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Review Article

SCIENTIFIC Research and Community

Composing Serverless Azure Functions in NodeJS with MySQL Database Integration

Bhargav Bachina

USA

ABSTRACT

This paper delves into the concept and implementation of serverless computing, particularly focusing on Azure Functions as a platform for deploying serverless applications. It introduces the notion of a Function app, a container that amalgamates functions into a single logical unit, thereby simplifying management, deployment, and resource sharing. Serverless computing is elucidated as Function as a Service (FaaS), a paradigm where business logic is executed in the form of functions without the need for manual infrastructure management. Azure Functions enables developers to host and execute business logic seamlessly, without the concerns of provisioning infrastructure. The platform supports a multitude of programming languages, including C#, Java, JavaScript, TypeScript, and Python, offering versatility in development approaches. The paper further explores the utilization of triggers, specifically HTTP triggers, for executing code in response to HTTP requests. It highlights the development process within Visual Studio Code, facilitated by the Azure Functions extension, which allows for the comprehensive creation and deployment of projects. Additionally, the distinction between Consumption service plans and App Service Plans is examined, along with the prerequisite of linking every function app to a storage account. Deployment methodologies, both locally and through the Azure portal, are outlined, along with the capabilities for monitoring logs via the Azure portal's Monitor section. This comprehensive overview provides insights into leveraging Azure Functions for efficient, scalable, and manageable serverless application development.

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Azure Functions represent an efficient method for executing code snippets in the cloud, liberating developers from the complexities of managing the infrastructure traditionally required for code hosting. This platform supports a diverse array of programming languages, including C#, Java, JavaScript, PowerShell, Python, and others as documented in the Azure Functions supported languages guide. A notable feature of Azure Functions is the consumption plan, which offers a cost-effective payment model based solely on the execution time of the code, ensuring that resources are automatically scaled according to user demand.

The practice of writing serverless code has gained widespread popularity, with Azure Functions leading the way by providing a flexible and economical approach to code execution. This serverless model allows developers to focus on their code, written in various programming languages such as Java, Python, NodeJS, and more, without worrying about the operational aspects of server management. This paper will specifically explore the development of NodeJS Azure Functions, integrating MySQL as the database backend. Through this exploration, we aim to demonstrate the versatility and efficiency of Azure Functions in supporting serverless application development, emphasizing the ease of deployment, scalability, and cost-effectiveness inherent in the serverless computing paradigm.

- Prerequisites
- Example Project
- Project Structure
- Create MySQL Server on Azure
- Install Azure Data Studio
- Connect MySQL Through Azure Data Studio
- Create a Database and Table
- Configure MySQL in Azure Functions
- Summary
- Conclusion

Prerequisites

You need to know a lot of things as prerequisites if you want to write serverless NodeJS REST API. First, you need to create two accounts: a GitHub account to store the source code and Microsoft Account to deploy that code using Function App Service. Let's create these accounts by following the below links. You can start both for free.

- GitHub Account
- Microsoft Azure Account

Since we are building the NodeJS REST API application you need to be familiar with nodejs, and javascript. You need to install NodeJS on your local machine.

- NodeJS
- Javascript
- Azure Data Studio
- MySQL

- Sequelize
- VSCode

NodeJS

As an asynchronous event-driven JavaScript runtime, Node.js is designed to build scalable network applications.

Sequelize

Sequelize provides various methods to assist in querying your database for data.

Azure Data Studio

Azure Data Studio offers additional experiences available as optional extensions. It's built for data professionals who use SQL Server and Azure databases on-premises or in multi-cloud environments.

MySQL Community Edition

Community Edition relational Database

VSCode

The editor we are using for the project. It's open-source and you can download it here.

Postman

Manual testing of your APIs

If you are new to NodeJS and don't know how to build REST API with it, I would recommend going through the below article. We used the project from this article as a basis for this post.

- How to write production-ready Node.js Rest API Javascript version
- How To Write Serverless NodeJS REST API With Azure Functions

Microsoft Azure Account

You should have a Microsoft Azure Account. You can get a free account for one year. You should see the below screen after you log in.

Azure Account



Azure Home Screen

You need to create a subscription for your account. The most common is the Pay as You Go subscription.

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Pay-As-You-Go Subscription

You need a subscription to be associated with your tenant so that all the cost is billed to this subscription. If you are new to Azure, please go through the below article on how to get started with Azure.

· How To Get Started with Azure

Example Project

Here is the Github link for the example project you can just clone and run on your machine.

// clone the project

git clone https://github.com/bbachi/azure-func-mysql.git

There are four endpoints in this project. Let's look at one endpoint. Each endpoint has index.js and function.json files as below. The function.json has details such as route, method type, etc. The index.js file is the main file and starting file of the API and the controller is called from here.

• Files (https://gist.github.com/bbachi/0ffa11a2457301db6081c6 994c28d95b#file-index-js)

We are using azure function-core tools for the development phase that speeds up your development. You just need to run this command after installing all dependencies.

// install dependencies npm install

// start the server in development phase
npm start



Running the Application

Project Structure

Let's understand the project structure that we have here. The starting point of the application is folders as shown below and we have all the scripts, dependencies, etc in the package.json.

// endpoints/folders

- api-tasks-delete
- api-tasks-edit
- api-tasks-list

api-tasks-save



Project Structure

Each endpoint has index.ts and function.json files as below. The *function.json* has details such as route, method type, etc. The *index.js* file is the main file and starting file of the API and the controller is called from here.

• Files (https://gist.github.com/bbachi/0ffa11a2457301db6081c6 994c28d95b#file-index-js)

We have a controller, service, and repository in the src folder. All the logging-related configuration goes into api.logger.js under the folder logger. We have the local.settings.json file for all the environment-related configurations. We have a db.config.js file for all the database configurations.

Create MYSQL Server on Azure

There are so many ways we can create and deploy MySQL servers; we will use Azure to create one for this post. Let's login into the Azure portal and create Azure Database for MySQL. You need an Azure Subscription and Account to create one. Please go through the below article on how to create those if you are new to Azure. • How To Get Started with Azure

Let's Create a Resource Group for The Demo Project

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Creating a resource group

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Creating a resource group

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Resource Group

Let's create resources under this resource group. We can select from the marketplace below. Let's select Azure Database for MySQL Flexible Server.



Azure Database for MySQL Flexible Server

You can give a unique name on the creation page.

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Flexible Server

You must select the Authentication method. I am selecting the MySQL authentication-only option and gave it an admin username and password.

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Authentication Method

We can enable public access for this demo on the networking tab.

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Allowing Public Access

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Public Access

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Geo-redundancy	Not Enabled	<u></u>	
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Allow public access from any Azure service within Azure to this server	Yes		
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Security (Change)			
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Creating Server

It takes some time to create the server.

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Deployment in Progress



Deployment Completed

You can go to the overview page after the deployment.

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Install Azure Data Studio

Azure Data Studio is a cross-platform tool that can be used to connect databases from several database engines. You can write queries and execute them. There are so many extensions you can install based on your requirement. You can learn about that in the below link.

• What is Azure Data Studio (https://learn.microsoft.com/en-us/ azure-data-studio/what-is-azure-data-studio)

Here is the download link you can download the Data Studio based on your OS.

• Download Azure Data Studio (https://learn.microsoft.com/en-us/ azure-data-studio/download-azure-data-studio)





Azure Data Studio

Connect MYSQL through Azure Data Studio

Since we are connecting to the MySQL database, we need to have that extension installed below.

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MySQL extension

Once the extension is installed, we can click the new button to connect to the server.

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Connecting To the MySQL Database

Let's get the MySQL Connection details from the Azure portal below.



MySQL Connection Details

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sources	Connection Detail	5	
story	Connection type	MySQL	~
	Server name *	azure-mysql-demo mysql database azure.com	
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SQL Connection

You can see all the details once connected.

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MySQL Connected

Create a Database and Table

Let's create a Database by clicking on the Query Tool below.

Create Database Tasks



Database Creation

You can see the Database created in the dropdown below.

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Database Created

Let's run the following query to create the database table.

• Query SQL (https://gist.github.com/bbachi/7aa313f0ec81e0fe 73d08c48758b632d#file-database-sql)

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	4:13:05 PM Started executing overy at Line.3 Commands completed successfully Total execution time: 00:00:00.318	0y -

Executing the query

Let's run the following query to verify whether the table is created or not.

Select * from tasks

14 sele	ct + from TASKS					
Results M	essages					
10	NAME	DESCRIPTION	CREATEDAT	UPDATEDAT	CREATEDBY	UPDATEDBY

Table Created

Configure MYSQL in Azure Functions

Let's configure MySQL from our application. The first thing we need to do is to get the connection string or connection details. You can get it from the properties in the Azure Portal.

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MySQL Connection Details

The next thing is to install mysql2 with the following command.

// install client and sequelize
npm install mysql2
npm install sequelize

Let's place the connection string and database name in the application properties file as below. You have to URL encode the password if you have any special characters in the password.

You need to define the DB environment variables in the file called local.settings.json as below. Storing configuration in the environment separate from code is based on The Twelve-Factor App methodology.

local.settings.json

(https://gist.github.com/bbachi/d8e09e95063e7b7f243df1e1874 3438b#file-local-settings-json)

Let's define the configuration class where it creates a connection with the connection details from the properties. We are using mysql2 to connect with MySQL for all the queries. This client makes it easy for you to interact with MySQL. Sequelize is a promise-based NodeJS ORM tool for many relational databases such as Postgres, MYSQL, etc [1-4].

• db.config.js

(https://gist.github.com/bbachi/2c186a005ef08db1a86170c2cfc 52b94#file-db-config-js)

We need to define a model for our collection as below. We need to define the schema for the collection and then you need to pass that schema to the model and export it as a module.

• task.model.js

(https://gist.github.com/bbachi/1baecb0a5bf81bfe78aa7a5dff75 1f72#file-task-model-js)

Finally, here is the repository class which uses the above model for all the CRUD operations.

task.repository.js

(https://gist.github.com/bbachi/e721c43fab8207fbeb94acfdb0b5 5749#file-task-repository-js)

We have this service file in between the controller and repository for any data manipulation if needed.

task.service.js

(https://gist.github.com/bbachi/8d11f6d04235d4f43f2e89f7b1aa c7ab#file-task-service-js)

Since we are doing this locally. We must disable the SSL for connecting. We should set the parameter require_secure_transport OFF under the section called Server Parameters.





With all the above files in place, we can hit the following URL.

http://localhost:7071/api/tasks



API GET URL

Summary

- The container that groups functions into a logical unit for easier management, deployment and sharing of resources is called Function app.
- Serverless computing can be thought of as a function as a service (FaaS), or a microservice that is hosted on a cloud platform. Your business logic runs as functions, and you don't have to manually provision or scale infrastructure.
- Azure Functions is a serverless application platform. It allows developers to host business logic that can be executed without provisioning infrastructure.
- You can write Azure functions in several languages such as C#, java, javascript, typescript, Python, etc.
- You need to use this trigger when you want to execute the code in response to a request sent through the HTTP protocol.
- You need to install the Azure Functions extension. Once you install the Azure Functions extension for Visual Studio Code you can create the entire project from VSCode itself.
- Function apps may use one of two types of service plans. The first service plan is the Consumption service plan, and another is the App Service Plan.
- Every function app should be linked with a storage account. When you create a function app, it must be linked to a storage account.
- You need an Azure Functions extension for Visual Studio Code to develop the entire thing locally.
- When you deploy it to the function app you can see it in the Azure portal.
- To deploy locally, you can click on the up-arrow icon in the Azure Functions extension in the VSCode.
- You can monitor logs of the API by accessing the Monitor section of each function on the Azure portal.

Conclusion

In conclusion, Azure Functions emerges as a pivotal solution in the realm of serverless computing, offering a streamlined and efficient approach for developers to deploy and manage their business logic in the cloud. By abstracting away the complexities associated with infrastructure management, Azure Functions enables the execution of code in a variety of programming languages, such as C#, Java, JavaScript, TypeScript, and Python, without the overhead of provisioning and scaling resources. The utilization of Function apps facilitates the grouping of functions into logical units, simplifying management, deployment, and resource sharing.

Furthermore, the platform's flexibility is showcased through its support for multiple triggering options, including HTTP requests, and its accommodation of diverse development environments via extensions for Visual Studio Code. The choice between Consumption and App Service plans offers tailored solutions to meet different operational and financial requirements, underscored by the necessity of linking function apps to a storage account for optimal functionality. Deployment capabilities, both locally and through the Azure portal, coupled with comprehensive monitoring tools, underscore the efficacy and convenience of Azure Functions in the serverless landscape. This exploration of Azure Functions underscores its significance as a robust platform that not only simplifies the development process but also aligns with the evolving needs of modern cloud-based applications. overhead of provisioning and scaling resources. The utilization of Function apps facilitates the grouping of functions into logical units, simplifying management, deployment, and resource sharing. Furthermore, the platform's flexibility is showcased through its support for multiple triggering options, including HTTP requests, and its accommodation of diverse development environments via extensions for Visual Studio Code. The choice between Consumption and App Service plans offers tailored solutions to meet different operational and financial requirements, underscored by the necessity of linking function apps to a storage account for optimal functionality. Deployment capabilities, both locally and through the Azure portal, coupled with comprehensive monitoring tools, underscore the efficacy and convenience of Azure Functions in the serverless landscape. This exploration of Azure Functions underscores its significance as a robust platform that not only simplifies the development process but also aligns with the evolving needs of modern cloud-based applications.

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