



Amazon Web Services Information Package United Kingdom

August 2019

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1.0 AWS Overview

Amazon has a long history of using a decentralised IT infrastructure. After over a decade of building and running the highly scalable web application, Amazon.com, the company realised that it had developed a core competency in operating massive scale technology infrastructure and data centres, and embarked on a much broader mission of serving a new customer segment—developers and businesses—with web services they can use to build sophisticated, scalable applications. Today, Amazon Web Services, Inc. (AWS) is the fastest-growing multi-billion enterprise IT vendor in the world. AWS has been operating since 2006 and currently supports an almost limitless variety of workloads for millions of customers worldwide.



Figure 1 – Snapshot of Public Sector Customers in the UK and Europe. There are over one hundred thousand active UK AWS customers

The AWS Cloud is uniquely positioned to provide scalable, cost-efficient solutions to the UK public sector, helping find ways cloud services can be employed to meet mandates, reduce costs, drive efficiencies, and increase innovation. Tens of thousands of government agencies, educational institutions, and non-profits around the world are already using AWS to address a diverse set of use cases, from complex government systems to mission-critical intelligence projects dealing with large volumes of sensitive data. Case studies about government agencies and educational institutions migrating to the AWS Cloud can be found at [AWS Public Sector Case Studies](#).

AWS offers more than 165 fully featured services, including compute, storage, networking, database, analytics, application services, deployment, management, developer, mobile, Internet of Things (IoT), Artificial Intelligence (AI), security, hybrid and enterprise applications, all of which are listed at [AWS Cloud Products](#). **Figure 2** on the following page is a simple view of some of the AWS Cloud and associated services.

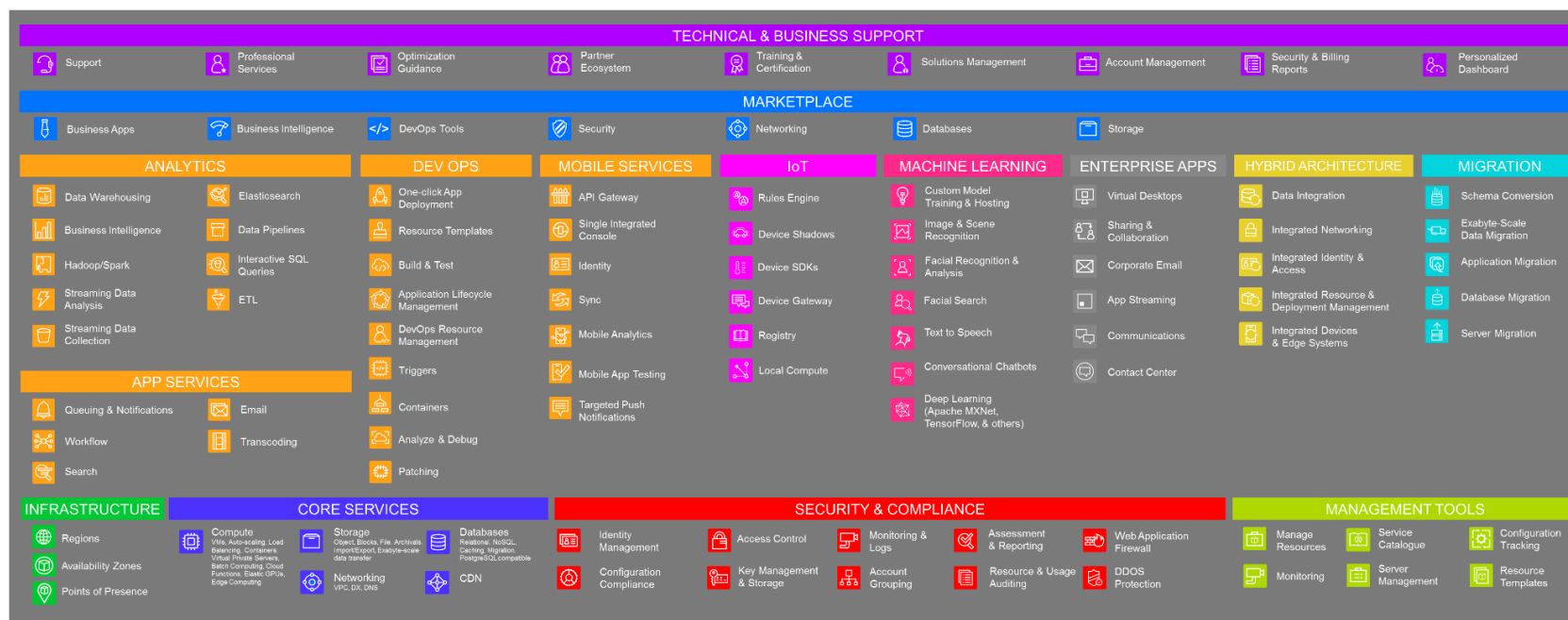


Figure 2 – High-Level View of the AWS Cloud

AWS offerings are provided with a range of [supporting components](#) like management tools, networking services, and application augmentation services, with multiple interfaces to AWS Application Programming Interface (API)-based services, including Software Development Kits (SDKs), Integrated Development Environment (IDE) toolkits, and Command Line Tools.

With AWS, you can programmatically provision, monitor, and automate all the components of your cloud environment. AWS tools and features enable customers to maintain consistent controls without restricting development velocity. AWS provides four kinds of [management tools](#) (provisioning, operations management, monitoring & logging, and managed services for configuration management) that all work together and are integrated with every part of the AWS Cloud, from Amazon Elastic Compute Cloud (Amazon EC2) to Amazon DynamoDB, in order to allow customers to easily control all parts of their cloud infrastructure.

AWS Cloud services are hosted within our global data centre footprint, allowing customers to consume services without having to build or manage facilities or equipment. AWS Cloud services are offered in separate Regions in a number of separate geographic areas. A Region is a physical location in the world where we have multiple, isolated locations known as Availability Zones that are engineered to be isolated from failures in other zones (see **Figure 3** below). Availability Zones consist of one or more discrete data centres, each with redundant power, networking, and connectivity, and housed in separate facilities.

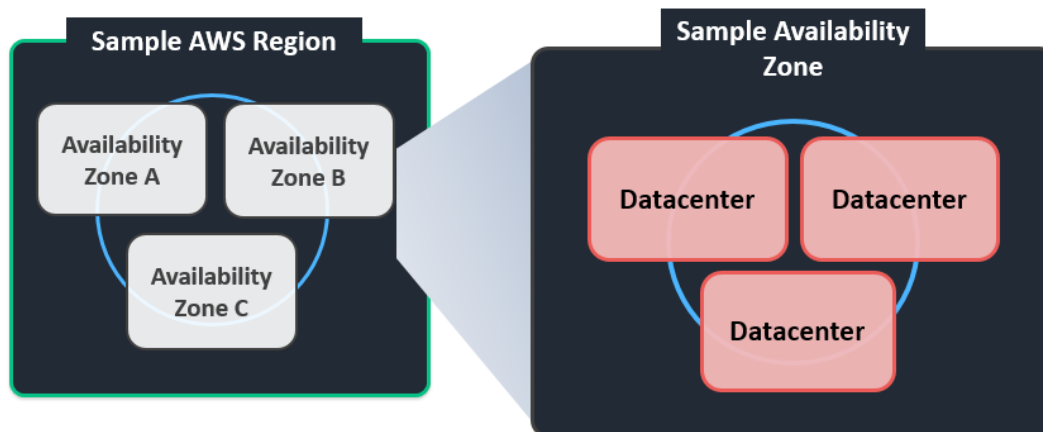


Figure 3 – Each Availability Zones can consist of multiple data centres, and at full scale can contain hundreds of thousands of servers. Every AWS Region contains 2+ zones and some Regions have as many as 6 zones

Availability Zones are engineered to be isolated from failures in other zones, and to provide inexpensive, low-latency network connectivity to other zones in the same Region. By hosting workloads in separate zones, you can protect your applications from the failure of a single location. Availability Zones offer the ability to operate production applications and databases that are more highly available, fault tolerant, and scalable than would be possible with a single data centre.

Customers have access to 22 AWS Regions around the globe, including five Regions in the EU—United Kingdom (London), Ireland (Dublin), Germany (Frankfurt), France (Paris), and Sweden (Stockholm) —with another EU Region (located in Milan, Italy) coming soon. Customers can choose to use one Region, all Regions, or any combination of Regions. Together, our EU Regions allow customers to architect highly fault tolerant applications while storing their data in the EU.



AWS EU Regions: London, Dublin, Paris, Frankfurt and Stockholm, with Milan coming soon

The AWS Cloud provides customers with the flexibility to run workloads and store data within multiple geographic Regions as well as across multiple Availability Zones within each Region. You decide which AWS Region(s) house your data, and it resides only in the Region(s) you specify, for as long as you choose. For example, a customer can choose to deploy their AWS Cloud services and data exclusively in the London Region, and

customer content is not moved outside of London unless the customer decides to move it.

We are steadily expanding global infrastructure to help our customers achieve lower latency and higher throughput. As our customers grow their businesses, AWS will continue to provide infrastructure that meets their global requirements. The AWS products and services that are available in each Region are listed in [our Region Table](#).

Figure 4 displays our 22 global Regions and 69 Availability Zones (and one local Region in Osaka, Japan¹). Three more AWS Regions (and 9 Availability Zones) in Cape Town, Jakarta, and Milan have been announced.

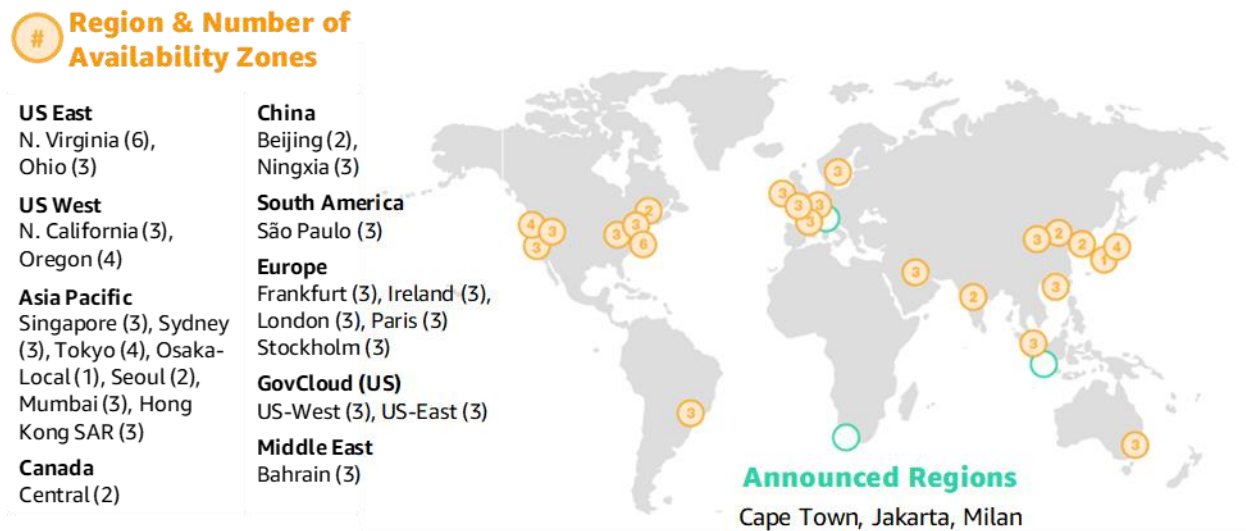


Figure 4 – AWS’s Global Infrastructure Consists of 21 Regions and 66 Availability Zones

To deliver content to end users with lower latency, Amazon CloudFront uses a global network of 187 Points of Presence (176 Edge Locations and 11 Regional Edge Caches) in 69 cities across 30 countries. Visit our website for a list of current [Amazon CloudFront edge locations](#).

¹ For customers who specifically need to replicate their data or applications over greater geographic distances, there are AWS Local Regions. An AWS Local Region is a single datacentre designed to complement an existing AWS Region. Like all AWS Regions, AWS Local Regions are completely isolated from other AWS Regions.

2.0 Benefits of Cloud Computing

Table 1 highlights the benefits of cloud computing, many of which are unique to the AWS Cloud.

Table 1 – Benefits of the Cloud

Benefit of Cloud	Benefit to Customers
Only Pay for What You Need	The fundamental difference between cloud computing and traditional IT is that in a cloud model customers are not buying physical assets. Instead of having to invest heavily in data centres and servers before you know how you're going to use them, you can use cloud computing and only pay for the resources you consume. The primary benefit of this approach lies in optimisation, and not having to invest heavily in physical data centres and servers, which inevitably leads to limited capacity or idle resources.
Access to Greater Service Breadth and Depth	Cloud computing allows you to access industry-shaping technology quickly, at an affordable cost, no matter what the scale. AWS has developed the broadest collection of services available from any cloud provider. We have been continually expanding our services to support virtually any cloud workload, and now have more than 165 fully featured services that range from compute, storage, networking, database, analytics, application services, deployment, management, IoT, AI, mobile, and more. Refer to the Gartner 2019 Magic Quadrant for Cloud IaaS, Worldwide for a third-party assessment of our broad service offerings.
Scalability	When you make a capacity decision prior to deploying an application, you often either end up sitting on expensive idle resources or dealing with limited capacity. With cloud computing, these problems go away. You can access as much or as little as you need and scale up and down as required with only a few minutes' notice. Combining software-defined infrastructure with AWS products featuring modern programming methods lets you design your computerised systems to rapidly scale resources (and costs) up or down based on actual demands on the system.
Increase Speed and Agility	In a cloud computing environment, new IT resources are only ever a click away, which means you reduce the time it takes to make those resources available to your developers from weeks to just minutes. This results in a dramatic increase in agility for the organisation, since the cost and time it takes to experiment and develop is significantly lower.
Global Footprint	Cloud computing allows you to easily deploy applications in multiple Regions around the world with just a few clicks, providing lower latency and a better experience at minimal cost. Our approach to Regions and Availability Zones provides global coverage for high-availability, low-latency applications. As noted above, an AWS Region is a physical location in the world where we have multiple zones. Availability Zones consist of one or more discrete data centres, each with redundant power, networking, and connectivity and housed in separate facilities. These zones offer the ability to operate production applications and databases that are more highly available, fault tolerant, and scalable than would be possible with a single data centre. AWS currently has 22 Regions and 69 Availability Zones throughout the world (with 9 more Availability Zones and 3 more Regions announced). Information on each Region can be found at AWS Global Infrastructure .

Pace of Innovation

Since our inception, AWS has been an innovator in defining cloud computing by working to get new products in the hands of customers quickly and then rapidly iterating and improving on those products based on customer feedback.

Our continual innovation helps customers maintain state-of-the-art IT infrastructure without having to make recapitalisation investments. In addition, our rich network of third-party applications also provides complementary functionality that further extends the power and breadth of the AWS environment.

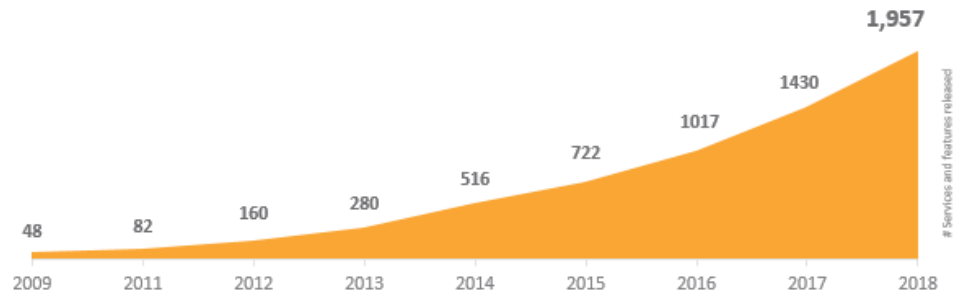


Figure 5 – Significant service and feature releases - AWS has launched more than 6,000 new features and/or services since 2006

Benefit from Massive Economies of Scale

By using cloud computing, you can achieve a lower variable cost than you can get on your own. Because usage from millions of customers is aggregated in the cloud, AWS can achieve high economies of scale, which translates into lower pay-as-you-go prices.

AWS continues to lower the cost of cloud computing for our customers. We continually focus on reducing our data centre hardware costs, improving our operational efficiencies, lowering our power consumption, and passing savings back to customers. We have a history of continually lowering prices, and have reduced prices 73 times since AWS launched in 2006.

Security and Compliance

AWS customers obtain greater security in the cloud than is available in traditional data centres. The AWS Cloud infrastructure has been designed and managed in alignment with many regulations, standards, and industry best practices. AWS is under a constant state of audit to comply with multiple risk management and compliance regimes, all of which are described on the [AWS Compliance page](#).

Auditability

The message-based interoperability of web services allows customer configuration and use of AWS products to be uniformly logged, monitored, and audited.

Focus on Core Competencies

The ultimate benefit of the cloud is that customers can spend less time on undifferentiated tasks and more time focusing on the core competencies that add value to their organisations.

3.0 Cost Benefits of the Cloud

With AWS, you pay only for the individual services you need, for as long as you use them, without requiring long-term contracts or complex licensing.

Given that AWS has over 165 fully featured services, we advise customers to view the [AWS Pricing webpage](#) for pricing of each service, and to view the AWS whitepaper [How AWS Pricing Works](#), which summarises our pricing methodology.

Some AWS pricing principles include:

- **Pay as You Go** – No minimum commitment or long-term contract is required. You can turn off cloud resources and stop paying for them when they are not needed, maximising Return on Investment (ROI) through full utilisation.
- **Pay Less When You Reserve** – For certain AWS products, you can invest in reserved capacity, paying a low up-front fee to receive a significant discount. This results in overall savings of up to 60% (depending on the type of instance reserved) over equivalent on-demand capacity.
- **Pay Even Less per Unit by Using More** – AWS pricing is tiered for storage and data transfer, so the more you use, the less you pay per gigabyte.

The cost savings benefits of the AWS Cloud compared to on-premises infrastructure include:

- **Stop Spending Money on Data Centre Operations** – Cloud computing vendors do the heavy lifting of racking, stacking, and powering servers, so you can focus on your customers/citizens and core business rather than on IT infrastructure.
- **Do More for Less** – Moving to the cloud is not just an effort to increase cost savings and avoidance for the sake of the obvious monetary value; it is also about the increase in technological competitiveness that comes with it. If you can deliver twice the capability at the same cost, that equates to savings.
- **Benefit from Economies of Scale** – Millions of customers are aggregated in the AWS Cloud, which translates into lower, pay-as-you-go prices. We continually focus on reducing our data centre hardware costs, improving our operational efficiencies, lowering our power consumption, and passing savings back to customers. AWS has a history of continually lowering prices and has reduced prices 68 times since AWS launched in 2006.
- **Move from a Forecast-Procurement Model to a Consumption Model** – Instead of investing more in optimising data centres and servers, pay only for the resources you consume and increase or decrease usage depending on need, not elaborate forecasting. For example, development and test environments are typically only used for eight hours a day during the workweek. You can stop these resources when they are not in use for a potential cost saving of 75% (40 hours versus 168 hours).
- **Transparently Attribute Expenditure** – The cloud makes it easier to identify the cost of a system and attribute IT costs to individual business owners. This helps measure ROI and gives those owners an incentive to optimise their resources and reduce costs, an important capability that allows oversight on IT revenue and expenditures.
- **Use Managed Services to Reduce Cost of Ownership** – In the cloud, managed services remove the operational burden of maintaining servers for tasks like sending email or managing databases. And because managed

services operate at cloud scale, they can offer a lower cost per transaction or service.

- **Continuously Re-evaluate Design Choices** – Unlike traditional IT infrastructure approaches where you are required to make large capital investments in hardware and software, AWS offers pay-as-you-go pricing for most of its services. This means you are not bound by decisions made at a design level at the beginning of a project's lifecycle. This reduces the risks of overprovisioning or not being able to meet unexpected demand. You can continually re-evaluate your design decisions. You can also explore the use of new AWS products to see if they lead to even greater efficiencies.

Additional considerations regarding the AWS pricing model and optimising spend include:

- Compare the projected costs of both planned and new IT initiatives over 1, 3, or 5 years (or whichever timeframe is appropriate for the initiative). Take into account that the costs that come with initial migration efforts (such as System Integrators [SIs] or managed services engagements) and overall IT costs will normalise in the longer term.
- [Consolidate accounts](#) - When AWS customers consolidate accounts under a single bill, they can designate one account as a payer account and link other accounts to it. This provides a combined view of AWS charges incurred by all accounts, as well as a cost report for each individual account associated with the payer account. A benefit of this approach is that it treats all of the accounts on the consolidated bill as one account and they can all receive the hourly cost benefit of reserved resources purchased by any other account.
- Monitoring tools and services (native AWS Cloud services such as [Amazon CloudWatch](#) and [Cost Explorer](#), or third-party tools like Splunk, CloudCheckr, or Data Dog) can be used to analyse cloud usage and spending, and customers can build-in alerts to notify them when they approach custom usage thresholds and projected/budgeted spend. These alerts enable customers to determine whether to reduce usage to avoid overages, or prepare additional funding to cover costs that exceed the projected budget.
- Use AWS tools that [automate service provisioning](#). This allows for optimal resource utilisation, scaling up resources when needed, and then scaling down resources when they are not being used. The use of tools such as AWS Config, Amazon CloudWatch, AWS OpsWorks, Auto Scaling, and AWS CloudFormation helps customers use resources efficiently, and achieve cost optimisation through a continuous cycle of assessment, benchmarking, and integration with operations. More information on cost optimisation is available in the AWS whitepaper [Cost Optimization with AWS](#).
- Calculating a total cost of ownership (TCO) at the beginning of a cloud migration will help customers understand the costs and savings of the migration and to plan for them. AWS provides a [TCO calculator](#) to enable customers to compare the cost of running applications in an on-premises or traditional hosting

environment to the cost of AWS. Customers can describe their on-premises or hosting environment configuration to produce a detailed cost comparison with AWS.

3.1 The Value of Moving to the Cloud

According to a 2018 International Data Corporation (IDC) report commissioned by AWS, “IDC’s analysis shows that the 27 organizational AWS customers interviewed are achieving strong value at an average of \$20.97 million per year per organization over five years”.

Our TCO Team and Solutions Architects are happy to work with customers in estimating the potential cloud savings benefits of migrating to AWS in relation to customer targets.



Figure 6 – IDC Whitepaper, sponsored by AWS, [“Fostering Business and Organizational Transformation to Generate Business Value with Amazon Web Services” February 2018](#)

3.2 Reserved Instances

As an example of paying less when you reserve, AWS customers can look to [Reserved Instances \(RIs\)](#) to optimise costs in a cloud model. An AWS compute "instance" is a virtual server with CPU, memory, storage, and networking capacity. AWS offers four ways to pay for instances. In this example, we focus on "On-Demand" instances and RIs.

- With **On-Demand** instances, customers pay for compute capacity by the hour with no long-term commitments or up-front payments. You can increase or decrease compute capacity depending on the demands of an application, and only pay the specified on-demand hourly rate for the instances used. In essence, this is the simple cloud pay-per-use model.

- **RI**s are best suited to customers with predictable compute usage, allowing you to reserve compute capacity and receive a discount on usage compared to running On-Demand instances. The discounted usage price is reserved for the duration of the contract, allowing customers to better predict compute costs over the term of the contract.

With RIs, customers can save up to 75% over equivalent on-demand capacity. RIs are offered on a 1-year or 3-year term, and are available in 3 options - all up-front (AURI), partial up-front (PURI) or no up-front payments (NURI). The larger the up-front payment, the greater the discount a customer receives. When the term of the RI ends and a customer does not renew by purchasing another RI, they can simply continue to use the same compute instance without interruption (it will then be charged at the On-Demand rate).

Additionally, AWS provides customers with a [Reserved Instance Marketplace](#), so that if they have excess RI capacity they can list an RI on the Marketplace and sell it to someone who needs additional capacity (an optimisation of IT assets not possible in a traditional on-premises model). By advance paying for IT (such as in the RI example above) customers can predictably manage part of their IT budget in a fashion that is not too dissimilar to an on-premises model, while also gaining the cost savings and vast technological benefits of the cloud.

3.3 Cost Management

AWS Cost Management tools are used by IT professionals, financial analysts, resource managers, and developers across all industries to access detailed information related to their AWS costs and usage, analyse their cost drivers and usage trends, and take action on their insights.

[AWS Cost Management tools](#) provide visibility into AWS costs and usage. There is a range of AWS Cost Management tools to help you access, understand, allocate, control, and optimise your costs.

3.3.1 View the Overall Status of Your AWS Costs and Usage

The [AWS Billing Dashboard](#) lets you view the status of your month-to-date AWS expenditure, pinpoint the services that account for the majority of your overall expenditure, and understand at a high level how your costs are trending. From the Billing Dashboard, you can access a number of other cost management tools that can help you dig deeper into your AWS costs and usage.

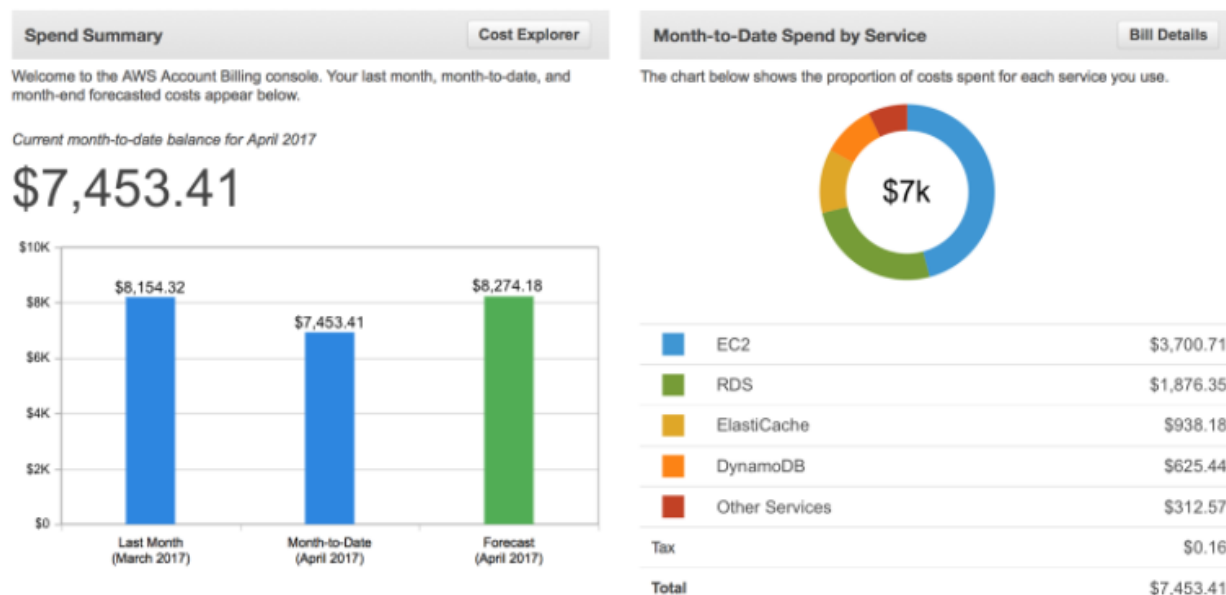


Figure 7 – AWS Billing Dashboard

3.3.2 Access Your Monthly Bill

The bills page gives you access to the most up-to-date information on your costs and usage, including your monthly bill and a detailed breakdown of the AWS Cloud services you are using. To further analyse your bill, you can also download a CSV or PDF file.

Total	\$7,453.41 USD
AWS Marketplace Charges	\$15.00
▼ Usage Charges and Recurring Fees	\$15.00
Invoice 32342548 - AWS Service Charges: Usage charge for this statement period	2015-09-15 \$15.00
AWS Service Charges	\$7,438.41
▼ Usage Charges and Recurring Fees	\$7,414.41
Invoice 32342513 - AWS Service Charges: Usage charge for this statement period	2015-09-15 \$7,414.41
▼ New Purchases and Adjustments	\$24.00
Invoice 32342506 - AWS Service Charges: Subscription charge	2015-09-15 \$12.00
Invoice 32342507 - AWS Service Charges: Subscription charge	2015-09-15 \$12.00

Figure 8 – Sample Summary of AWS Monthly Bill

3.3.3 Explore Your Costs and Usage

[AWS Cost Explorer](#) helps you visualise, understand, and manage your AWS costs and usage over time. This is done via an intuitive interface that enables you to quickly create custom reports (including charts and tabular data) that enable you to analyse your cost and usage data, both at a high level and for highly specific requests. Default reports include:

- **Monthly Costs by AWS Service** – AWS Cost Explorer includes a default report that helps you visualise the costs and usage associated with your top five cost-accruing AWS Cloud services, and gives you a detailed breakdown on all services in the table view. The reports let you adjust the time range to view historical data going back up to twelve months to gain an understanding of your cost trends.
- **EC2 Monthly Cost and Usage** – The EC2 Monthly Cost and Usage report gives you the ability to view all of your AWS costs over the past two months, as well as your current month-to-date costs. From there, you can dive deeper into the costs and usage associated with particular linked accounts, regions, tags, and more.

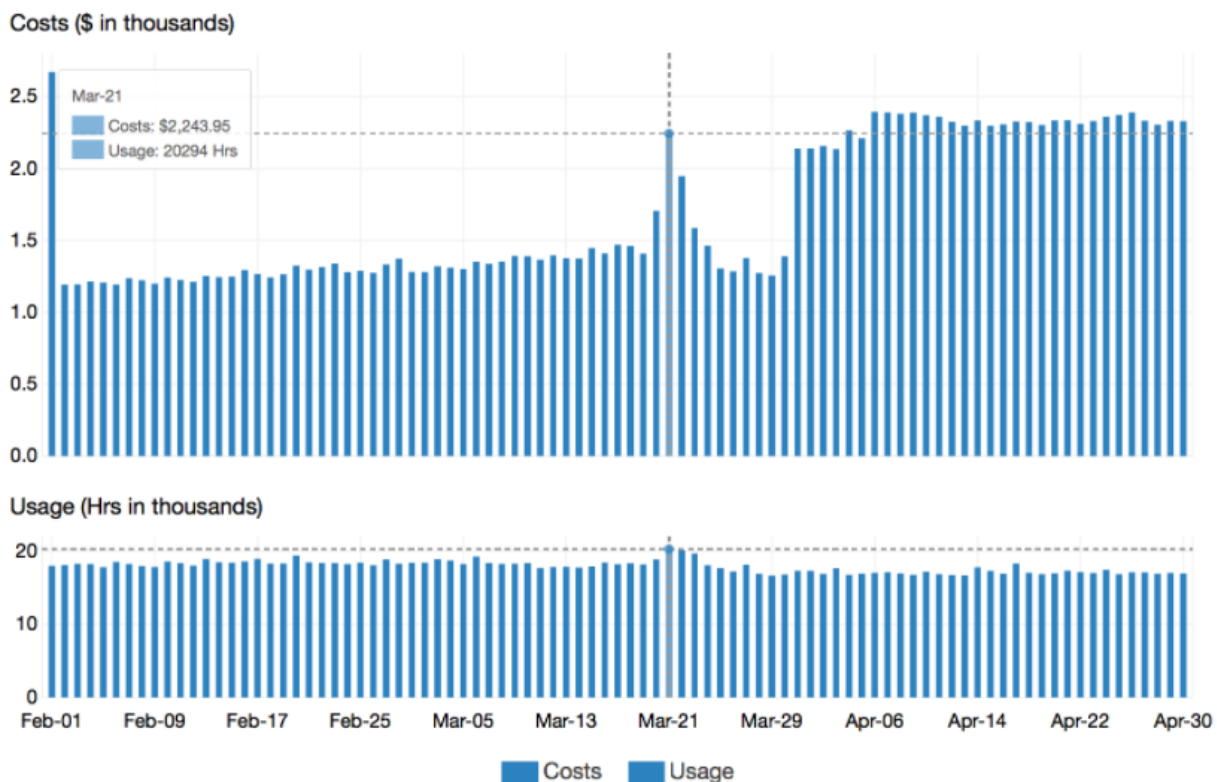


Figure 9 – Cost and Usage Report

- **Monthly Running Costs** – The Monthly Running Costs report gives you an overview of all of your running costs over the past three months, and provides forecast numbers for the coming month with a corresponding confidence interval. This report gives you good insight into how your costs are trending, and helps you plan ahead.
- **RI Reporting** – AWS provides a number of RI-specific cost management solutions out-of-the-box to help you better understand and manage your RIs. Using the RI Utilization and Coverage reports available in AWS Cost Explorer, you can visualise your RI data at an aggregate level or inspect a particular RI

subscription. To access the most detailed RI information available, you can use the AWS Cost & Usage Report. You can also set a custom RI utilisation target via AWS Budgets and receive alerts when your utilisation drops below the threshold you define.

- **Monthly Costs by Linked Account** – The Monthly Costs by Linked Account report lets you view the distribution of costs across your organisation. To recreate this chart for your linked accounts, all you have to do is add "Linked Account" as the grouping dimension in Cost Explorer.

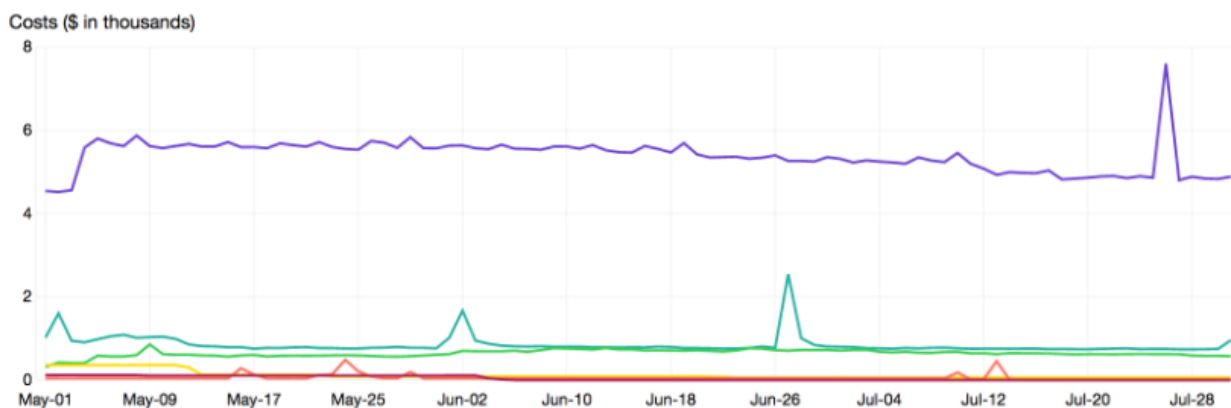


Figure 10 – Monthly Costs by Linked Account

3.3.4 Set Custom Cost and Usage Budgets

[AWS Budgets](#) gives you the ability to set custom budgets that alert you when your costs or usage exceed (or are forecast to exceed) your budgeted amount. Budgets can be tracked at the monthly, quarterly, or yearly level and you can customise the start and end dates. You can further refine your budget to track costs associated with multiple dimensions, such as AWS service, linked account, tag, and others. Budget alerts can be sent via email and/or an Amazon Simple Notification Service (Amazon SNS) topic.

You can also use AWS Budgets to set a custom reservation utilisation target and receive alerts when your utilisation drops below the threshold you define. RI utilisation alerts support Amazon EC2, Amazon Relational Database Service (Amazon RDS), Amazon Redshift, and Amazon ElastiCache reservations. Budgets can be created and tracked from the AWS Budgets dashboard or via the Budgets API.

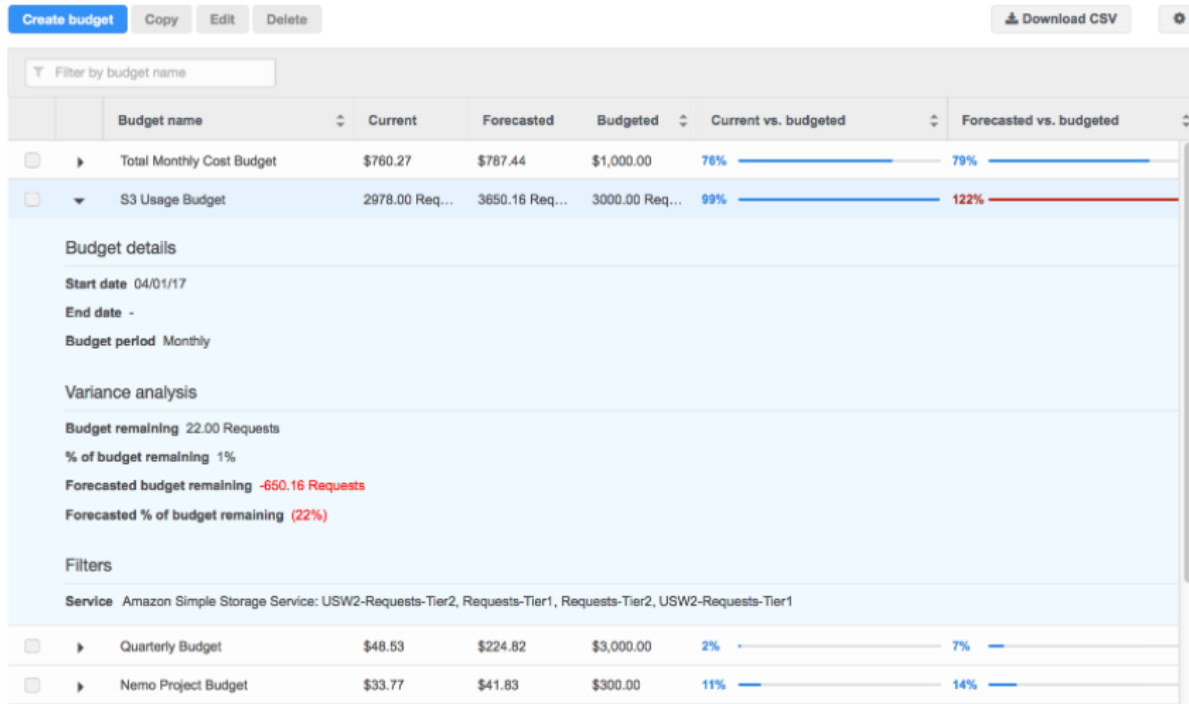


Figure 11 – Sample AWS Budgets Dashboard

3.3.5 Access Comprehensive Cost and Usage Data

The [Cost & Usage Report](#) is your one-stop-shop for accessing the most granular data about your AWS costs and usage, including additional metadata about AWS Cloud services, pricing, and reservations (e.g., Amazon EC2 RIs). For additional insight, you can access a set of specialised AWS usage reports. The report gives you the ability to delve deeply into your AWS cost and usage data, understand how you are using your AWS implementation, and identify opportunities for optimisation.

	M	N	O	P	R	S	T
	Item/ProductCode	Item/UsageType	Item/Operation	Item/AvailabilityZone	Item/UsageAmount	Item/CurrencyCode	Item/LineItemDescription
1	AmazonEC2	CW-AlarmMonitorUsage	Unknown		0.00134409	USD	\$0.00 per alarm-month - first 10 alarms
2	AmazonS3	Requests-Tier1	ListAllMyBuckets		2	USD	\$0.00 per request - PUT, COPY, POST, or LIST requests under the monthly global free tier
3	AmazonEC2	CW-AlarmMonitorUsage	Unknown		0.00134409	USD	\$0.00 per alarm-month - first 10 alarms
4	AmazonEC2	AP2-EBS-VolumeUsage-gp2	CreateVolume-Gp2		0.01344086	USD	\$0.00 per GB-month of General Purpose (SSD) provisioned storage under monthly free tier
5	AmazonEC2	AP2-EBS-VolumeUsage-gp2	CreateVolume-Gp2		0.01344086	USD	\$0.00 per GB-month of General Purpose (SSD) provisioned storage under monthly free tier
6	AmazonEC2	USW2-BoxUsage-t2.micro	RunInstances:0002	us-west-2a	1	USD	\$0.00 per Windows t2.micro instance-hour (or partial hour) under monthly free tier
7	AmazonEC2	USW2-BoxUsage-t2.micro	PublicIP-Out		0.00000174	USD	\$0.00 per GB - data transfer out under the monthly global free tier
8	AmazonEC2	USW2-USE1-AWS-Out-Bytes	PublicIP-In		0.00000138	USD	\$0.00 per GB - US West (Oregon) data transfer from US East (Northern Virginia)
9	AmazonEC2	USW2-USE1-AWS-In-Bytes	PublicIP-In		0.00000149	USD	\$0.00 per GB - US West (Oregon) data transfer from US West (Northern California)
10	AmazonS3	Requests-Tier1	ListAllMyBuckets		2	USD	\$0.00 per request - PUT, COPY, POST, or LIST requests under the monthly global free tier
11	AmazonEC2	USW2-DataTransfer-Out-Bytes	RunInstances		0.00038344	USD	\$0.00 per GB - data transfer out under the monthly global free tier
12	AmazonEC2	USW2-USW1-AWS-Out-Bytes	PublicIP-Out		0.00000174	USD	\$0.00 per GB - data transfer out under the monthly global free tier
13	AmazonEC2	USW2-DataTransfer-In-Bytes	RunInstances		0.00030951	USD	\$0.00 per GB - data transfer in per month
14	AmazonEC2	USW2-BoxUsage-t2.micro	RunInstances:0002	us-west-2a	1	USD	\$0.00 per Windows t2.micro instance-hour (or partial hour) under monthly free tier
15	AmazonEC2	USW2-USW1-AWS-Out-Bytes	PublicIP-Out		0.00000349	USD	\$0.00 per GB - data transfer out under the monthly global free tier
16	AmazonEC2	USW2-USW1-AWS-In-Bytes	PublicIP-In		0.00000276	USD	\$0.00 per GB - US West (Oregon) data transfer from US West (Northern California)
17	AmazonEC2	AP2-EBS-VolumeUsage-gp2	CreateVolume-Gp2		0.01344086	USD	\$0.00 per GB-month of General Purpose (SSD) provisioned storage under monthly free tier
18	AmazonEC2	CW-AlarmMonitorUsage	Unknown		0.00134409	USD	\$0.00 per alarm-month - first 10 alarms
19	AmazonEC2	USW2-BoxUsage-t2.micro	RunInstances:0002	us-west-2a	1	USD	\$0.00 per Windows t2.micro instance-hour (or partial hour) under monthly free tier
20	AmazonEC2	USW2-DataTransfer-Regional-Bytes	PublicIP-Out		0.00000349	USD	\$0.00 per GB - regional data transfer under the monthly global free tier
21	AmazonEC2	USW2-DataTransfer-In-Bytes	RunInstances		0.00012071	USD	\$0.00 per GB - data transfer in per month
22	AmazonEC2	USW2-DataTransfer-Regional-Bytes	PublicIP-In		0.00000302	USD	\$0.00 per GB - regional data transfer under the monthly global free tier
23	AmazonEC2	USW2-USE1-AWS-Out-Bytes	PublicIP-Out		0.00000174	USD	\$0.00 per GB - data transfer out under the monthly global free tier
24	AmazonEC2	USW2-DataTransfer-Out-Bytes	RunInstances		0.00045736	USD	\$0.00 per GB - data transfer out under the monthly global free tier
25	AmazonEC2	USW2-DataTransfer-In-Bytes	RunInstances		0.00036737	USD	\$0.00 per GB - data transfer in per month
26	AmazonEC2	USW2-APN2-AWS-In-Bytes	PublicIP-In		0.00000005	USD	\$0.00 per GB - US West (Oregon) data transfer from Asia Pacific (Seoul)
27	AmazonEC2	USW2-APN2-AWS-Out-Bytes	PublicIP-Out		0.00000018	USD	\$0.00 per GB - data transfer out under the monthly global free tier
28	AmazonEC2	USW2-USE1-AWS-In-Bytes	PublicIP-In		0.00000153	USD	\$0.00 per GB - US West (Oregon) data transfer from US East (Northern Virginia)
29	AmazonEC2	USW2-DataTransfer-Out-Bytes	RunInstances		0.00039945	USD	\$0.00 per GB - data transfer out under the monthly global free tier
30	AmazonEC2	CW-AlarmMonitorUsage	Unknown		0.00134409	USD	\$0.00 per alarm-month - first 10 alarms

Figure 12 – Sample AWS Cost and Usage Report

4.0 Security

As cloud computing customers are building systems on top of cloud infrastructure, the security and compliance responsibilities are shared between the Cloud Service Provider (CSP) and cloud customers. In an Infrastructure as a Service (IaaS) model, you control how you architect and secure your applications and data put on the infrastructure, while the CSP is responsible for providing services on a highly secure and controlled infrastructure, and providing a wide array of additional security features.

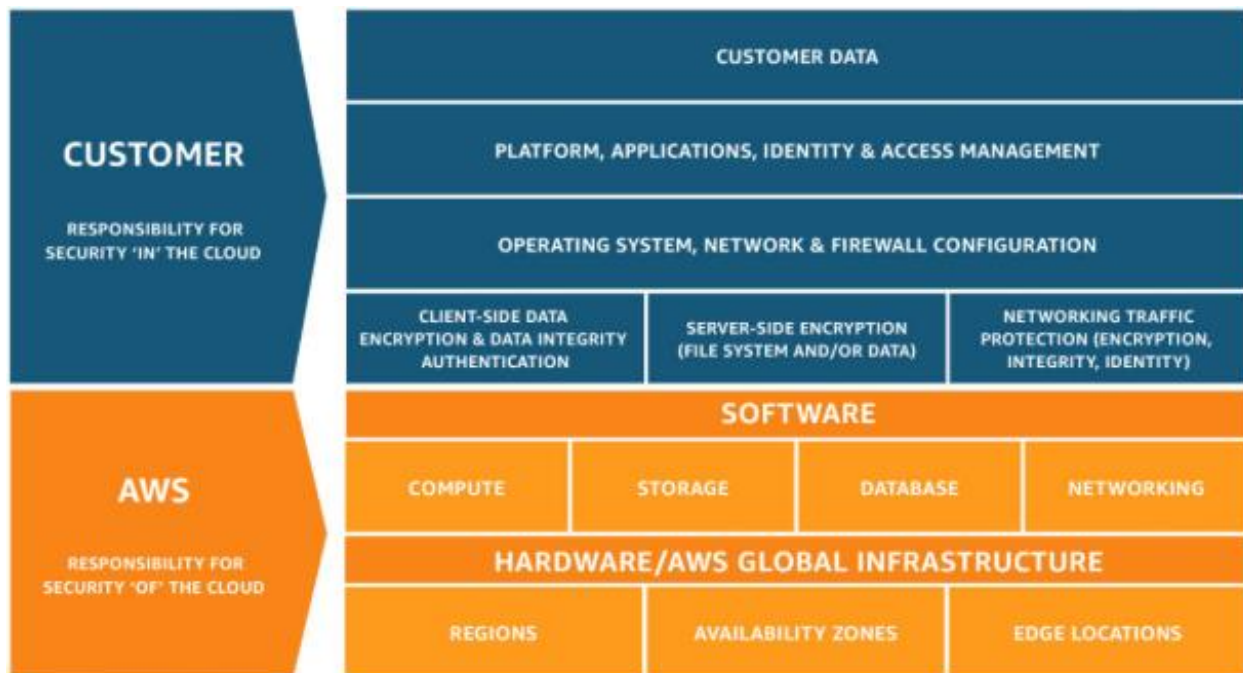


Figure 13 – The AWS Shared Responsibility Model

The level of CSP and customer responsibilities in this shared responsibility model depends on the cloud deployment model (see the [NIST Definition of Cloud Computing models](#)). AWS's shared responsibility model is depicted in **Figure 13**.

- **AWS Responsibility** – AWS operates, manages, and controls the infrastructure components, from the host operating system and virtualisation layer down to the physical security of the facilities in which the services operate.
- **Customer/Partner Responsibility** – Customers/partners assume responsibility and management of the guest operating system (including updates and security patches), other associated application software, configuration of the AWS-provided security group firewalls, and other security, change management, and logging features.

Our shared responsibility model is explained in more detail [here](#).

4.1 Data Privacy

AWS does not access customer data, and you are given the choice as to how you store, manage, and protect your data. There are five important basic concepts regarding data ownership and management in the cloud shared responsibility model:

1. Customers continue to own their data.
2. Customers choose the geographic location(s) in which to store their data—it does not move unless the customer decides to move it.
3. Customers can download or delete their data whenever they like.
4. Customers can “crypto-delete” their data by deleting the master encryption keys that are required to decrypt the data keys, which are, in turn, required to decrypt the data.
5. Customers should consider the sensitivity of their data and decide if and how to encrypt the data while it is in transit and at rest.

AWS gives customers ownership and control over their customer content by design through simple but powerful tools that allow customers to determine where their customer content will be stored, secure their customer content in transit or at rest, and manage access to AWS services and resources for their users. We also implement responsible and sophisticated technical and physical controls designed to prevent unauthorised access to or disclosure of customer content. See the [AWS Data Privacy FAQ](#) for more information.

Maintaining customer trust is an ongoing commitment, and we strive to inform customers of the privacy and data security policies, practices, and technologies we have put in place. These commitments include:

- **Access** – Customers manage access to their customer content and AWS Cloud services and resources. We provide an advanced set of access, encryption, and logging features (such as [AWS CloudTrail](#)) to help you do this effectively. We do not access or use customer content for any purpose other than as legally required for maintaining the AWS services and providing them to our customers and their end users.



A number of the best-practice security patterns are achievable with the call of an API. We can script and automate for a high degree of consistency. We can isolate systems and tightly control access. These capabilities are harder to achieve in our internal environment but are available out of the box with AWS.

James Tomkins

Head of IT Architecture, The Met Office (U.K.)



- **Storage** – Customers choose the Region(s) in which their customer content will be stored. We will not move or replicate customer content outside of the customer’s chosen Region(s), except

as legally required and as necessary to maintain the AWS Cloud services and provide them to our customers and their end users.

- **Security** – Customers choose how their customer content is secured. We offer our customers strong encryption capabilities for customer content in transit or at rest, and we provide customers with the option to manage their own encryption keys.
- **Security Assurance** – We have developed a security assurance program using global privacy and data protection best practices in order to help customers establish, operate, and leverage our security control environment. These security protections and control processes are independently validated by multiple third-party independent assessments.

The AWS virtual infrastructure has been designed to provide optimum availability while ensuring complete customer privacy and segregation. Our highly secure data centres use state-of-the-art electronic surveillance and multi-factor access control systems and maintain strict, least-privileged-based access authorisations. Our environmental systems are designed to minimise the impact of disruptions to operations, and our multiple geographic Regions and Availability Zones allow customers to remain resilient in the face of most failure modes, including natural disasters or system failures. AWS manages over 1,800 security controls to provide an optimally secure environment for all of our customers. See AWS's [data centre security controls](#).

In addition, network traffic between Availability Zones and individual data centres travels over private network segments by default. These private network segments are fully isolated from the public Internet and not routable externally. AWS resources can be configured to reside only on isolated AWS network segments and to avoid using any public IP addresses or routing over the public Internet. Note that communication between Regions is across the public Internet. Therefore, you should use the appropriate encryption methods to protect your data.

AWS security engineers and solutions architects have developed [whitepapers and operational checklists](#) to help you select the best options for your needs and to recommend security best practices, such as storing secret keys and passwords in a secure manner and rotating or changing them frequently.

In order to help government customers accelerate their journey to the cloud, we have published [Using AWS in the Context of Common Privacy & Data Protection Considerations](#) to help customers understand:

- The way AWS Cloud services operate, including how customers can address security and encrypt their content;
- The geographic locations where customers can choose to store content and other relevant considerations; and

- The respective roles the customer and AWS each play in managing and securing content stored on AWS Cloud services.

4.2 Automating Security Best Practices

Automating security best practices is one of the key security enablers that the cloud brings to public sector customers. Software-based security mechanisms improve the ability to securely scale more rapidly and cost effectively. Customers can create and save a custom baseline image of a virtual server and then use that image automatically on each new server that is launched, creating an entire infrastructure that is defined and managed in a template.

When customers build in automation to their cloud architecture, along with management features such as [AWS Service Catalog](#) (which provides a permission-controlled self-service capability for using AWS services), they can securely and repeatedly allow end users access to the resources they need, in a fraction of the time it takes to do so using cloud offerings that do not have deployment tools such as [AWS CloudFormation](#). Additional information can be found in the below whitepapers:

- [Introduction to AWS Security by Design](#)
- [AWS Governance at Scale](#)
- [Automating Governance on AWS](#)

4.3 Built-in Security Features

Not only are applications and data protected by highly secure facilities and infrastructure, they are also protected by extensive network and security monitoring systems. AWS and our partners offer hundreds of tools and features to help you meet your security objectives concerning visibility, auditability, controllability, and agility. These tools and features provide basic but important security measures such as Distributed Denial of Service (DDoS) protection and password brute-force detection on AWS accounts.

4.3.1 Security, Identity, and Compliance Products

Cloud security at AWS is the highest priority. AWS customers benefit from a data centre and network architecture built to meet the requirements of the most security-sensitive organisations. The AWS Cloud provides the ability to scale and innovate, while still maintaining a secure environment. You only pay for the services that you use, meaning that you can have the security you need, but without the up-front expenses, and at a lower cost than in an on-premises environment.

Table 2 – Some AWS Cloud Security Services and Features

Service	Product Type	Description
Amazon Virtual Private Cloud (Amazon VPC)	Logically Isolated Virtual Network	Amazon VPC lets you provision a logically isolated section of the AWS Cloud where you can launch AWS resources in a virtual network that you define. You have complete control over

		your virtual networking environment, including selection of your own IP address range, creation of subnets, and configuration of route tables and network gateways.
<u>AWS Artifact</u>	Compliance Reports	The AWS Artifact portal provides on-demand access to AWS security and compliance documents, also known as audit artifacts.
<u>AWS Certificate Manager</u>	SSL/TLS Certificates	AWS Certificate Manager is a service that lets you easily provision, manage, and deploy Secure Sockets Layer/Transport Layer Security (SSL/TLS) certificates.
<u>Amazon Cloud Directory</u>	Directory	Amazon Cloud Directory enables you to build flexible cloud-native directories for organising hierarchies of data along multiple dimensions.
<u>AWS CloudHSM</u>	Key Storage & Management	The AWS CloudHSM service helps you meet corporate, contractual, and regulatory compliance requirements for data security by using dedicated Hardware Security Module (HSM) appliances within the AWS Cloud.
<u>Amazon Cognito</u>	User Sign-Up & Sign-In	Amazon Cognito lets you add user sign-up/sign-in and access control to your web and mobile apps quickly and easily.
<u>AWS Directory Service</u>	Directory	AWS Directory Service for Microsoft Active Directory (Enterprise Edition), also known as AWS Microsoft AD, enables your directory-aware workloads and AWS resources to use managed Active Directory in the AWS Cloud.
<u>Amazon GuardDuty</u>	Threat Detection	Amazon GuardDuty is a managed threat detection service that provides you with a more accurate and easy way to continuously monitor and protect your AWS accounts and workloads.
<u>AWS Identity and Access Management (IAM)</u>	Access Control	Use AWS IAM to control users' access to AWS services. Create and manage users and groups, and grant or deny access.
<u>Amazon Inspector</u>	Security Assessment	Amazon Inspector is an automated security assessment service that helps improve the security and compliance of applications deployed on the AWS Cloud.
<u>AWS Key Management Service (KMS)</u>	Key Storage & Management	AWS KMS is a managed service that makes it easy for you to create and control the encryption keys used to encrypt your data.
<u>Amazon Macie</u>	Sensitive Data Classification	Amazon Macie is a machine learning-powered security service to discover, classify, and protect sensitive data.
<u>AWS Organizations</u>	Multiple Account Management	AWS Organizations offers policy-based management for multiple AWS accounts. With Organizations, you can create groups of accounts and then apply policies to those groups.

<u>AWS Shield</u>	DDoS Protection	AWS Shield is a managed Distributed Denial of Service (DDoS) protection service that safeguards web applications running on the AWS Cloud.
<u>AWS Secrets Manager</u>	Secrets management	AWS Secrets Manager enables you to easily rotate, manage, and retrieve database credentials, API keys, and other secrets throughout their lifecycle.
<u>AWS Single Sign-On</u>	Single Sign-On (SSO)	AWS Single Sign-On (SSO) is a cloud SSO service that makes it easy to centrally manage SSO access to multiple AWS accounts and business applications.
<u>AWS WAF</u>	Web Application Firewall	AWS WAF is a web application firewall that helps protect your web applications from common web exploits that could affect application availability, compromise security, or consume excessive resources.

4.3.2 Management and Monitoring

Several of our built-in cloud security features focus on providing visibility into data, performance, and resource usage. The tools listed below can help you gain more insight into your cloud operations, giving you the means to better control your security and providing information for data-driven decisions. You can also monitor infrastructure logs and metrics using real-time dashboards and alarms.

Table 3 – Some of the AWS Cloud Monitoring and Management Services

Service	Product Type	Description
<u>AWS Personal Health Dashboard</u>	Monitor Health and Performance	AWS Personal Health Dashboard provides a personalised view into the performance and availability of the AWS services you are using, as well as alerts that are automatically triggered by changes in the health of those services. Personal Health Dashboard provides proactive notifications of scheduled activities, such as any changes to the infrastructure powering your resources, enabling you to better plan for events that may affect you.
<u>AWS Trusted Advisor</u>	Real Time Optimisation and Security Guidance	AWS Trusted Advisor is a convenient way for you to see where you could use a little more security. It monitors AWS resources and alerts customers to security configuration gaps such as overly permissive access to certain Amazon EC2 instance ports and Amazon S3 buckets, minimal use of role segregation using IAM, and weak password policies.
<u>Amazon CloudWatch</u>	Service Visibility	Amazon CloudWatch enables you to collect and track metrics, collect and monitor log files, and set alarms. Amazon CloudWatch can monitor AWS resources such as Amazon EC2

		instances, Amazon DynamoDB tables, and Amazon RDS database instances, as well as custom metrics generated by your applications and services, and any log files your applications generate. You can use Amazon CloudWatch to gain system-wide visibility into resource utilisation, application performance, and operational health, using these insights to react intelligently and keep applications running smoothly.
<u>AWS CloudTrail</u>	Track Activity and API Usage	AWS CloudTrail provides logs of all user activity within an AWS account. The recorded information includes the identity of the API caller, the time of the API call, the source IP address of the API caller, the request parameters, and the response elements returned by the AWS Cloud service. The AWS API call history produced by AWS CloudTrail enables security analysis, resource change tracking, and compliance auditing.
<u>AWS Config</u>	Record and Evaluate Configurations of Resources	With the AWS Config service, you can immediately discover all of your AWS resources and view the configuration of each. You can receive notifications each time a configuration changes, as well as dig into the configuration history to perform incident analysis.
<u>AWS Systems Manager</u>	Gain Operational Insights and Take Action	AWS Systems Manager provides a unified user interface so you can view operational data from multiple AWS services and allows you to automate operational tasks across your AWS resources. With Systems Manager, you can group resources, like Amazon EC2 instances, Amazon S3 buckets, or Amazon RDS instances by application, view operational data for monitoring and troubleshooting, and take action on your groups of resources. Systems Manager simplifies resource and application management, shortens the time to detect and resolve operational problems, and makes it easy to operate and manage your infrastructure securely at scale
<u>AWS Organizations</u>	Policy-Based Management for Multiple AWS Accounts	AWS Organizations allows you to create groups of AWS accounts that you can use to more easily manage security and automation settings. With Organizations, you can centrally manage multiple accounts to help you scale. You can control which AWS services are available to individual accounts, automate new account creation, and simplify billing.
<u>AWS Managed Services</u>	Infrastructure Operations Management for AWS	AWS Managed Services provides ongoing management of your AWS infrastructure so you can focus on your applications. AWS Managed Services automates common activities such as change requests, monitoring, patch

management, security, and backup services, and provides full-lifecycle services to provision, run, and support your infrastructure. Our rigor and controls help to enforce your corporate and security infrastructure policies, and enable you to develop solutions and applications using your preferred development approach.

4.4 AWS Security Documentation

We provide dedicated security chapters in the AWS documentation for over 40 services. Security is a key component of your decision to use the cloud. These chapters can help your organisation get in-depth information about both the built-in and the configurable security of AWS services. This information goes beyond “how-to.” It can help developers—as well as Security, Risk Management, Compliance, and Product teams—assess a service prior to use, determine how to use a service securely, and get updated information as new features are released.

AWS security documentation is available online here:
<https://docs.aws.amazon.com/security/>

4.5 Third-Party Security Tools

AWS also offers access to additional third-party security tools to complement and enhance our customers’ operations in the AWS Cloud. APN Partners offer hundreds of familiar and industry-leading products that are equivalent to, identical to, or integrate with existing controls in a customer’s on-premises environments. Customers can browse and purchase APN Partner products on the [AWS Marketplace](#). These products complement existing AWS Cloud services to enable customers to deploy a comprehensive security architecture and provide a more seamless experience across their cloud and on-premises environments. APN Partner security products cover multiple areas of security, including application security, policy management, identity management, security monitoring, vulnerability management, and endpoint protection. **Figure 14** is a snapshot of some of the APN Partners and categories of products available under the security category in the AWS Marketplace.



Figure 14 – AWS Marketplace provides access to many familiar and trusted security vendors.

4.6 Managing Security in the Cloud versus On-Premises

Managing security in the cloud is much like managing security in on-premises data centres, only without customers having to deal with the costs and complexities of protecting facilities and hardware. Lower cost and higher efficiency are two of the most obvious benefits of using the cloud, as opposed to building and running a physical data centre. You can also obtain greater security in the cloud than is available in traditional data centres, with benefits that include:

- **Free Security Tools** – Many of our security features and services are free, like individual firewalls (security groups) for Amazon EC2 instances, security logging with AWS CloudTrail, private subnets with Amazon VPC, user access control with IAM, and automatic encryption of archived data in Amazon Glacier.
- **Independent Regions Provide Data Privacy Compliance** – With our data centres located in so many [geographical Regions](#) across the world, you can choose the area that meets your data privacy requirements. Customers always retain control of which Region(s) are used to store and process content. AWS only stores and processes each customers' content in the Region(s), and using the services, chosen by the customer, and otherwise will not move customer content without the customer's consent, except as legally required.
- **Significant DDoS Protection** – Along with AWS Shield, AWS's size and scale can help you be DDoS-resilient. AWS infrastructure is equipped to handle extremely large amounts of traffic. In addition, when you use AWS services like Elastic Load Balancing, Auto Scaling, Amazon CloudWatch, and Amazon CloudFront, you can architect a highly available system that can help you weather DDoS attacks.
- **Security Economies of Scale** – The smallest AWS customers reap the same security benefits as the largest customers when they operate in our cloud. AWS has a large, dedicated security team and a variety of systems and tools that continuously monitor and protect the underlying cloud infrastructure.
- **No More Duplicate Data Centres for Disaster Recovery** – Availability Zones provide the ability to place resources, such as instances, and data in multiple locations. When you use AWS features like Auto Scaling and Elastic Load Balancing, you can architect your solution so that production systems remain online and so that traffic is always routed to healthy instances. You can continuously replicate your data and have it ready to bring online if your primary nodes fail, only paying for the nodes when you actually use them.
- **Continuous Hardware Replacement and Upgrade** – We are always improving our infrastructure. We replace end-of-life hardware with the latest processors that not only improve performance and speed but also include the latest secure technology, like the Intel Advanced Encryption Standard New Instructions (AES-

NI) encryption instruction set, which significantly speeds up the execution of the AES algorithm.

- **Part of the Compliance Work Is Done** – Because AWS has already received many certifications for our infrastructure, part of your compliance work has already been done. You only have to certify the applications and architectures you create on the AWS Cloud.

4.7 New Governance Models

With cloud computing you get the chance to build the IT environment you want, not simply manage the one you have. The cloud enables customers to: (1) start with a full inventory of all IT assets; (2) manage all of these assets centrally; and (3) create alerts regarding usage/billing/security/etc. All of these vital benefits of the cloud help customers have an optimised - and to the fullest extent, automated - architecture, with no need to continually procure and install new hardware. This is done by the Cloud Service Provider (CSP), allowing customers to shift focus from undifferentiated infrastructure management to the mission-critical operational level.

The AWS Cloud provides almost incomparable capabilities for asset tracking, inventory management, change management, log management and analysis, and overall visibility and governance. The AWS Management Console provides a single view of an entire infrastructure, with additional third-party management and monitoring products available on AWS Marketplace. With [Amazon CloudWatch](#), customers can monitor AWS Cloud resources and the applications that run on AWS. With [AWS Config](#), customers get full visibility of the state of AWS resources, monitoring changes over time and viewing the full history of configuration changes for a resource. The AWS API call history produced by [AWS CloudTrail](#) enables security analysis, resource change tracking, and compliance auditing.

When it comes to billing, customers can [tag each AWS resource](#) to track usage and spend. Additionally, services such as [AWS Trusted Advisor](#) augment AWS and third-party monitoring and optimisation products to provide best practices (or checks) in areas including cost optimisation, security, fault tolerance, and performance improvement.

One helpful way to view AWS is that it is effectively a very large API. Whether you are launching a new server or changing a security setting, you are just making API calls. Every change to the environment is logged and recorded (the who, what, where, and when of each change is recorded). This provides governance, control, and visibility that is only possible in a cloud environment like the AWS Cloud. It also provides the hooks for DevSecOps to continuously track changes and enable deep security automation.

5.0 Compliance

Cloud accreditation certifications and evaluations provide customers with assurance that Cloud Service Providers (CSPs) have effective physical and logical security

controls in place. When public sector entities leverage these reports, they avoid subjecting themselves to overly burdensome processes or approval workflows that may not be required for a cloud environment. Using such accreditations also enables you to build a quicker, more efficient compliance process.



Figure 15 – AWS Certifications and Accreditations

As with everything at Amazon, the success of our security and compliance program is primarily measured by one thing: our customers' success. Our customers' requirements drive our portfolio of compliance reports, attestations, and certifications that enable our customers to run a secure and compliant cloud environment.

The AWS Cloud infrastructure has been designed and is managed in alignment with regulations, standards, and best practices, including:

- General Data Protection Regulation (GDPR)
- International Organization for Standardization (ISO) 27001
- ISO 27017
- ISO 27018
- ISO 9001
- System and Organization Controls (SOC) 1, SOC 2, and SOC 3
- Cloud Security Alliance (CSA)
- Payment Card Industry Data Security Standard (PCI DSS) version 3.2
- UK Cyber Essentials Plus
- UK Data Protection Act 1998
- UK National Cyber Security Centre (NCSC) Cloud Security Principles
- Cloud Computing Compliance Controls Catalog (C5) (Germany)
- Cloud Infrastructure Services Providers in Europe (CISPE)
- Data Processing Addendum (DPA) Authorisation (Spain)
- EU Data Protection Directive (Directive 95/46/EC) Model Clauses
- Federal Bureau of Investigation (FBI) Criminal Justice Information Services (CJIS)
- Federal Information Processing Standard (FIPS) 140-2

- Federal Information Security Management Act (FISMA)
- Federal Risk and Authorization Management Program (FedRAMP)
- Information Security Registered Assessors Program (IRAP) (Australia)
- International Computer Room Experts Association (ICREA)
- International Traffic in Arms Regulations (ITAR)
- IT Grundschutz (Germany)
- National Institute of Standards and Technology (NIST) 800-171
- Personal Information Protection and Electronic Documents Act (PIPEDA)
- Singapore Multi-Tier Cloud Security (MTCS) Level 3
- US Health Insurance Portability and Accountability Act (HIPAA)

For information on all of the security regulations and standards with which AWS complies, visit the [AWS Compliance page](#).

5.1 Compliance in the UK

5.1.1 NCSC UK Cloud Security Principles

The AWS compliance whitepaper [Using AWS in the Context of NCSC UK's Cloud Security Principles](#) is intended to assist organisations using AWS for UK OFFICIAL classified workloads in alignment with National Cyber Security Centre's (NCSC) [Cloud Security Principles](#) published under the [Cloud Security Guidance](#). This document aims to help the reader understand:

- How AWS implements security processes and provides assurance over those processes for each of the Cloud Security Principles.
- The roles the customer and AWS play in managing and securing content stored on the AWS Cloud.
- The way AWS services operate, including how customers can address security and risk management using AWS Cloud services.

AWS provides a [Quick Start](#) that sets up a standardised AWS Cloud environment that supports workloads that are classified as United Kingdom (UK) OFFICIAL. This data classification is associated with guidance and controls that help public sector organisations manage risk and security when handling information assets.

The AWS environment built by the Quick Start aligns with the following guidelines that fall in scope with UK-OFFICIAL:

- NCSC Cloud Security Principles
- Center for Internet Security (CIS) Critical Security Controls

The Quick Start template automatically configures the AWS resources and deploys a multi-tier, Linux-based web application in a few simple steps, in about 30 minutes. The [security controls matrix](#) (Microsoft Excel spreadsheet) shows how the Quick Start components map to NCSC and CIS security requirements.

5.1.2 UK Cyber Essentials Plus

[Cyber Essentials Plus](#) is a UK Government-backed, industry-supported certification scheme introduced in the UK to help organisations demonstrate operational security against common cyber-attacks. It demonstrates the baseline controls AWS implements to mitigate the risk from common Internet-based threats, within the context of the UK Government's [10 Steps to Cyber Security](#). It is backed by industry, including the Federation of Small Businesses, the Confederation of British Industry, and a number of insurance organisations that offer incentives for businesses holding this certification.

Cyber Essentials sets out the necessary technical controls; the related assurance framework shows how the independent assurance process works for Cyber Essentials Plus certification through an annual external assessment conducted by an accredited assessor. Due to the regional nature of the certification, the certification scope is limited to the [AWS EU \(London & Dublin\) Regions](#). Refer again to the whitepaper [Using AWS in the Context of NCSC UK's Cloud Security Principles](#) for more information.

5.1.3 Connectivity for OFFICIAL Workloads

The UK Government recognises that local data centres from hyper scale public cloud providers can deliver secure solutions for OFFICIAL workloads. In order to meet the special security needs of public sector organisations in the UK with respect to OFFICIAL workloads, we have worked with our Direct Connect Partners to make sure that obligations for connectivity to the [Public Services Network](#) (PSN) and N3 can be met.

5.1.4 UK National Health Service (NHS) Workloads

AWS has published the whitepaper [Using AWS in the Context of UK Healthcare IG SoC Process](#) to assist organisations using AWS for UK NHS workloads. UK's Department of Health sponsors the Health and Social Care Information Centre (HSCIC) to provide information, data, and IT systems for commissioners, analysts, and clinicians in health and social care. As part of this role, HSCIC publishes guidance and requirements on Information Governance (IG). IG Statement of Compliance (IG SoC) is a process by which organisations enter into an agreement with HSCIC for access to HSCIC's services, in order to preserve the integrity of those services. Currently, AWS does not directly access services provided by HSCIC. However, AWS partners or customers may have or require access to HSCIC services and are hence required to comply with the IG SoC process. This whitepaper aims to help you understand:

- The role that the customer and/or partner and AWS play in ownership, management, and security of the content stored on the AWS Cloud;
- A reference architecture that demonstrates the shared responsibility model to meet IG SoC requirements; and
- How AWS aligns with each of the 17 requirements for a Commercial Third Party within HSCIC's IG Toolkit requirements.

5.1.5 General Data Protection Regulation

All AWS services are General Data Protection Regulation ([GDPR](#)) ready. This means that, in addition to benefiting from all of the measures that AWS already takes to maintain services security, customers can deploy AWS services as a key part of their GDPR compliance plans. See the [AWS GDPR Hub](#) for public sector.

AWS has completed the entirety of our GDPR service readiness audit, validating that all generally available services and features adhere to the high privacy bar and data protection standards required of data processors by the GDPR in order to give customers and APN partners an environment in which they can confidently build their own GDPR-compliant products, services, and solutions.

We have a new Data Processing Agreement (DPA) that meets the requirements of the GDPR. For more information on how customers can enter into the AWS Data Processing Addendum, please see the AWS Security blog post [here](#).

The GDPR aims to strengthen the security and protection of personal data in the EU and harmonise EU data protection law. The GDPR replaces the EU Data Protection Directive, as well as all local laws relating to it. AWS welcomes the GDPR. It protects European citizens' fundamental right to privacy and the protection of personal data. It introduces robust requirements that will raise the bar for data protection, security, and compliance and will push the industry to implement stringent controls. In addition to our own compliance, AWS is committed to offering services and resources to our customers to help them comply with GDPR requirements that may apply to their operations.

One of the key aspects of the GDPR is that it creates consistency across EU member states on how personal data can be processed, used, and exchanged securely. Organisations need to demonstrate the security of the data they are processing and their compliance with GDPR on a continual basis, by implementing and regularly reviewing robust technical and organisational measures, as well as compliance policies.

AWS provides specific features and services that help customers to meet the requirements of GDPR:

Access Control: Allow only authorised administrators, users, and applications access to AWS resources

- Multi-Factor-Authentication (MFA)
- Fine granular access to objects in Amazon S3-Buckets/ Amazon SQS/ Amazon SNS and others
- API-Request Authentication
- Geo-Restrictions
- Temporary access tokens through AWS Security Token Service

Monitoring and Logging: Get an overview of activities on your AWS resources

- Asset Management and Configuration with AWS Config

- Compliance Auditing and security analytics with AWS CloudTrail
- Identification of configuration challenges through AWS Trusted Advisor
- Fine granular logging of access to Amazon S3 objects
- Detailed information about flows in the network through Amazon VPC-FlowLogs
- Rule-based configuration checks and actions with AWS Config Rules
- Filtering and monitoring of HTTP access to applications with WAF functions in AWS CloudFront

Encryption: Encrypt Data on AWS

- Encryption of your data at rest with AES256 (EBS/S3/Glacier/RDS)
- Centralised managed Key Management (by AWS Region)
- IPsec tunnels into AWS with the VPN-Gateways
- Dedicated HSM modules in the cloud with AWS CloudHSM

Strong Compliance Framework and Security Standards

- ISO 27001 certified
- ISO 27017 certified
- ISO 27018 certified
- ISO 9001 certified
- Cloud Computing Compliance Controls Catalog (C5) – German Government-backed attestation scheme
- AWS, alongside auditor TÜV TRUST IT, has published a [Customer Certification Workbook](#) that provides guidance on achieving German BSI IT Grundschutz compliance in the Cloud.

You should consider the following [key points](#) for GDPR compliance:

- **Territorial reach** – Determining whether the GDPR applies to your organisation's activities is essential to ensuring your organisation's ability to satisfy its compliance obligations.
- **Data subject rights** – The GDPR enhances the rights of data subjects in a number of ways. You need to make sure you can accommodate the rights of data subjects if you are processing their personal data.
- **Data breach notifications** – If you are a data controller, you must report data breaches to the data protection authorities without undue delay and in any event within 72 hours of you becoming aware of a data breach.
- **Data protection officer (DPO)** – You may need to appoint a DPO who will manage data security and other issues related to the processing of personal data.
- **Data protection impact assessment (DPIA)** – You may need to conduct and, in some circumstances, you might be required to file with the supervisory authority a DPIA for your processing activities.

- **Data processing agreement (DPA)** – You may need a DPA that will meet the requirements of the GDPR, particularly if personal data is transferred outside the European Economic Area (EEA).

We also have teams of compliance, data protection, and security experts, as well as APN Partners, working with customers across Europe to answer their questions and help them run workloads in the cloud in compliance with the GDPR. For more information, please see our [GDPR Center](#). **Note:** The GDPR replaced the existing Directive 95/46/EC. As of May 25, 2018, the existing Data Protection Directive, and the laws relating to it, no longer apply.

5.1.6 Cloud Infrastructure Services Providers of Europe

In February 2017, [we announced](#) AWS's membership in the Association of [Cloud Infrastructure Services Providers in Europe](#) (CISPE). CISPE is a coalition of about twenty cloud infrastructure (also known as IaaS) providers who offer cloud services to customers in Europe. CISPE was created to promote data security and compliance within the context of cloud infrastructure services. This is a vital undertaking: both customers and providers now understand that cloud infrastructure services are very different from traditional IT services (and even from other cloud services such as SaaS). Many entities were treating all cloud services as the same in the context of data protection, which led to confusion on the part of both the customer and providers with regard to their individual obligations.

5.1.6.1 CISPE Code of Conduct

Also in February 2017, [AWS announced](#) compliance with the [CISPE Code of Conduct](#). The CISPE Code of Conduct helps cloud customers ensure that their cloud infrastructure provider is using appropriate data protection standards to protect their data in a manner consistent with the GDPR. AWS has declared that Amazon EC2, Amazon S3, Amazon RDS, AWS Identity and Access Management (AWS IAM), AWS CloudTrail, and Amazon Elastic Block Storage (Amazon EBS) are fully compliant with the CISPE Code of Conduct. This declaration provides customers with assurances that they fully control their data in a safe, secure, and compliant environment when they use AWS. For more information about AWS's compliance with the CISPE Code of Conduct, please visit the [CISPE website](#).

The CISPE Code of Conduct helps cloud customers ensure that their cloud infrastructure provider is using appropriate data protection standards to protect their data consistent with the GDPR. A few key benefits of the Code include:

- **Clarifying who is responsible for what when it comes to data protection** – The Code of Conduct explains the role of both the provider and the customer under the GDPR, specifically within the context of cloud infrastructure services.
- **The Code of Conduct sets out what principles providers should adhere to** – The Code of Conduct develops key principles within the GDPR about clear actions and commitments that providers should undertake to help customers

comply. Customers can rely on these concrete benefits in their own compliance and data protection strategies.

- **The Code of Conduct gives customers the security information they need to make decisions about compliance** – The Code of Conduct requires providers to be transparent about the steps they are taking to deliver on their security commitments. These steps include notification around data breaches, data deletion, and third-party sub-processing, as well as law enforcement and governmental requests. Customers can use this information to fully understand the high levels of security provided.

5.2 Making Compliance Easier on the AWS Cloud

The AWS Cloud includes a number of features and services that can help you manage compliance:

- **AWS Config:** A fully-managed service that provides you with an AWS resource inventory, configuration history, and configuration change notifications to enable security and regulatory compliance. With AWS Config, you can discover existing and deleted AWS resources, determine your overall compliance against rules, and dive into configuration details of a resource at any point in time. AWS Config enables compliance auditing, security analysis, resource change tracking, and troubleshooting.
- **AWS Service Catalog:** To create and manage catalogues of IT services that you have approved for use on AWS, from virtual machine images, servers, software, and databases to complete multi-tier application architectures. AWS Service Catalog allows you to centrally manage commonly deployed IT services, and helps you achieve consistent governance to meet your compliance requirements, while enabling users to quickly deploy the approved IT services they need.
- **Amazon GuardDuty:** Offers threat detection and continuous security monitoring for malicious or unauthorised behaviour to help you protect your AWS accounts and workloads. The service monitors for activity that indicates a possible account compromise, potentially compromised instance, or reconnaissance by attackers, and continuously monitors data access activity for anomalies that might signal unauthorised access or inadvertent data leaks.
- **AWS Artifact:** Review and download reports and details about more than 2,500 security controls by using AWS Artifact, our automated compliance reporting tool available in the AWS Management Console. AWS Artifact provides on-demand access to our security and compliance documents, also known as audit artifacts. You can use the artifacts to demonstrate the security and compliance of your AWS infrastructure and services to your auditors or regulators. Examples of audit artifacts include System and Organization Controls (SOC) and Payment Card Industry (PCI) reports.

- **Amazon Inspector:** An automated security assessment service that helps improve the security and compliance of applications deployed on AWS. Amazon Inspector automatically assesses applications for vulnerabilities or deviations from best practices. After performing an assessment, Amazon Inspector produces a detailed list of security findings prioritized by level of severity. To help you get started quickly, Amazon Inspector includes a knowledge base of hundreds of rules that are mapped to common security best practices and vulnerability definitions. Examples of built-in rules include checking whether remote root login is enabled, or whether vulnerable software versions are installed. These rules are regularly updated by AWS security researchers.

5.3 Automating for Compliance

Customers can create pre-built and customisable reference architectures with the tools AWS provides, and a level of effort and expertise.

5.3.1 Automation Methods

AWS CloudFormation is the core of AWS infrastructure automation. The service allows you to automatically deploy complete architectures by using pre-built JSON-formatted template files. The set of resources created by an AWS CloudFormation template is referred to as a “stack.”

When building enterprise-wide AWS CloudFormation templates to automate compliance, we recommend that you use a modular design. Use separate stacks based on the commonality of configuration among applications. This can help automate and enforce the baseline standards for security and compliance.

An organization with a decentralized cloud governance model can use this automation structure to establish “blueprint” architectures and allow workload owners full control of deployment at all levels. In contrast, an organization with a centralized cloud team that is responsible for provisioning might allow workload owners to provision only the application-level components of the architecture while retaining responsibility for initial account provisioning, IAM controls, and Amazon VPC configuration.

5.3.2 Infrastructure as Code

AWS CloudFormation templates and associated scripts, documents, and parameter files can be managed just as any application code would be. We recommend that you use version control repositories such as Git or Subversion (SVN) to track changes and allow multiple users to efficiently push updates.

Capabilities such as version control, testing, and rapid deployment are possible with AWS CloudFormation templates just as with any source code. A full Continuous Integration/Continuous Deployment (CI/CD) solution can be implemented using additional tools, such as Jenkins.

You can store pre-built use case packages in either a source code repository or in an S3 bucket. This allows provisioning teams and workload owners to easily pull down the latest versions of these files.

5.3.3 Auditing

Automating architecture deployment in AWS can help simplify the process of auditing and accrediting deployed applications. Having a base configuration for components such as IAM and VPC controls ensures that workload owners are deploying architectures based on compliance standards. The customer's security personnel can "sign off" on reusable template packages that are based on customer security standards and compliance requirements as compliant.

The security accreditation and auditing process can make use of automation with the following AWS capabilities:

- **Tagging:** AWS resources can be queried for common tags. Tags can be applied at the stack level to all resources that support tagging.
- **Template validation:** A scripted validation of the configuration can be tested against the AWS CloudFormation template files prior to deployment.
- **SNS notification:** A nested stack in a template can be configured to send notifications about stack events to an Amazon SNS topic. These Amazon SNS topics can be used to alert individuals, groups, or applications that a specific template has been deployed in the account.
- **Testing deployed resources:** Through the AWS API, scripted tests can be conducted to validate that deployed architectures meet security requirements. For example, tests can be run to detect if any security group has open access to certain ports or if there is an internet gateway in a VPC that should not have one.
- **ISV solutions:** Third-party solutions for analysing deployed architectures are available from AWS Partners. Security control validation can also be implemented through solutions such as Telos' Xacta risk management solution.

6.0 Service Level Agreements (SLAs)

Instead of recycling existing SLAs, we encourage public sector organisations to shift focus to building well-architected and optimised solutions that use capabilities that are unique to the cloud, such as AWS's multiple Availability Zones or Regions, which can ease the burden of achieving SLA standards.

AWS currently provides SLAs for more than 100 services. Due to the rapidly evolving nature of AWS's product offerings, SLAs are best reviewed directly on our website:

<https://aws.amazon.com/legal/service-level-agreements/>.

7.0 Partner Network

The [AWS Partner Network \(APN\)](#) has tens of thousands of APN Partners from all across the globe (see Error! Reference source not found. below), and it continues to grow at a rapid pace. It is very likely that the SIs and ISVs that you already work with are in the APN.

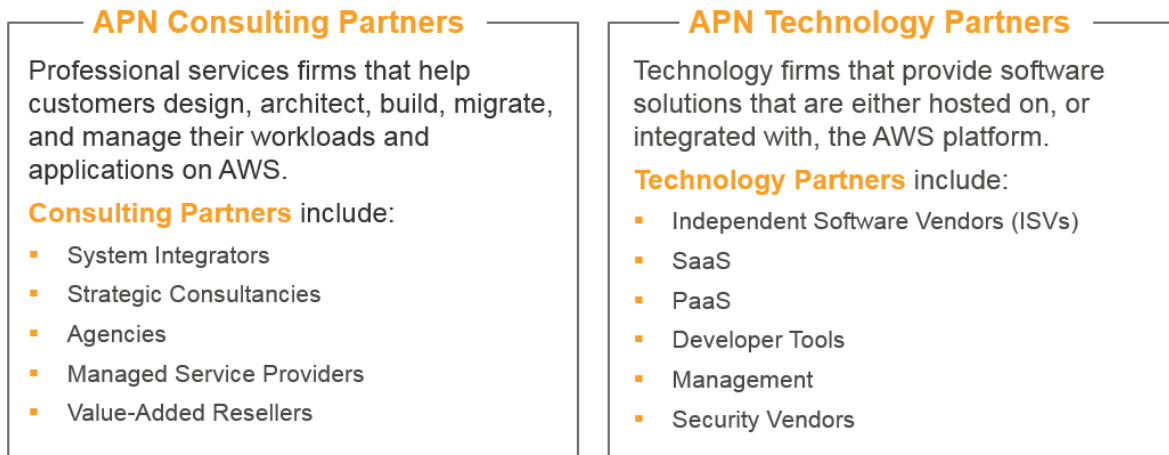


Figure 16 – AWS's Extensive Partner Network

APN Partners bring unique and proven experience in helping to design, architect, build, migrate, and manage workloads and applications in the cloud.

- The **AWS Consulting Partner Program** is a global network comprised of thousands of professional services firms that have invested in their AWS practice. They have experience in deploying customer solutions on the AWS Cloud, a bench of trained and certified technical consultants, expertise in project management, and a financially stable consulting business related to AWS Cloud services.
- **APN Technology Partners** provide software solutions that are either hosted on, or integrated with, the AWS Cloud. APN Technology Partners include ISVs, Software as a Service (SaaS) providers, Platform as a Service (PaaS) providers, developer tool providers, and management and security vendors. APN Technology Partners gain access to a variety of tools, training, and support that enables them to more efficiently build their solutions on the AWS Cloud.

The [AWS Public Sector Partner Program](#) enables partners to accelerate their business growth on the AWS Cloud through alignment with our public sector sales, marketing, partner, and bid teams; designation as a public sector partner in our APN Partner Solutions Finder; and eligibility for further unique benefits and differentiation programs.

Additional [APN Partner programs](#) such as the AWS Channel Reseller Program, AWS Managed Service Program, AWS Competency Program, and AWS SaaS Partner Program are listed on the AWS website.

8.0 AWS Marketplace

[AWS Marketplace](#) is a curated digital catalogue that makes it easy for customers to find, buy, deploy, and manage third-party software and services that customers need to build solutions and run their businesses. AWS Marketplace offers 39 product categories and more than 4,800 software listings from more than 1,400 ISVs. Popular categories include security, networking, storage, machine learning, business intelligence, database, and devOps. AWS Marketplace also simplifies software licensing and procurement with flexible pricing options and multiple deployment methods.

Customers can quickly launch pre-configured software with just a few clicks, and choose software solutions in AMI and SaaS formats, as well as other formats. Flexible pricing options include free trial, hourly, monthly, annual, multi-year, and BYOL, and get billed from one source. AWS handles billing and payments, and software charges appear on customers' AWS bill.

Every product on AWS Marketplace has been through a curation process. On the listing page, there can be one or more offerings for the product. When the provider submits a product in AWS Marketplace, they define the price of the product, and the terms and conditions of use. When a customer subscribes to a product offering, they agree to the pricing, and terms and conditions set for the offer.

The product can be free to use or can have an associated charge. The charge becomes part of the customer's AWS bill, and once they pay, AWS Marketplace pays the provider. Products can take many forms. For instance, a product can be offered as an Amazon Machine Image (AMI) or Amazon Machine Images (AMIs) that can be instantiated using the customer's AWS account. The product could also be configured to use AWS CloudFormation templates for delivery to the customer. The product could also be software as a service (SaaS) offerings from an ISV, or a web ACL, set of rules, or conditions for AWS WAF.

9.0 Moving to the Cloud

All cloud journeys are unique, but many share commonalities. There are common patterns, approaches, and best practices that can be implemented to streamline the process. Recognising this, we provide cloud migration guidance and best practices gained from thousands of engagements that you can use to build a cloud migration strategy that best meets your customer's unique needs.

9.1 AWS Professional Services

The AWS Professional Services organisation is a global team of experts who augment the project team (of either the customer, APN partner or both) with specialised skills and experience to accelerate the execution of enterprise cloud computing initiatives. In this way, Professional Services provides expertise to fill knowledge gaps in APN Partner and customer organisations. Professional Services consultants can also assist Partner project teams to accelerate execution of their customers' cloud computing initiatives.

Combining the broad range of consulting services and solutions available from the APN with focused support from AWS Professional Services provides customers with the breadth of skills and resources needed to best realise the potential of the AWS Cloud.

AWS Professional Services are best used to achieve specific project goals and business outcomes, augmenting the capability of the customer or partner's project team. We have a philosophy of skills transfer and making our customers and partners self-sufficient rather than landing long term consulting teams. Our objective is to help Partners build their skills more quickly and accelerate time to value for their customers. AWS Professional Services personnel are expected to maintain a deep, specialised knowledge of specific AWS services.

AWS Professional Services provides a collection of offerings which help customers achieve specific outcomes related to enterprise cloud adoption. They also deliver focused guidance through our global specialty practices, which cover a variety of solutions, technologies, and industries. In addition to working alongside customers and APN Partners, they also share their experience through tech talk webinars, White Papers, and blog posts that are available to anyone.

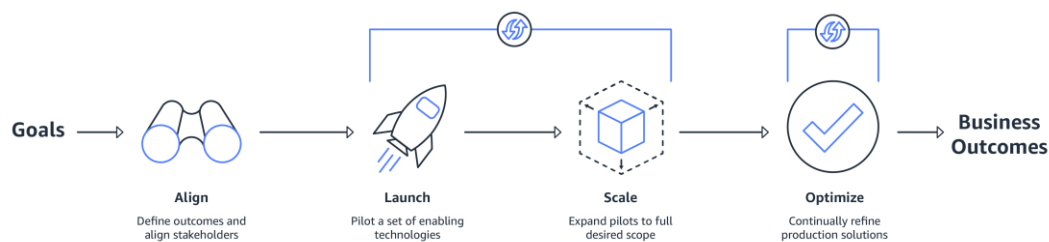


Figure 17 – AWS Professional Services help customers and partners to deliver business outcomes

Moving to the cloud requires knowledge, tools, and alignment of your business and IT strategy. Strong collaboration between customer teams, AWS Partner Network (APN) Partners, and AWS Professional Services team consistently produces impactful enterprise business outcomes through each stage of the process, as illustrated in **Figure 17**. Combining the broad range of consulting services and solutions available from the APN with focused support from AWS Professional Services provides you with the breadth of skills and resources needed to best realise the potential of the AWS Cloud.

9.1.1 AWS Specialty Practices

AWS Professional Services provides global specialty practices to support your efforts in focused areas of enterprise cloud computing. Specialty practices deliver targeted guidance through best practices, frameworks, tools, and services across solution, technology, and industry subject areas. Their deep expertise helps you take advantage of business benefits available with the AWS Cloud. Some examples include:

- **Advisory** - Achieve organisational change and tangible business outcomes from adopting the AWS Cloud
- **Large-Scale Migration** - Automate and accelerate the migration of large numbers of applications to the AWS Cloud
- **Security, Risk and Compliance** - Develop the confidence and technical capability to migrate and manage your most sensitive workloads to the AWS Cloud
- **Big Data & Analytics** - Derive more value from your data assets using AWS services for big data and analytics
- **Artificial Intelligence (AI) & Machine Learning (ML)** - Develop artificial intelligence capabilities using Amazon AI/ML services, platforms, frameworks, and infrastructure
- **Internet of Things (IoT)** - Connect devices to the AWS Cloud by leveraging purpose-built managed services for IoT
- **Databases** - Architect, migrate, and administer a wide range of AWS managed database services to fit your specific application requirements

A full list of AWS Specialty Practices is available online [here](#).

9.1.2 AWS Cloud Adoption Framework

AWS Professional Services created the AWS Cloud Adoption Framework (AWS CAF) to help organisations design and travel an accelerated path to successful cloud adoption. The guidance and best practices provided by the CAF framework help you build a comprehensive approach to cloud computing across your organisation, and throughout your IT lifecycle. Using the AWS CAF helps you realise measurable business benefits from cloud adoption faster and with less risk.

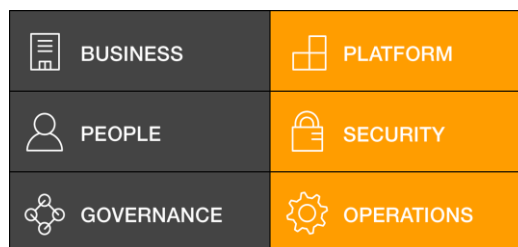


Figure 18 - Six Perspectives of the AWS CAF

At the highest level, the AWS CAF breaks down the complicated process of planning into six manageable areas of focus, termed “perspectives”, as illustrated in **Figure 18**. Perspectives represent top-level areas of focus spanning people, process, and technology. Capabilities identify specific aspects within each perspective that require

attention, while skills and processes, organized into work streams, provide prescriptive guidance to help build actionable plans.

The AWS CAF helps an organisation develop and execute a comprehensive IT strategy and plan by separating complex IT environments into manageable areas of focus. Each perspective is supported by a knowledge base of reusable assets, including tools to reduce the time and cost of a cloud deployment.

A brief description of each AWS CAF perspective is provided below:

- **Business Perspective** – Helps stakeholders understand how to update staff skills and organisational processes involved in business support capabilities, to optimise business value with cloud adoption.
- **People Perspective** – Provides guidance for stakeholders responsible for people development, training, and communications. Helps stakeholders understand how to update staff skills and organisational processes with cloud-based competencies.
- **Governance Perspective** – Provides guidance for stakeholders who support business processes with technology, and who are responsible for managing and measuring the resulting business outcomes. Helps stakeholders understand how to update staff skills and organisational processes necessary for business governance in the cloud.
- **Platform Perspective** – Helps stakeholders understand how to update staff skills and organisational processes necessary to deliver, maintain, and optimise cloud solutions and services.
- **Security Perspective** – Provides guidance for stakeholders responsible for staff skills and organisational processes necessary so that the workloads deployed or developed in the cloud align to the organisation's security control, resiliency, and compliance requirements.
- **Operations Perspective** – Helps stakeholders understand how to update staff skills and organisational processes necessary for system health and reliability through the move to the cloud, and as an agile, ongoing, cloud computing best practice.

The AWS CAF offers a way for customers transitioning to a cloud-based IT environment to learn and plan for the impact that cloud has on the execution of specific capabilities. An organisation's journey begins with their leadership team reviewing the six AWS CAF perspectives. Through each perspective, the team creates comprehensive workstreams spanning multiple disciplines and teams. These workstreams capture gaps in skills, processes, and dependencies; the results are an action plan to guide an organisation's change management through their journey to the cloud.

AWS Professional Services offer particular services that align with each of the Perspectives, examples of which are listed in **Table 4** below.

Table 4 – AWS Professional Services aligned with CAF Perspectives

CAF Perspective	Portfolio Offering
Business	Cloud Journey Simulation (CJS) Workshop
	CAF Envisioning Workshop
	CAF Alignment Workshop
	Executive Security Workshop
	Business Case Accelerator
People	Cloud Centre of Excellence (CCOE)
	People, Platform and Product Operating Model On AWS)
Governance	Cost Governance
	Risk Governance
	Governance at Scale
	Data Governance
Platform	Migration Readiness Assessment
	Migration Readiness and Planning
	High Level Landing Zone Design
	DevOps on AWS
	Application Discovery Workshop
	CI/CD Accelerator
Security	Enterprise Security Blueprint
	Security Assessment and Planning
	Security Incident Response Simulations
Operations	Operations Assessment
	Cloud Operations Accelerator

9.1.3 AWS Professional Services on G-Cloud

We have 78 service offers listed on the UK Government's Digital Marketplace (G-Cloud). Below is a selection of some of the other most popular offerings we provide to our UK Government customers:

- **Training & Skills Assessment** - advisory services to help customers to assess AWS training and skills needed for their organisation
- **Security Assessment** - a health check/assessment supporting the customer's organisation with increased security awareness leading to potential positive

financial, operational and/or business impacts. This includes review of current security posture, identification of possible business outcomes/benefits, a detailed report with maturity assessment, and prioritised recommendations on next steps.

- **Migration Readiness Assessment** - we assist customers in assessing their migration goals and state of readiness for a migration to AWS, resulting in a data driven readiness assessment and proposed outline of work. The engagement includes a 4 to 6 hour workshop which compares current capabilities to industry best practices.
- **Well Architected on AWS** - our Professional Services consultants transfer knowledge on architectural proven methods for designing reliable, secure, efficient cost-effective systems in the cloud. We work with the customer onsite to review workloads against best practices for architecting and assist with initial remediations.
- **DevSecOps on AWS Workshop** - our Professional Services consultants lead participants through a workshop to give an overview of DevSecOps culture, guiding them to manage cloud security through a DevOps methodology. The workshop provides a primer on metrics and KPIs for organisations to help measure effectiveness and promote the continuous iteration of security controls.

For a full listing of AWS Professional Services offers available on G-Cloud, please see the Digital Marketplace [here](#).

9.2 AWS Data Migration Services

Data is the cornerstone of successful cloud application deployments. Your evaluation and planning process may highlight the physical limitations inherent to migrating data from on-premises locations into the cloud. AWS offers a suite of tools to help you move data via networks, roads and technology partners.

Table 5 – Choosing the Right Migration Tool

If you need to integrate:	Consider	Description
An online link to AWS Cloud storage services so you can:		
Privately connect your data centre directly to an AWS Region	AWS Direct Connect	AWS Direct Connect makes it easy to establish a dedicated network connection from your premises to the AWS Cloud. Using AWS Direct Connect, you can establish private connectivity between AWS and your data centre, office, or colocation environment, which in many cases can reduce your network costs, increase bandwidth throughput, and provide a more consistent network experience than Internet-based connections.

Physically transport petabytes of data in batches to the cloud	AWS Snowball	Snowball is a petabyte-scale data transport solution that uses secure appliances to transfer large amounts of data into and out of the AWS Cloud. Using Snowball addresses common challenges with large-scale data transfers including high network costs, long transfer times, and security concerns. Transferring data with Snowball is simple, fast, secure, and can be as little as one-fifth the cost of high-speed Internet.
Build hybrid storage that preserves existing on-prem investment and adds AWS Cloud services	AWS Snowball Edge	AWS Snowball Edge is a 100TB data transfer device with on-board storage and compute capabilities. You can use Snowball Edge to move large amounts of data into and out of AWS, as a temporary storage tier for large local datasets, or to support local workloads in remote or offline locations.
Migrate exabytes of data in batches to the cloud	AWS Snowmobile	AWS Snowmobile is an Exabyte-scale data transfer service used to move extremely large amounts of data to AWS. You can transfer up to 100PB per Snowmobile, a 45-foot long ruggedized shipping container, pulled by a semi-trailer truck. Snowmobile makes it easy to move massive volumes of data to the cloud, including video libraries, image repositories, or even a complete data centre migration. Transferring data with Snowmobile is secure, fast, and cost effective.
Work with S3 over long geographic distances	Amazon S3 Transfer Acceleration	Amazon S3 Transfer Acceleration enables fast, easy, and secure transfers of files over long distances between your client and your Amazon S3 bucket. Transfer Acceleration leverages Amazon CloudFront's globally distributed AWS Edge Locations. As data arrives at an AWS Edge Location, it is routed to your Amazon S3 bucket over an optimised network path.
An offline way to move data in large batches so you can:		
Integrate existing on-prem resources with the cloud	AWS Storage Gateway 3rd Party Gateways	The AWS Storage Gateway service enables hybrid storage between on-premises environments and the AWS Cloud. It seamlessly integrates on-premises enterprise applications and workflows with Amazon's block and object cloud storage services through industry standard storage protocols. It provides low-latency performance by caching frequently accessed data on-

		premises, while storing data securely and durably in AWS Cloud storage services.
Physically transport petabytes of data in an appliance with on-board storage and compute capabilities	AWS Snowball Edge	AWS Snowball Edge is a 100TB data transfer device with on-board storage and compute capabilities.
Push backups or archives to the cloud with minimal disruption	Technology Partnerships	AWS has partnered with industry vendors to make it very easy to bring your backups and archives into the cloud. The simplest way to move your data may be via an Amazon S3 connector embedded in your existing backup software. The clear advantage to this approach is that the backup catalogue stays consistent, so you maintain visibility and control across jobs that span disk, tape and cloud.
Collect and ingest multiple streaming data sources	Amazon Kinesis Data Firehose	Amazon Kinesis Data Firehose is the easiest way to load streaming data into data stores and analytics tools. It can capture, transform, and load streaming data into Amazon S3, Amazon Redshift, Amazon Elasticsearch Service, and Splunk, enabling near real-time analytics with existing business intelligence tools and dashboards you're already using today.

9.3 Migration Partner Solutions

Enterprises migrating to AWS require expertise, tools, and alignment of business and IT strategy. Another option to accelerate your migration, and time to results, is through partnership. The [AWS Partner Competency Program](#) has validated which partners have demonstrated that they can help enterprise customers migrate applications and legacy infrastructure to AWS – see [Migration Partner Solutions](#) for details.

9.4 Application Migration Methodology

To illustrate commonalities in a cloud migration, Error! Reference source not found. below displays an application migration methodology. The methodology outlined provides a standardised general process of migration. It also contains the work products in each phase commonly performed as part of application migrations. They are not intended to operate in sequence, but can be multi-threaded, with some activities being performed concurrently.

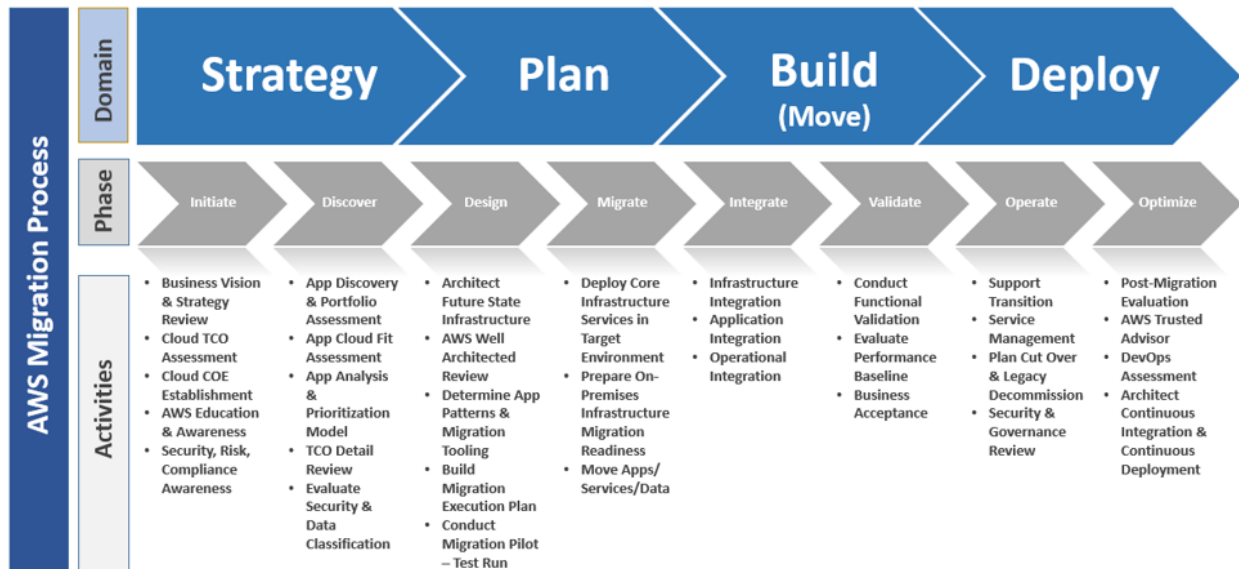


Figure 19 – AWS Application Migration Methodology

Some of the AWS Cloud's native features and services for cloud migration such as [AWS Database Migration Service](#), [AWS Server Migration Service](#), and [AWS Snowball](#) are described in the whitepaper [An Overview of AWS Cloud Data Migration Services](#).

10.0 Case Studies

AWS has dedicated teams focused on helping our customers in government organisations pave the way for innovation and, ultimately, make the world a better place through technology. The AWS website contains information detailing [AWS customer success stories in the UK public sector](#).

There are over one hundred thousand active UK AWS customers. Below are a few example case studies:

10.1 Central Government

10.1.1 Ministry of Justice

Summary

[Ministry of Justice \(MoJ\)](#) is using AWS to modernise their technology and make the justice system more efficient for citizens. By moving to the AWS Cloud, the MoJ can use technology to enhance the effectiveness and fairness of the services it provides to British citizens.

The MoJ is a ministerial department of the UK government. MoJ had an on-premises data centre but lacked the ability to change and adapt rapidly to the needs of citizens. As more digital services were created, MoJ turned to AWS to automate, consolidate, and deliver constituent services.

By using AWS Cloud services like Amazon EC2, Amazon Simple Storage Service (Amazon S3), and Route 53, MoJ has been able to use technology as an enabler for justice to be fair and more effective. AWS is helping the MoJ digital team drive down the cost and time it takes to create and deliver these new services securely. MoJ Digital is using AWS for a growing number of citizen services, with 19 currently in production.

Quote

“Public cloud has had a transformational effect on the Ministry of Justice. We can adapt to user need, we can listen to the data that we’re getting about how people are using our services, and we can build much more effective software than if we were constrained by the environment that we were delivering on to”

David Rogers, Head of Architecture and Security, UK Ministry of Justice

Services referenced

- Amazon Elastic Compute Cloud (Amazon EC2)
- Amazon Simple Storage Service (Amazon S3)
- Amazon Route 53

Links

- [Case study](#)
- [Presentation by Tom Read, Chief Digital and Information Officer, Ministry of Justice](#)

10.1.2 Driver and Vehicle Licensing Agency

Summary

[Driver and Vehicle Licensing Agency \(DVLA\)](#) maintains the registration and licensing of drivers in Great Britain, the registration and licensing of vehicles, and is responsible for the collection and enforcement of VED in the UK.

The DVLA hold 47.9 million driver records, representing 91% of the population of the UK over the age of 16 and their Driver and Vehicle registers are National Information Infrastructure. They processed almost 50 million licensing transactions in 2016/7 with an impressive 68% processed online. They also collect around £6 billion each year in vehicle tax.

DVLA has a cloud-first strategy, with the AWS EU (London) Region being the destination of choice for many of their services including their Strategic Card Payments platform which helps the DVLA achieve PCI DSS compliance and supports 3D secure payments. In the last 12 months, the DVLA processed 17.5 million online payment transactions, taking around £2.5 billion. Their Vehicle Excise Duty (VED) Calculation Service, which determines the amount of VED for any vehicle, and the Vehicle Enquiry Service API, which is the start of the DVLA’s API platform, also run in the UK region.

The Vehicle Enquiry Service API uses serverless architecture including AWS API Gateway and Lambda, and is designed to handle over 1 billion requests per month. It was stood up in development in less than a week and went into production in just ten weeks.

Quote

“We stood up a working prototype in just a few days using Amazon API Gateway. The speed with which we were able to deliver it was unprecedented.”

Matt Lewis, Chief Architect, Driver and Vehicle Licensing Agency

Services referenced

- Amazon API Gateway
- AWS Lambda

Links

- [Case study](#)

10.1.3 Driver and Vehicle Standards Agency

Summary

[Driver and Vehicle Standards Agency \(DVSA\)](#) helps Great Britons stay safe on their roads by setting standards for driving and motorcycling and making sure that drivers, vehicle operators, and MOT garages follow roadworthiness standards. DVSA also provides a range of licensing, testing, education, and enforcement services. One cornerstone of these standards is the MOT test, a compulsory annual test for safety and exhaust emissions of motor vehicles of more than a specified age.

DVSA deliver MOT as a digital service directly to over 23,000 UK garages with over a million transactions per week. With ten weeks to go-live and based on the finding of an independent cloud assessment, the DVSA took the key decision to move to AWS—making them the first national agency to do so. They chose AWS for their experience in the cloud and the scalability, reliability, and security, needed by this important service for British motorists.

Since going live on the AWS Cloud, DVSA has recorded over 45 million tests. This has enabled garages to issue 150,000 Ministry of Transport (MOT) test results every day, equating to more than 250 tests per minute. The system is in constant use by around 60,000 MOT testers in 22,700 garages across Great Britain. DVSA continue to improve the MOT service, using agile delivery and new releases issued on a weekly basis, with close to 200 made since moving to AWS

Quote

"AWS enabled DVSA to rapidly develop and deploy new services that would meet the needs of its customers"

James Munson, Director of Digital Services and Technology, Driver and Vehicle Standards Agency

Services referenced

- Amazon Relational Database Service (Amazon RDS)
- AWS Support

Links

- [Case study](#)

10.1.4 The Met Office

Summary

[The Met Office](#) has been providing weather information for more than 160 years and is a widely respected national weather service in the UK.

The Met Office is using AWS to support the Met Office Weather App - available for iOS and Android - and, since it went live in January 2016, has attracted more than half a million users. The Met Office now has a cloud operations team with five specialists and has been able to increase agility, speed, and scalability while reducing costs.

The Met Office has reported that, in addition, they have removed more than 50 percent of the cost of their initial design compared to an on-premises solution. The automation of traditionally time-consuming workloads enables the organisation to iterate and release new applications 30 times more frequently. In addition, the Met Office can rapidly scale up when the workload grows and then shut down resources that are no longer required. With AWS, infrastructure provisioning has gone from months to minutes and getting data to a customer now takes 10 seconds instead of 10 minutes. The Met Office data storage now also scales almost linearly by 1,000 percent, whereas the previous architecture could not support a 50 percent increase.

Quote

"Our data storage scales by 1,000 percent with AWS, whereas the legacy system couldn't support a 50 percent increase."

James Tomkins, Chief Architect, Met Office

Services referenced

- Amazon Elastic Compute Cloud (Amazon EC2)
- AWS Lambda

- Amazon Simple Storage Service (Amazon S3)
- Amazon Relational Database Service (Amazon RDS)
- Amazon ElastiCache
- Amazon API Gateway
- Amazon EC2 Container Service (Amazon ECS)
- Amazon Direct Connect

Links

- [Case study](#)

10.1.5 MirrorWeb

Summary

[MirrorWeb](#) provides the digital history of the UK Government by archiving all government websites and social media feeds. MirrorWeb helped the UK National Archives move 120 TB of data to the cloud. Twenty years of data, 480 websites, and 1.2 million files without index made the move a challenge, but MirrorWeb migrated the data to the AWS Cloud in two weeks using AWS Snowball and AWS Lambda. The company processed the data in Amazon S3, and ran AWS Lambda functions as the data was written, indexing 144 million documents in an hour. The total cost of the data transfer was \$25.

Services referenced

- AWS Snowball
- AWS Lambda
- Amazon Simple Storage Service (Amazon S3)

Links

- [Case study](#)

10.1.6 UK Data Service

Summary

The UK Data Service is using Amazon Web Services to provide highly secure access to data via scalable APIs, providing new ways for researchers, citizens, policymakers, and businesses to get value from the United Kingdom's data resources. The UK Data Service provides unified access to the United Kingdom's largest collection of social, economic, and population data. The Service will ingest data using a customized open-source infrastructure running on Amazon EC2, hosting the cloud portion of its data lake on Amazon S3.

Quote

“Working with AWS means we can deliver greater value for public investment than if we tried to build infrastructure on our own. AWS has demonstrated its commitment to helping us innovate with disruptive technologies with a clear pathway to core operational infrastructure.”

Nathan Cunningham, Associate Director, UK Data Service

Services referenced

- Amazon Elastic Compute Cloud (Amazon EC2)
- Amazon Simple Storage Service (Amazon S3)
- Amazon Relational Database Service (Amazon RDS)

Links

- [Case study](#)

10.1.7 National Rail Enquiries

Summary

National Rail Enquiries (NRE) provides a centralized online service for Train Operating Companies (TOCs) in the UK. The company was created by a number of train operators in 1996, when the industry went to a privatized approach.

Prior to signing on with Amazon Web Services (AWS), NRE operated two traditional data centres, each of which hosted more than 100 physical servers. To maintain consistent service, NRE maintained enough servers so that the site had the potential at all times to handle loads three to four times that of a normal day. The solution needed to be prepared for the kind of high-capacity loads that occur during rail service disruptions, such as heavy snows.

NRE looked at both infrastructure providers and IT consultants at the same time, and ultimately selected Amazon Partner Network (APN) Premiere Consulting Partner KCOM as a consultant and AWS for commoditized infrastructure provision. Using AWS enabled NRE to save about 20 percent in infrastructure costs and makes it easier to provision and make changes.

NRE sees the AWS solution as very successful, particularly in terms of availability for its customers. On the day NRE launched the new system, the UK experienced its worst storm in 30 years. The load was 60 percent higher than the previous busiest day, but the service remained largely available, and site users were able to access the system throughout the storm. NRE's adoption of the commoditized infrastructure has been so successful that other companies within the rail industry are looking at how they can adopt some of the same strategies.

Quote

“By using AWS, we’ve been able to reduce infrastructure costs by 20 percent and gained the flexibility to react dynamically to demand”

Gary Ashby, Hosting Strategy Lead, National Rail Enquiries

Services referenced

- Amazon Elastic Compute Cloud (Amazon EC2)
- Elastic Load Balancing
- Amazon Relational Database Service (Amazon RDS)

Links

- [Case study](#)

10.2 Local Government

10.2.1 Transport for London

Summary

[Transport for London \(TfL\)](#) is London’s transport authority, responsible for all forms of transport from the tube, DLR, and trains to trams, buses, taxis, and cycles, walking and driving.

TfL has been able to build a website on AWS with a greatly improved user experience across mobile, tablet, and desktop that can rapidly scale to 30x normal traffic in busy periods and is now regularly supporting 81% of Londoners and over 20 million visits per month using AWS. TfL's extensive open data API has also seen more than 2,000 new developers sign up to access live information in the last six months, helping millions of Londoners plan their journeys more easily across the Capital. As a result, 90% of customers now say they are satisfied with TfL’s website services, the highest number ever recorded.

Using AWS, TfL can supply their web application across many platforms and devices and innovate more quickly for customers. The scalability of the AWS Cloud was immediately visible to TfL when, one month after launching, industrial action on the Tube led to significantly increased website demand, peaking at over one million pages an hour. The new service performed flawlessly and maintained full availability throughout.

Services referenced

- Amazon Elastic Compute Cloud (Amazon EC2)
- Amazon Simple Storage Service (Amazon S3)
- Amazon Route 53
- Amazon Simple Queue Service (Amazon SQS)
- Amazon Relational Database Service (Amazon RDS)

- Amazon Simple Notification Service (Amazon SNS)
- Amazon Simple Storage Service Glacier

Links

- [Case study](#)
- [Presentation by Phil Young, Head of TfL Online, Transport for London](#)

10.2.2 Peterborough City Council

Summary

[Peterborough City Council](#) is using the security of the AWS Cloud to process and store sensitive data relating to the citizens of Peterborough. The council has taken a cloud first strategy and moved their entire IT infrastructure to AWS to help towards cutting £25 million from their budget.

The council is moving all of their technology systems, including sensitive data and personally identifiable information. What attracted the council to AWS was the high availability they could achieve and the high levels of security. By gaining access to security tools such as encryption and a highly accredited infrastructure, the council believes they are improving their security posture by moving from on-premises to the AWS Cloud.

Links

- [Presentation by Richard Godfrey, Assistant Director Digital, Peterborough City Council](#)

10.2.3 Aylesbury Vale District Council

Summary

[Aylesbury Vale District Council \(AVDC\)](#) has saved around £6 million by moving all of their IT to AWS, and are the first council in the country to do so. Now the council is using AWS to help leverage AI to transform internal operations and improve customer interactions as part of a five-year strategy to improve efficiencies and reduce costs. Working with APN Partner Arcus Global, AVDC is the first council in the UK to use AI-powered voice control - using Amazon Lex - to serve residents' needs.

One part of the new five-year strategy will focus on allowing customers to self-serve, allowing them to see their own data and amend it as and when necessary; for example, customers can manage their details, pay/view their council tax, order new/replacement garbage bins, and more. This will allow the council to cut costs, as on average it costs 0.17p per website visit to resolve a query, compared to £5 per phone call and £14 for a face-to-face visit.

Links

- [Case study](#)

10.3 Health

10.3.1 NHS Business Services Authority

Summary

[NHS Business Services Authority \(NHS BSA\)](#) uses AI to handle calls for the European Health Insurance Card (EHIC) Prescription Prepayment Certificate (PPC) and HR Shared Services.

They had a specific business challenge in that a high volume of calls being handled by agents were simple requests for information. The volume of these calls led to a longer wait time for callers, and consequently higher costs for NHS BSA. By routing incoming calls through an Amazon Lex-enabled chatbot, which understands natural language and intent without requiring callers to use specific phrases, 42% of calls were resolved without ever being attended by a human operator.

This represented a saving of approximately £520,000, drastically reduced wait times for callers, and provided more time to focus on calls that require human expertise. Less than one week after the trial period began, NHS BSA were able to adopt a 24/7 call centre.

This improvement in cost, time, and patient outcomes is typical of a successful adoption of cloud services. Lead Cloud Architect for NHS BSA Chris Suter said: “As a public-sector agency, we spend taxpayer money. We need to show value for that. In our partnership with Arcus Global and by using Amazon Connect, BSA satisfies that public need and provides savings to NHS that can be funnelled back into better healthcare.”

Quotes

“As a public-sector agency, we spend taxpayer money. We need to show value for that. In our partnership with Arcus Global and by using Amazon Connect, BSA satisfies that public need and provides savings to NHS that can be funnelled back into better healthcare.”

Chris Suter, Lead Cloud Architect, NHS Business Services Authority

Services referenced

- Amazon Connect
- Amazon Lex

Links

- [Case study](#)

10.3.2 National Institute for Health Research (NIHR)

Summary

The UK's National Institute for Health Research (NIHR) plays a fundamental role in the development of new health services and treatments in the UK by supporting the management and coordination of clinical trials in the NHS. The NIHR Clinical Research Network Coordinating Centre manages the Clinical Research Network (CRN) on behalf of the Department of Health.

By leveraging the AWS Cloud, 23,000 users across research teams, regulators, and other authorised individuals can now track the status of trials centrally through a single portal. This has simplified data collection through improvements to the workflow and user interface, and the platform's new design can accommodate future integrations with external systems. Additionally, when the public responds to appeals for research participants, the platform can scale up and down to handle spikes in traffic.

Quote

"Properly built application systems running on AWS, which are effectively configured, give the CRN a level of reliability, resilience, security, performance, flexibility, and future-proofing not previously experienced by the organisation. The CRN embraced 'cloud first' and have been able to decommission all on-premises data centre capability."

Nick Hirst, Chief Information Officer, Clinical Research Network Coordinating Centre

Links

- [Case study](#)

10.4 Not-for-profit Organisations

10.4.1 Institute of Cancer Research

Summary

[Institute of Cancer Research \(ICR\)](#) is one of the world's most influential cancer research institutes, with an outstanding record of achievement dating back more than 100 years. To date, scientists at the ICR have been working to identify the genes that cause cancer, understand the biology of tumours, and design new cancer treatments.

Using AWS and working with APN Partner Alces Flight, ICR has been able to calculate the exact dose of Photon radiation required by a cancer patient in near real-time. Using AWS, preliminary results by researchers have shown that not only were costs significantly reduced to a few US dollars per hour, but imaging runtimes fell from minutes to seconds (1.1 minutes to 10.9 seconds for simulating a clinical prostate and liver case up to 1% statistical uncertainty).

Anonymised data was used in the trial, which was run using instances based in the AWS EU (Dublin) Region. With further configuration, the team hopes to achieve real-time imaging processing to allow precise radiation treatment of only tumorous areas.

Links

- [Blog post](#)

10.4.2 JustGiving

Summary

[JustGiving](#) – Using AWS, JustGiving can rapidly scale their business while saving 30% on the cost of running a traditional data centre. JustGiving is one of the world's largest social platforms for giving that has helped 30 million users in 164 countries raise \$4.5 billion for over 41,000 good causes, including raising £4 million in donations for the support of the families of loved ones killed and injured in the attacks in Manchester.

During this time, peak traffic to the site was 10x the normal levels, and they managed 36,000 concurrent visits, driven in part by celebrities such as Ariana Grande and Eminem tweeting links to the donations page.

Charity donations are very much like eCommerce with the business being very peaky. Around big charity events, like the London Marathon, or social media events such as the IceBucket challenge, JustGiving needs to be able to scale to millions of concurrent users and afterward scale back down to a minimum again.

Using AWS, JustGiving can bring business analytics to their platform and added value to charities to help them understand how people are donating to maximise the fundraising that is possible. For charities, where funds for innovating is tight, this gives an invaluable insight.

Quote

"We're a trusted brand for 24 million users and 13,000 causes that are using us to raise funds. We wanted to find a solution for cloud services that we could bring into that trust network. AWS was really the only player for that."

Richard Atkinson, Chief Information Officer, JustGiving

Services referenced

- Amazon Elastic Compute Cloud (Amazon EC2)
- Auto Scaling
- Elastic Load Balancing
- Amazon ElastiCache
- Amazon Relational Database Service (Amazon RDS)
- Amazon Simple Storage Service (Amazon S3).

- Amazon Redshift
- Amazon Elastic MapReduce (Amazon EMR)
- Amazon Kinesis
- AWS Lambda
- Amazon DynamoDB
- Amazon Simple Queue Service (Amazon SQS)
- Amazon Simple Notification Service (Amazon SNS)

Links

- [Case study](#)

10.4.3 Comic Relief

Summary

[Comic Relief](#) – Using AWS allows Comic Relief to massively scale up their applications for the few hours of the year when donations peak. One such example is Red Nose Day which, since its launch in 1988, has become something of a British institution. It's the day, every two years when people across the land can get together and do something funny to raise money for charity. In 2017 Red Nose Day raised £74m.

AWS underpins much of the donation systems and infrastructure needed to scale with 100% uptime and reliability. For the rest of the year, Comic Relief run their operations on the AWS Cloud in a scaled-down form to minimize costs. On March 24th, 2017, during a seven-hour window, the service at its peak was capable of taking 300 donations a second across the web and mobile. AWS also supported the event with a dedicated team who spent the night with Comic Relief.

10.4.4 National Trust

Summary

[National Trust](#) – With more than four million members and more than 20 million visitors to its properties each year, the National Trust is the largest membership organisation in the United Kingdom. Its core purpose is to “protect historic places and spaces—forever, for everyone”. The Trust relies on its network of about 67,000 volunteers and up to 15,000 employees, depending on the time of year, to keep its extensive operations running smoothly and to give its members and visitors excellent experiences across the UK.

The National Trust is using AWS to create a 360-degree view of members and other supporters, including when and where they interact with the different arms of the organisation, providing insight into supporter interaction with the Trust including: where they're based, what their visiting patterns are, and how they use the Trust. Using AWS, the Trust created a data warehouse (Single Supporter View [SSV]) that holds data from multiple operational systems, including CRM, events booking, and the online shop.

Running the SSV data warehouse on the AWS Cloud is about a third of the Total Cost of O of hosting and licensing the data warehouse on traditional technologies. Moreover, with the system's capacity to scale, the Trust knows its current 3TB of data can easily be doubled or tripled without a corresponding increase in costs. If, for example, the Trust decides it wants to bring in twice the amount of data, there will only be a 20 percent increase in price, versus an entire hardware refresh, which is what would be required using traditional technologies. The National Trust worked with Sirocco Systems, a Standard APN Partner.

Quote

"We calculated that running our SSV data warehouse on AWS would be about a third of the TCO of hosting and licensing the data warehouse on traditional technologies."

Glen Yarwood, IT Operations Director, National Trust

Services referenced

- Amazon Redshift
- Amazon Elastic Compute Cloud (Amazon EC2)
- Amazon Simple Storage Service (Amazon S3)
- Amazon Virtual Private Cloud (Amazon VPC)

Links

- [Case study](#)

10.4.5 Royal National Institute for the Blind

Summary

[The Royal National Institute of Blind People \(RNIB\)](#) is a UK charity offering information, support, and advice to almost two million people in the UK with sight loss. For the past eight decades the RNIB's free talking book service has provided access to fiction and non-fiction books for adults and children and today has 25,000 titles available.

Using Amazon Polly, the RNIB is making even more titles accessible to members. Naturalness of speech is critical to captivating and engaging users and with Amazon Polly, the RNIB is able to create and distribute information that would otherwise not be accessible to the visually impaired. For example, now, with Amazon Polly, RNIB is able to make short shelf-life content, such as monthly magazines, accessible in a cost-effective way, something that was previously too expensive and time-consuming to deliver.

Services referenced

- Amazon Polly

Links

- [RNIB story on Amazon Echo](#)

10.4.6 Royal Opera House

Summary

Last year, London's Royal Opera House (ROH) conducted 478 performances, reaching 700,000 through its main stage performances. Ticket sales came at predictable peak times, yet these peaks were difficult and costly to manage with outdated IT. Wishing to simplify its infrastructure while creating a more accessible online ticket purchase experience that aligned with ROH's philosophy of creating better access to the arts, ROH looked for a better solution. Since migrating to the AWS Cloud, ticket purchase wait times have decreased from four hours to minutes.

Links

- [Case study](#)

10.4.7 Age UK

Summary

[Age UK](#) is the UK's largest charity dedicated to helping everyone make the most of later life. They have the vision to make the UK a great place to grow older and they work every day to achieve this by providing companionship, advice, and support for older people who need it most.

Scalability, cost savings, and security are key in delivering Age UK's services to more than 7 million people every year. In 2012, Age UK turned to AWS to help revamp their technology to better support the older generation in the UK.

The initial migration to the AWS Cloud allowed the team to launch a new server in minutes instead of the weeks it took previously with their on-premises environment. Since 2012, Age UK has shifted all of its development and testing environments into the cloud.

Quote

"One of the biggest benefits has been allowing our digital team to experiment and deliver services faster. We are able to spin up test environments and get new features out quicker. Before we were reactive. When we wanted to spin up servers, it would take a couple of weeks to put in a request, process the request, and then make improvements to the services,"

Richard Holland, Solutions Architect, Age UK

Services referenced

- AWS Snowball
- Amazon Simple Storage Service (Amazon S3)
- Amazon Elastic Compute Cloud (Amazon EC2)
- Amazon Relational Database Service (Amazon RDS)
- Amazon CloudFront
- AWS Elastic Beanstalk
- AWS CloudFormation

Links

- [Blog post](#)

10.5 Education

10.5.1 Universities and Colleges Admissions Service (UCAS)

Summary

[The Universities and Colleges Admissions Service \(UCAS\)](#), the British admission service for students applying to university, is part of the UK's critical national infrastructure as it matches students to universities.

For students and parents all over the UK, A-level results day is one of the most important moments in the calendar year. On this day, the number of people accessing the UCAS system in a short period of time is very high, and the UCAS website sees a huge spike in usage. Critical online systems can receive hundreds of logins per second with students logging on as early as possible to find out if they have been accepted onto their chosen course, and in total UCAS will handle in excess of a million logins during that one day.

Using AWS, UCAS can scale up for this single day when incredibly high numbers of users need their service. This is cost-effective as it eliminates the need to have expensive hardware under-utilised through periods of less intense activity. UCAS has also turned to AWS Cloud technology for a large proportion of its critical backend infrastructure.

Links

- [Case study](#)

10.5.2 Pearson

Summary

The cloud plays a major role in [Pearson's](#) transformation into a digital education company. Using AWS, the IT team created a platform product teams use to create next-generation apps for education without having to write code to connect infrastructure and service components. The containerized platform runs on AWS, which enables teams to

release features and updates globally at any time, and saves the company money compared to running the solution on-premises.

Links

- [Case study](#)

10.5.3 Career Colleges Trust

Summary

[Career Colleges Trust](#) helps 14-19 year olds take the next step to a fulfilling career by equipping them with the skills and experience they need to succeed. With AWS, the organisation developed a program that allows students to learn the skills to enter a career in the digital and technology industries. Their projects in the cloud have introduced participating students to technologies like machine learning and virtual reality. Students get involved in industry projects and develop enterprise and communication skills, to prepare them for work and life.

Links

- [Case study](#)

10.5.4 Blackboard

Summary

Blackboard, the world's leading provider of learner success-focused technology solutions and services for the education market, is going all in on AWS by moving 29 data centres on four continents to AWS.

Blackboard conducted an evaluation of major cloud platforms for the massive data centre migration, and ultimately chose AWS for its reliability and scalability. The company also plans to leverage a wide range of AWS compute, database, storage, and network connectivity services to support its network of 16,000 schools and organizations in more than 100 countries.

The migration will entail moving thousands of virtual machines and multiple petabytes of data from data centres in North America, Europe, Asia, and Australia.

Quote

“By using AWS, we can take advantage of not only the operational strengths and global scale of AWS, but also the increasingly formidable breadth of capabilities it provides,”

Peter George, Chief Product Officer, Blackboard

Links

- [Case study](#)

10.5.5 Ravensbourne University London

Summary

By using [AWS Elemental](#) for its video streaming services, Ravensbourne University has been able to reach a higher number of students with higher satisfaction. Ravensbourne is an innovative, industry-focused university located in the heart of London that specializes in the cross-section between creativity and technology. The university uses AWS as a way to educate their broadcast and television students by streaming both live and recorded content.

Services referenced

- AWS Elemental

Links

- [Case study](#)

11.0 Industry Analyst Reports

Gartner, Inc., a leading information technology research company, recently released its 2019 [Magic Quadrant for Cloud Infrastructure as a Service, Worldwide](#)^{2 3} report. Gartner positions AWS highest in the Leaders Quadrant of this new Magic Quadrant. Cloud IaaS, in the context of this Magic Quadrant, is defined by Gartner as “highly automated offering in which computing resources owned by a service provider, complemented by storage and networking capabilities, are offered to customers on demand.”

² Gartner, Magic Quadrant for Cloud Infrastructure as a Service, Worldwide, Raj Bala, Bob Gill, Dennis Smith, David Wright, July 2019. ID G00365830. Gartner does not endorse any vendor, product or service depicted in its research publications, and does not advise technology users to select only those vendors with the highest ratings. Gartner research publications consist of the opinions of Gartner's research organization and should not be construed as statements of fact. Gartner disclaims all warranties, expressed or implied, with respect to this research, including any warranties of merchantability or fitness for a particular purpose. The Gartner logo is a trademark and service mark of Gartner, Inc., and/or its affiliates, and is used herein with permission. All rights reserved.

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Source: Gartner (July 2019)

Figure 20 – 2019 Magic Quadrant for Cloud Infrastructure as a Service, Worldwide⁴

⁴ Changes to the IaaS report MQ graphic are not permitted (and no exceptions granted). The "no changes" rule applies to all text elements (including disclaimer). You are not allowed to add an AWS, Gartner or "other" logo or background. You cannot circle dots on the MQ graphic and you cannot show year-over-year comparisons of MQs. No Gartner quotes may be added.

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AWS, for the fourth consecutive year, is also positioned highest in execution and furthest in vision within the Leaders Quadrant of Gartner's 2018 [Magic Quadrant for Public Cloud Storage Services, Worldwide](#)⁵ report.



Figure 21 – Gartner 2018 Magic Quadrant for Public Cloud Storage Services, Worldwide

More analyst reports can be found at [AWS in Analyst Research](#).

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⁵ Gartner, Magic Quadrant for Public Cloud Storage Services, Worldwide, Raj Bala (Sr Director, Analyst), Julia Palmer (Sr Director, Analyst), published 31 July 2018 - ID G00340206.

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12.0 How to Buy AWS Cloud Services

Cloud computing provides public sector organisations with rapid access to flexible and low-cost IT resources. Organisations can provision the right type and size of computing resources they need to power their newest bright ideas or operate their IT departments, removing the need for large investments in hardware. As part of this effort, cloud computing presents an opportunity to re-evaluate existing procurement strategies in order to create a fast, flexible acquisition process that capitalises on the full scale and flexibility of the cloud. The acquisition of cloud services is unlike most traditional technology acquisitions in the public sector, and procurement considerations should be a key element of the cloud acquisition process in order to reap the benefits of decreasing cloud costs, increasing performance through improved infrastructure, and enhanced functionality through system-wide innovation.

AWS has published a whitepaper “10 Considerations for a Cloud Procurement” which is available online [here](#).

12.1 G-Cloud

Public sector organisations can use the [Digital Marketplace](#) to access cloud services through the UK G-Cloud framework. UK Government buyers can procure [250 AWS services on the Digital Marketplace](#) that are published on the current G-Cloud (G-Cloud 11) framework.

AWS offers guidance to help organisations through the creation of a valid call-off contract. AWS G-Cloud service offerings are augmented by AWS-based services offered by AWS Partner Network (APN) members.

12.2 CISPE Sample RFP

On May 28th 2019 the Cloud Infrastructure Services Providers in Europe (CISPE) published a new handbook Buying Cloud Services in Public Sector, available on the CISPE website at <https://cispe.cloud/1983-2/>.

The purpose of the Buying Cloud Services Handbook is to provide guidance to those Cloud customers wishing to purchase Cloud Services through a competitive procurement process, but lacking the expertise to draft a Cloud Framework Agreement.

The document is provided by CISPE for informational purposes only. It has not been developed in accordance with legal requirements for public procurement processes within any particular country or region.

The handbook also looks at additional selection criteria language for Call Offs or Mini Competitions when purchasing from a Cloud Framework Agreement. The sections of the handbook are organised to resemble a generic IT RFP. Sample generic RFP and selection criteria language is accompanied by commentary to help customers understand why a cloud RFP is different from a traditional IT RFP.

13.0 Sustainability

AWS has exceeded 50% renewable energy for our businesses and is committed to reaching 100% renewable energy. We have built nine renewable energy plants (wind and/or solar), with three more planned currently—two of which are in Europe. We intend to keep expanding this capability.

13.1 Cloud is Inherently Greener than On-Premises

Any analysis on the climate impact of a data centre should consider resource utilisation and energy efficiency, in addition to power mix. Carbon emissions are driven by three main factors: the number of servers running, the total energy required to power each server, and the carbon intensity of energy sources used to power these servers.

A typical large-scale cloud provider achieves approximately 65% server utilisation rates versus 15% on premises, which means when companies move to the cloud, they typically provision fewer than $\frac{1}{4}$ of the servers than they would on premises. In addition, a typical on-premises data centre is 29% less efficient in its use of power compared to a typical large-scale cloud provider that uses world-class facility designs, cooling systems, and workload-optimised equipment. Adding these together (fewer servers used plus more power efficient servers), customers only need 16% of the power as compared to on-premises infrastructure. This represents an 84% reduction in the amount of power required.

13.2 Keeping up with Our Commitment to 100% Renewable Energy

We've made a lot of progress on our commitment to 100% renewable energy usage, and carbon neutrality.

In addition to the nine existing renewable energy facilities built by Amazon, Amazon has announced three new wind farms. These projects—one in Ireland, one in Sweden, and one in the United States—will total over 229 megawatts (MW), with expected generation of over 670,000 megawatt hours (MWh) of renewable energy annually.

Once complete, these projects, combined with AWS's nine existing renewable energy projects, are expected to generate more than 2,700,000 MWh of renewable energy annually—equivalent to the annual electricity consumption of over 262,000 homes.

13.3 Making Amazon Carbon Neutral as a Whole

Amazon is committed to minimising our carbon emissions by optimising our transportation network, improving product packaging to drive efficiency in the distribution of products, implementing energy efficiency measures in our operations, and using renewable energy to run our business. We have also joined numerous industry partnerships to express support for action on climate change and to accelerate the transition to a low-carbon economy.

In 2019 we [announced Shipment Zero](#), Amazon's vision to make all Amazon shipments net zero carbon, with 50% of all shipments net zero by 2030. To track our progress on

this journey and as part of an overall commitment to sharing our sustainability goals, we plan to share Amazon's company-wide carbon footprint, along with related goals and programs, later this year.

As of March 2019, Amazon hosts solar energy systems on 47 fulfilment facility rooftops worldwide, with the capacity to generate over 85 MW of power. Amazon has set a goal to host solar energy systems at 50 fulfilment network buildings by 2020. In September 2016, Amazon announced Amazon Wind Farm Texas, a new 253 MW wind farm in Scurry County, Texas, that will generate 1,000,000 MWh of wind energy annually.

14.0 Corporate Social Responsibility

AWS, and Amazon more broadly, supports a number of programmes directed towards enhancing employability (particularly for service personnel and their dependents, and for young people) and a broad range of community activities.

14.1 Investment and Job Creation in the United Kingdom

AWS believes in the enormous potential for the UK adopting cloud technologies. The following statistics give a view of how we have supported jobs and growth in the United Kingdom:

- **£9.3 billion** invested since 2010 – more than any other country in Europe
- **25,000** full time permanent Amazon employees
- **373,000** companies and creative professionals building their businesses with Amazon Marketplace, Amazon Web Services and Kindle Direct Publishing
- **85,000+** jobs supported by independent businesses selling on Amazon Marketplace

14.2 AWS re:Start

In 2017, following the launch of the AWS London Region, AWS rolled out a UK-focused training and job placement programme called AWS re:Start. The programme has been designed to educate young adults, military veterans, members of the military reserve, those leaving the Armed Forces, and service spouses on the latest software development and cloud computing technologies.

AWS re:Start is the result of a close collaboration between the Ministry of Defence, QA Consulting (an APN Training Partner) and The Prince's Trust. In conjunction with members of the AWS Partner Network (APN) and customers, the programme aims to offer work placements to 1,000 people.

AWS re:Start training and work placements for the Armed Forces are delivered through the Ministry of Defence and the Career Transition Partnership (CTP). AWS is a signatory to the Armed Forces Covenant; and re:Start is an active expression of that commitment.

AWS re:Start accommodates participants at all levels of experience – even those with no previous technical knowledge. Participants who join AWS re:Start complete technical training classes, led by AWS certified instructors, and gain experience through on-the-job training. They learn about multi-tier architectures, application programming interfaces (APIs), and microservices. Training content for the AWS re:Start program is curated by AWS in collaboration with QA Consulting, who deliver the training courses.

Organisations that have pledged job placements to AWS re:Start include Annalect, ARM, Claranet, Cloudreach, Direct Line Group, EDF Energy, Funding Circle, KCOM, Sage, Tesco Bank, and Zopa. Participants completing the programme are eligible for many different technical positions within these companies, including sought-after entry level positions such as first-line help desk support, IT support analyst, software developer, IT support technician, network engineer, IT recruitment consultant, and IT sales roles.

The programme also provides them with the fundamental knowledge needed to start working with AWS to build technology start-up businesses. The Young Adults thread of AWS re:Start is delivered via The Prince's Trust Get into Technology initiative. In addition to technical training, the 'Get into Technology' programme supports students with mentoring, soft work skills, and help in applying for jobs including resume writing and interview skills.

In the seven months since the commencement of re:Start, 46 ex-military personnel and 15 young disadvantaged adults have been trained and have graduated from the programme (a further 50 military veterans and 30 young people will be trained before the end of 2017) 27 re:Start graduates have accepted job placements with AWS customers & partners, 6 of which have converted to permanent hires with Direct Line, Bboxx, Bluecoat Software, QA Consulting, Securestorm and Sage People) AWS have provided 4 placements to date in the Solution Architecture & Commercial Sales teams (3 young people / 1 Military veteran)

14.3 Amazon in the Community

The Amazon in the Community programme focuses on helping children and young people succeed in the digital world, and we support a range of local charities through England, Scotland and Wales around our fulfilment centres, customer service centre, development centres, Fashion Photography Studio and head office, to help improve the life outcomes of the next generation. The causes we support range from local schools to children's hospitals to Scout groups.

Amazon has been investing in the communities in which we operate for many years. Individuals, teams and entire sites actively participate to raise funds for and deliver monetary and product donations to charities in their local community.

Employees at each Amazon location are able to select the local charities and community organisations to which they wish to donate. Employees are invited to nominate charities, and the local Charity Committee then creates a shortlist of three

charities which employees vote on monthly. We also provide toys, books and Kindles to children in need throughout the festive season.

14.4 Amazon Breakfasts

Amazon is working in partnership with Magic Breakfast to help ensure that no child is too hungry to learn through the provision of healthy breakfasts. Research shows a strong positive link between children eating a nutritious breakfast at school and pupil attainment.

We are funding one million breakfasts in 77 schools across the UK in the 2017-18 school year, ensuring over 5,000 children a day get a nutritious breakfast and are able to start the day ready to learn.

14.5 In Kind Direct

In Kind Direct re-distributes products donated by retailers and manufacturers to charities working in the UK. Amazon is In Kind Direct's biggest donor – in 2016 more than 1,700 UK charities benefited from Amazon's donations of more than £1.2 million worth of goods.

Our goods have supported a range of charities including Community Youth Project, a charity working in Newbury; Y services for Young People, a charity based in Hampshire; Ripples Foundation, a charity focused on woman empowerment and youth development; and Alington House Community Association in County Durham.

Since 2009, Amazon has donated more than £3.4 million of products to thousands of charities across Britain through In Kind Direct.

14.6 Beanstalk

Amazon is working in partnership with the charity Beanstalk to help children improve their reading. Our funding enables community and employee volunteers to deliver one-to-one reading support to build confidence and ability among primary school children.

Beanstalk has set the ambition to support 18,000 children with their reading by 2018 and we are committed to helping the charity to reach this goal.

14.7 The Amazon Women in Innovation Bursary

The Amazon Women in Innovation Bursary is helping young women from less advantaged backgrounds fulfil their ambitions of a career in innovation and technology by providing financial support. We are supporting three students per year into the programme, and providing the funding over their four years of study.

The programme is run at universities in cities where we have a development centre, including the University of Edinburgh, King's College London and Churchill College at the University of Cambridge.

14.8 Enactus

Amazon is supporting Enactus, a charity which inspires student innovation. We are supporting Enactus's global student competition which celebrates projects that deliver social good.

Our employee volunteers provide business advice and personal development support to help build the social innovators of the future. We help coach project teams who have the opportunity to participate in a global project.

Appendix - Useful Links

AWS Overview

- What is Cloud Computing:
<https://aws.amazon.com/what-is-cloud-computing/>
- Types of Cloud Computing:
<https://aws.amazon.com/types-of-cloud-computing/>
- Choosing a Cloud Environment:
<https://aws.amazon.com/choosing-a-cloud-platform/>
- About AWS:
<https://aws.amazon.com/about-aws/>
- AWS Global Infrastructure:
<https://aws.amazon.com/about-aws/global-infrastructure/>
- AWS Data Centres:
<https://aws.amazon.com/compliance/data-center/data-centers/>

AWS Solutions

- Websites and Web Hosting:
<https://aws.amazon.com/websites/>
- Development and Test:
<https://aws.amazon.com/dev-test/>
- Backup and Recovery:
<https://aws.amazon.com/backup-recovery/>
- Data Archive:
<https://aws.amazon.com/archive/>
- Disaster Recovery:
<https://aws.amazon.com/disaster-recovery/>
- Big Data:
<https://aws.amazon.com/big-data/>
- High Performance Computing:
<https://aws.amazon.com/hpc/>
- Internet of Things:
<https://aws.amazon.com/iot/>
- Financial Services:
<https://aws.amazon.com/financial-services/>
- Health

<https://aws.amazon.com/health/>

- Life Sciences:
<https://aws.amazon.com/health/life-sciences/>
- Genomics:
<https://aws.amazon.com/health/genomics/>
- Business Applications:
<https://aws.amazon.com/business-applications/>
- DevOps:
<https://aws.amazon.com/devops/>
- Serverless:
<https://aws.amazon.com/serverless/>

AWS Products and Services

- List of all AWS Cloud services:
<https://aws.amazon.com/products/>
- AWS Marketplace:
<https://aws.amazon.com/marketplace/>
- AWS service documentation:
<http://aws.amazon.com/documentation/>

AWS in the Public Sector

- AWS Public Sector Homepage:
<https://aws.amazon.com/government-education/>
- Public Sector Resources:
<https://aws.amazon.com/government-education/resources/>
- State and Local Government:
<https://aws.amazon.com/stateandlocal/>
- Defence and Aerospace:
<https://aws.amazon.com/government-education/defense/>
- Education:
<https://aws.amazon.com/education/>
- AWS Educate:
<https://aws.amazon.com/education/awseducate/>
- Non-profit Organisations
<https://aws.amazon.com/government-education/nonprofits/>

- AWS Government Partners:
<https://aws.amazon.com/partners/government/>
- AWS Public Sector Blog:
<https://aws.amazon.com/blogs/publicsector/>
- Public Sector Customers:
<https://aws.amazon.com/solutions/case-studies/government-education/all-government-education-nonprofit/>

AWS Partner Network

- AWS Partner Network:
<https://aws.amazon.com/partners/>
- AWS Partner Directory:
<http://www.aws-partner-directory.com/>
- AWS Partner Programs:
<https://aws.amazon.com/partners/programs/>
- AWS Public Sector Partner Program:
<https://aws.amazon.com/partners/public-sector/>

AWS Professional Services

- AWS Professional Services:
<https://aws.amazon.com/professional-services/>
- AWS Cloud Adoption Framework:
<https://aws.amazon.com/professional-services/CAF/>

AWS Pricing

- AWS Pricing Overview:
<http://aws.amazon.com/pricing/>
- Pricing for each service:
<https://aws.amazon.com/pricing/services/>
- AWS Economics Center:
<https://aws.amazon.com/economics/>
- Cost Optimisation:
<https://aws.amazon.com/pricing/cost-optimization/>

- AWS Simple Monthly Calendar:
<http://calculator.s3.amazonaws.com/index.html>
- AWS TCO Calculator:
<http://aws.amazon.com/tco-calculator/>

AWS Billing

- AWS Cost Management:
<https://aws.amazon.com/aws-cost-management/>
- AWS Billing and Cost Management:
<http://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/billing-what-is.html>
- Consolidated Billing:
<http://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/consolidated-billing.html>
- Cost Explorer:
<http://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/cost-explorer-what-is.html>
- AWS Budgets and Forecasts:
<http://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/budgets-managing-costs.html>

AWS Security and Compliance

- AWS Security Center:
<http://aws.amazon.com/security/>
- AWS Shared Responsibility Model:
<http://aws.amazon.com/security/sharing-the-security-responsibility/>
- AWS Security Features:
<http://aws.amazon.com/security/aws-security-features/>
- AWS Compliance:
<http://aws.amazon.com/compliance/>
- AWS Data Privacy:
<http://aws.amazon.com/compliance/data-privacy-faq/>
- Access Control:
<http://aws.amazon.com/iam/>

- AWS Security Blog:
<https://blogs.aws.amazon.com/security/>

AWS Support

- AWS Support Tiers:
<https://aws.amazon.com/premiumsupport/>
- Support Knowledge Center:
<https://aws.amazon.com/premiumsupport/knowledge-center/>
- AWS Trusted Advisor:
<https://aws.amazon.com/premiumsupport/trustedadvisor/>

AWS Training and Best Practices

- AWS Training and Certification:
<http://aws.amazon.com/training/>
- AWS Architecture Center:
<http://aws.amazon.com/architecture/>
- AWS Quick Starts:
<https://aws.amazon.com/quickstart/>

Industry Analysis

- Analyst Reports:
<http://aws.amazon.com/resources/analyst-reports/>
- IDC Report: Quantifying the Business Value of Amazon Web Services:
http://d0.awsstatic.com/analyst-reports/IDC_Business_Value_of_AWS_May_2015.pdf
- IDC Marketscape: Worldwide Infrastructure as a Service 2017 Vendor Assessment:
https://d1.awsstatic.com/analyst-reports/IDC_MarketScape_IaaS_2017.pdf

AWS Case Studies

- AWS Case Studies:
<https://aws.amazon.com/solutions/case-studies/>

- Public Sector Case Studies:
<http://aws.amazon.com/solutions/case-studies/government-education/>

Procurement

- How to Buy Cloud:
<https://aws.amazon.com/how-to-buy/>
- AWS Public Sector Contract Center:
<http://aws.amazon.com/contract-center/>
- 10 Considerations for a Cloud Procurement Whitepaper:
<http://d0.awsstatic.com/whitepapers/10-considerations-for-a-cloud-procurement.pdf>
- How to Buy Cloud Computing Services for your Agency (Webinar):
<https://aws.amazon.com/webinars/buying-cloud-computing-services/>

AWS Legal

- AWS Customer Agreement:
<http://aws.amazon.com/agreement/>
- AWS Service Terms:
<https://aws.amazon.com/service-terms/>
- AWS Acceptable Use Policy:
<http://aws.amazon.com/aup/>
- AWS Trademark Guidelines:
<http://aws.amazon.com/trademark-guidelines/>
- AWS Site Terms:
<http://aws.amazon.com/terms/>
- AWS Privacy Policy:
<https://aws.amazon.com/privacy/>
- AWS Tax Help:
<http://aws.amazon.com/tax-help/>

Additional Resources

- AWS Blog:
<https://aws.amazon.com/blogs/aws/>
- AWS Discussion Forums:
<https://forums.aws.amazon.com/index.jspa>

- What's New from AWS:
<http://aws.amazon.com/new/>
- AWS YouTube Channel:
<https://www.youtube.com/user/AmazonWebServices>
- AWS Twitter Feed:
<https://twitter.com/awscloud>
- AWS on SlideShare:
<http://www.slideshare.net/AmazonWebServices>
- Events and Webinars
<https://aws.amazon.com/about-aws/events/>
- An E-Book of Cloud Best Practices:
<https://medium.com/aws-enterprise-collection/an-e-book-of-cloud-best-practices-for-your-enterprise-4a211840c55b#.corzpjf3m>
- Backup and Recovery Approaches Using AWS:
https://d0.awsstatic.com/whitepapers/Storage/Backup_and_Recovery_Approaches_Using_AWS.pdf

AWS Whitepapers

- AWS Whitepapers:
<http://aws.amazon.com/whitepapers/>
- Overview of AWS Whitepaper:
<http://d0.awsstatic.com/whitepapers/aws-overview.pdf>
- Security Resources and Whitepapers:
<http://aws.amazon.com/security/security-resources/>
- Introduction to AWS Security Processes:
https://d0.awsstatic.com/whitepapers/Security/Intro_Security_Practices.pdf
- AWS Compliance whitepapers:
<http://aws.amazon.com/compliance/aws-whitepapers/>
- AWS Risk and Compliance Whitepaper:
https://d0.awsstatic.com/whitepapers/compliance/AWS_Risk_and_Compliance_Whitepaper.pdf
- AWS Storage Services Overview:
<https://d0.awsstatic.com/whitepapers/Storage/AWS%20Storage%20Services%20Whitepaper-v9.pdf>