Reference Architecture for HIPAA on the AWS Cloud

Quick Start Reference Deployment

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This guide is also available in HTML format at https://docs.aws.amazon.com/quickstart/latest/compliance-hipaa/.
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About This Guide

This Quick Start reference deployment guide discusses architectural considerations and steps for deploying security-focused baseline environments on the Amazon Web Services (AWS) Cloud. Specifically, this Quick Start deploys a model environment that can help organizations with workloads that fall within the scope of the U.S. Health Insurance Portability and Accountability Act (HIPAA). The Quick Start addresses certain technical requirements in the Privacy, Security, and Breach Notification Rules under the HIPAA Administrative Simplification Regulations (45 C.F.R. Parts 160 and 164). The deployment guide includes links for viewing and launching AWS CloudFormation templates that automate the deployment.

This Quick Start is part of a set of AWS compliance offerings, which provide security-focused architecture solutions to help Managed Service Providers (MSPs), cloud provisioning teams, developers, integrators, and information security teams follow strict security, compliance, and risk management controls. For additional Quick Starts in this category, see the Quick Start catalog.
IMPORTANT: PLEASE READ

You must have an AWS Business Associate Addendum (BAA) in place, and follow its configuration requirements, before running protected health information (PHI) workloads on AWS. You should not use your AWS account in connection with PHI until you have accepted the AWS BAA and configured your AWS account(s) as required by the AWS BAA. Under HIPAA regulations, covered entities and business associates are responsible for putting in place a business associate agreement between themselves and each of their business associates. You are solely responsible for determining whether you and your organization need a business associate agreement with AWS. If you determine you need a business associate agreement with AWS, you can accept the AWS BAA through a self-service portal in AWS Artifact. It is your responsibility to obtain a BAA from AWS. For more information about the AWS BAA, please visit the AWS HIPAA Compliance webpage.

This Quick Start does not address state-specific laws that may apply to you. This Quick Start only addresses requirements set forth under HIPAA, a U.S. federal law. Many individual states have adopted rules that are different and in some cases, stricter than those that are federally mandated under HIPAA.

This Quick Start will not, by itself, make you HIPAA-compliant. The information contained in this Quick Start package is not exhaustive, and must be reviewed, evaluated, assessed, and approved by you in connection with your organization’s particular security features, tools, and configurations. The security controls reference document included with this Quick Start explains how this Quick Start can be used to help support your compliance with certain requirements under the HIPAA Privacy and Security Rules. However, it is the sole responsibility of you and your organization to determine which HIPAA regulatory requirements are applicable to you, and to ensure that you comply with those applicable requirements. Importantly, most of the requirements under HIPAA are not technical but administrative (that is, people- and process-oriented). Although the security controls reference that is included with this Quick Start lists and discusses both the technical and administrative requirements, this Quick Start cannot help you comply with the non-technical HIPAA requirements.
Does HIPAA Apply to Your Organization?

Customers are solely responsible for determining whether HIPAA applies to them, and if so, for complying with their obligations under HIPAA, the AWS BAA, and all other applicable laws, rules, and regulations. AWS does not provide legal or compliance advice. Customers should consult with qualified legal counsel or consultants, as needed, to ensure that their use of AWS complies with HIPAA, the terms of the AWS BAA, and other applicable laws, rules, and regulations.

Quick Links

If you have an AWS account that already meets the technical requirements for this Quick Start deployment, you can launch the Quick Start to build the architecture shown in Figure 2. The template is launched in the US East (N. Virginia) Region by default. If you have an AWS GovCloud (US) account, you can launch the template in the AWS GovCloud (US) Region.

The deployment takes approximately 30 minutes. If you're new to AWS or to configuring architectures for HIPAA workloads on AWS, please read the overview and follow the detailed pre-deployment and deployment steps described in this guide.

If you want to take a look under the covers, you can view the main template that automates this deployment. The main template includes references to child templates, and provides default settings that you can customize by following the instructions in this guide. For descriptions of the templates and guidance for using the nested templates separately, see the Templates Used in this Quick Start section of this guide.

To see how HIPAA regulatory requirements map to Quick Start architecture decisions, components, and configurations, view the security controls reference (Microsoft Excel spreadsheet). The excerpt in Figure 1 provides a sample of the available information.
We’d like your feedback  After you deploy this Quick Start, please take a few minutes to fill out our survey. Your response is anonymous and will help us improve this and other compliance-related reference deployments.

About Quick Starts

Quick Starts are automated reference deployments for key workloads on the AWS Cloud. Each Quick Start launches, configures, and runs the AWS compute, network, storage, and other services required to deploy a specific workload on AWS, using AWS best practices for security and availability.

Overview

AWS Compliance Architectures

AWS compliance solutions help streamline, automate, and implement secure baselines in AWS—from initial design to operational security readiness. They incorporate the expertise of AWS solutions architects, security, and compliance personnel to help you build a secure and reliable architecture easily through automation.

This Quick Start includes AWS CloudFormation templates, which can be integrated with AWS Service Catalog, to automate building a baseline architecture that fits within your organization’s larger HIPAA compliance program. It also includes a security controls
reference, which maps HIPAA regulatory requirements to architecture decisions, features, and configuration of the baseline.

**Architecture for HIPAA on AWS**

Deploying this Quick Start builds a multi-tier, Linux-based web application in the AWS Cloud. Figures 2 and 3 illustrate the architecture.

**Note** You can also [download these diagrams](#) in Microsoft PowerPoint format, and edit the icons to reflect your specific workload.

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**Figure 2:** Standard three-tier web architecture for HIPAA on AWS depicting integration with multiple VPCs (notional development VPC shown)
The sample architecture includes the following components and features:

- Basic AWS Identity and Access Management (IAM) configuration with custom IAM policies, with associated groups, roles, and instance profiles
- Standard, external-fac ing Amazon Virtual Private Cloud (Amazon VPC) Multi-AZ architecture with separate subnets for different application tiers and private (backend) subnets for application and database
- Amazon Simple Storage Service (Amazon S3) buckets for encrypted web content, logging, and backup data
- Standard Amazon VPC security groups for Amazon Elastic Compute Cloud (Amazon EC2) instances and load balancers used in the sample application stack
- Three-tier Linux web application using Auto Scaling and Elastic Load Balancing, which can be modified and/or bootstrapped with customer application
- A secured bastion login host to facilitate command-line Secure Shell (SSH) access to Amazon EC2 instances for troubleshooting and systems administration activities

Figure 3: Production VPC design for HIPAA on AWS
• Encrypted, Multi-AZ Amazon Relational Database Service (Amazon RDS) MySQL database

• Logging, monitoring, and alerts using AWS CloudTrail, Amazon CloudWatch, and AWS Config rules

• Encrypted secondary EBS volumes on all EC2 instances

AWS Services

The core AWS components used by this Quick Start include the following AWS services. (If you are new to AWS, see the Getting Started with AWS.)

• **AWS CloudTrail** – AWS CloudTrail records AWS API calls and delivers log files that include caller identity, time, source IP address, request parameters, and response elements. The call history and details provided by CloudTrail enable security analysis, resource change tracking, and compliance auditing.

• **Amazon CloudWatch** – Amazon CloudWatch is a monitoring service for AWS Cloud resources and the applications you run on AWS. You can use Amazon CloudWatch to collect and track metrics, collect and monitor log files, set alarms, and automatically react to changes in your AWS resources.

• **AWS Config** – AWS Config is a fully managed service that provides you with an AWS resource inventory, configuration history, and configuration change notifications to enable security and governance. AWS Config rules enable you to automatically check the configuration of AWS resources recorded by AWS Config. 

  **Note** The AWS Config rules feature is currently available in the AWS Regions listed on the AWS Regions and Endpoints webpage.

• **Amazon EBS** – Amazon Elastic Block Store (Amazon EBS) provides persistent block-level storage volumes for use with Amazon EC2 instances in the AWS Cloud. Each Amazon EBS volume is automatically replicated within its Availability Zone to protect you from component failure, offering high availability and durability. Amazon EBS volumes provide the consistent and low-latency performance needed to run your workloads.

• **Amazon EC2** – The Amazon Elastic Compute Cloud (Amazon EC2) service enables you to launch virtual machine instances with a variety of operating systems. You can choose from existing Amazon Machine Images (AMIs) or import your own virtual machine images.
• **Elastic Load Balancing** – Elastic Load Balancing automatically distributes traffic across multiple EC2 instances, to help achieve better fault tolerance and availability.

• **Amazon Glacier** – Amazon Glacier is a storage service for archiving and long-term backup of infrequently used data. It provides secure, durable, and extremely low-cost storage, supports data transfer over SSL, and automatically encrypts data at rest. With Amazon Glacier, you can store your data for months, years, or even decades at a very low cost.

• **Amazon RDS** – Amazon Relational Database Service (Amazon RDS) enables you to set up, operate, and scale a relational database in the AWS Cloud. It also handles many database management tasks, such as database backups, software patching, automatic failure detection, and recovery, for database products such as MySQL, MariaDB, PostgreSQL, Oracle, Microsoft SQL Server, and Amazon Aurora. This Quick Start includes a MySQL database by default.

• **Amazon VPC** – The Amazon Virtual Private Cloud (Amazon VPC) service lets you provision a private, logically isolated section of the AWS Cloud where you can launch AWS services and other 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.

**HIPAA Eligible Services**

You must process, store, and transmit protected health information (PHI) using only HIPAA Eligible Services, as defined in the AWS BAA. The most current list of HIPAA Eligible Services can be found at [https://aws.amazon.com/compliance/hipaa-eligible-services-reference/](https://aws.amazon.com/compliance/hipaa-eligible-services-reference/). You may use the full range of AWS services with non-PHI data, even in a HIPAA Account under the AWS BAA.
Best Practices
The architecture built by this Quick Start supports AWS best practices for high availability and security:

- Multi-AZ architecture intended for high availability
- Isolation of instances between private/public subnets
- Security groups limiting access to only necessary services
- Network access control list (ACL) rules to filter traffic into subnets as an additional layer of network security
- A secured bastion host instance to facilitate restricted login access for system administrator actions
- Standard IAM policies with associated groups and roles, exercising least privilege
- Monitoring and logging; alerts and notifications for critical events
- S3 buckets (with security features enabled) for logging, archive, and application data
- Implementation of proper load balancing and Auto Scaling capabilities
- HTTPS-enabled Elastic Load Balancing (ELB) load balancers with hardened security policy
- Amazon RDS database backup and encryption
- HTTPS to the endpoint. Traffic is carried encrypted to the ELB load balancer, and then sent encrypted to the instance.

How You Can Use This Quick Start
You can use this Quick Start to build an environment that serves as an example for learning, as a prototyping environment, or as a baseline for customization.

Since AWS provides a very mature set of configuration options (and new services are being released all the time), this Quick Start provides security templates that you can use for your own environment. These security templates (in the form of AWS CloudFormation templates) provide a comprehensive rule set that can be systematically enforced. You can use these templates as a starting point and customize them to match your specific use cases.
Cost
You are responsible for the cost of the AWS services used while running this Quick Start reference deployment. There is no additional cost for using the Quick Start. The AWS CloudFormation templates for this Quick Start include configuration parameters that you can customize. Some of these settings will affect the cost of deployment. For cost estimates, see the pricing pages for each AWS service you will be using. Prices are subject to change.

AWS CloudFormation Templates
An AWS CloudFormation template is a JSON (JavaScript Object Notation) or YAML-formatted text file that describes the AWS infrastructure needed to run an application or service along with any interconnections among infrastructure components. You can deploy a template and its associated collection of resources (called a stack) by using the AWS Management Console, the AWS Command Line Interface (AWS CLI), or the AWS CloudFormation API. AWS CloudFormation is available at no additional charge, and you pay only for the AWS resources needed to run your applications. Resources can consist of any AWS resource you define within the template. For a complete list of resources that can be defined within an AWS CloudFormation template, see the AWS Resource Types Reference in the AWS documentation.

AWS CloudFormation Stacks
When you use AWS CloudFormation, you manage related resources as a single unit called a stack. In other words, you create, update, and delete a collection of resources by creating, updating, and deleting stacks. All the resources in a stack are defined by the stack’s AWS CloudFormation template.

To update resources, you first modify the stack templates and then update the stack by submitting the modified template. You can work with stacks by using the AWS CloudFormation console, AWS CloudFormation API, or AWS CLI.

For more information about AWS CloudFormation and stacks, see Get Started in the AWS CloudFormation documentation.

Templates Used in this Quick Start
This Quick Start uses nested AWS CloudFormation templates to deploy the architecture for a multi-tier, Linux-based web application.

The Quick Start consists of a main template and seven child templates: IAM, logging, production VPC, management VPC, Config rules, NAT instance, and application. These
templates are designed to deploy the architecture within stacks that align with AWS best practices and the security compliance framework. The following table describes each template and its dependencies. To view the child templates, see the GitHub repository.

<table>
<thead>
<tr>
<th>Stack and template</th>
<th>Description</th>
<th>Dependencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main stack</strong></td>
<td>Primary template file that deploys the rest of the stacks and passes parameters between nested templates automatically.</td>
<td>None</td>
</tr>
<tr>
<td>(main.template)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or see GovCloud version</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IAM stack</strong></td>
<td>Creates a basic IAM configuration with custom policies, groups, and roles.</td>
<td>None</td>
</tr>
<tr>
<td>(iam.template)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Logging stack</strong></td>
<td>Sets up baseline AWS Config rules for monitoring. Enables AWS CloudTrail, S3 buckets, and bucket policies for logging and archive data. Creates standard Amazon CloudWatch alarms for security-related CloudTrail events.</td>
<td>None</td>
</tr>
<tr>
<td>(logging.template)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Production VPC stack</strong></td>
<td>Configures a secure VPC for a public-facing application that includes subnets, NAT instances, route tables, and custom network access control list (network ACL) rules.</td>
<td>None</td>
</tr>
<tr>
<td>(vpc-production.template)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Management VPC stack</strong></td>
<td>Configures a secure VPC for management functions that support the production VPC, and includes subnets, NAT, route tables, custom network access control list (network ACL) rules, and a restricted, public-facing bastion host to support a secured login path for administrator access.</td>
<td>Production VPC stack</td>
</tr>
<tr>
<td>(vpc-management.template)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Config rules stack</strong></td>
<td>Sets up baseline AWS Config rules for monitoring.</td>
<td>IAM, Production VPC, and Management VPC stacks</td>
</tr>
<tr>
<td>(config-rules.template)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NAT instance stack</strong></td>
<td>Conditionally launched by the Management and Production VPC templates to set up EC2 instances for NAT.</td>
<td>None</td>
</tr>
<tr>
<td>(nat-instance.template)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Application stack</strong></td>
<td>Sets up EC2 instances for reverse proxy and web application, an Amazon RDS database, HTTPS Elastic Load Balancing, Amazon CloudWatch alarms, and Auto Scaling groups.</td>
<td>Production VPC stack</td>
</tr>
<tr>
<td>(application.template)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The AWS CloudFormation template `main.template` is the entry point for launching the entire architecture, and also allows parameters to be passed into each of the nested stacks. The JSON templates for those nested stacks deploy the resources for the architecture.

To deploy the entire architecture (including IAM and Amazon VPC), use `main.template` when launching the stacks. To deploy the full package, the IAM user must have permissions
to deploy the resources each template creates, which includes IAM configuration for groups and roles.

You can also edit **main.template** to customize stacks or to omit stacks to be deployed. This can be useful for provisioning teams who must deploy the initial base architecture in accounts for application owners. For more information about deployment options and use cases, see [Deployment Methods](#).

Additionally, you can deploy each stack independently. However, this requires that you pass individual parameters to each template upon launch, instead of relying on the main template to pass these values automatically.

### Managing the Quick Start Source Files

We’ve provided a [GitHub repository](https://github.com/) for the tools and templates for this Quick Start so you can modify, extend, and customize them to meet your needs. You can also use your own Git or Apache Subversion source code repository, or use [AWS CodeCommit](https://aws.amazon.com/codecommit/). This is recommended to ensure proper version control, developer collaboration, and documentation of updates.

The GitHub repository for this Quick Start includes the following directories:

<table>
<thead>
<tr>
<th>Directory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>assets</td>
<td>Security controls matrix, architecture diagrams, and landing page assets</td>
</tr>
<tr>
<td>templates</td>
<td>AWS CloudFormation template files for deployment</td>
</tr>
<tr>
<td>submodules</td>
<td>Scripts and sub-templates used by the Quick Start templates</td>
</tr>
</tbody>
</table>

**Uploading the Templates to Amazon S3**

The Quick Start templates are available in an Amazon S3 bucket for Quick Starts. If you’re using your own S3 bucket, you can upload the AWS CloudFormation templates by using the AWS Management Console or the AWS CLI, by following these instructions.

**Using the Console**

1. Sign in to the AWS Management Console and open the Amazon S3 console at [https://console.aws.amazon.com/s3/](https://console.aws.amazon.com/s3/).

2. Choose a bucket to store the templates in.

3. Choose **Upload** and specify the local location of the file to upload.

4. Upload all template files to the same S3 bucket.
5. Find the template URLs by selecting each template file, and then choosing Properties. Make a note of the URLs.

**Using the AWS CLI**
2. Use the following AWS CLI command to upload each template file:

   ```bash
   aws s3 cp <template file>.template s3://<s3bucketname>/
   ```

**Updating the Amazon S3 URLs**
The template for the main stack lists the Amazon S3 URLs for the nested stacks. If you upload the templates to your own S3 bucket and would like to deploy the templates from there, you must modify the Resources section of the `main.template` file.

**Planning the Deployment**

**Prerequisites**

**AWS Business Associate Addendum**
Before you use AWS services with protected health information (PHI), you must accept the [AWS Business Associate Addendum](http://aws.amazon.com/baa/) (BAA) and ensure that the AWS account(s) you use with PHI are configured as required by the BAA. You do not necessarily have to accept the AWS BAA before deploying this Quick Start (for example, if you deploy it for demo or testing purposes), as long as you do not use the Quick Start with PHI.

**Specialized Knowledge**
This Quick Start requires a moderate to high level of understanding of HIPAA legal requirements, and the processes needed to achieve and manage HIPAA compliance within a traditional hosting environment. Before you deploy the Quick Start, please review the important notes at the beginning of this guide about customer responsibilities under HIPAA and the AWS BAA.

This Quick Start is designed for Information Technology (IT) professionals and security personnel, and assumes familiarity with basic security concepts in the area of networking, operating systems, data encryption, operational controls, and cloud computing services. If you are new to AWS, visit [https://aws.amazon.com/getting-started/](https://aws.amazon.com/getting-started/) for more information about AWS.
This deployment guide also requires a moderate level of understanding of AWS services and requires the following, at a minimum:

- Access to a current AWS account with IAM administrator-level permissions
- Basic understanding of AWS services, AWS service limits, and AWS CloudFormation
- Knowledge of architecting applications on AWS
- Understanding of security and compliance requirements in the customer organization

AWS offers training and certification programs to help you develop skills to design, deploy, and operate your infrastructure and applications on the AWS Cloud. Whether you are just getting started or looking to deepen your technical expertise, AWS has a variety of resources to meet your needs. For more information, see the AWS Training and Certification website, or read the AWS Training and Certification Overview.

**AWS Account**

If you don’t already have an AWS account, create one at [https://aws.amazon.com](https://aws.amazon.com) by following the on-screen instructions. Part of the sign-up process involves receiving a phone call and entering a PIN using the phone keypad.

**Technical Requirements**

Before you launch the Quick Start, your account must be configured as specified in the following table. Otherwise, deployment might fail. For step-by-step configuration instructions, see the Pre-Deployment Steps section.

<table>
<thead>
<tr>
<th>Resources</th>
<th>Resource</th>
<th>Default</th>
<th>Used in this deployment (by default)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VPCs</td>
<td>5 per region</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EIPs</td>
<td>5 per region</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>IAM groups</td>
<td>100 per account</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>IAM roles</td>
<td>250 per account</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Amazon EC2 Auto Sc</td>
<td>20 per region</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ELB load balancers</td>
<td>20 per region</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Regions

The AWS services used in this Quick Start exist in all commercial regions, but AWS Config rules, which are used for configuration enforcement, are currently available only in the regions listed in AWS Regions and Endpoints. If you require this capability, you must deploy in one of these regions until AWS Config rules become available more widely.

It is important to be aware of what is available in the region you choose to deploy. To see the latest list of supported services per region, see AWS Regions and Endpoints in the AWS documentation. For information about service differences in the AWS GovCloud (US) Region, see Supported Services in the AWS GovCloud documentation.

AWS Config and AWS Config rules

If you deploy this Quick Start in an AWS Region where AWS Config and AWS Config rules are available, the AWS CloudFormation template config-rules.template will attempt to automatically use the service. However, the deployment will fail if you have not previously manually set up AWS Config in that region. Before you deploy the Quick Start, navigate to the AWS Config console, and choose the Get Started Now button. Note that this feature is currently available only in the AWS Regions listed in AWS Regions and Endpoints.

Amazon S3 URLs

If you’re copying the templates to your own S3 bucket for deployment, make sure that you update the Resources section of the main.template file with a valid and accessible URL. Otherwise, deployment will fail.

IAM permissions

To deploy the Quick Start using the console, you must be logged in to the AWS Management Console with IAM permissions for the resources and actions the templates will deploy. The AdministratorAccess managed policy within IAM provides sufficient permissions, although your organization may choose to use a custom policy with more restrictions.

S3 buckets

Unique S3 bucket names are automatically generated based on the account number and region. If you delete a stack, the logging buckets are not deleted (to support security review). If you plan to re-deploy this Quick Start in the same region, you must first manually delete the previously created S3 buckets; otherwise, the re-deployment will fail.

Deployment Methods

You can deploy the Quick Start templates by using AWS CLI commands or from the AWS Management Console. You can also deploy the template package as an AWS Service Catalog product. AWS Service Catalog enables a self-service model for deploying applications and architecture on AWS. You can create portfolios that include one or more products, which are defined by AWS CloudFormation templates. You can grant IAM users, groups, or roles access to specific portfolios, which they can then launch from a separate interface. We’ve provided step-by-step instructions for the AWS Management Console deployment option in the following sections.
Pre-Deployment Steps

Before you deploy the HIPAA Quick Start templates, follow the instructions in this section to confirm that your account is set up correctly:

- Review the service limits and service usage of your AWS account and request increases if required, to ensure that there is available capacity to launch resources in your account.

- Ensure that your AWS account is set up with at least one SSH key pair (but preferably two separate key pairs) in the AWS Region where you plan to deploy, for use with the bastion login host and other Amazon EC2 hosts.

- Ensure that you have manually set up AWS Config in the AWS Config console, if you are deploying into an AWS Region where AWS Config is available. AWS Config is currently available only in the regions listed in AWS Regions and Endpoints.

Review AWS Service Limits

To review and (if necessary) increase service limits for the resources you need for the HIPAA Quick Start deployment, you use the AWS Trusted Advisor console and the Amazon EC2 console. You’ll need the resources specified in the Technical Requirements table.

Use Trusted Advisor to view the existing service limits for Amazon VPC, IAM groups, and IAM roles within your account, and ensure that there is availability to deploy additional resources:


2. In the navigation pane, choose Performance.

3. On the Performance page, scroll through the list of performance checks until you find Service Limits, and expand that section.

4. Scroll through the service limit names and compare the Limit Amount column to the Current Usage column, to ensure that you can allocate the following without exceeding the default limit in the AWS Region you will deploy this Quick Start into (US East [N. Virginia] is recommended):
   - Two (2) more VPCs
   - Six (6) more IAM groups
   - Five (5) more IAM roles
If an increase is needed, you can choose the limit name to open the limit increase request form shown in Figure 4.

![Figure 4: Requesting a service limit increase](image)

Now use the Amazon EC2 console to check your limits for Elastic IP addresses, load balancers, and Auto Scaling groups:

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/).
2. In the navigation pane, under **Network & Security**, choose **Elastic IPs**.
3. Count the number of allocated Elastic IPs (if any) displayed in the list, and ensure that you can allocate three (3) more without exceeding the default limit of 5 (or the limit increase you previously requested).
4. In the navigation pane, under **Load Balancing**, choose **Load Balancers**.
5. Count the number of existing load balancers (if any) displayed in the list and ensure that you can create two (2) more without exceeding the default limit of 20 (or the limit increase you previously requested).
6. In the navigation pane, under **Auto Scaling**, choose **Auto Scaling Groups**.
7. Count the number of existing Auto Scaling groups (if any) displayed in the list and ensure that you can create two (2) more without exceeding the default limit of 20 (or the limit increase you previously requested).

Create Amazon EC2 Key Pairs

Make sure that at least one Amazon EC2 key pair exists within your AWS account in the region where you are planning to deploy the Quick Start.

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. Use the region selector in the navigation bar to choose the AWS Region where you plan to deploy.
3. In the navigation pane, under Network & Security, choose Key Pairs.
4. In the key pair list, verify that at least one available key pair (but preferably two available key pairs) exist and make note of the key pair name(s). You’ll need to provide a key pair name for the parameters pEC2KeyPairBastion (for bastion host login access) and pEC2KeyPair (for all other Amazon EC2 host login access) when you launch the Quick Start. Although you can use the same key pair for both parameters, we recommend that you use a different key pair for each. This recommendation is based on a hardened security concept. We publicly expose the bastion box but keep other instances as private, so if the bastion key pair becomes compromised, it will not affect your live data instances.

If you want to create a new key pair, choose Create Key Pair. For additional information, see the Amazon EC2 documentation.

![Figure 5: Creating a key pair](image)

**Note** If you’re deploying the Quick Start for testing or proof of concept, we recommend that you create a new key pair instead of specifying a key pair that’s already being used by a production instance.
Set up AWS Config

If AWS Config has not yet been initialized in the region where you are deploying this Quick Start, follow the steps below in the region where you are planning to deploy the Quick Start.

1. Open the AWS Config console at https://console.aws.amazon.com/config/.
2. Use the region selector in the navigation bar to choose the AWS Region where you plan to deploy.
3. In the AWS Config console, choose Get Started.

![AWS Config console](image)

**Figure 6: AWS Config console**

4. On the Set up AWS Config screen, you are prompted to select or create an IAM role for AWS Config. You may leave all default values in place, or make modifications as you see fit, and then choose Next.
Figure 7: AWS Config setup screen
5. You are now presented with a screen to add rules. Choose **Skip**.

AWS Config can check the configuration of your resources against rules that you define. Choose one or more of the following rules to get started. After setting up AWS Config, you can customize these rules, set up other rules provided by AWS Config, or create your own rules.

Learn more about AWS Config rules and pricing details.

![Additional AWS Config screen for rules](image)

**Figure 8: Additional AWS Config screen for rules**

6. On the next screen, you are prompted to review the information. Choose **Confirm**.

![Confirm choices for AWS Config](image)

**Figure 9: Confirm choices for AWS Config**
7. Choose the **Settings** button. You should now see **Recording is on** in the window, indicating that AWS Config is now active in this AWS Region.

![Figure 10: AWS Config activation verification](image)

## Deployment Steps

Follow the step-by-step instructions in this section to sign in to your AWS account, customize the Quick Start templates, and deploy the software into your account.

### What We’ll Cover

The procedure for deploying the Quick Start architecture on AWS consists of the following steps, which we’ll cover in detail in the following sections.

**Step 1. Sign in to your AWS account**

- Sign in to your AWS account, and make sure that it's configured correctly.

**Step 2. Launch the stacks**

- Launch the main AWS CloudFormation template into your AWS account.
- Enter values for required parameters.
- Review the other template parameters, and customize their values if necessary.

**Step 3. Test your deployment**

- Use the URL provided in the **Outputs** tab for the main stack to test the deployment.
- Use the IP address for the bastion host provided by the **Outputs** tab for the main stack, and use your private key if you would like to connect to that host through SSH.
Step 1. Sign in to Your AWS Account

1. Sign in to your AWS account at https://aws.amazon.com with an IAM user role that has the appropriate privileges (see IAM Permissions earlier in this document).

2. Make sure that your AWS account is configured correctly. See the Technical Requirements and Pre-Deployment Steps sections for information. Note that if you plan to use an AWS Region with the AWS Config capability, you must first set up the AWS Config service manually by following the instructions in the previous section.

3. Use the region selector in the navigation bar to choose the AWS Region where you want to deploy the HIPAA architecture on AWS.

Amazon EC2 locations are composed of Regions and Availability Zones. Regions are dispersed and located in separate geographic areas. This Quick Start uses the m3.large instance type for the WordPress and Nginx portion of the deployment. m3.large instances are currently available in all AWS Regions except China (Beijing). The AWS Config Rules service is currently available only in the AWS Regions listed in AWS Regions and Endpoints.

![Figure 11: Choosing an AWS Region](image)

**Tip** Consider choosing a region closest to your data center or corporate network to reduce network latency between systems running on AWS and the systems and users on your corporate network. If you plan to use the optional AWS Config rules capability, you must choose one of the regions listed in AWS Regions and Endpoints.
4. Select the key pair that you created earlier. In the navigation pane of the Amazon EC2 console, choose **Key Pairs**, and then choose the key pair from the list.

**Step 2. Launch the Stacks**

This automated AWS CloudFormation template deploys the Quick Start architecture in multiple Availability Zones into Amazon VPCs. Please review the technical requirements and pre-deployment steps before launching the stacks.

1. **Launch the AWS CloudFormation template** into your AWS account.

   The template will be deployed into the AWS Region that appears in the navigation bar at the upper-right corner of the AWS Management Console. You can change the region by using the region selector in the navigation bar. Note that if you select a region where AWS Config is available, make sure to manually initialize the AWS Config service in that region.

   If you have an AWS GovCloud (US) account, you can launch the template in the AWS GovCloud (US) Region.

   The stacks take approximately 30 minutes to create.

   **Note** You are responsible for the cost of the AWS services used while running this Quick Start reference deployment. There is no additional cost for using this Quick Start. For full details, see the pricing pages for each AWS service you will be using in this Quick Start. Prices are subject to change.

   You can also download the template to use it as a starting point for your customization.

2. On the **Select Template** page, keep the default settings for the template URL, and then choose **Next**.

3. On the **Specify Details** page, provide the seven required parameter values for the template. These are described in the following table.

<table>
<thead>
<tr>
<th>Parameter label (name)</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Password (pDBPassword)</td>
<td><strong>Requires input</strong></td>
<td>Password for the database administrator account. This must be a <strong>complex password</strong> that's between 8 and 28 mixed, alphanumeric characters.</td>
</tr>
<tr>
<td>Notification Email Address (pNotifyEmail)</td>
<td><a href="mailto:distlist@example.org">distlist@example.org</a></td>
<td>Notification email address for security events (you will receive confirmation email).</td>
</tr>
<tr>
<td>Parameter label (name)</td>
<td>Default</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Existing SSH Key for Bastion Instance (pEC2KeyPairBastion)</td>
<td>Requires input</td>
<td>The SSH key pair in your account to use for bastion host login (see pre-deployment steps).</td>
</tr>
<tr>
<td>Existing SSH Key for Other Instances (pEC2KeyPair)</td>
<td>Requires input</td>
<td>The SSH key pair in your account to use for all other host logins (see pre-deployment steps).</td>
</tr>
<tr>
<td>Support Config (pSupportsConfig)</td>
<td>Requires input</td>
<td>Select Yes if you are deploying in an AWS Region where AWS Config is available and you want to use AWS Config (see pre-deployment steps).</td>
</tr>
<tr>
<td>First Availability Zone (pAvailabilityZoneA)</td>
<td>Requires input</td>
<td>Select your desired first Availability Zone (Note: Some Availability Zones may be restricted. If the deployment fails, you may need to use a different Availability Zone.)</td>
</tr>
<tr>
<td>Second Availability Zone (pAvailabilityZoneB)</td>
<td>Requires input</td>
<td>Select your desired second Availability Zone (Note: Some Availability Zones may be restricted. If the deployment fails, you may need to use a different Availability Zone.)</td>
</tr>
</tbody>
</table>

**AWS Quick Start Configuration:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick Start S3 Bucket Name (QSS3BucketName)</td>
<td>aws-quickstart</td>
<td>S3 bucket name for the Quick Start assets. This bucket name can include numbers, lowercase letters, uppercase letters, and hyphens (-), but should not start or end with a hyphen. You can specify your own bucket if you copy all of the assets and submodules into it, if you want to override the Quick Start behavior for your specific implementation.</td>
</tr>
<tr>
<td>Quick Start S3 Key Prefix (QSS3KeyPrefix)</td>
<td>quickstart-compliance-hipaa/</td>
<td>S3 key prefix for the Quick Start assets. This prefix can include numbers, lowercase letters, uppercase letters, hyphens (-), and forward slashes (/), but should not start or end with a forward slash (which is automatically added). This parameter enables you to override the Quick Start behavior for your specific implementation.</td>
</tr>
</tbody>
</table>

4. On the **Options** page, you can specify tags (key-value pairs) for resources in your stack and set additional options. You can use the tags to organize and control access to resources in the stacks. When you’re done, choose **Next**.

5. On the **Review** page, review the settings and select the acknowledgement check box. This simply states that the template will create IAM resources.
6. Choose **Create** to deploy the stack.

7. Monitor the status of the stack being deployed. When the status field shown in Figure 13 displays **CREATE_COMPLETE** for all the stacks deployed, the cluster for this reference architecture is ready. Since you’re deploying the full architecture, you’ll see eight stacks listed (for the main template and seven nested templates).
Step 3. Test Your Deployment

To test your deployment, choose the link for **LandingPageURL**, as shown in Figure 14. This URL is available from the **Outputs** tab for the main stack:

![CloudFormation Stack Outputs](image)

**Figure 14: Opening the landing page**

The link should launch a new page in your browser that looks similar to Figure 15.
This deployment builds a working demo of a Multi-AZ WordPress site. To connect to the WordPress site, choose the URL provided for the WordPress application on the landing page shown in Figure 15. This URL is also available from the WebsiteURL link on the Outputs tab for the main stack.
**Note** WordPress is provided for testing and proof-of-concept purposes only; it is not intended for production use. You can replace it with another application of your choice.

This URL brings up the page shown in Figure 16. You can install and test the WordPress deployment from here.

![WordPress Installation](image)

**Figure 16: Installing WordPress**

**Note** The WordPress application included in this Quick Start deployment is for demo purposes only. Application-level security, including patching, operating system updates, and addressing application vulnerabilities, is the customer’s responsibility (see the [AWS Shared Responsibility Model](#)). For this Quick Start, we recommend that you delete the AWS CloudFormation stacks after your proof-of-concept demo or testing is complete.
Now that you’ve deployed and tested the HIPAA reference architecture on AWS, please take a few minutes to complete our survey for this Quick Start. Your response is anonymous and will help us improve these reference deployments.

Deleting the Stacks

When you’ve finished using the baseline environment, you can delete the stacks. Deleting a stack, either via CLI and APIs or through the AWS CloudFormation console, will remove all the resources created by the template for that stack. The only exceptions are the S3 buckets for logging and backup. By default, the deletion policy for those buckets is set to “Retain,” so you have to delete them manually.

Important This Quick Start deployment uses nested AWS CloudFormation templates, so deleting the main stack will remove the nested stacks and all associated resources.

Troubleshooting

If you encounter a CREATE_FAILED error when you deploy the Quick Start, refer to the following table for known issues and solutions.

<table>
<thead>
<tr>
<th>Error message</th>
<th>Possible cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following resource(s) failed to create: [rConfigRuleForRequiredTags,</td>
<td>The Support Config parameter was set to Yes, but AWS Config isn’t available</td>
<td>Set the Support Config parameter to No, or select another region. Also make sure that AWS Config is</td>
</tr>
<tr>
<td>rConfigRuleForUnrestrictedPorts, rConfigRuleForSSH, rConfigRulesLambdaRole]</td>
<td>in the region you selected, or AWS Config has not been initialized.</td>
<td>set up properly, as described in the pre-deployment steps.</td>
</tr>
<tr>
<td>Maximum VPCs limit reached</td>
<td>You’ve exceeded the number of VPCs allowed in your account.</td>
<td>Delete VPCs and/or request a limit increase. Try to create the stack again. For more information, see technical requirements.</td>
</tr>
<tr>
<td>Maximum EIPs limit reached</td>
<td>You’ve exceeded the limit of Elastic IP addresses in your account.</td>
<td>Disassociate Elastic IPs or request a Elastic IP limit increase, and try to create the stack again. For more information, see technical requirements.</td>
</tr>
<tr>
<td>Other limits exceeded</td>
<td>You’ve exceeded the use of resources in your AWS account.</td>
<td>See technical requirements, and request service limit increases as necessary.</td>
</tr>
</tbody>
</table>
If the problem you encounter isn’t covered in this table, we recommend that you re-launch the template with **Rollback on failure** set to **No** (this setting is under **Advanced** in the AWS CloudFormation console, **Options** page) and open a support case in the [AWS Support Center](https://aws.amazon.com/support) for further troubleshooting. When rollback is disabled, the stack’s state will be retained and the instance will be left running, so the support team can help troubleshoot the issue.

**Important** When you set **Rollback on failure** to **No**, you’ll continue to incur AWS charges for this stack. Please make sure to delete the stack when you’ve finished troubleshooting.

---

### Integrating with AWS Service Catalog

You can add the AWS CloudFormation templates for this Quick Start to AWS Service Catalog as portfolios or products to manage them from a central location. This helps support consistent governance, security, and compliance requirements. It also enables users to quickly deploy only the approved IT services they need.

For complete information about using AWS Service Catalog, see the [AWS documentation](https://aws.amazon.com/documentation/servicecatalog/). The following table provides links for specific tasks.

<table>
<thead>
<tr>
<th>To</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a new portfolio</td>
<td><a href="https://aws.amazon.com/documentation/servicecatalog/">Creating and Deleting Portfolios</a></td>
</tr>
<tr>
<td>Create a new product</td>
<td><a href="https://aws.amazon.com/documentation/servicecatalog/">Adding and Removing Products</a></td>
</tr>
<tr>
<td>Give users access</td>
<td><a href="https://aws.amazon.com/documentation/servicecatalog/">Granting Access to Users</a></td>
</tr>
<tr>
<td>Assign IAM roles for deploying stacks</td>
<td><a href="https://aws.amazon.com/documentation/servicecatalog/">Applying Launch Constraints</a></td>
</tr>
<tr>
<td>Assign tags to portfolios to track resource ownership, access, and cost allocations</td>
<td><a href="https://aws.amazon.com/documentation/servicecatalog/">Tagging Portfolios</a></td>
</tr>
<tr>
<td>Perform other administrative tasks</td>
<td><a href="https://aws.amazon.com/documentation/servicecatalog/administrator/">AWS Service Catalog Administrator Guide</a></td>
</tr>
<tr>
<td>Launch products from AWS Service Catalog</td>
<td><a href="https://aws.amazon.com/documentation/servicecatalog/user/">AWS Service Catalog User Guide</a></td>
</tr>
</tbody>
</table>
Additional Resources

AWS services

- AWS CloudFormation
  https://aws.amazon.com/documentation/cloudformation/
- Amazon EC2 User Guide for Linux:
- Amazon VPC
  https://aws.amazon.com/documentation/vpc/
- AWS CloudTrail
  https://aws.amazon.com/documentation/cloudtrail/
- AWS Config
  https://aws.amazon.com/documentation/config/
- Amazon CloudWatch
  https://aws.amazon.com/documentation/cloudwatch/
- AWS Identity and Access Management
  https://aws.amazon.com/documentation/iam/
- Amazon RDS
  https://aws.amazon.com/documentation/rds/
- AWS CLI
  https://aws.amazon.com/documentation/cli/
- AWS Service Catalog
  https://aws.amazon.com/documentation/servicecatalog/

HIPAA

- HIPAA Compliance page on the AWS website
  https://aws.amazon.com/compliance/hipaa-compliance/
- Step-by-step guide to accepting the AWS Business Associate Addendum on AWS Artifact
  https://aws.amazon.com/artifact/getting-started/#BAA_Agreements
- AWS Whitepaper: Architecting for HIPAA Security and Compliance on Amazon Web Services
  https://d0.awsstatic.com/whitepapers/compliance/AWS_HIPAA_Compliance_Whitepaper.pdf
• U.S Department of Health & Human Services (HHS) HIPAA website
  https://www.hhs.gov/hipaa/for-professionals/index.html

Quick Start Reference Deployments

• AWS Quick Start home page
  https://aws.amazon.com/quickstart/

Send Us Feedback

You can visit our GitHub repository to download the templates and scripts for this Quick Start, to post your feedback, and to share your customizations with others.

If you haven’t filled out our survey yet, please take a few minutes to do so. Your response is anonymous and will help us improve the quality of this HIPAA Quick Start and other AWS reference deployments.

For Further Assistance

If you need assistance with an enterprise implementation of the capabilities introduced through this Quick Start, AWS Professional Services can guide and assist with the related training, customization, and implementation of deployment and maintenance processes. Please contact your AWS Account Manager for further information, or send an inquiry to compliance-accelerator@amazon.com.

Document Revisions

<table>
<thead>
<tr>
<th>Date</th>
<th>Change</th>
<th>In sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 2017</td>
<td>Removed references to dedicated VPC</td>
<td>Revisions throughout guide</td>
</tr>
<tr>
<td>February 2017</td>
<td>Initial publication</td>
<td>—</td>
</tr>
</tbody>
</table>