# Voicemail for Amazon Connect

## Implementation Guide

*Huyen Dang, Onica, Inc*

*Erin Hall*

*Girish Mallenahally*

March 2020

*Last updated: August 2022 (refer to Revisions)*

## Contents

## About this guide

This implementation guide was created by Onica, Inc. in collaboration with Amazon Web Services (AWS).

This implementation guide discusses architectural considerations and configuration steps for deploying Voicemail for Amazon Connect in the AWS Cloud. It includes links to AWS CloudFormation templates that launch and configure the AWS services required to deploy this solution using AWS best practices for security and availability.

This guide is intended for IT administrators and DevOps professionals who have practical experience architecting in the AWS Cloud.

# Overview

The Voicemail for Amazon Connect solution helps call center administrators and managers automate a voicemail solution using Amazon Connect. A customer can call in, enter the extension number of the agent they want to speak with, and leave a voicemail for that specific agent. The solution generates voicemail recordings and transcripts that are delivered to agents using their preferred communication setting: SMS and/or email.

This solution launches a web portal that administrators and managers can sign in to and configure voicemail settings for each agent. They have the options to transcribe the voicemails using Amazon Transcribe and decide whether to send the voicemail recording as a .wav file or an encrypted Amazon S3 URL.

In 30 minutes or less, your customers can leave voicemails for Amazon Connect agents who will receive emails and/or text messages with the voicemail recordings and transcripts.

## Cost

You are responsible for the cost of the AWS services used while running this reference deployment. As of August 2022, the cost for running this solution with default settings in the US East (N. Virginia) Region is approximately **$0.035 for each minute-long voicemail**. Prices are subject to change. For full details, see the pricing webpage for each AWS service used in this solution.

After you deploy the Voicemail for Amazon Connect AWS CloudFormation template, enable the AWS Cost and Usage Report to track costs associated

with the deployment. This report delivers billing metrics to an Amazon Simple Storage Service (Amazon S3) bucket in your account. It provides cost estimates based on usage throughout each month and finalizes the data at the end of the month. For more information about the report, see What Are AWS Cost and Usage Reports? in the *Cost and Usage Report User Guide*.

## Architecture Overview

Deploying this solution with the default parameters builds the following environment in the AWS Cloud.

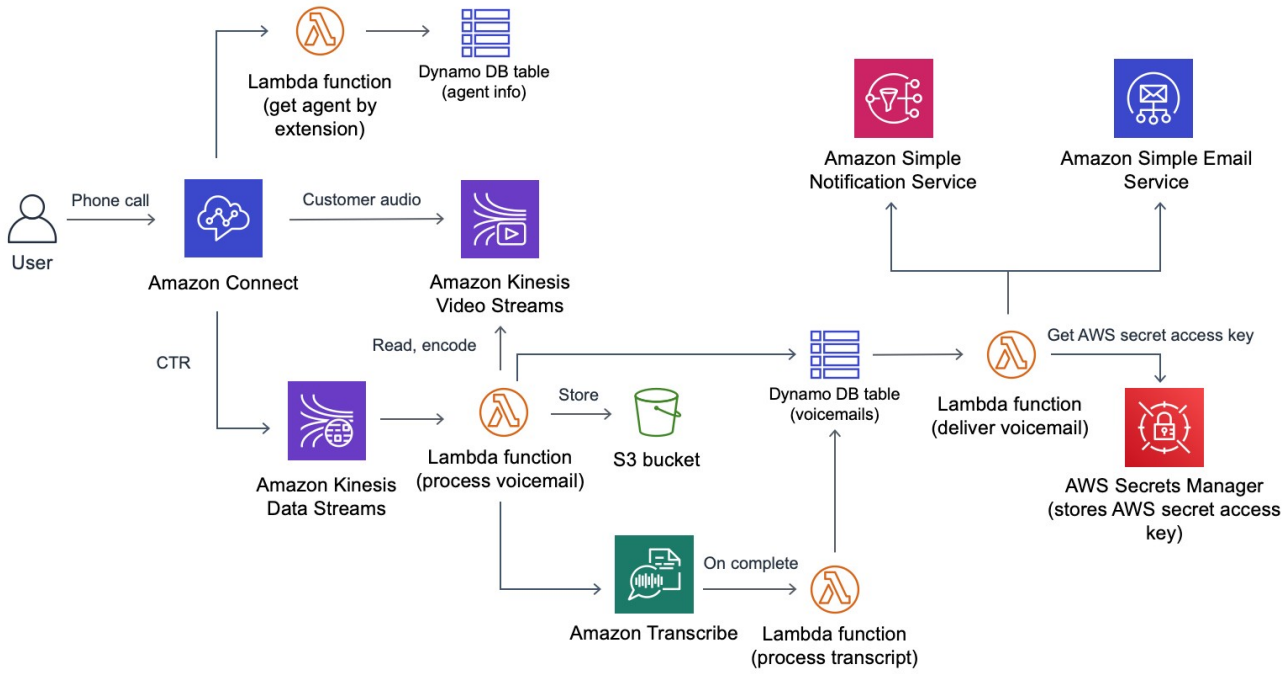


**Figure 1: Voicemail for Amazon Connect serverless architecture**

The AWS CloudFormation template configures a serverless architecture that includes an Amazon Kinesis Data Streams that Amazon Connect uses to stream contact trace record (CTR) events. The CTRs that Amazon Connect emits help determine the start and end time of each audio recording waiting to be processed.

The template uses an AWS Lambda function for CTR events that pass through Kinesis Data Streams. The Lambda function checks the configured transcript preferences in the voicemail system and initiates a transcript job using the Amazon Kinesis Video Streams data provided by the CTR.

The template includes three Amazon DynamoDB tables: a DynamoDB table that stores agent extensions and voicemail delivery preferences; a DynamoDB table that stores the global configuration options, including encryption, transcription, and approved countries for SMS notifications; and a DynamoDB table that stores the timestamp, transcription metadata, storage location, and transcribe job status for the recordings. It stores recordings in an Amazon S3 bucket.

The template uses an AWS Lambda function invoked by transcription-ready Amazon EventBridge (Amazon CloudWatch Events) events. The Lambda function uses the events provided by the transcribe service, `IN_PROGRESS | COMPLETED`, to deliver transcripts and audio recordings to agents. Another AWS Lambda function is invoked by DynamoDB events to deliver transcripts and recordings based on agent delivery preferences. This Lambda function creates a presigned URL using an AWS Identity and Access Management (IAM) user role, which was automatically generated by the AWS CloudFormation template and the Signature Version 4 signing process. AWS Secrets Manager stores the IAM user credentials–the access key and secret access key. Both keys are used together to create the presigned URL. The presigned URL is valid up to seven days. As a best practice, we recommend frequent access key rotation to meet your security and compliance requirements.

The template uses Amazon API Gateway endpoint to expose provisioning endpoints through HTTPS.

The template deploys a Voicemail for Amazon Connect Management Portal with the following architecture.

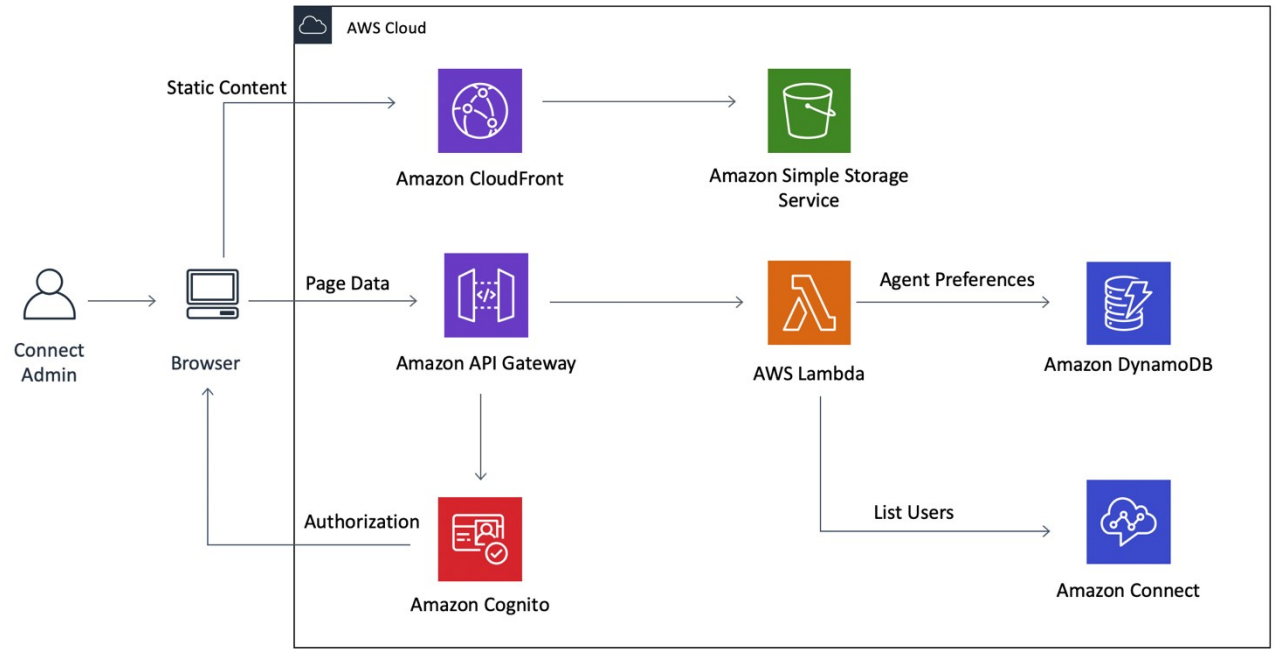


**Figure 2: Voicemail for Amazon Connect Management Portal architecture**

The Voicemail for Amazon Connect Management Portal contains the following serverless resources:

- An Amazon CloudFront distribution to serve HTTPS requests to an S3 bucket hosting the Amazon Connect Voicemail Management Portal.
- AWS Lambda functions to handle actions taken by the users on the Amazon Connect Voicemail Management Portal.
- An S3 bucket to store the source code of the Lambda functions invoked by the Amazon Connect Voicemail Management Portal.
- An Amazon API Gateway resource to provide connectivity to the Lambda functions used by the Amazon Connect Voicemail Management Portal. These functions give access to the users table and voicemail.
- An Amazon Cognito configuration to manage user access to the Amazon Connect Voicemail Management Portal.
- Custom resources to copy and modify the web portal files hosted by Amazon to an S3 bucket created during the CloudFront distribution deployment. The copy process also modifies the files to use the API Gateway endpoints and API key generated during deployment.

# AWS CloudFormation Template

This solution uses AWS CloudFormation to automate the deployment of Voicemail for Amazon Connect in the AWS Cloud. It includes the following AWS CloudFormation template, which you can download before deployment:

**voicemail-for-amazon-connect.template:** Use this template to launch Voicemail for Amazon Connect and all associated components. The default configuration deploys a portal for admins to login and configure agent extension numbers, the backend infrastructure for the voicemail system, and contact flows for the customer experience. You can also customize the template based on your specific needs.

# Automated Deployment

Before you launch the automated deployment, please review the architecture, configuration, and other consideration discussed in this guide. Follow the step-by-step instructions in this section to configure and deploy Voicemail for Amazon Connect into your account.

**Time to deploy:** Approximately 30 minutes

## Prerequisites

### Technical Requirements

To deploy this solution, you will need:

- An active AWS account. If you don't have an AWS account, you can create one at https://aws.amazon.com.
- An Amazon Connect instance with administrative permissions.
  1. Update the telephony options to enable users to call your contact center. Choose **I want to handle incoming calls with Amazon Connect**.
  2. Copy your Amazon Connect instance ID to a text file. You can locate your instance ID in the **Overview** section for your Amazon Connect instance.

```
Instance ARN: arn:aws:connect:us-east-1:XXXXXXXXX:instance/<Instance ID>
```

For information on creating an instance, see Create an Amazon Connect Instance in the *Amazon Connect Administrator Guide*.

- The AWS Identify and Access Management (IAM) rights to launch AWS CloudFormation templates that create IAM roles. For information on IAM rights, see Getting Started in the *AWS Identify and Access Management User Guide*.

## What We'll Cover

The procedure for deploying this architecture on AWS consists of the following steps. For detailed instructions, follow the links for each step.

Step 1. Launch the Stack

- Launch the AWS CloudFormation template into your AWS account.
- Enter values for required parameters: **Amazon Connect instance ID**, **admin email**, **admin first name**, **admin last name**, **manager email**, **manager first name**, **manager last name**, and **delivery email**.
- Review the other template parameters, and adjust if necessary.

Step 2. Configure your Amazon Connect Instance

Step 3. Log in to the Voicemail for Amazon Connect Management Portal

Step 4. Generate and Download Contact Flows

Step 5. Import Contact Flows

Step 6. Claim a Phone Number

Step 7. Leave a Voicemail

## Step 1. Launch the Stack

This automated AWS CloudFormation template deploys Voicemail for Amazon Connect in the AWS Cloud. You must have an AWS account and a configured Amazon Connect instance before launching the stack.

**Note**: You are responsible for the cost of the AWS services used while running this solution. See the Cost section for more details. For full details, see the pricing webpage for each AWS service you will be using in this solution.

1. Sign in to the AWS Management Console and click the button to the right to launch the Voicemail for Amazon Connect AWS CloudFormation template. You can also download the template as a starting point for your own implementation.

Launch Solution

2. The template launches in the US East (N. Virginia) Region by default. To launch the solution in a different AWS Region, use the Region selector in the console navigation bar.

**Note**: This solution uses the Amazon Connect, Amazon Transcribe, Amazon Kinesis Video Stream services, and Amazon Simple Email Service which are currently available in specific AWS Regions only. Therefore, you must launch this solution in an AWS Region where those services are available. For the most current availability by Region, see AWS service offerings by Region.

3. On the **Create stack** page, verify that the correct template URL is in the **Amazon S3 URL** text box and choose **Next**.
4. Navigate to the **Specify stack details** page. Name your solution stack.
5. Navigate to the **Parameters** page. Review the parameters for the template and modify them as necessary. This solution uses the following default values.

Use the following parameters for the Voicemail for Amazon Connect solution.

| Parameter | Default | Description |
|---|---|---|
| **Amazon Connect Instance ID** | *<Requires input>* | The instance ID of your Amazon Connect instance. |
| **Recordings URL Expiration Time (seconds)** | 900 | The time when the encrypted Amazon S3 URL expires. Provide a different number to extend or shorten the expiration time of the URL (maximum of seven days). After the URL expires, the admin must give the agent a new URL. The default 900 is 15 minutes. |

This solution uses the following parameters for the Voicemail for Amazon Connect Management Portal.

| Parameter | Default | Description |
|---|---|---|
| **Admin Email** | *<Requires input>* | The administrator email address for the Voicemail for Amazon Connect Management Portal. An email is sent to this email address with the temporary password. |
| **Admin First Name** | Jane | |
| **Admin Last Name** | Doe | |

| Parameter | Default | Description |
|---|---|---|
| **Manager Email** | *<Requires input>* | The manager email address for the Voicemail for Amazon Connect Management Portal. An email is sent to this email address with the temporary password. Managers cannot change the global voicemail encryption and transcription settings. This must be a different email address than the admin email address. |
| **Manager First Name** | John | |
| **Manager Last Name** | Doe | |
| **Delivery Email** | *<Requires input>* | The transcription delivery email. This email must be verified by Amazon Simple Email Service before deploying the stack. |
| **IsSamlInstance** | false | Determines whether you are using SAML for your Amazon Connect instance. The default value is `false`. Set to `true` if you are using SAML for your Amazon Connect instance.<br><br>**Note:** If using SAML, you must deploy a new stack. You can only update the stack if this parameter is set to `false`. |
| **Allowable SMS Countries** | US, CA | The list of AWS Regions delineated by commas available for SMS messages when voicemail transcripts are sent. For more information, refer to the Supported Regions and Countries list. |
| **User Pool Domain Prefix** | *<Requires input>* | The prefix for the Amazon Cognito user pool domain. this must be all lowercase and accepts the '-' character. The domain is globally unique. |

6. Choose **Next.**
7. On the **Configure stack options** page, choose **Next**.
8. On the **Review** page, review and confirm the settings. Check the boxes acknowledging that the template will create AWS Identity and Access Management (IAM) resources, and acknowledging that AWS CloudFormation may require the capability `CAPABILITY_AUTO_EXPAND`.
9. Choose **Create stack** to deploy the stack.
   The AWS CloudFormation template deploys three additional nested stacks:
   - **CopyLambdaArtifacts—**Deploys an S3 bucket that will hold the Lambda artifacts copied from the hosted bucket.

- **VoicemailStack—**Deploys the serverless infrastructure that drives the Voicemail for Amazon Connect Management Portal, audio recording processing, job transcription, user management DynamoDB tables, and other resources referenced in Figure 1.
- **VoicemailPortalStack—**Deploys the CloudFront distribution that serves the files in the S3 `voicemail-portal` S3 bucket.

During deployment, temporary passwords are delivered to the Admin and Manager Email from **no-reply@verificationemail.com**. Use these credentials to log into the Voicemail for Amazon Connect Management Portal.

You can view the status of the stack in the AWS CloudFormation console in the **Status** column. You should see a status of `CREATE_COMPLETE` in approximately 30 minutes. However, depending on the AWS Region in which you deployed the stack, it may take additional time beyond the 30 minutes for the CloudFront distribution to create and populate the Amazon Connect Voicemail Management Portal. If you get an access denied error when attempting to navigate to the portal, the CloudFront propagation may still be in progress.

**Note:** In addition to the primary AWS Lambda functions, this solution includes the `solution-helper` Lambda function, which runs only during initial configuration or when resources are updated or deleted.

When running this solution, you will see multiple Lambda functions in the AWS Management Console. Do not delete the `solution-helper` function, as it is necessary to manage associated resources, even though it is not run regularly while using the solution.

## Step 2. Configure Your Amazon Connect Instance

Before you can send callers to the new voicemail system, you must configure the instance to send contact trace records to a Kinesis Stream. The data sent to the Kinesis Stream feeds into a Lambda function that provides the start and end location of the audio recording in the stream.

The CloudFormation stack automatically creates a Kinesis Data Streams. Use the following steps to implement the default Kinesis Data Stream:

1. Navigate to the Amazon Connect console and select the instance you used for the AWS CloudFormation deployment.

2. Update the Data storage options to **enable Live media streaming**.
   - **Encryption**: Select KMS key by name and select the default master key `aws/kinesisvideo` in the KMS master key dropdown.
   - **Data retention period**: Keep the default setting (1 Day).
3. In the **Data streaming** settings section, select **Enable data streaming**.
4. In the **Contact Trace Records** section, select **Kinesis Stream** and choose the Kinesis Stream that begins with the stack name you created when you deployed the solution.

Use the following steps to implement an existing Kinesis Data Stream that was previously configured in your Amazon Connect instance for contract trace records:

1. Navigate to the AWS Lambda console.
2. Find the function with `KvsProcessRecord` in the title.
3. Select the **IAM role** associated with the function, and choose **edit** to modify the JSON policy. Replace the Kinesis Data Stream created by the stack with the Kinesis Data Stream you want to use.
4. Choose **Lambda function** and select **Add trigger**.
5. Select the Kinesis Data Stream you want to use and choose **Save**.

## Step 3. Log in to the Voicemail for Amazon Connect Management Portal

Use the following process to log in to the Amazon Connect Voicemail Management Portal.

1. Sign in to the AWS CloudFormation console.
2. On the **Stacks** page, select the Voicemail for Amazon Connect stack.
3. Select the **Outputs** tab.
4. Under the **Key** column, locate **DistributionDomainName** and choose the corresponding URL under the **Value** column to navigate to the Amazon CloudFront domain URL.
5. On the Voicemail for Amazon Connect Management Portal page, sign in as the administrator.

Your administrator password must contain at least one uppercase letter, lowercase letter, number, and special character.

Upon initial login, you must select **Sync Agents** to connect the portal with the Amazon Connect instance. Amazon Connect automatically updates every 24 hours.

## Step 4. Generate and Download Contact Flows

Use the following process to generate and download the contact flows.

1. Sign in to the Voicemail for Amazon Connect Management Portal as the administrator.
2. Select the gear icon located in the top right of the navigation bar to view the **Global Configurations and Generate Contact Flow modals**.
3. Keep the default settings and **download** the contact flows titled `VM-Greeting.json` and `VM-Agent.json`.

**Note:** The values you enter when you generate and download your contact flow do NOT persist in the web portal's UI. Instead, all the fields under the **Generate Contact Flow** section are set to the default values every time you open the settings modal. Values populated in the contact flow JSON file are saved.

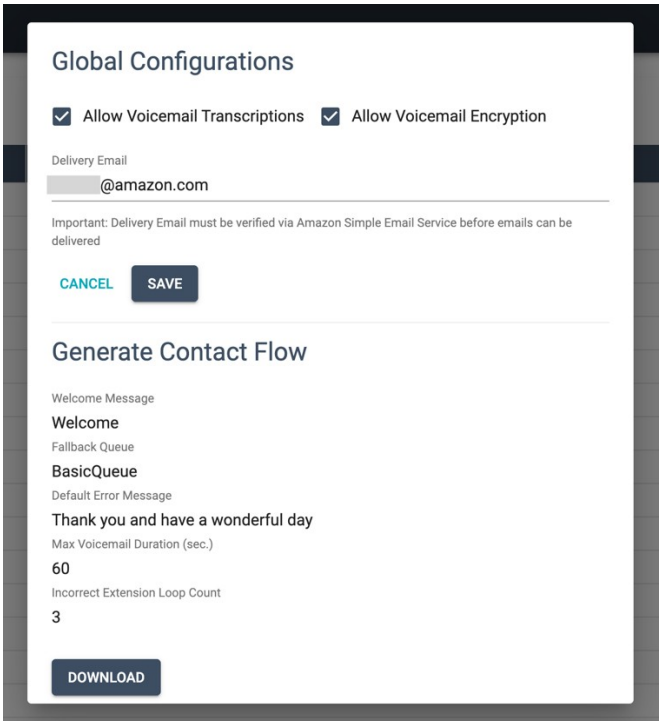


**Figure 3: Global Configurations and Generate Contact Flow modal**

## Step 5. Import Contact Flows

Use the following process to import contact flows.

1. Access your Amazon Connect instance using the access URL provided by the Amazon Connect virtual contact center instances page.
2. Navigate to the **Contact Flows** page by hovering over the routing icon in left menu bar and selecting **Contact Flows**.

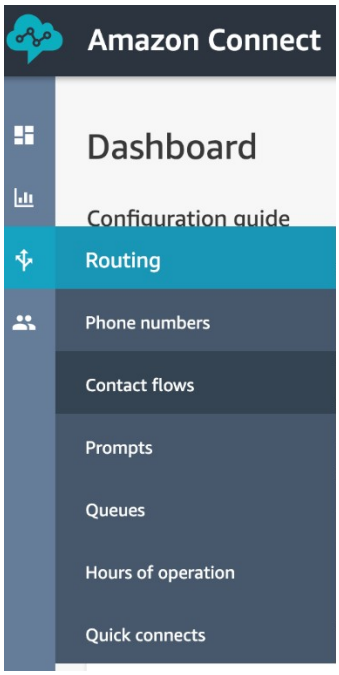


**Figure 4: Create contact flows section**

3. Select the dropdown in the upper right corner of the **Contact Flows** page, and then select **Create customer queue flow**.
4. Select the dropdown next to the Save button. From the dropdown menu, choose **Import flow (beta).**
5. Choose **Select** to open the directory browser Window and find `VM-Agent.json` in your zip file. Choose **Import**.
6. Choose **Publish**.
7. Navigate to the **Contact Flow** page. Select **Create contact flow**.
8. Select the dropdown next to the dimmed Save button. From the dropdown menu, choose **Import flow (beta)**.
9. Choose **Select** to open the directory browser Window and find the `VM-Greeting.json` in your zip file. Choose **Import**.
10. Select **Publish**.

## Step 6. Claim a Phone Number

Use the following process to claim a new or existing phone number for your Amazon Connect instance:

1. Navigate to the **Claim a phone number** section in the dashboard. If you have a **View phone numbers** option, select it, and skip to step 5. Otherwise, select **Begin**.
2. Choose your **Country**, **Type**, and **Phone number** from the options available. Select **Next**.
3. Select **Skip for now** and navigate to the dashboard.
4. Choose **View Phone numbers** from the **Claim a phone number** section to manage your newly claimed phone number.
5. Choose the claimed phone number from the **Manage Phone numbers** page.
6. On the **Edit Phone number** page, select the **Contact flow / IVR** dropdown menu and choose **VM-Greeting** to assign the Voicemail System contact flow to your chosen phone number.
7. Select **Save**.

## Step 7. Leave a Voicemail

To test the voicemail integration, assign extension numbers to your Amazon Connect agents and then call the number you assigned.

1. Sign in to the Amazon Connect Voicemail Management Portal as the administrator or manager.
2. Select an agent to open the **Agent Voicemail Settings** modal. If you do not have available agents, go back to your Amazon Connect instance and choose **Configure users** to add more users to your calling system. Return to the Voicemail for Amazon Connect Management Portal and choose **Refresh**.
3. Assign an agent an extension number. Extension numbers must be 5 digits or less.
4. Check the transcribe and encrypt check boxes as desired. If you enable encryption, the voicemail recording arrives as a signed S3 URL email attachment. If encryption is turned off, the voicemail recording arrives as a plan text email attachment. The default expiration time for the signed S3 URL is 15 minutes (900 seconds) by default and the maximum expiration time for the presigned URL is one week from the time of creation.
5. Check the email and SMS delivery options as desired. Checking the SMS box allows you to enter a phone number for the SMS delivery, enter a phone number, and **Save**.

> **Note**: Your SMS delivery may be limited by your spending limit. By default, your AWS account's text messaging spending limit is set to $1.00 per month. You can open a support ticket to increase the value. Email addresses must be verified by Amazon Simple Email Service (SES).

6. Call the number for your Amazon Connect instance and enter the extension number. If the agent you are trying to reach is unavailable you will be prompted to leave a voicemail after the beep. After you end the call, the voicemail is saved and transcribed. The agent will receive a text and/or email with the voicemail.

# Security

When you build systems on AWS infrastructure, security responsibilities are shared between you and AWS. This shared model can reduce your operational burden as AWS operates, manages, and controls the components from the host operating system and virtualization layer down to the physical security of the facilities in which the services operate. For more information about security on AWS, visit the AWS Security Center.

## IAM Roles

AWS Identity and Access Management (IAM) roles enable customers to assign granular access policies and permissions to services and users on AWS. This solution creates several IAM roles, including roles that grant the solution's AWS Lambda functions access to the other AWS services used in this solution.

## Amazon CloudFront

This solution deploys a static website hosted in an Amazon S3 bucket. To help reduce latency and improve security, this solution includes an Amazon CloudFront distribution with an origin access identity, which is a special CloudFront user that helps restrict access to the solution's website bucket. For more information, refer to Restricting Access to Amazon S3 Content by Using an Origin Access Identity.

## Amazon Cognito

Amazon Cognito allows customers to add user sign up, sign in, and access control to their web and mobile apps quickly and easily. This solution creates a user pool with two users in Amazon Cognito (a manager and an admin). It

demonstrates how different user groups can be used to control functionality. For more information, refer to How to Get Started with User Pools.

# Additional Resources

## AWS Services

- Amazon Connect
- Amazon Kinesis Video Streams
- Amazon DynamoDB
- AWS Lambda
- Amazon Simple Storage Service
- Amazon Transcribe
- AWS CloudFormation
- Amazon Cognito
- AWS Secrets Manager

# Appendix A: Troubleshooting

**Issue:** Agents are not receiving emails for their voicemails and transcripts.

> **Resolution:** Agent email address and/or the **Delivery Email** has not been verified by Amazon Simple Email Service.

**Issue:** Agents have suddenly stopped receiving text messages for their voicemails and transcripts.

> **Resolution:** Your SMS delivery may be limited by your spending limit. By default, your AWS account's text messaging spending limit is set to $1.00 per month. You can open a support ticket to increase this value.

**Issue:** The stack fails at the step to customize the Amazon Cognito User Pool user interface.

> **Resolution:** If the domain for the Amazon Cognito User Pool is not globally unique, the domain and user interface creation fail. Redeploy the stack with a unique domain name.

**Issue:** The contact flow fails to download.

> **Resolution:** The contact flow creation has a dependency on a queue named `BasicQueue`. Create a new queue, name it `BasicQueue`, then download the contact flow.

**Issue:** The administrator cannot download the flow and sync agents.

**Resolution:** If you get access denied exceptions when trying to sync agents and download contact flows, verify that you entered the instance ID of your Amazon Connect instance, and not the instance ARN, for the **Amazon Connect Instance ID** parameter.

**Issue:** The contact flow fails to download.

**Resolution:** Manager email and administrator cannot be the same when deploying the CloudFormation stack.

If these email addresses are the same, you will not be able to download the contact flows.

# Appendix B: Adding Admins and Managers

You can manually create new users in the Amazon Cognito User Pools and assign them to the appropriate groups.

1. Navigate to the Amazon Cognito console.
2. Select **Manage User Pools**.
3. Select the User Pool created by the stack.
4. Choose **Users and Groups**.
5. Select **Create user** and enter the new user's information.
6. Choose the user you just created and select **Add to group**.

# Appendix C: Enabling Language Support

You can enable language support and transcribe voicemail recordings.

1. Go to your `VM-Greeting.json` contact flow settings.
2. Create a `languageCode` attribute and set it to your desired language.

English is the default language. For more information and a comprehensive list of available languages, refer to the Amazon Transcribe Developer Guide.

# Appendix D: Solution Variant

It is common to direct customers to agents based on the number the customer dialed.

You can use the following steps to create a Lambda function to pull the last four digits of the number dialed and upload a new contact flow that replaces the Voicemail Greeting flow created in this solution.

1. Go to the GitHub repository for the solution and open the source/solutionVariants/DID folder.
2. Download the Lambda function and the contact flow from the folder.
3. Go to your AWS account and navigate to the AWS **Lambda** console in the same AWS Region that you deployed your stack in.
4. Create a Lambda function, name it, and select the most recent Python runtime.
5. Copy the code from the Lambda function you downloaded in Step 2, paste it into the Lambda console, and select **Save**.
6. Go to the Amazon Connect console in AWS and select the instance that you deployed.
7. Select **Contact flows** in the left menu.
8. In the **Lambda** section, select the function you created in Step 5 and choose **Add Lambda function.**
9. Log in to your Amazon Connect instance and navigate to the **Contact flows page**.
10. Select **Create contact flow**.
11. Select the dropdown arrow in the upper right corner and choose **Import flow (beta)**.
12. Select the contact flow you downloaded in Step 2.
13. In the first **Invoke AWS Lambda** function block, select the contact flow created in Step 5.
14. In the second **Invoke AWS Lambda** function block, enter the ARN of the contact flow created by the stack that contains the name `GetAgentByExtension`. You can find this ARN in the Lambda console or by copying it from the Voicemail Greeting contact flow that was created by this solution.
15. Choose **Publish**.

# Appendix E: AWS Lambda Functions

The following list describes the AWS Lambda functions used in this solution.

- **SolutionHelperFunction:** This Lambda function copies the assets required by the web application from the hosted Amazon Simple Storage Service (Amazon S3) bucket.
- **CopyArtifactsHelperFunction:** This Lambda function copies the Lambda function artifacts from the hosted Amazon S3 bucket.
- **GetAgentByExtensionLambdaFunction:** This Lambda function is initiated by the contact flow to retrieve the agent username based on the phone extension number provided by the caller.
- **KvsProcessRecordingLambdaFunction:** This Lambda function processes the Amazon Kinesis Video Streams for the customer's voice message. If transcription is enabled, it initiates the transcription job using the Kinesis Video Streams data provided by the CTR and stores the recording in the S3 bucket. An item is created in the `ContactVoicemailTable` Amazon DynamoDB table.
- **TranscriptionEventsLambdaFunction:** This Lambda function is initiated by Amazon EventBridge (Amazon CloudWatch Events) when transcription status changes. This Lambda function updates the transcription status of the contact to COMPLETED in the `ContactVoicemailTable` DynamoDB table.
- **ContactVoicemailStreamLambdaFunction:** This Lambda function is initiated when records are written to the `ContactVoicemailTable` DynamoDB table. A transcript and an audio recording are delivered to an agent after the transcription status of the contact is set to COMPLETED.
- **AuthorizerLambdaFunction:** This Lambda function authorizes the user with the necessary permissions from Amazon Cognito.
- **BuildContactFlowLambdaFunction:** This Lambda function builds the contact flows used by this solution.
- **CognitoUsersConfigLambdaFunction:** This Lambda function creates an Amazon Cognito user for the administrator to log in to the Voicemail for Amazon Connect Management Portal and configure agent extension numbers.
- **ConnectSyncLambdaFunction:** This Lambda function syncs the agents to connect the Voicemail for Amazon Connect Management Portal with the Amazon Connect instance.

- **GlobalSettingsGetLambdaFunction:** This Lambda function retrieves the global settings from the `GlobalTable` DynamoDB table that stores the global configuration options, including encryption, transcription, and approved countries for SMS notifications.
- **GlobalSettingsUpdateLambdaFunction:** This Lambda function updates the global settings in the `GlobalTable` DynamoDB table that stores the global configuration options, including encryption, transcription, and approved countries for SMS notifications.
- **AgentsGetByIdLambdaFunction:** This Lambda function retrieves agent information by ID and stores them in the the `UsersTable` DynamoDB table.
- **AgentsGetLambdaFunction:** This Lambda function retrieves agent information.
- **AgentsUpdateByIdLambdaFunction:** This Lambda function updates user management information in the `UsersTable` DynamoDB table based on ID.
- **ConnectSyncRequestLambdaFunction:** This Lambda function helps agents connect the Voicemail for Amazon Connect Management Portal with the Amazon Connect instance.

# Appendix F: Collection of Operational Metrics

This solution includes an option to send anonymous operational metrics to AWS. We use this data to better understand how customers use this solution and related services and products. When enabled, the following information is collected and sent to AWS:

- **Solution ID:** The AWS solution identifier
- **Unique ID (UUID):** Randomly generated, unique identifier for each Voicemail for Amazon Connect deployment
- **Timestamp:** Data-collection timestamp
- **Status:** The status of the function call: Success or Failure

Note that AWS will own the data gathered via this survey. Data collection will be subject to the AWS Privacy Policy. To opt out of this feature, complete one of the following tasks.

Modify the AWS CloudFormation template mapping section as follows:

```
   "Send" : {
      "AnonymousUsage" : { "Data" : "Yes" }
   },
```

to

```
   "Send" : {
      "AnonymousUsage" : { "Data" : "No" }
   },
```

# Source Code

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

# Revisions

| Date | Change |
|---|---|
| **March 2020** | Initial release |
| **April 2020** | Bug fixes and documentation for enabling language support. |
| **September 2020** | Added IAM user role support; bug fixes; for more information, refer to the CHANGELOG.md file in the GitHub repository. |
| **July 2021** | Release version 1.0.3: Updated nodejs10.x to nodejs12.x and Java8 to Java8.al2. For more information, refer to the CHANGELOG.md file in the GitHub repository. |
| **December 2021** | Release version 1.0.4: Updates to remediate the RCE 0-day exploit found in Apache Log4j. For more information, refer to the CHANGELOG.md file in the GitHub repository. |
| **April 2022** | Release version 1.0.5: Updates to remediate the RCE 0-day exploit found in Apache Log4j. For more information, refer to the CHANGELOG.md file in the GitHub repository. |
| **August 2022** | Release version 1.1.0: security and bug fixes. For more information, refer to the CHANGELOG.md file in the GitHub repository. |

## Notices

Customers are responsible for making their own independent assessment of the information in this document. This document: (a) is for informational purposes only, (b) represents current AWS product offerings and practices, which are subject to change without notice, and (c) does not create any commitments or assurances from AWS and its affiliates, suppliers or licensors. AWS products or services are provided “as is” without warranties, representations, or conditions of any kind, whether express or implied. The responsibilities and liabilities of AWS to its customers are controlled by AWS agreements, and this document is not part of, nor does it modify, any agreement between AWS and its customers.

Voicemail for Amazon Connect is licensed under the terms of the Apache License Version 2.0 available at The Apache Software Foundation.