Bootcamp-Project 4

MULTI-REGION DISASTER RECOVERY SETUP WITH TRAFFIC MANAGER

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Introduction

In today's cloud-native environments, building highly available and resilient applications is a fundamental requirement for businesses. This project focuses on designing and implementing a **multi-region disaster recovery solution** using **Microsoft Azure** services. The goal is to deploy a web application across two Azure regions, ensuring business continuity even during regional outages. The architecture uses **Azure Traffic Manager** for intelligent traffic distribution, **Azure App Services** for hosting the web application instances, **Azure SQL Database with Geo-Replication** for backend resiliency, and **Azure Storage with Geo-Redundant Storage (GRS)** for data durability.

The project also includes simulating a regional failure to validate the disaster recovery strategy, setting up monitoring and alerting mechanisms with **Azure Monitor**, and generating a report analyzing failover behaviour and system response times.

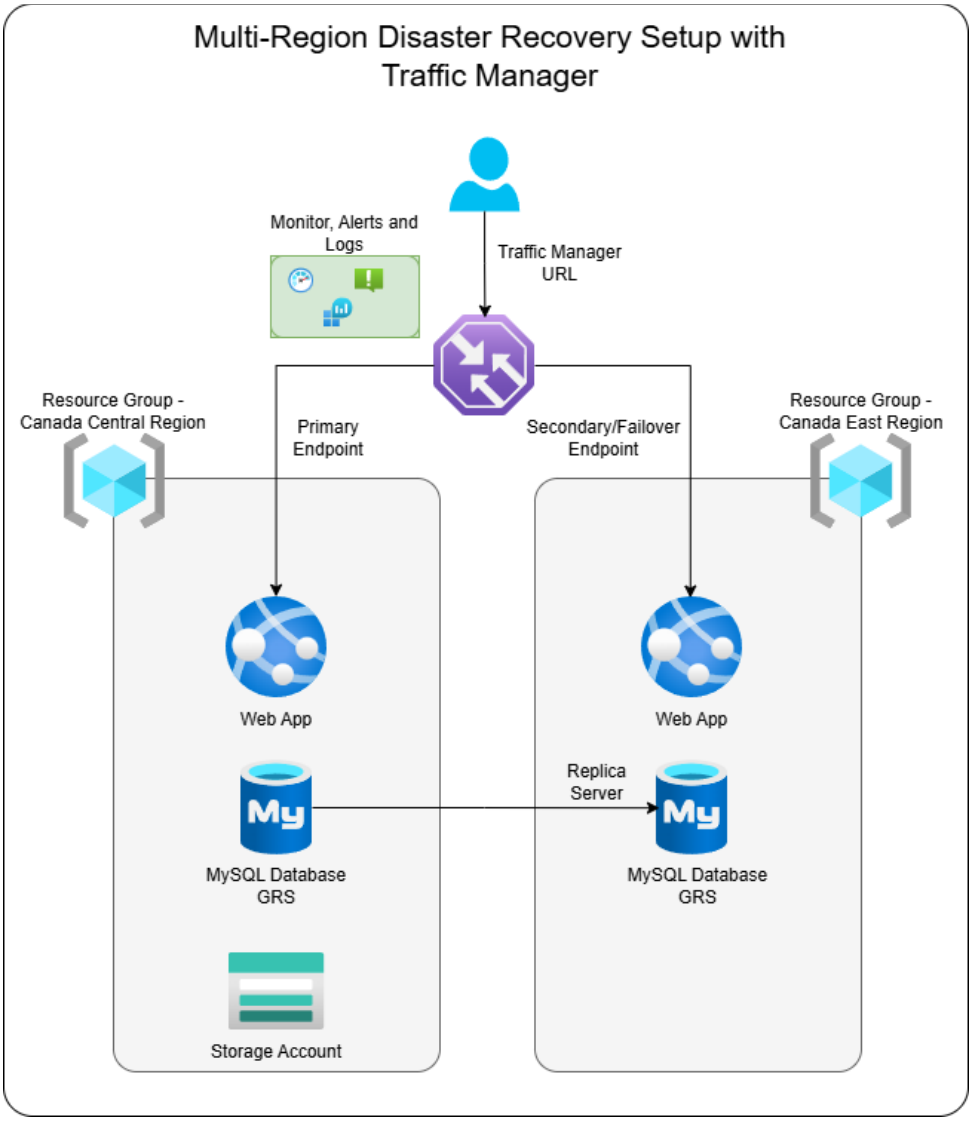
Project Objectives

- **Multi-Region Deployment:** Deploy instances of a web application in two separate Azure regions (East US and West US).
- **Backend Resiliency:** Configure Azure SQL Database Geo-Replication and Azure Storage Account with GRS to ensure data redundancy.
- **Traffic Management:** Set up Azure Traffic Manager with priority-based routing to automatically failover traffic to the secondary region during outages.
- **Failover Simulation:** Perform a controlled failover by stopping the primary web app and validate automatic traffic redirection.
- **Monitoring and Alerting:** Enable Azure Monitor, set up alerts for endpoint health, and collect diagnostic logs for tracking system behaviour.
- **Reporting:** Generate a basic report summarizing the failover event, response time, and system logs for validation.

Expected Outcome

This project will achieve a working, resilient multi-region web application setup on Azure. The web application will automatically reroute traffic to a healthy secondary region during primary region failures, ensuring minimal downtime and uninterrupted service availability. Backend databases and storage will remain consistent and available across regions through geo-replication. Monitoring and alerting systems will provide real-time visibility into system health and performance.

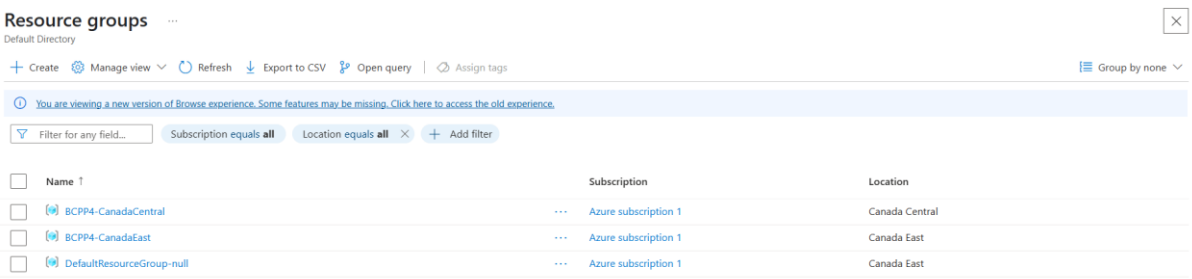
Architecture Diagram



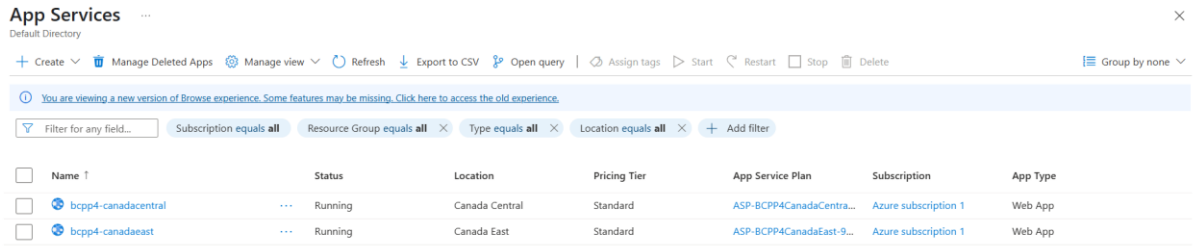
Solution Steps

1. App Deployment

A. Creation of Resource groups in Two different regions (Canada Central and Canada East)

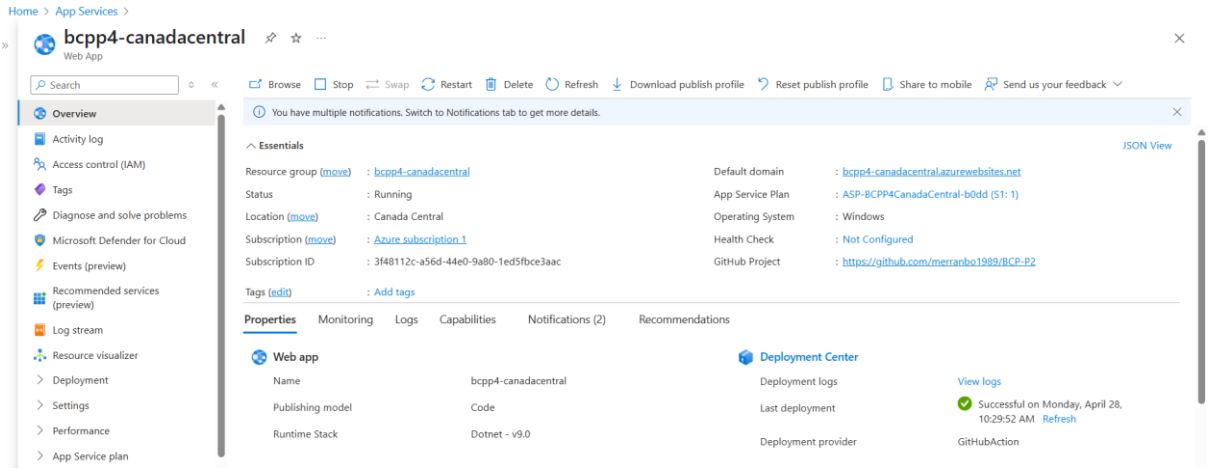


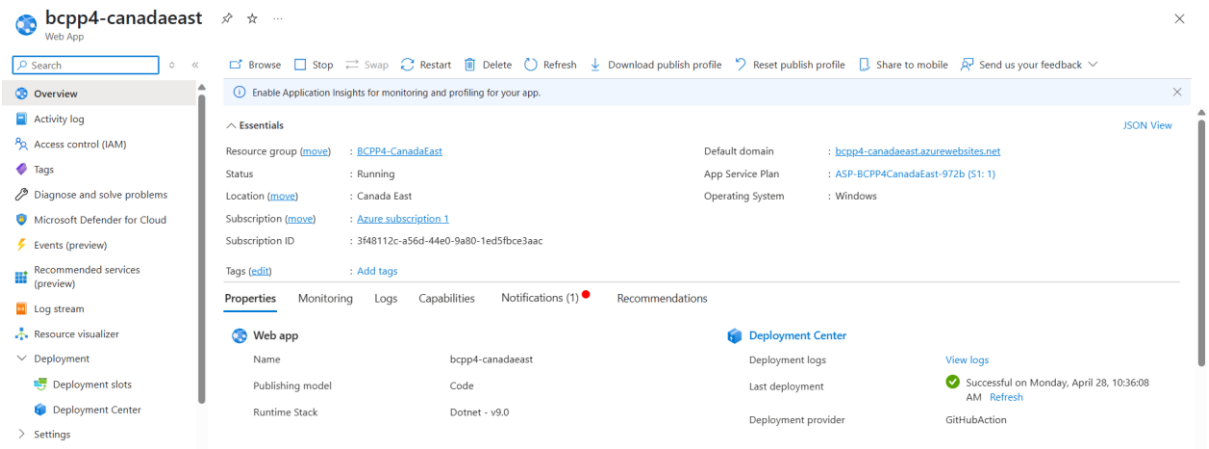
B. Creation of Web Apps in both the regions.

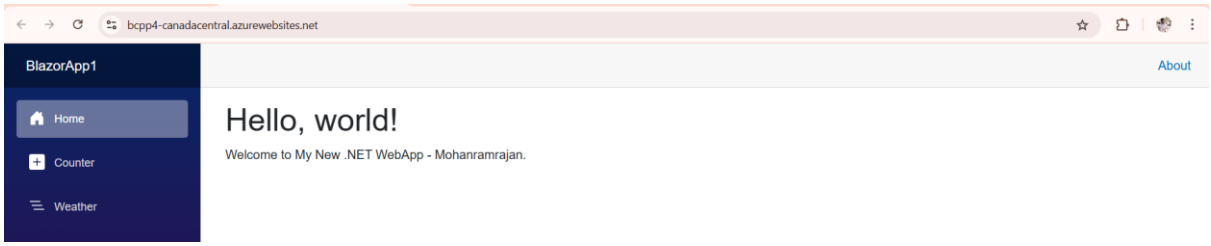


C. Deploy the sample .NET web app into the web app created in both the regions

Code Repository: https://github.com/merranbo1989/BCP-P2.git

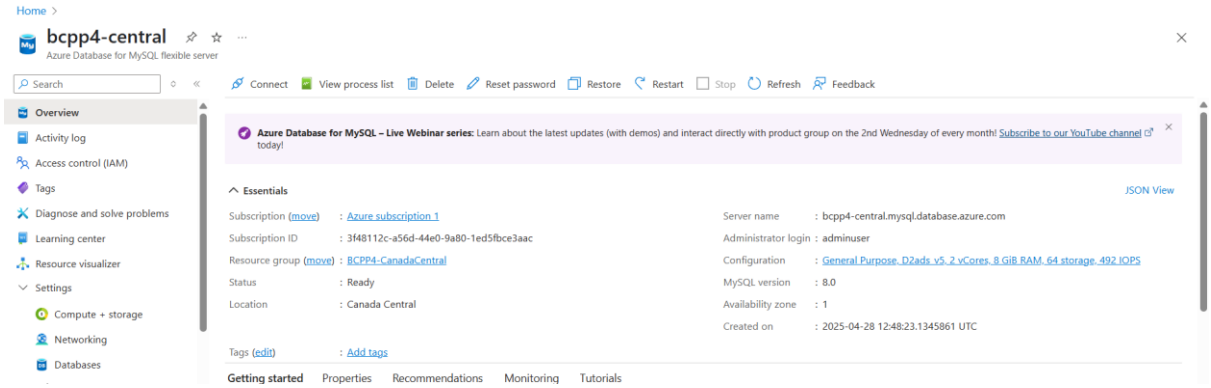




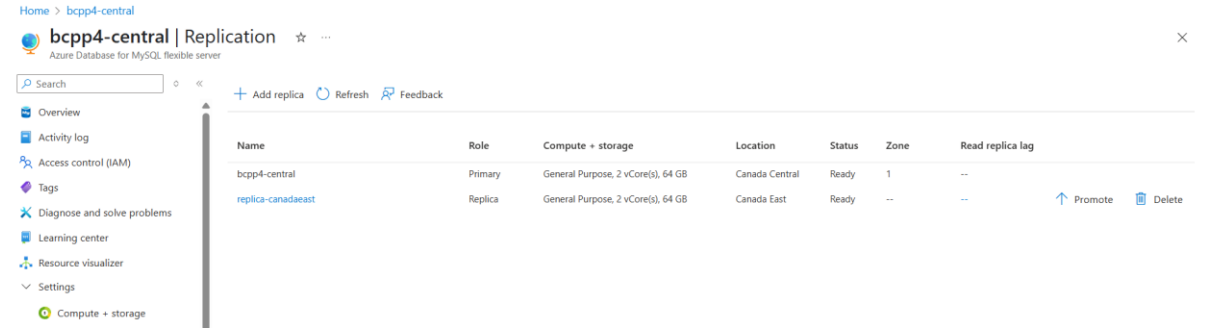


2. Backend Set-up

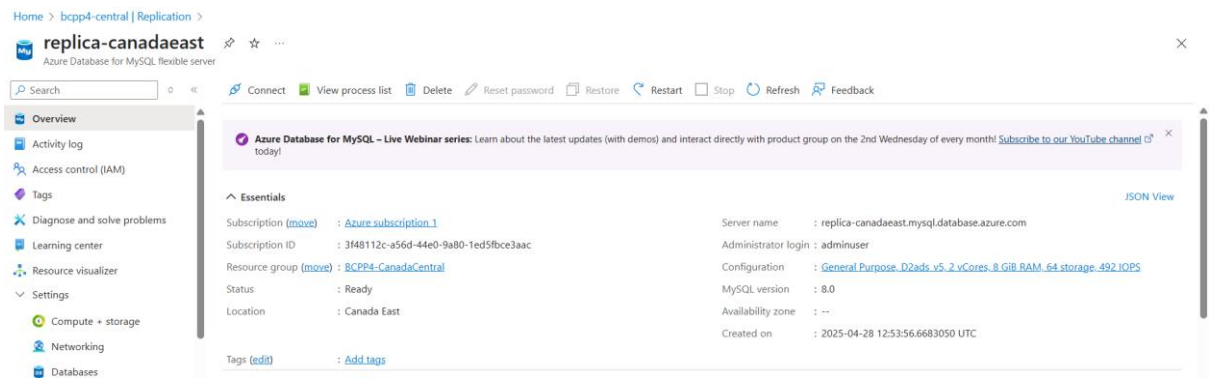
A. Creation of Azure SQL flexible server in “Canada Central (Primary)” region with GRS option enabled.

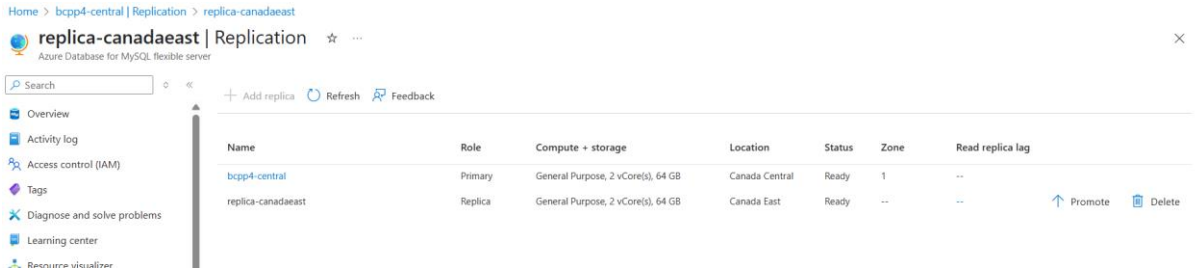


B. Use replication option to deploy a replica of this server into the secondary region (“Canada East”).



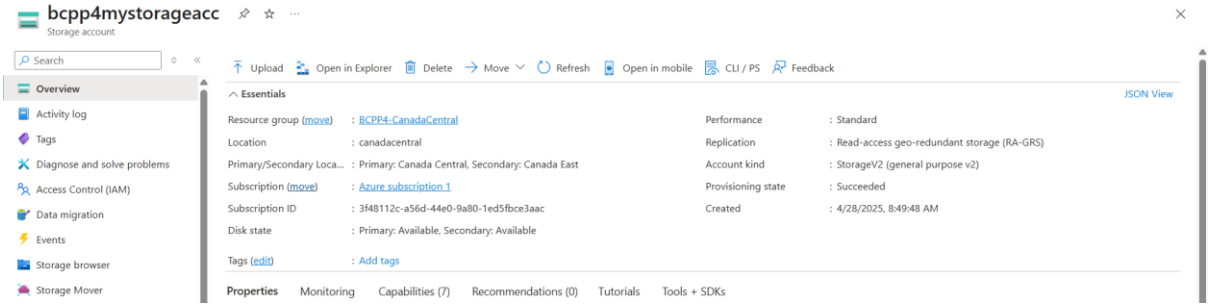
C. Check if the replicated server is provisioned in the secondary region



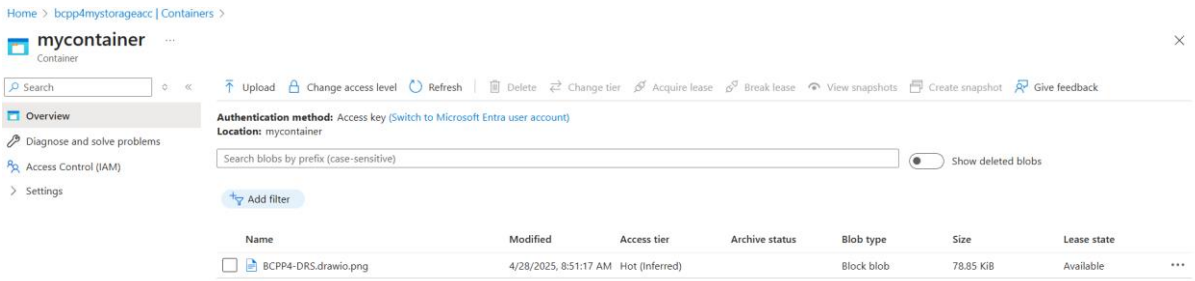


3. Storage Account

A. Create a Storage Account in the Primary region with GRS option enabled.

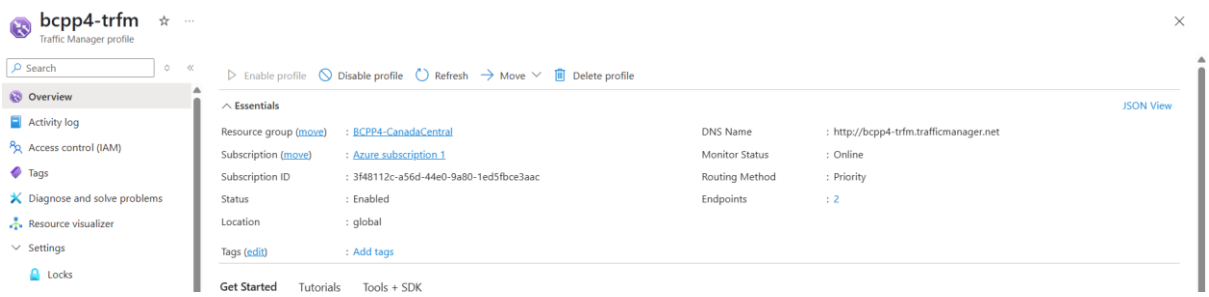


B. Upload a static file (.txt or .png) to ensure the availability

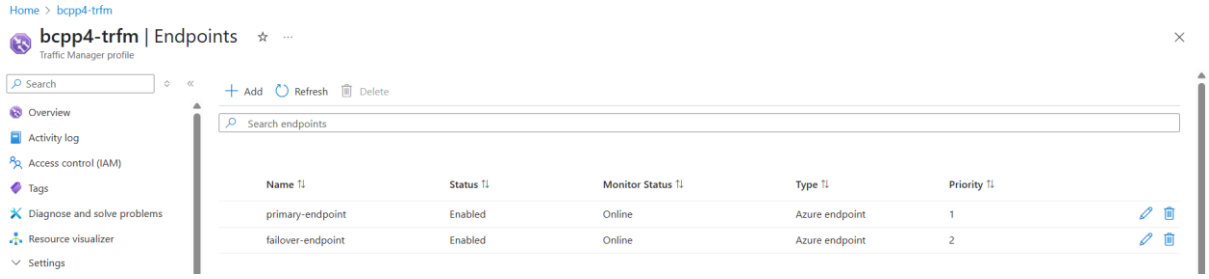


4. Traffic Manager Profile

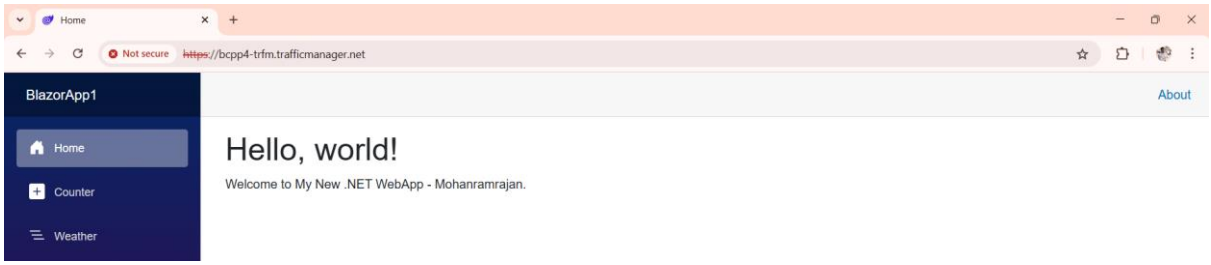
A. Create a new Traffic Manager profile in Azure with routing method selected as “Priority”

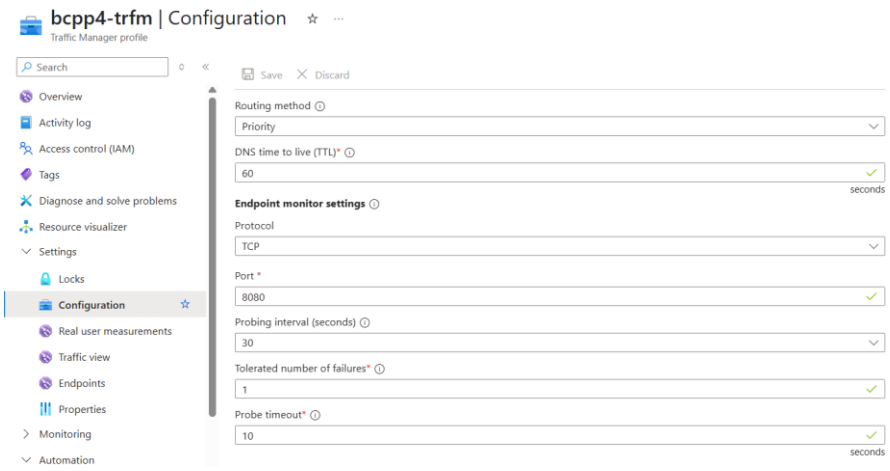


B. Add the endpoints for Primary (Canada Central), and Secondary (Canada East) App services.



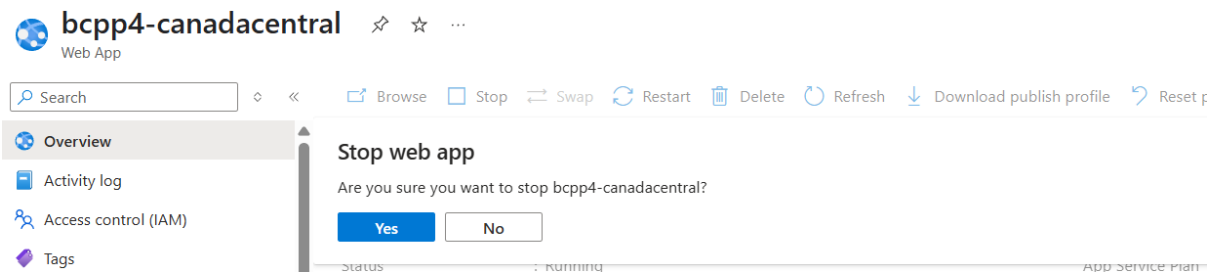
C. Check the Traffic Manager URL (https://bcpp4-trfm.trafficmanager.net/) to see if the application is launching successfully

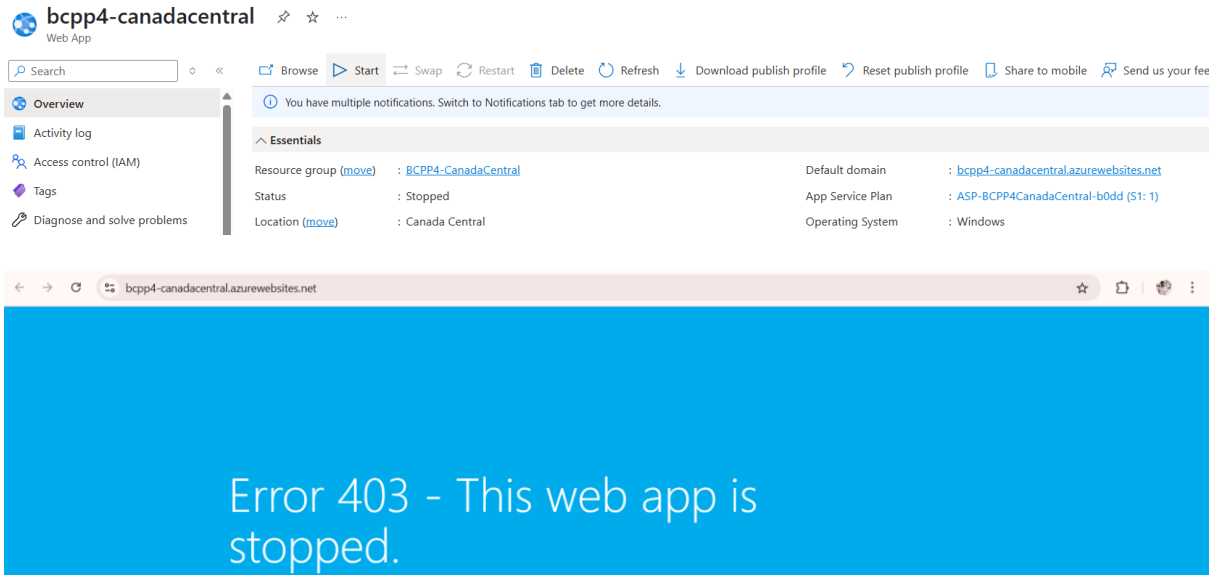




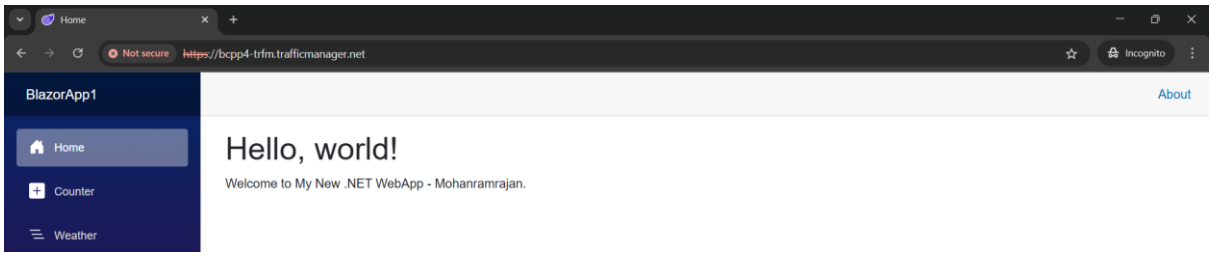
Failover Simulation

A. Manually stop the Primary App service in Canada Central region





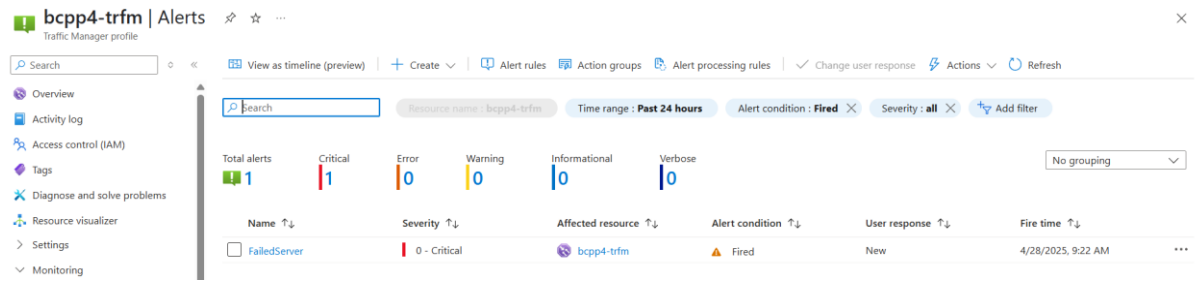
B. Now launch the Traffic Manager URL: https://bcpp4-trfm.trafficmanager.net/, The application hosted in the secondary region (Canada East) should be routed by the traffic manager.

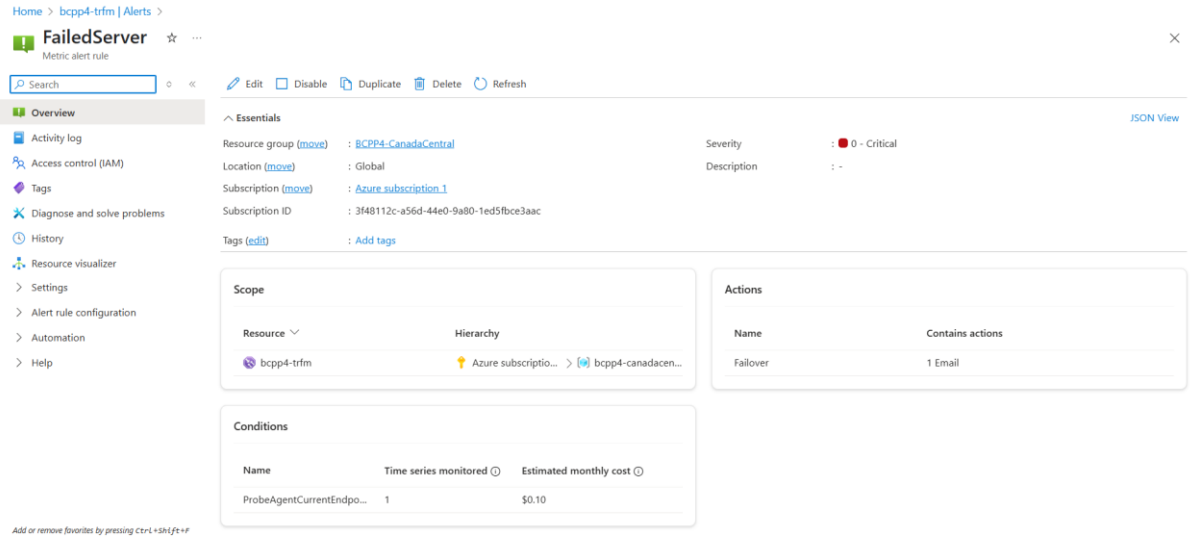


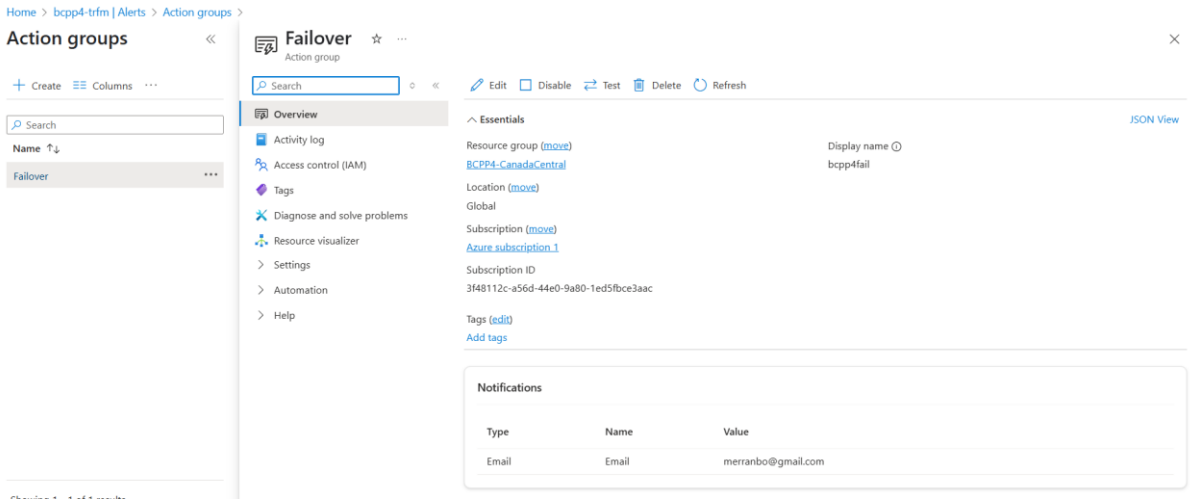
Monitoring & Alerts

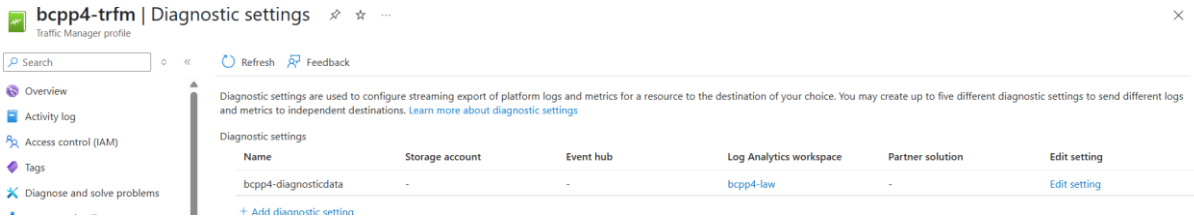
A. Alerts and Action Groups

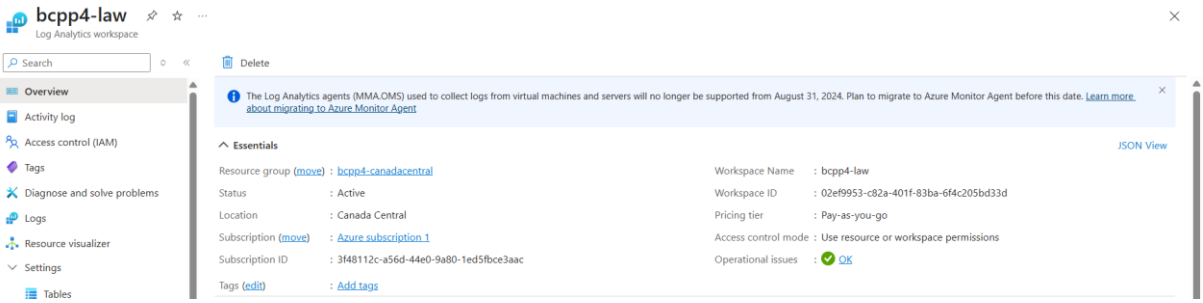
1. Creation of Alerts, Conditions, and Action Groups to notify the user about the failure

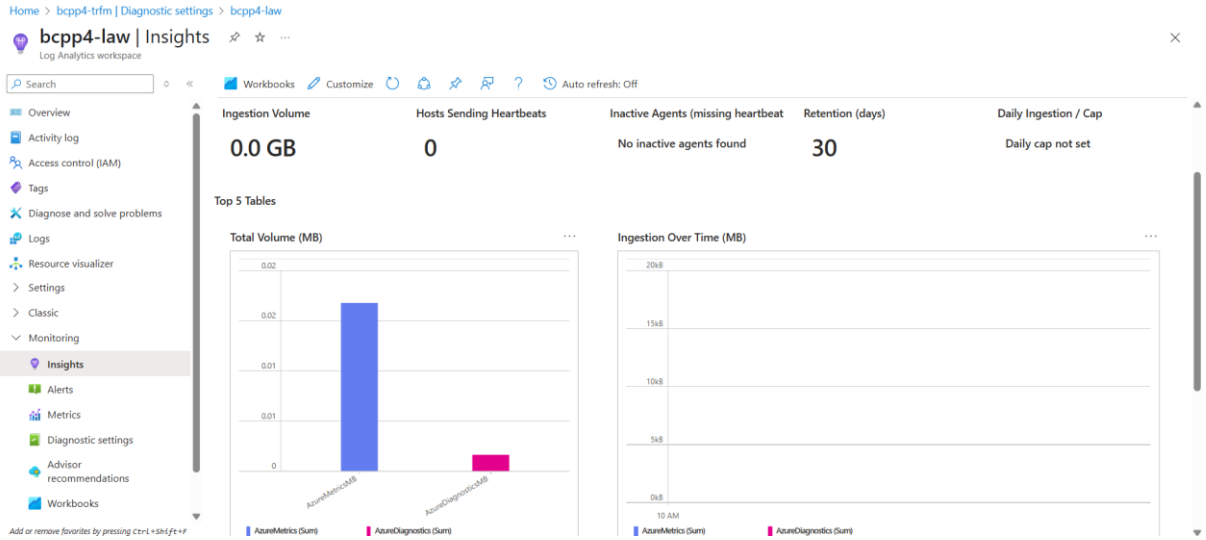


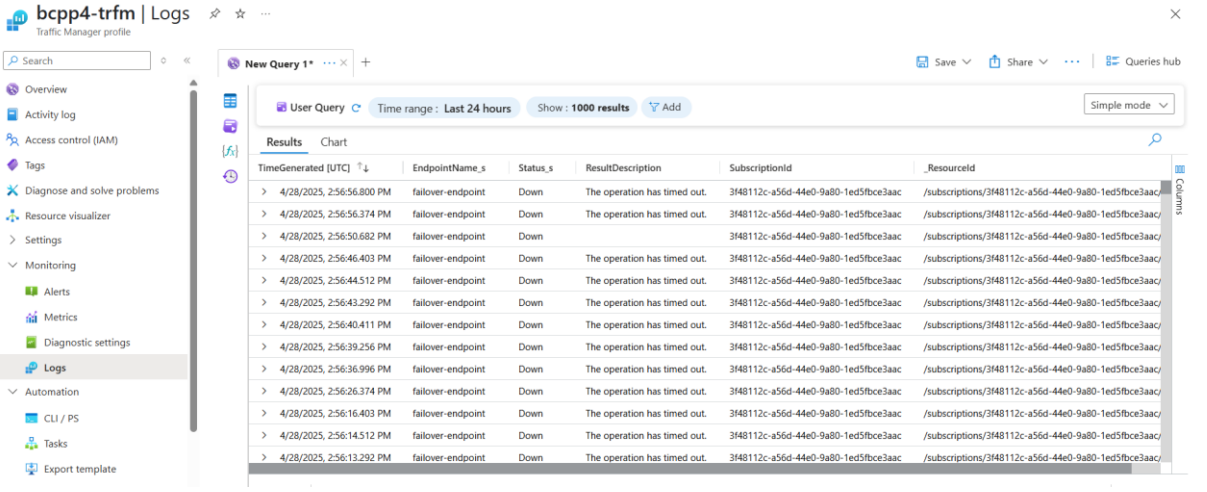

Home > bcpp4-trfm | Alerts >
FailedServer
Metric alert rule
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
History
Resource visualizer
Settings
Alert rule configuration
Automation
Help
Edit
Disable
Duplicate
Delete
Refresh
Essentials
JSON View
Resource group (move) : BCPP4-CanadaCentral
Location (move) : Global
Subscription (move) : Azure subscription 1
Subscription ID : 3f48112c-a56d-44e0-9a80-1ed5fbce3aac
Tags (edit) : Add tags
Severity : 0 - Critical
Description : -
Scope
Resource
Hierarchy
bcpp4-trfm
Azure subscriptio...
bcpp4-canadacen...
Actions
Name
Contains actions
Failover
1 Email
Conditions
Name
Time series monitored
Estimated monthly cost
ProbeAgentCurrentEndpo...
1
$0.10
Add or remove favorites by pressing Ctrl+Shift+F

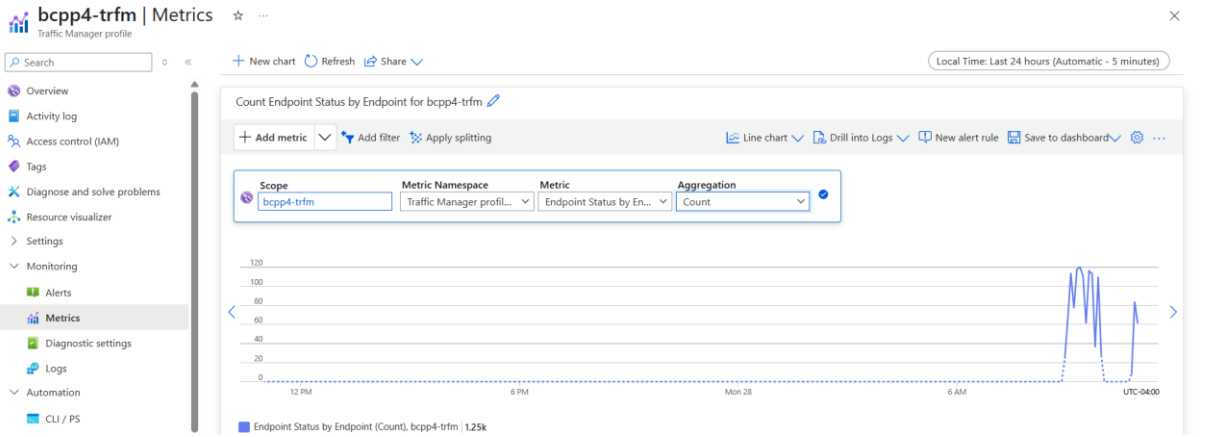

Home > bcpp4-trfm | Alerts > Action groups >
Action groups
Create
Columns
Search
Name
Failover
Failover
Action group
Edit
Disable
Test
Delete
Refresh
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Resource visualizer
Settings
Automation
Help
Essentials
JSON View
Resource group (move)
BCPP4-CanadaCentral
Location (move)
Global
Subscription (move)
Azure subscription 1
Subscription ID
3f48112c-a56d-44e0-9a80-1ed5fbce3aac
Tags (edit)
Add tags
Display name
bcpp4fail
Notifications
Type
Name
Value
Email
Email
merranbo@gmail.com

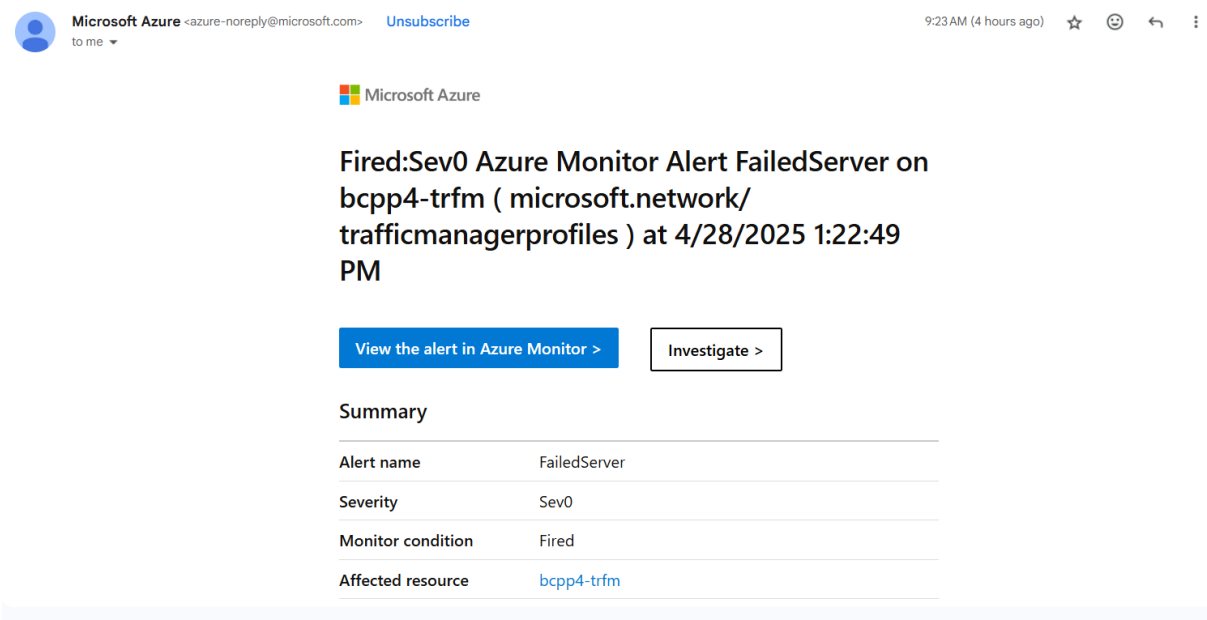

bcpp4-trfm | Diagnostic settings
Traffic Manager profile
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Refresh
Feedback
Diagnostic settings are used to configure streaming export of platform logs and metrics for a resource to the destination of your choice. You may create up to five different diagnostic settings to send different logs and metrics to independent destinations. Learn more about diagnostic settings
Diagnostic settings
Name
Storage account
Event hub
Log Analytics workspace
Partner solution
Edit setting
bcpp4-diagnosticdata
-
-
bcpp4-law
-
Edit setting
+ Add diagnostic setting


bcpp4-law
Log Analytics workspace
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Logs
Resource visualizer
Settings
Tables
Delete
The Log Analytics agents (MMA,OMS) used to collect logs from virtual machines and servers will no longer be supported from August 31, 2024. Plan to migrate to Azure Monitor Agent before this date. Learn more about migrating to Azure Monitor Agent
Essentials
JSON View
Resource group (move) : bcpp4-canadacentral
Status : Active
Location : Canada Central
Subscription (move) : Azure subscription 1
Subscription ID : 3f48112c-a56d-44e0-9a80-1ed5fbce3aac
Tags (edit) : Add tags
Workspace Name : bcpp4-law
Workspace ID : 02ef9953-c82a-401f-83ba-6f4c205bd33d
Pricing tier : Pay-as-you-go
Access control mode : Use resource or workspace permissions
Operational issues : OK


Home > bcpp4-trfm | Diagnostic settings > bcpp4-law
bcpp4-law | Insights
Log Analytics workspace
Search
Workbooks
Customize
Auto refresh: Off
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Logs
Resource visualizer
Settings
Classic
Monitoring
Insights
Alerts
Metrics
Diagnostic settings
Advisor recommendations
Workbooks
Ingestion Volume
0.0 GB
Hosts Sending Heartbeats
0
Inactive Agents (missing heartbeat
No inactive agents found
Retention (days)
30
Daily Ingestion / Cap
Daily cap not set
Top 5 Tables
Total Volume (MB)
Ingestion Over Time (MB)
AzureMetrics (Sum)
AzureDiagnostics (Sum)


bcpp4-trfm | Logs
Traffic Manager profile
New Query 1*
Save
Share
Queries hub
User Query
Time range : Last 24 hours
Show : 1000 results
Add
Simple mode
Results
Chart
TimeGenerated [UTC]
EndpointName_s
Status_s
ResultDescription
SubscriptionId
_ResourceId
Columns


bcpp4-trfm | Metrics
Traffic Manager profile
New chart
Refresh
Share
Local Time: Last 24 hours (Automatic - 5 minutes)
Count Endpoint Status by Endpoint for bcpp4-trfm
Add metric
Add filter
Apply splitting
Line chart
Drill into Logs
New alert rule
Save to dashboard
Scope
bcpp4-trfm
Metric Namespace
Traffic Manager profil...
Metric
Endpoint Status by En...
Aggregation
Count
12 PM
6 PM
Mon 28
6 AM
UTC-04:00
Endpoint Status by Endpoint (Count), bcpp4-trfm 1.25k



Conclusion

This project successfully demonstrates the design and implementation of a highly available, multi-region disaster recovery setup using Microsoft Azure services. By leveraging **Azure Traffic Manager**, **Azure App Services**, **Azure SQL Database with Geo-Replication**, and **Azure Storage with GRS**, the solution ensures business continuity and minimizes service disruptions during regional outages.

Through controlled failover testing and proactive monitoring with **Azure Monitor** and alerts, the project validates the resilience and responsiveness of the system. This hands-on exercise not only highlights best practices for building fault-tolerant cloud applications but also reinforces the importance of automated failover strategies, continuous monitoring, and geo-redundant architecture in achieving high availability and disaster recovery goals in modern cloud environments.