

Cloud Methodologies to Build an Intelligent Interactive Voice Response

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Abstract: The process explained in this research article provides details of enabling interactive voice response for a business using Cloud technologies which are built on text, speech and Artificial Intelligence. With the Amazon AI technologies these processes can be built and automated within few hours and using less infrastructure. These also provide the computing resources on pay per use basis. This paper provides details of different Amazon cloud services which are available and helps in building the intelligent interactive voice response for a call center.

Keywords: Cloud Technologies, Artificial Intelligence, Amazon Lex, Amazon Connect, Amazon Polly

1. Introduction

In any business process, support of the business plays a vital role. Supporting customers by answering questions related to the products purchased or to be purchased needs some clarifications before customer makes a decision. And this is not limited to just purchases but there are other processes after the purchase like making a payment, checking the next payment due date, account information, warranty details of the purchase etc.

These are mundane or monotonous tasks for employees if this is not automated and this will increase the business maintenance cost as number of people to support such tasks has to be evaluated time to time basis depending on the number of calls the employees supports.

2. Achieving IVR

Interactive voice response can be achieved by using latest cloud technologies which is AI enabled amazon web services such as Amazon Lex and Amazon Polly. There is contact center service called Amazon Connect which is simple to use using drag and drop options and lambda server less functions which can be used to perform certain activity.

“Figure 1” explains the architecture of the Amazon connect interacting with Amazon Lex and Amazon Polly by using Lambda function to connect to Dynamo DB to send and read data.

There are multiple Amazon services included in order to set up the IVR process for business or call center.

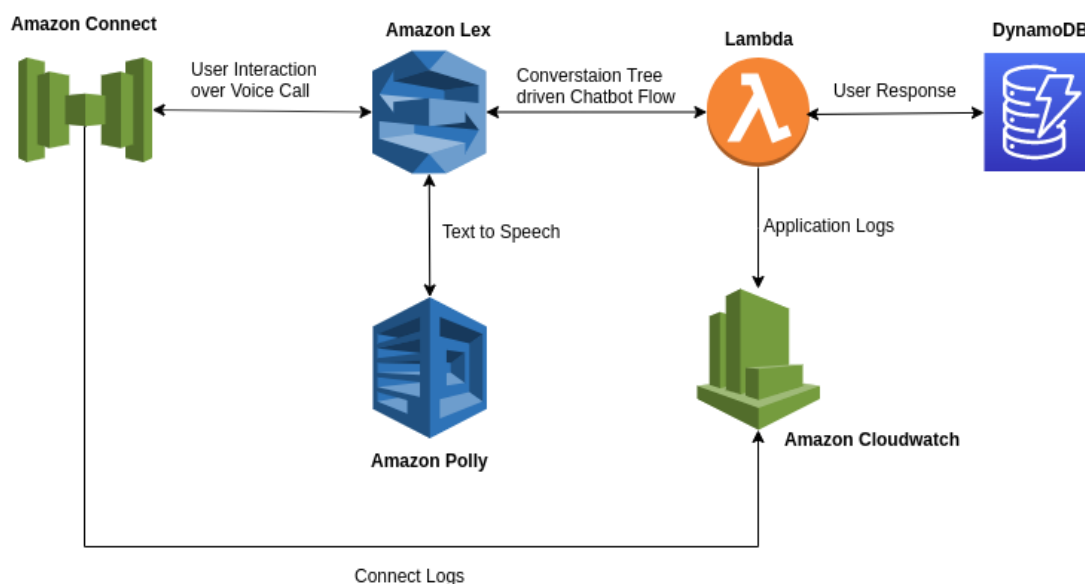


Figure 1: Architecture of Amazon Connect

2.1 Amazon Lex

Amazon Lex is an AWS service for building conversational interfaces for applications using voice and text. You can then add the conversational interfaces to bots on mobile devices, web applications, and chat platforms (for example, Facebook Messenger).

Lex provides the advanced deep learning functionalities of automatic speech recognition (ASR) for converting speech to text, and natural language understanding (NLU) to recognize the intent of the text, to enable you to build applications with highly engaging user experiences and lifelike conversational interactions.

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2.2 Amazon Polly

Amazon Polly is AWS's AI-enabled service for converting text to lifelike speech.

Amazon Polly is a service that turns text into lifelike speech. Polly lets you create applications that talk, enabling you to build entirely new categories of speech-enabled products. Polly is an Amazon AI service that uses advanced deep learning technologies to synthesize speech that sounds like a human voice.

2.3 Amazon Connect

Amazon Connect [1] is an Omni channel cloud contact center. You can set up a contact center in a few steps, add agents who are located anywhere, and start engaging with your customers.

Personalized experiences for your customers can be created using Omni channel communications. For example, you can dynamically offer chat and voice contact, based on such factors as customer preference and estimated wait times. Agents, meanwhile, conveniently handle all customers from just one interface.

Amazon Connect is an open platform that you can integrate with other enterprise applications, such as Salesforce. In addition, you can take advantage of the AWS ecosystem to innovate new experiences for your customers.

“Figure 2” provides the key characteristics of Amazon connect.

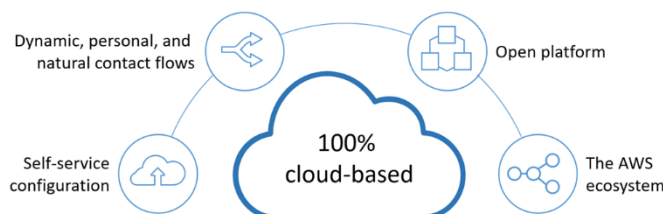


Figure 2. Amazon Connect characteristics

2.4 Amazon Lambda

AWS Lambda lets you run code without provisioning or managing servers. Pay only for the compute time you consume.

With Lambda, can run code for virtually any type of application or backend service - all with zero administration. Just upload your code and Lambda takes care of everything required to run and scale your code with high availability. You can set up your code to automatically trigger from other AWS services or call it directly from any web or mobile app.

2.5 Amazon Kendra

Amazon Kendra [2] is an enterprise search service that enables your users to intuitively search unstructured data using natural language. It returns specific answers to questions, giving users an experience that's close to

interacting with a human expert. It is highly available and scalable, tightly integrated with other AWS services, and offers enterprise-grade security.

Amazon Kendra users can ask the following types of questions, or queries:

Factoid questions — Simple who, what, when, or where questions, such as “Who is Amazon’s CEO?” or “What is the height of the Space Needle?” Factoid questions have fact-based answers that can be returned in the form of a single word or phrase. The precise answer, however, must be explicitly stated in the ingested text content.

Descriptive questions — Questions whose answer could be a sentence, passage, or an entire document. For example, “How do I connect my Echo Plus to my network?” or “How do I get tax benefits for lower income families?”

Keyword searches — for questions where the intent and scope isn't clear, for example, vacation policy or health benefits, Amazon Kendra uses its deep learning models to return relevant documents.

2.6 Amazon DynamoDB and AWS CloudWatch

Other AWS services which are used as part of this research paper is AWS DynamoDB which can be used as database to store the customer related data and AWS Cloudwatch which helps in logging the call flows and how services are working and retrieving information in case of failure. This can be used to correct the services set up and prevent failures in future.

3. Process for Connecting AWS services

As we saw from the previous section 2.1 to 2.6 on different AWS services, let's connect them together in order to see how the flow works when implemented in actual business use case scenario.

- User will call the designated number specified by the business for customer support. This is set up using Amazon connect.
- Once the user picks the call or call connected to IVR flow, Amazon Connect will pass over the user's context to the defined contact flow so that the user can then start conversing with the bot.
- The Amazon Lex bot will now receive the user's speech and convert the user's speech into text and pass it over to the Lambda function that drives the chatbot logic.
- The AWS Lambda function will now understand the user's context and accordingly will perform certain actions and elicit back a response in text.
- This text will then be converted to speech using Amazon Polly and passed over to Amazon Connect to be relayed over to the user.

The flow will repeat these above steps based on the configuration set up as per the business needs.

Let's now see a sample business use case of a call center IVR which can be set up using Amazon connect.

- Customer calls to the call center number displayed on the company website.
- Amazon Connect call flow is triggered and greets customer and provides option to select in order to continue further.
- Customer chooses the required option and customer attributes such as phone is automatically retrieved and Lex starts to fill up the slots defined and triggers lambda code hook to validate the customer inputs.
- Confirmation prompts from Lex will ask for customer to say yes or no for any specific question and based on customer response lambda function will be retrieving the data from DynamoDb based on the matched customer attributes and responses the details back to Lex and which in turn turns to speech and conveys the message to the customer.
- Based on next customer response or action the IVR will take the corresponding path.
- If customer wants to terminate the conversation or choose to speak to the next available agent then the flow can connect to the agent queue and next available agent can talk.

- c) Setting customer attributes such as 'Call Number' helps to identify if existing caller or a new caller. This requires additional set of Lambda function to be written in order to validate from the existing customer database.
- d) The flow will be linked in the sequence and the same is triggered in the way it's interconnected. Error logging behavior can be set or when an error occurs you can route to the agent queue where next available customer agent can answer the call and resolve customer issues.
- e) 'Get Customer Input' is where the Amazon Lex can be utilized to perform the validation and fulfillment if the customer request is satisfied.
- f) "Figure 5-7" provides the details of how to store the customer input into the flow.

4. Build IVR in Amazon Connect

Below steps provides the details on the set up required in Amazon Connect to build an IVR for business.

- a) Login to amazon connect dashboard. Claim a phone number you want to associate your flow. "Figure 3" shows how to login and claim a phone number to start with the process.

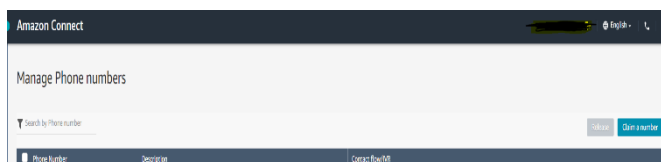


Figure 3: Claim phone number in Amazon Connect

- b) Select 'Create Contact Flow' option to create a new flow. And start building the flow with setting the logging behavior, voice and contact attributes. All the call recordings and logs will be available in the 'AWS Cloud Watch' logs.

"Figure 4" shows how to set up a flow in Amazon Connect.

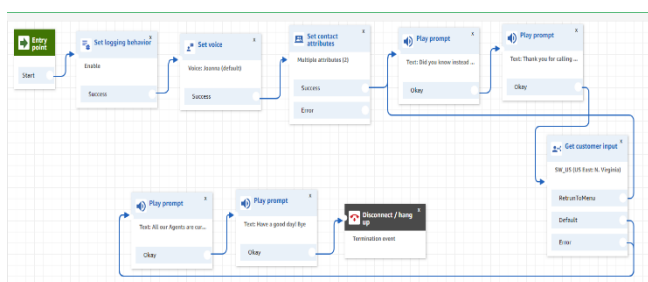


Figure 4: Create IVR flow in Amazon Connect

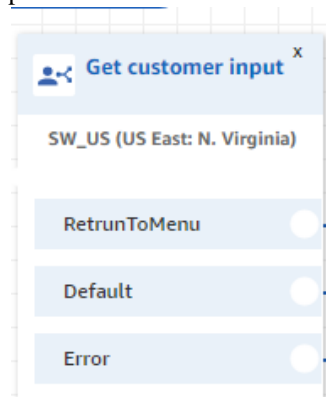


Figure 5: Get Customer Input

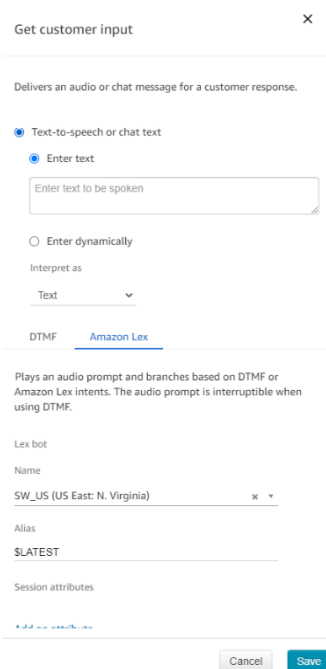


Figure 6: Get Customer Input

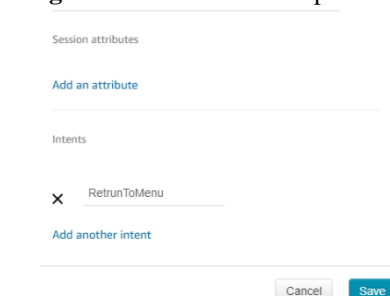


Figure 7: Save Customer Input

- g) In Amazon Lex, Utterances, Lambda initialization and validation, slots, confirmation prompt, fulfillment and response can be set.

The screenshot shows the Amazon Lex console interface for configuring an utterance. At the top, it says 'OrderFlowers 1 Edit'. Under 'Sample utterances', there are two input fields: 'I would like to order some flowers' and 'I would like to pick up flowers'. Below that, 'Lambda initialization and validation' has a checkbox for 'Initialization and validation code hook'. 'Slots' and 'Confirmation prompt' are expandable sections. 'Fulfillment' has two radio buttons: 'AWS Lambda function' (selected) and 'Return parameters to client'. 'Response' is also an expandable section. At the bottom, there are 'Save Intent' and 'Detach intent' buttons.

Figure 8: Amazon Lex utterances set up

- h) After setting up the code required then the flow can be saved and published.
- i) User can configure and dial the number associated with the flow and the process will trigger the lex and the by the slots the value will be fulfilled in the sequence defined and fulfillment will be returned to the calling customer.

Above steps from a-h shows the set up required and helps in building the automation for business processes and number of calls can be fulfilled with self-service interactive voice response.

5. Benefits to Business

By describing all these cloud services we were able to solve the business problem by reducing the monotonous calls by creating the IVR flow and the model chosen to solve this problem. This is pay-per-use-model which minimizes the cost incurred by the business. You will pay only for the time

the flow and other services used and idle time is not paid. This can be also integrated with other third party services such as venmo or PayPal to do the payment online.

A lot of business optimizations can be done and most of the calls can be answered and responded by chat by Lex bot and does not require more resources to support the business.

6. Conclusion

Interactive voice response was achieved by using the AI capable Amazon Lex, Polly and connect services.

This reduces the traffic on the call center of a business and monotonous calls can be diverted and answered using the Text to speech model by using Amazon Lex and Amazon Polly.

With the cloud technologies the pay per use model reduces the cost incurred by the business to support the customer support functions.

References

- [1] <https://docs.aws.amazon.com/connect/latest/adminguide/what-is-amazon-connect.html>
- [2] <https://docs.aws.amazon.com/kendra/latest/dg/what-is-kendra.html>

Author Profile



Sharan Kumar Paratala Rajagopal is a Senior Manager with Capgemini America, Inc. having 14+ years of design, development and architecture experience. He is specialized in Java/J2EE, Integration methodologies, Guidewire Product, Data Analytics, AI and Cloud technologies. He has vast domain experience in Public Services, Hospitality and Property & Casualty Insurance. He has also contributed multiple technical articles to major Dev communities and authored many research topics in the areas of AI, Cloud, Data Analytics and Data Visualization.

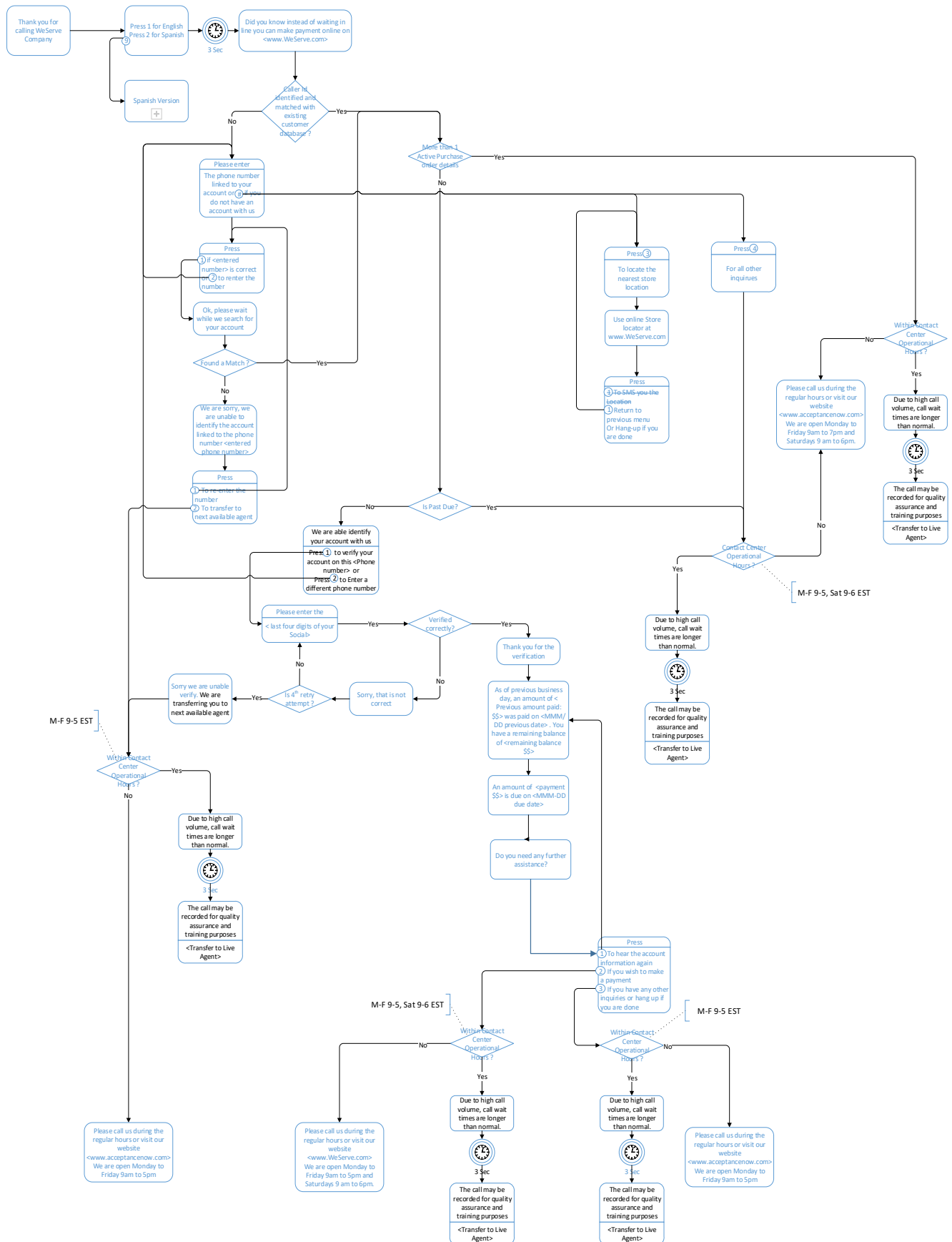


Figure 9: Business use case for building IVR