolerance.

The 7R assessment focuses on seven key areas:

- Rehosting Assessing whether workloads have been optimally rehosted to leverage cloud architectures and managed services.
- **Refactoring** Evaluating whether applications have been re-architected to take advantage of cloud-native features like auto-scaling and serverless.
- **Repurchasing** Determining if commercial software has transitioned to SaaS versions rather than just rehosting existing licenses.
- Replatforming Analysing whether platforms have been migrated to modern, managed cloud services.
- Retire Identifying workloads that should be retired rather than migrated.
- Retain Documenting reasons to keep certain applications in their current environment.
- Right size Ensuring instance types, storage and resource allocations are properly sized for cloud.



The 7R review provides a comprehensive evaluation of an organisation's cloud adoption across these key dimensions. The output is an actionable set of recommendations that guide an enterprise towards an optimised, resilient cloud operating model aligned with AWS best practices. Conducting periodic 7R assessments ensures cloud environments continue to evolve to take advantage of new AWS capabilities over time.



Healthcare Mission Accelerators

Mission Accelerators provide a powerful mechanism for NHS organisations to achieve strategic objectives and accelerate outcomes. By tapping into AWS' deep expertise across cutting-edge technologies like genomics, telehealth, and health data analytics, NHS organisations can build next-generation capabilities to enhance patient care.

AWS partners closely with NHS teams to understand their unique goals and challenges. Whether it's reducing wait times, improving diagnosis, or enabling personalised care, AWS brings proven experience implementing transformative solutions globally. Our technical specialists and partners then collaborate to delivery customised AWS Mission Accelerator packages.

These Mission Accelerator packages provide NHS organisations with valuable assets to build knowledge and skills leveraging the AWS Cloud. Assets may include detailed reference architectures showing how to modernise infrastructure or implement new clinical applications. Immersive technical workshops demonstrate how to securely migrate health data to AWS or leverage services like AWS data and compute services. Leadership sessions on topics like cybersecurity, cost optimisation, and cloud governance provide executive guidance on cloud adoption best practices.

By delivering this combination of technical, architectural, and leadership knowledge transfer, AWS Mission Accelerators aim to build organisation and enable innovation. NHS teams are empowered to quickly and safely harness the full capabilities of the cloud to advance their missions. They gain the skills to optimise costs, accelerate deployment of new services, and comply with healthcare regulations.

Build foundation	Gain leadership support	Deliver quick wins	Build & reuse	Engage & evangelise	Scale, reorganise & innovate
Skills assessment & training	Cloud adoption framework	Healthcare landing zone accelerator	Migration (VMware)	AWS Community Builder	Modernisation Acceleration Program
Business case and migration evaluator	Experience Based Acceleration workshop	Storage Bundle	EPR Levelling up accelerator	Well Architected Reviews	Interactive Learning
HIMSS INFRAM Assessment	ICS Data Strategy accelerator	Resilience Bundle	Secure Data Environments accelerator		Innovation
		Connectivity Bundle	Digital Front Door accelerator		The Next Generation Hospital
		Data Bundle	Genomics accelerator		
		Skills and e	nablement		
NHS skills accelerator		Certification		NHS Deep Racer League	



AWS provides a stable, secure and resilient hosting service. As an NHS organisation, we continue to develop and expand. AWS services offer additional storage and processing capacity over the next five years, which is much needed. By using advanced technology systems through AWS, we are attracting and retaining talented IT staff who recognise the advantages it brings."

Martin Sadler

Chief Information Officer; Sandwell and West Birmingham NHS Trust



The AWS team can help you on your cloud journey

As NHS organisations look to adopt cloud technologies, they can benefit greatly from the expertise of aligned AWS teams. AWS Solution Architects can advise on best practices for cloud architecture design, the AWS Professional Services (Pro-Serve) team help execute cloud adoption from initial strategy through workload migration and management, applying lessons learned from healthcare projects worldwide.

With access to this level of cloud proficiency, NHS organisations can confidently embark on their cloud journey knowing AWS healthcare team are ready to provide strategic guidance and hands-on help every step of the way. By leveraging AWS cloud expertise, NHS leaders can effectively transform healthcare IT to be proactive, efficient and innovative in improving patient care through technology. These teams include:

Solution architects

Engage with a solution architect dedicated to your account and industry. Brainstorm use cases and get support for solution implementation.

AWS Pro-Serve

Health industry experts with proven success who work with the largest health organisations globally.

AWS Partner Network

Let AWS partners help you with the POC and build integrations with your current systems. Access health solutions in AWS Marketplace.

Customer success team

A organisationed Advisor on how to use AWS cloud products and services to best serve your organisation and customers.

Healthcare team

Deep health domain-specific expertise. Access to a global knowledge base of solutions, industry experts and use cases.

Account team

NHS organisation domain-specific expertise. Customer obsessed to drive the best outcomes for the organisation.

To conclude

Many NHS organisations have already embarked on an AWS cloud journey. By following the key steps outlined in this guide - learning AWS fundamentals, starting small with pilots, establishing secure foundations, developing staff skills and gradually scaling cloud adoption. NHS organisations can successfully realise the benefits of the cloud in a low risk way.

The rewards of moving to the AWS Cloud include enhanced resilience, security, interoperability, and sustainability across NHS IT environments. Cloud technology allows organisations to become more agile in deploying new capabilities to improve patient care and staff productivity. It opens the door to cutting-edge technologies like AI/ML, IoT, big data analytics, and mobile apps.

It is important that NHS leaders approach cloud adoption as an ongoing strategic initiative, not a one-time project. Careful change management and stakeholder engagement will be vital. A long-term commitment to developing in-house cloud skills is required. Leaders should draw on the experience of other industries and private sector organisations that have successfully navigated similar journeys. By partnering with expert AWS solutions providers, NHS organisations can make their cloud vision a reality and futureproof healthcare IT for the challenges ahead.

With the right strategy, skills and partners, AWS empowers organisations to reinvent patient experiences, streamline clinician workflows and set new standards for healthcare delivery. By taking the first steps on an AWS cloud adoption journey today, NHS organisations can begin building the next generation of digital healthcare services.

Get started

To get started contact your <u>AWS account team</u> to learn more on how we can:

- Support you on your cloud journey
- Understand your technical landscape
- Build your cloud business case
- Identify the best procurement route for your NHS organisation
- Identify quick wins and initial migration opportunities

AWS resources

- Guidance for NHS organisations Adopting AWS Cloud Services
- AWS for Health
- AWS Partner Network

Get in touch

Email: aws-uk-healthcare@amazon.com

