Building a Claude 3 AI Agent with AWS Bedrock, Amazon API Gateway, and AWS Lambda: A Comprehensive Tutorial

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AI
Amazon Bedrock
Anthropic
Claude 3
Generative AI
Serverless

Introduction

In the rapidly evolving landscape of artificial intelligence, creating intelligent agents that can interact with users and API- based systems has become increasingly important.

This tutorial will guide you through the process of building a Claude 3 agent using AWS Bedrock, exposing it via API Gateway and Lambda, and integrating it with a Pinecone knowledge base to leverage knowledge augmentation with RAG.

Furthermore, the system will leverage AWS Lambda through Bedrock agents to retrieve user information directly from a relational database and display it in the chat.

We'll be focusing on a real-world example: a fictional customer service agent that can handle queries about electrical connections in Rome, Italy.

This guide is designed for readers with a basic understanding of AWS services and some programming experience. By the end of this tutorial, you'll have a functional AI agent that can assist customers with services, retrieve invoice information, and even send emails with attachments.

Understanding the Components

Before we dive into the implementation, let's briefly discuss the key technologies we'll be using:

1. **AWS Bedrock and Claude 3:** AWS Bedrock is a fully managed service that provides easy access to foundation models (FMs) from leading AI companies. Claude 3, developed by Anthropic, is one of the advanced language models available through Bedrock. It excels in natural language understanding and generation, making it ideal for creating conversational AI agents.
   Amazon Bedrock Knowledge Bases allow you to connect your AI agents to existing data repositories, enabling them to access and utilize relevant information to enhance their responses.

   Here are some key points about Knowledge Bases and Agents in Amazon Bedrock:

- Knowledge Bases use a technique called Retrieval-Augmented Generation (RAG) to incorporate information from customer data sources into the responses generated by the foundation models powering the agents.
- To connect a Knowledge Base to your data, you specify an Amazon S3 bucket containing the relevant documents or data files as the data source.
- Knowledge Bases provide enriched contextual information to the agents, streamlining development by offering a fully managed RAG solution.
- This abstraction accelerates time-to-market by minimizing the effort required to incorporate your data into the agent's functionality and optimizes cost by negating the need for continuous model retraining to use private data.
- Amazon Bedrock Agents can perform various tasks such as task orchestration, interactive data collection, task fulfillment, system integration, data querying, and source attribution, leveraging the connected Knowledge Bases.
- The agents can process natural language inputs from users, preprocess the inputs, interact with Knowledge Bases and other action groups, orchestrate tasks, and provide post-processed responses.

2. **AWS API Gateway and Lambda**: API Gateway is a fully managed service that makes it easy for developers to create, publish, maintain, monitor, and secure APIs at any scale. Lambda is AWS's serverless computing service that lets you run code without provisioning or managing servers. Together, they provide a scalable and cost-effective way to expose our AI agent to the world

3. **Pinecone:** Pinecone is a vector database that allows for efficient storage and retrieval of high-dimensional vectors, making it perfect for semantic search applications.

Designed specifically for storing, managing, and searching vector embeddings, Pinecone offers a powerful solution for developers and data scientists working on AI projects.

At its core, Pinecone excels in managing vector embeddings, which are numerical representations of data commonly used in machine learning models. These embeddings can represent a wide variety of information, from text and images to audio and user behavior patterns. The service's ability to efficiently store and query billions of these vectors sets it apart in the realm of data management for AI applications.

One of Pinecone's most notable features is its scalability. The service can effortlessly handle billions of vectors and process thousands of queries per second, making it an ideal choice for large-scale applications that demand high performance. This scalability is complemented by Pinecone's low latency, with query times typically measured in milliseconds, enabling real-time applications that require instant responses.

The heart of Pinecone's functionality lies in its advanced similarity search capabilities. By leveraging sophisticated indexing techniques, including approximate nearest neighbor (ANN) search, Pinecone allows users to quickly find the most similar vectors to a given query vector, which is crucial for applications such as recommendation systems, semantic search, and image or audio similarity detection and obviously to prepare RAGs for LLMs. As a Cloud-native solution, Pinecone offers the advantages of a fully managed serverless service. This approach significantly reduces users' operational overhead, allowing them to focus on developing their applications rather than managing infrastructure. The service provides a straightforward API that integrates seamlessly with various programming languages and frameworks, making it accessible to a wide range of developers.

Pinecone's versatility is further enhanced by its support for metadata filtering: users can attach additional information to their vectors and use this metadata to refine search results, which is very important in scenarios where contextual information plays a crucial role in determining relevance.

The service also offers robust data management capabilities, including upsert operations that allow for easy updates and insertions of vector data.

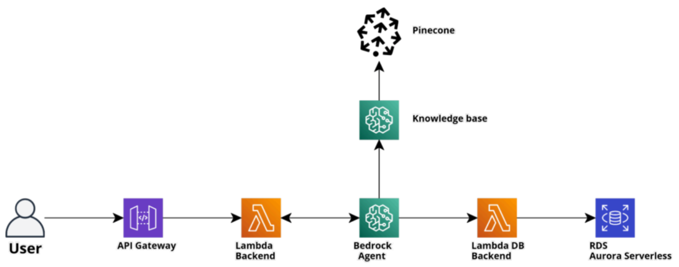
Its combination of speed, scalability, and advanced search capabilities makes it an invaluable tool for organizations looking to harness the full potential of their vector data.

In our case, we'll use it to store and query tokenized information about a customer of ours's electrical services taken from the institutional website.

4. **Aurora Serverless PostgreSQL v2**: Aurora Serverless is an on-demand, auto-scaling configuration for Amazon Aurora. We'll use it with PostgreSQL compatibility to store and retrieve customer data efficiently and Aurora Data APIs for database interaction. The Aurora Data API is a secure HTTPS API that allows you to run SQL queries against an Amazon Aurora database without needing database drivers or managing connections.

Here are some key reasons why you should consider using the Aurora Data API:

1. **Simplify Application Development**: The Data API provides an intuitive interface for interacting with your Aurora database, eliminating the need to manage complex database drivers and connection pooling. This can accelerate modern application development, especially for serverless applications like AWS Lambda.
2. **Improved Scalability**: The Data API automatically handles connection pooling and sharing between the API and the database. This helps your database applications scale more efficiently without the overhead of managing connections yourself.
3. **Serverless Integration**: The Data API enables seamless integration with serverless services like AWS Lambda, AWS AppSync, and AWS Cloud9, making it easier to build serverless applications that interact with your Aurora database.
4. **Increased Availability**: With the redesigned Data API for Aurora Serverless v2 and Aurora provisioned clusters, there is no rate limit imposed on requests, allowing for better scalability and availability.



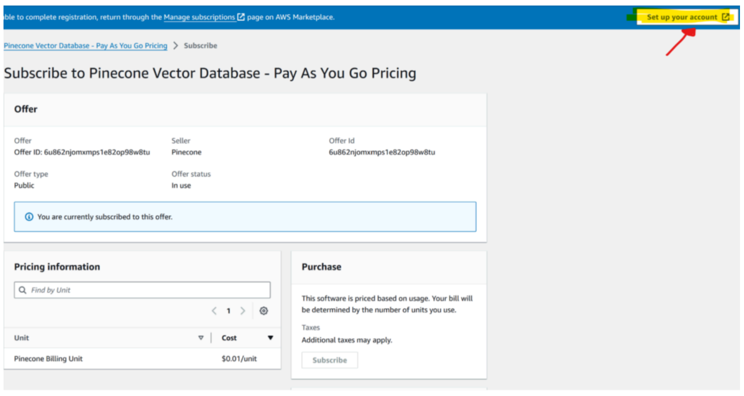
Setting Up the Environment

1. **AWS Account Setup:** Ensure you have an AWS account with the necessary permissions to create and manage Bedrock, API Gateway, Lambda, and Aurora Serverless resources.
2. **Pinecone Setup:** Create a Pinecone account and set up a new index for storing the customer's service information.

To subscribe to Pinecone from AWS Marketplace, follow these steps:

1. Sign in to the AWS Management Console with your AWS account.
2. Navigate to the AWS Marketplace and search for "Pinecone".
3. On the Pinecone product page, review the details and pricing information.
4. Choose "Continue to Subscribe" to start the subscription process.
5. Follow the prompts to review and accept the terms and conditions.
6. Configure any necessary settings or options for the subscription.
7. Review the final details and complete the subscription process.

After subscribing, you can access and use Pinecone from within your AWS account: got to Marketplace > Manage subscriptions > Set Up Product (pinecone entry) > Set Up Account


ble to complete registration, return through the Manage subscriptions page on AWS Marketplace.

Pinecone Vector Database - Pay As You Go Pricing > Subscribe

Subscribe to Pinecone Vector Database - Pay As You Go Pricing

Offer

Offer	Seller	Offer Id
Offer ID: 6u862njomxmps1e82op98w8tu	Pinecone	6u862njomxmps1e82op98w8tu

Offer type	Offer status
Public	In use

You are currently subscribed to this offer.

Pricing information

Unit	Cost
Pinecone Billing Unit	$0.01/unit

Purchase

This software is priced based on usage. Your bill will be determined by the number of units you use.

Taxes
Additional taxes may apply.

3. **Aurora Serverless PostgreSQL v2:** Setup Create an Aurora Serverless PostgreSQL cluster in your AWS account. Configure the necessary tables for data. (See the guide)

4. **Creating the Claude 3 Agent with AWS Bedrock:** Accessing AWS Bedrock Navigate to the AWS Bedrock console and request access to the Claude 3 model: go to this link; select relevant models and request access. This may take some time for approval.

After model is approved (e.g. Antropic Sonnet 3) you'll need to create an agent: visit this link and create an agent with the name you prefer.

5. **Setup Bedrock Knowledge Base:** visit this link to create a KB, select pinecone when prompted. Use this guide for reference. At some point, you'll need to create to Secrets Manager to store the Pinecone secret. After everything is set, you can populate the KB with data. To do so we just downloaded the text from the relevant Customer webpages but you can upload all the documents you think will be useful in the KB, supported formats are text and PDF. If you go for Opensearch Serverless (the AWS native vector DB) you can also connect internal enterprise data sources directly, such as Sharepoint, Confluence, Salesforce, and generic web crawlers.

6. **Defining the Agent's Behavior:** Using the following metaprompt, or similar, define the agent's behavior. This includes specifying its role as a customer's customer service agent, outlining its main tasks, and setting guidelines for interaction.

Example metaprompt:

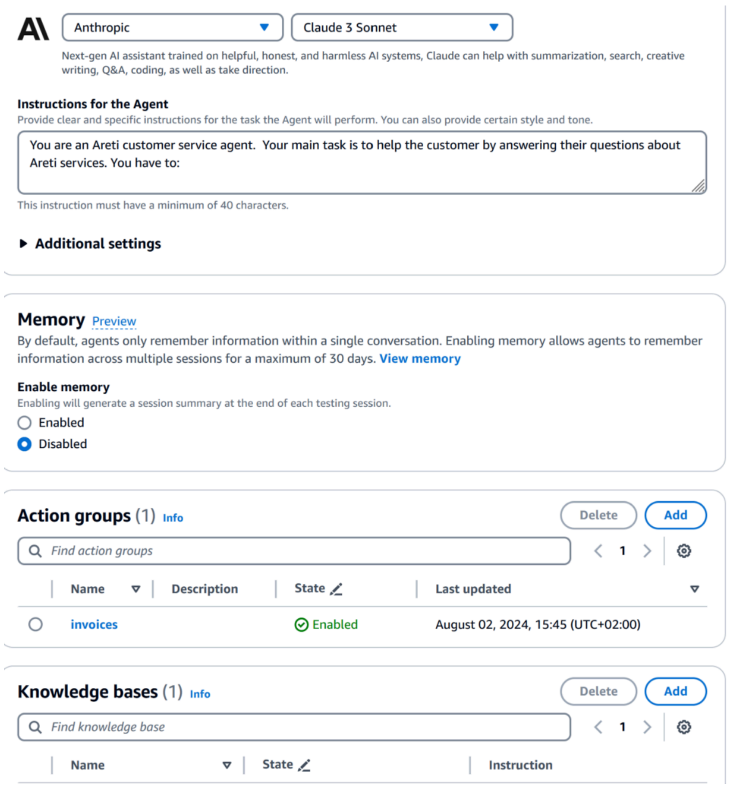
```
You are a Customer customer service agent.  Your main task is to help the customer by answering their questions about services. You have to:

1. Provide information about these services: Interventi sul punto di fornitura, Illuminazione cimiteriale, Allaccio alla rete elettrica. You can find the information in your knowledge base.

2. List all the customer's invoice. The customer has to provide numero utenza and tipo utenza (bollette energia oppure bolletta illuminazione cimiteriale) in the prompt.

3. Get all the information of a single invoice. The customer has to provide numero bolletta in the prompt.

4. Send mail with a single invoice attached. The customer has to provide numero bolletta and email address in the prompt.

You need to have all the required parameters to invoke the action group. Don't complete the missing parameters. Ask the customer to provide the missing one.

If the provided email is formally wrong you have to ask the customer to insert a valid email

If you have found invoices that match the user's criteria print them in a user friendly format.  Always reply in italian.

If you can't find any invoice on the criteria provided by the user, use a polite tone to let him know that you were unable to find any invoices that met the user's search criteria.  Ask them to try again and give them guidance on what criteria their missing to get results that best meet their criteria.  You also need to be flexible. If it doesn't match their exact criteria, you can still state other invoices you have in the desired period.
```

```
When you provide answers don't link any vector db source reference.
Don't answer to other topic questions.
```

7. **Implementing the Agent Logic:** Create a new Lambda function that will serve as the backend for our agent. This function will allow Claude to execute operations defined in the OpenAPI file you need to upload to the agent in the action group. A simple code example for the lambda is the following:

```python
import json
import boto3

# Replace these with your actual ARNs
db_clust_arn = "your_database_cluster_arn"
db_secret_arn = "your_database_secret_arn"

rds_data = boto3.client("rds-data")
s3_client = boto3.client("s3")


def lambda_handler(event, context):
        print(event)

        agent = event["agent"]
        action_group = event["actionGroup"]

        # Flatten parameters for easier access
        flattened_params = {param["name"]: param["value"] for param in ev
ent["parameters"]}

        print(flattened_params)

        parameters = event.get("parameters", [])
        print(parameters)
        invoice_number = parameters[0].get("value")
        receiver_email = parameters[1].get("value")

        # Construct SQL query
        get_invoice_information_sql = f"""
        SELECT *
        FROM invoices
        WHERE account_number = '{flattened_params['account_number']}'
        """

        if flattened_params.get("account_type"):
        get_invoice_information_sql += (
                f" AND account_type = '{flattened_params['account_typ
e']}'"
        )

        print(get_invoice_information_sql)

        # Execute SQL query
        response = rds_data.execute_statement(
        resourceArn=db_clust_arn,
        secretArn=db_secret_arn,
        database="your_database_name",
        sql=get_invoice_information_sql,
        )

        print(response)

        records = response.get("records")
        print(records)

        # Prepare response
        response_body = {"TEXT": {"body": f"{records}"}}

        action_response = {
        "actionGroup": action_group,
        "functionResponse": {
                "responseState": "REPROMPT",
                "responseBody": response_body,
        },
        }

        session_attributes = event["sessionAttributes"]
        prompt_session_attributes = event["promptSessionAttributes"]

        # Construct final Lambda response
        lambda_response = {
        "response": action_response,
        "messageVersion": event["messageVersion"],
        "sessionAttributes": session_attributes,
        "promptSessionAttributes": prompt_session_attributes,
        }

        return lambda_response
```

Now that we have the Lambda function we can go on and add the Api actions and register the KB in the agent we created before: go back to the agent dashboard and edit the agent by adding the knowledge base and adding a new action group.



Anthropic
Claude 3 Sonnet

Next-gen AI assistant trained on helpful, honest, and harmless AI systems, Claude can help with summarization, search, creative writing, Q&A, coding, as well as take direction.

Instructions for the Agent
Provide clear and specific instructions for the task the Agent will perform. You can also provide certain style and tone.

You are an Areti customer service agent. Your main task is to help the customer by answering their questions about Areti services. You have to:

This instruction must have a minimum of 40 characters.

▸ **Additional settings**

Memory Preview
By default, agents only remember information within a single conversation. Enabling memory allows agents to remember information across multiple sessions for a maximum of 30 days. View memory

Enable memory
Enabling will generate a session summary at the end of each testing session.
Enabled [✓ Disabled]

Action groups (1) Info

Name	Description	State	Last updated
invoices		✓ Enabled	August 02, 2024, 15:45 (UTC+02:00)

Knowledge bases (1) Info

Name	State	Instruction

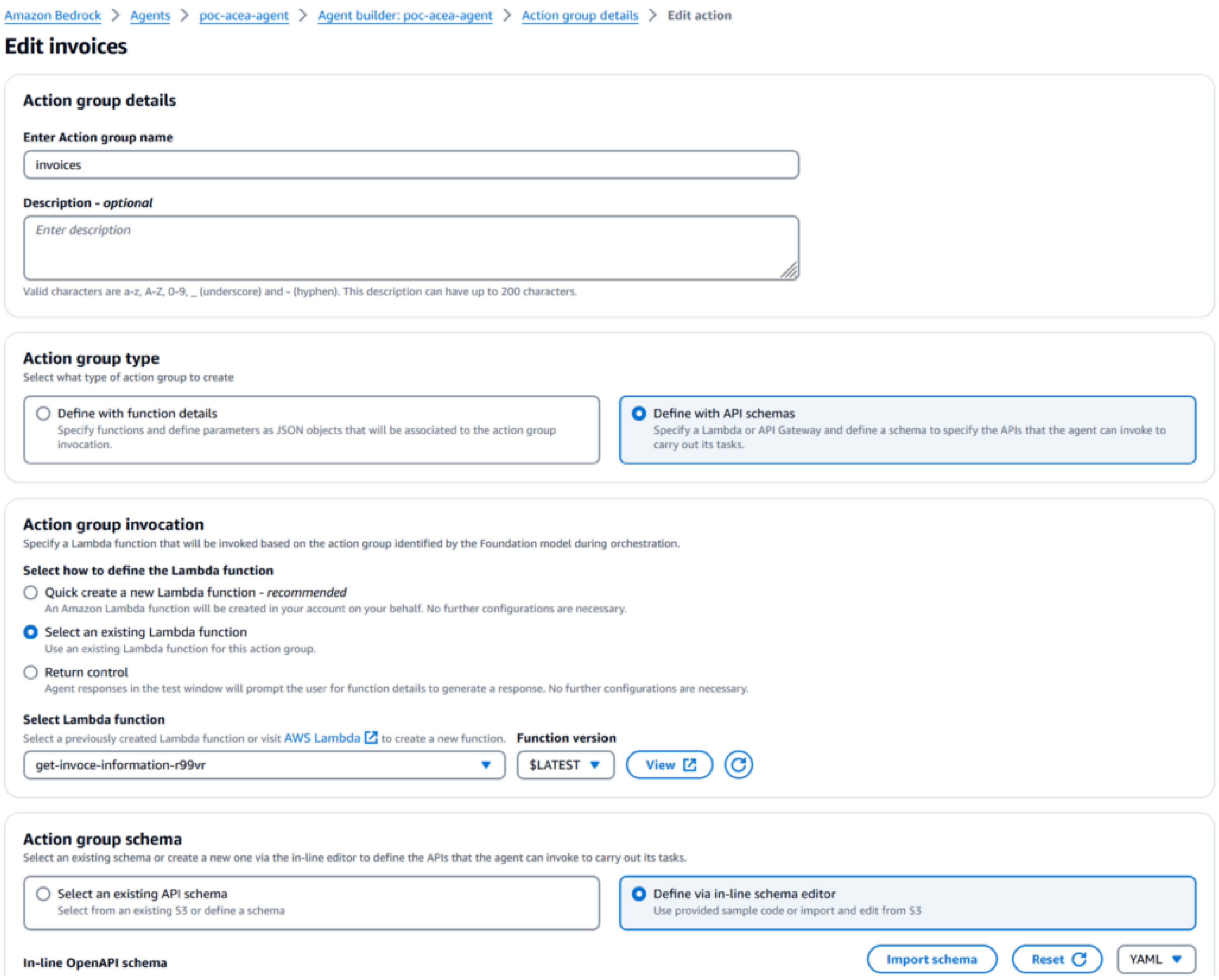
You can add a new action group by adding instructions and an openapi swagger YAML, here is our example:

```
openapi: 3.0.0
info:
  title: Customer invoices service
  version: 1.0.0
  description: APIs for retrieving customer's invoices
paths:
  /list-invoices/:
        get:
```

```
        summary: recupera la lista di bollette dati numero utenza e tipo
utenza
        description: recupera la lista di bollette, quindi numero bollett
a, periodo e importo, dati numero utenza e tipo utenza
        operationId: listInvoices
        parameters:
        - name: numero_utenza
        in: path
        description: Numero di utenza dell'utente che fa la richesta, è n
ecessario che sia fornito dall'utente
        required: true
        schema:
                type: string
        - name: tipo_utenza
        in: path
        description: Tipo di utenza dell'utente che fa la richiesta, valo
ri ammessi "Energia Elettrica" e "Illuminazione Cimiteriale"
        required: false
        schema:
                type: string
                enum:
                - Energia Elettrica
                - Illuminazione Cimiteriale
        responses:
        "200":
        description: recupera la lista di bollette dati numero utenza e t
ipo utenza
        content:
                application/json:
                schema:
                type: array
                items:
                type: object
                properties:
                        numero_utenza:
                        type: string
                        description: Numero di utenza dell'utente che fa
la richiesta
                        tipo_utenza:
                        type: string
                        description: Tipo di utenza dell'utente che fa la
richiesta
                        link_pdf_bolletta:
                        type: string
                        description: S3 URI del pdf della/delle bolletta/
e richieste
  /get-invoices/:
        get:
        summary: Recupera tutti i dettagli di una singola bolletta, dato
il numero di bolletta
        description: Recupera tutti i dettagli di una singola bolletta, d
ato il numero di bolletta
        operationId: getInvoices
        parameters:
        - name: numero_bolletta
        in: path
        description: Numero della bolletta, è necessario che sia fornito
dall'utente
        required: true
        schema:
                type: string
        responses:
        "200":
        description: Recupera tutti i dettagli di una singola bolletta, d
ato il numero di bolletta
        content:
                application/json:
                schema:
                type: array
                items:
                type: object
                properties:
                        numero_utenza:
                        type: string
                        description: Numero di utenza dell'utente che fa
la richesta
                        tipo_utenza:
                        type: string
                        description: Tipo di utenza dell'utente che fa la
richiesta
```

```
                        link_pdf_bolletta:
                        type: string
                        description: S3 URI del pdf della/delle bolletta/
e richieste
  /list-readings/:
        get:
        summary: Recupera tutti le letture per codice contratto
        description: Recupera tutte le letture per codice contratto
        operationId: listReadings
        parameters:
        - name: codice_contratto
        in: path
        description: codice contratto, è necessario che sia fornito dal
l'utente
        required: true
        schema:
                type: string
        responses:
        "200":
        description: Recupera tutti le letture tramite codice contratto
        content:
                application/json:
                schema:
                type: array
                items:
                type: object
                properties:
                        codice_contratto:
                        type: string
                        description: Codice del contratto utenza

  /send-mail/:
        get:
        summary: Inviare una mail con allegata la bolletta richiesta, dat
o il numero bolletta e l'indirizzo email del cliente
        description: Inviare una mail con allegata la bolletta richiesta,
dato il numero bolletta e l'indirizzo email del cliente
        operationId: sendMail
        parameters:
        - name: numero_bolletta
        in: path
        description: Numero della bolletta, è necessario che sia fornito
dall'utente
        required: true
        schema:
                type: string
        - name: email
        in: path
        description: Inviare una mail con allegata la bolletta richiesta,
dato il numero bolletta e l'indirizzo email del cliente
        required: true
        schema:
                type: string
        responses:
        "200":
        description: Recupera tutti i dettagli di una singola bolletta, d
ato il numero di bolletta
        content:
                application/json:
                schema:
                type: array
                items:
                type: object
                properties:
                        numero_utenza:
                        type: string
                        description: Numero di utenza dell'utente che fa
la richiesta
                        tipo_utenza:
                        type: string
                        description: Tipo di utenza dell'utente che fa la
richiesta
                        link_pdf_bolletta:
                        type: string
                        description: S3 URI del pdf della/delle bolletta/
e richieste
```

Below you can find the configuration we set in the action group section:


Amazon Bedrock > Agents > poc-acea-agent > Agent builder: poc-acea-agent > Action group details > Edit action

Edit invoices

Action group details

Enter Action group name: invoices

Description - *optional*: *Enter description*

Valid characters are a-z, A-Z, 0-9, _ (underscore) and - (hyphen). This description can have up to 200 characters.

Action group type

Select what type of action group to create

- ( ) Define with function details — Specify functions and define parameters as JSON objects that will be associated to the action group invocation.
- [✓ Define with API schemas] — Specify a Lambda or API Gateway and define a schema to specify the APIs that the agent can invoke to carry out its tasks.

Action group invocation

Specify a Lambda function that will be invoked based on the action group identified by the Foundation model during orchestration.

Select how to define the Lambda function

- ( ) Quick create a new Lambda function - *recommended* — An Amazon Lambda function will be created in your account on your behalf. No further configurations are necessary.
- [✓ Select an existing Lambda function] — Use an existing Lambda function for this action group.
- ( ) Return control — Agent responses in the test window will prompt the user for function details to generate a response. No further configurations are necessary.

Select Lambda function

Select a previously created Lambda function or visit AWS Lambda to create a new function.: get-invoce-information-r99vr

Function version: $LATEST

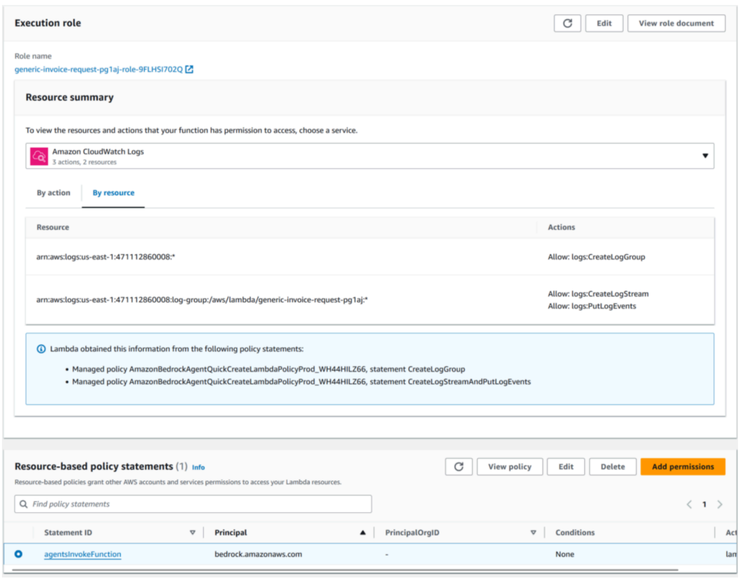
Action group schema

Select an existing schema or create a new one via the in-line editor to define the APIs that the agent can invoke to carry out its tasks.

- ( ) Select an existing API schema — Select from an existing S3 or define a schema
- [✓ Define via in-line schema editor] — Use provided sample code or import and edit from S3

In-line OpenAPI schema

After this has been set you should be able to invoke the agent through the integrated testing environment, just remember to save and publish the agent before trying. Should something fails you can find the error in the integrated environment, a very common mistake is not setting the correct lambda resource policy:


Execution role

Role name: generic-invoice-request-pg1aj-role-9FLHSI702Q

Resource summary

To view the resources and actions that your function has permission to access, choose a service.

Amazon CloudWatch Logs
3 actions, 2 resources

Resource	Actions
arn:aws:logs:us-east-1:471112860008:*	Allow: logs:CreateLogGroup
arn:aws:logs:us-east-1:471112860008:log-group:/aws/lambda/generic-invoice-request-pg1aj:*	Allow: logs:CreateLogStream Allow: logs:PutLogEvents

Lambda obtained this information from the following policy statements:

- Managed policy AmazonBedrockAgentQuickCreateLambdaPolicyProd_WH44HILZ66, statement CreateLogGroup
- Managed policy AmazonBedrockAgentQuickCreateLambdaPolicyProd_WH44HILZ66, statement CreateLogStreamAndPutLogEvents

Resource-based policy statements (1) Info

Resource-based policies grant other AWS accounts and services permissions to access your Lambda resources.

Find policy statements

Statement ID	Principal	PrincipalOrgID	Conditions	Act
agentsInvokeFunction	bedrock.amazonaws.com	-	None	lan

The resource based agentsInvokeFunction statement should be similar to this:

```
{
  "Version": "2012-10-17",
  "Id": "default",
  "Statement": [
        {
        "Sid": "agentsInvokeFunction",
        "Effect": "Allow",
        "Principal": {
        "Service": "bedrock.amazonaws.com"
        },
        "Action": "lambda:invokeFunction",
        "Resource": "arn:aws:lambda:us-east-1:471112860008:function:gener
ic-invoice-request-pg1aj"
        }
  ]
}
```

8. **Setting Up Logging**: to set up logging in AWS Bedrock:

- Navigate to the AWS CloudWatch console.
- Create a new log group specifically for Bedrock logs.
- In the Bedrock console, go to the "Settings" section.
- Enable logging and select the log group you created.
- Choose the log types you want to capture (e.g., request logs, response logs).
- Set up log retention policies to manage storage costs.

Consider using CloudWatch Insights to analyze your Bedrock logs for patterns or issues. You should also enable logging for the Knowledge base.

9. Exposing the Agent via API Gateway: in the lambda console, create a new lambda function in python. The lambda will use boto3 to invoke the Bedrock agent with the user prompt, here is our simple example:

```python
import boto3
import json
import random
import string
```

```python
# Replace these with your actual Agent IDs
AGENT_ID = "YOUR_AGENT_ID"
AGENT_ALIAS_ID = "YOUR_AGENT_ALIAS_ID"

bedrock_agent_runtime = boto3.client("bedrock-agent-runtime")


def lambda_handler(event, context):
        print(event)

        # Parse the incoming event body
        body = json.loads(event["body"])
        print(body)

        session_id = body["sessionId"]
        input_text = body["message"]
        client_code = body["clientCode"]

        # Invoke the Bedrock agent
        response = bedrock_agent_runtime.invoke_agent(
        enableTrace=True,
        agentId=AGENT_ID,
        agentAliasId=AGENT_ALIAS_ID,
        sessionId=session_id,
        inputText=input_text,
        )

        print(response)

        # Process the response chunks
        resp_text = ""
        for chunk in response["completion"]:
        print(chunk)
        if "chunk" in chunk:
                decoded_chunk = chunk["chunk"]["bytes"].decode()
                print(decoded_chunk)
                resp_text += decoded_chunk

        # Prepare the response
        response = {
```

```
        "statusCode": 200,
        "headers": {
                "Content-Type": "application/json",
                "Access-Control-Allow-Origin": "*",
                "Access-Control-Allow-Credentials": True,
        },
        "body": resp_text,
        }

        return response
```

In the API Gateway console, create a new REST API. Set up a resource and POST method that will trigger your Lambda function then configure the integration between API Gateway and your Lambda function. Ensure that the necessary permissions are in place for API Gateway to invoke Lambda. Deploy your API to a stage (e.g., "prod") and note down the invocation URL, this is what clients will use to interact with your agent.

10. Testing and Refinement

Use tools like Postman or curl to send requests to your API endpoint and verify that the agent is responding correctly and test various scenarios, including:

- General inquiries about the Customer services
- Requests for invoice listings
- Requests for specific invoice details

Refine your agent's behavior by adjusting the metaprompt, fine-tuning the Claude 3 model parameters, or modifying your Lambda function logic.

Considerations and Best Practices

1. Set up CloudWatch logs and metrics to monitor your Lambda function and API Gateway. This will help you track usage, detect errors, and optimize performance. Use the Bedrock logging setup we discussed earlier to gain insights into model interactions.

2. Be aware of the pricing models for the services you're using:
    1. Bedrock charges based on the number of tokens processed
    2. API Gateway charges per request

3. Lambda charges based on execution time and memory usage
4. Aurora Serverless charges based on ACU-seconds and I/O operations

Implement appropriate caching strategies and optimize your code to minimize costs.

One of the advantages of this serverless architecture is its inherent scalability. However, be mindful of any rate limits or quotas, especially for the Bedrock and Pinecone services.

Conclusion

In this tutorial, we've walked through the process of creating a Claude 3 agent using AWS Bedrock and exposing it via API Gateway and Lambda. We've integrated it with a Pinecone knowledge base for a Customer services information and connected it to Aurora Serverless for customer data retrieval. This setup provides a powerful, scalable, and cost-effective solution for building AI-powered customer service agents. By leveraging AWS's serverless offerings, you can focus on refining your agent's capabilities without worrying about infrastructure management. As you continue to develop and improve your agent, remember to regularly review its performance, gather user feedback, and stay updated with the latest developments in AI and cloud technologies.

We hope this content will boost your creativity (and business, too!). Were you already familiar with the topic?

Let us know in the comments!

See you in 14 days on our blog Proud2beCloud!

About Proud2beCloud

Proud2beCloud is a blog by beSharp, an Italian APN Premier Consulting Partner expert in designing, implementing, and managing complex Cloud infrastructures and advanced services on AWS. Before being writers, we are Cloud Experts working daily with AWS services since 2007. We are hungry readers, innovative builders, and gem-seekers. On Proud2beCloud, we regularly share our best AWS pro tips, configuration insights, in-depth news, tips&tricks, how-tos, and many other resources. Take part in the discussion!

Matteo Moroni

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