How to sync changes with logical replication between 2 PostgreSQL Single Server and Flexible Server

Last updated by | Eduardo Santana | Feb 24, 2022 at 6:30 AM PST

How to sync changes with logical replication between 2 PostgreSQL Single server without Private end Point and Flexible Server with Public access

Unfortunately it's not possible to sync changes between 2 PostgreSQL directly using Logical decoding. Instead you will have to create a consumer or use some software like Debezium: https://debezium.io/ .

Logical replication using PostgreSQL publication/subscription is not supported with Azure Database for PostgreSQL - Single Server. However, if the publisher is the Single Server and the subscriber is the Flexible Server, you can use Logical Replication to replicate data.

Please review pre-requisites in below documentation:

https://docs.microsoft.com/en-us/azure/postgresql/flexible-server/concepts-logical#pre-requisites-for-logical-replication-and-logical-decoding

1. Set the server parameter wal_level to logical. You should set the Logical wal_level on Publisher and the Subscriber servers (needs a restart).
2. On Flexible Server go to server parameters tab on the portal. On Single Server go to Replication tab on the Portal.
3. If you want to use pglogical extension, search for the shared_preload_libraries parameter, and select pglogical from the drop-down box.
4. Update max_worker_processes parameter value to at least 16. Otherwise, you may run into issues like WARNING: out of background worker slots. (Not available in Single Server).
5. Save the changes and restart the server to apply the wal_level change.
6. Confirm that your PostgreSQL instance allows network traffic from your connecting resource.

To get a stable setup, as you know these IPs might be changed, so allow Azure services is recommended here. However Customers may have some concerns regarding enabling Allow all Azure Services.

One possible solution is to set an alert rule based on your server log error messages. In case of your subscriber server IP changes, you will receive an alert and can then update your firewall rules with the new server IP.

Regarding how to find your Flexible server IP address you can follow this steps :

1. Connect to your flexible server

postgres=> create extension dblink; CREATE EXTENSION postgres=> select dblink_connect('myconn','host=YOUR_SINGLE_SERVER.database.azure.com dbname=postgres user=YOUR_USER@YOUR_SERVER password=xxxxxxxxxx');

ERROR: could not establish connection DETAIL: FATAL: no pg_hba.conf entry for host "xx.xxx.xxx.xxx", user " YOUR_USER ", database "postgres", SSL on FATAL: SSL connection is required. Please specify SSL options and

retry.

If you execute this statement and the connection is establish successfully you will get the below message.

dblink_connect

OK

(1 row)

Then you will have to disconnect from the server.

postgres=> SELECT dblink_disconnect('myconn');

dblink_disconnect

OK

(1 row)

Now you can add to your firewall rules on your publisher (single server) the subscriber IP (flexible server).

Configure both servers logs to Azure Monitor diagnostic following this procedure:

https://docs.microsoft.com/en-us/azure/postgresql/concepts-server-logs#resource-logs

https://docs.microsoft.com/en-us/azure/postgresql/flexible-server/concepts-logging

Please check detail steps in below documentation on how to set up a publication and a subscription:

https://docs.microsoft.com/en-us/azure/postgresql/flexible-server/concepts-logical#native-logical-replication

Basically you have to follow the below steps:

1. Connect to the publisher database.
2. Create a publication for the table.
3. Connect to the subscriber database.
4. Create a table with the same schema as on the publisher.
5. Create a subscription that will connect to the publication you created earlier

Please also check community documentation regarding Logical Replication:

https://www.postgresql.org/docs/11/logical-replication-restrictions.html

https://www.postgresql.org/docs/11/logical-replication.html

https://www.postgresql.org/docs/11/logical-replication-monitoring.html

https://www.postgresql.org/docs/11/catalog-pg-publication.html

https://www.postgresql.org/docs/11/sql-createpublication.html

https://www.postgresql.org/docs/11/sql-alterpublication.html

https://www.postgresql.org/docs/11/sql-droppublication.html

You can now set alerts in case the Flexible Server IP changes using your server logs in Azure Monitor diagnostic.

After setting the Logical replication we can see in Publisher server logs messages like the below:

AzureDiagnostics

| where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"

| where Category == "PostgreSQLLogs"

| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s

2/16/2022, 1:03:58.000 PM eduenconde connection received: host=xxx.xxx.xxx.xxx port=11448 pid=301920 LOG

2/16/2022, 1:03:58.000 PM eduenconde replication connection authorized: user=eduSSL enabled (protocol=TLSv1.2, cipher=ECDHE-RSA-AES256-GCM-SHA384, compression=off) LOG

2/16/2022, 1:03:58.000 PM eduenconde logical decoding found consistent point at 2B/1004F48 LOG

2/16/2022, 1:03:58.000 PM eduenconde could not receive data from client: An existing connection was forcibly closed by the remote host. LOG

2/16/2022, 1:03:58.000 PM eduenconde connection received: host=xxx.xxx.xxx.xxx port=42496 pid=301944 LOG

2/16/2022, 1:03:58.000 PM eduenconde replication connection authorized: user=eduSSL enabled (protocol=TLSv1.2, cipher=ECDHE-RSA-AES256-GCM-SHA384, compression=off) LOG

2/16/2022, 1:03:58.000 PM eduenconde starting logical decoding for slot "sub" LOG

2/16/2022, 1:03:58.000 PM eduenconde logical decoding found consistent point at 2B/1004F48 LOG

2/16/2022, 1:03:58.000 PM eduenconde connection received: host=xxx.xxx.xxx.xxx port=20224 pid=301948 LOG

2/16/2022, 1:03:58.000 PM eduenconde replication connection authorized: user=eduSSL enabled (protocol=TLSv1.2, cipher=ECDHE-RSA-AES256-GCM-SHA384, compression=off)

Removing subscriber IP from the firewall rules on Publisher server and after a Subscriber server restart (simulation of an IP change and breaking the connection between both servers), we got the following error

messages on the Subscriber server:

AzureDiagnostics

| where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"

| where Category == "PostgreSQLLogs"

| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s

| where Message contains "password authentication failed" or Message contains "no pg_hba.conf entry for host" or Message contains "could not connect to the publisher"

2/22/2022, 3:38:42.072 PM 2022-02-22 15:38:25 UTC-62150370.100-ERROR: could not connect to the publisher: FATAL: no pg_hba.conf entry for replication connection from host "xxx.xxx.xxx.xxx", user "edu", SSL on FATAL: SSL connection is required. Please specify SSL options and retry. ERROR

2/22/2022, 3:38:52.587 PM 2022-02-22 15:38:30 UTC-62150376.103-ERROR: could not connect to the publisher: FATAL: no pg_hba.conf entry for replication connection from host "xxx.xxx.xxx.xxx", user "edu", SSL on FATAL: SSL connection is required. Please specify SSL options and retry. ERROR

2/22/2022, 3:38:52.587 PM 2022-02-22 15:38:35 UTC-6215037b.107-ERROR: could not connect to the publisher: FATAL: no pg_hba.conf entry for replication connection from host "xxx.xxx.xxx.xxx", user "edu", SSL on FATAL: SSL connection is required. Please specify SSL options and retry. ERROR

And also got the following error messages on the Publisher server:

AzureDiagnostics

| where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"

| where Category == "PostgreSQLLogs"

| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s

| where Message contains "no pg_hba.conf entry for replication connection from host"

2/22/2022, 3:37:18.000 PM eduenconde no pg_hba.conf entry for replication connection from host "xxx.xxx.xxx.xxx", user "edu", SSL on FATAL

2/22/2022, 3:37:23.000 PM eduenconde no pg_hba.conf entry for replication connection from host "xxx.xxx.xxx.xxx", user "edu", SSL on FATAL

2/22/2022, 3:37:28.000 PM eduenconde no pg_hba.conf entry for replication connection from host "xxx.xxx.xxx.xxx", user "edu", SSL on FATAL

After adding the IP again in the firewall rules whitelist the connection between both servers is re-establish.

Subscriber server:

2/22/2022, 3:45:17.337 PM 2022-02-22 15:44:56 UTC-621504f8.286-LOG: logical replication apply worker for subscription "sub" has started LOG

Publisher server:

2/22/2022, 3:44:56.000 PM eduenconde connection received: host= xxx.xxx.xxx.xxx port=26122 pid=377776 LOG

2/22/2022, 3:44:56.000 PM eduenconde replication connection authorized: user=eduSSL enabled (protocol=TLSv1.2, cipher=ECDHE-RSA-AES256-GCM-SHA384, compression=off) LOG

2/22/2022, 3:44:56.000 PM eduenconde starting logical decoding for slot "sub" LOG

2/22/2022, 3:44:56.000 PM eduenconde logical decoding found consistent point at 2E/650001A0 LOG

Creating an alert rule based on the error messages in the log using the below queries:

Publisher

AzureDiagnostics

| where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"

| where Category == "PostgreSQLLogs"

| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s

| where Message contains "no pg_hba.conf entry for replication connection from host"

Subscriber

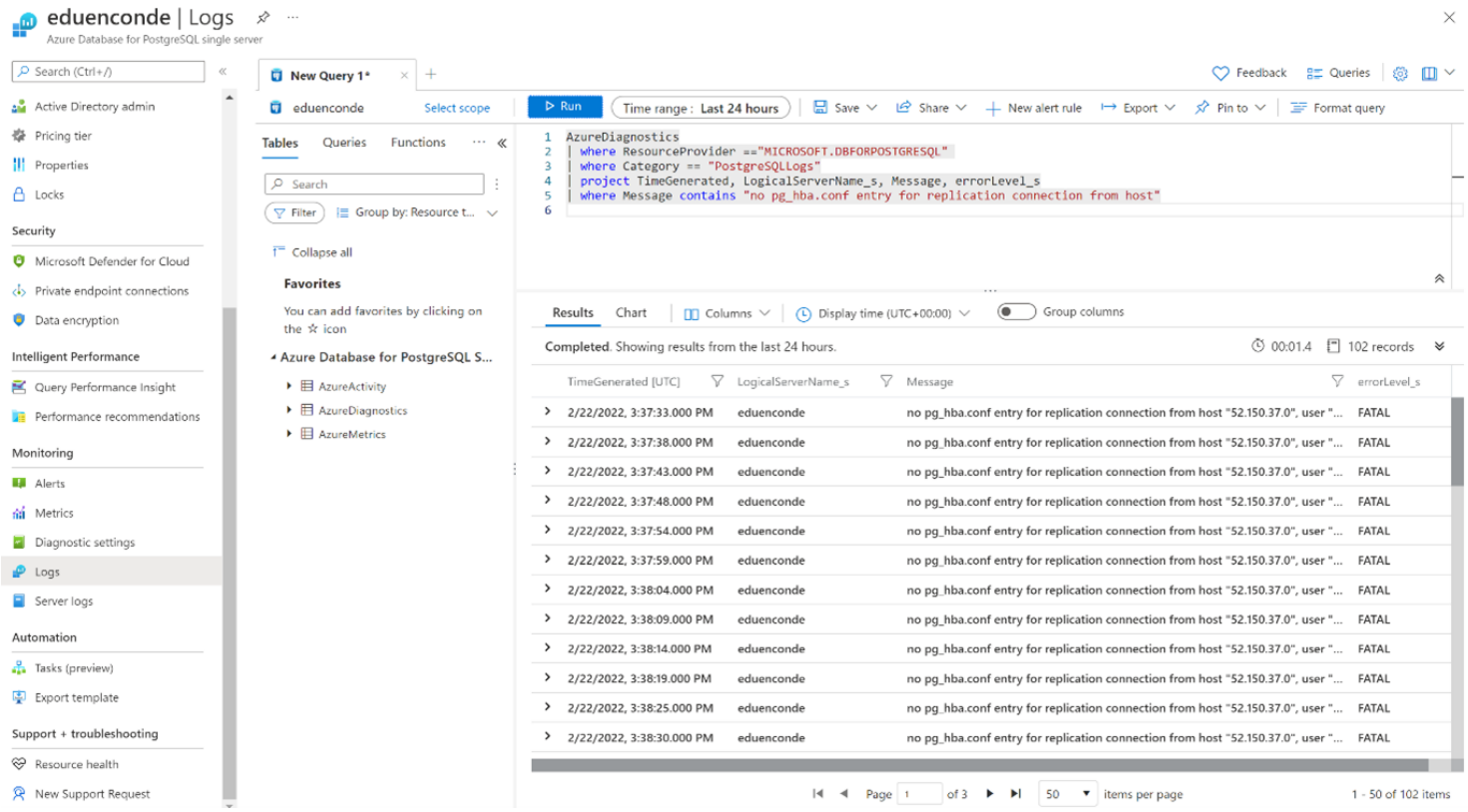
AzureDiagnostics

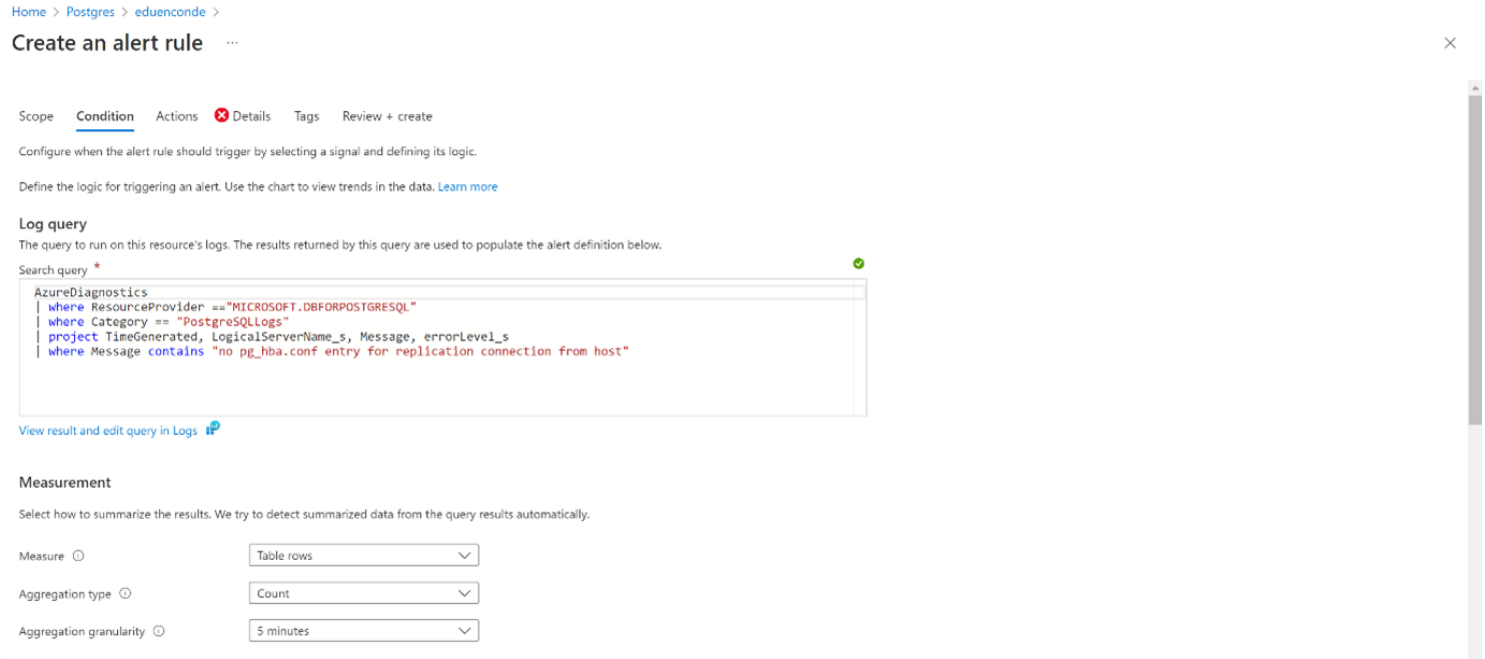
| where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"

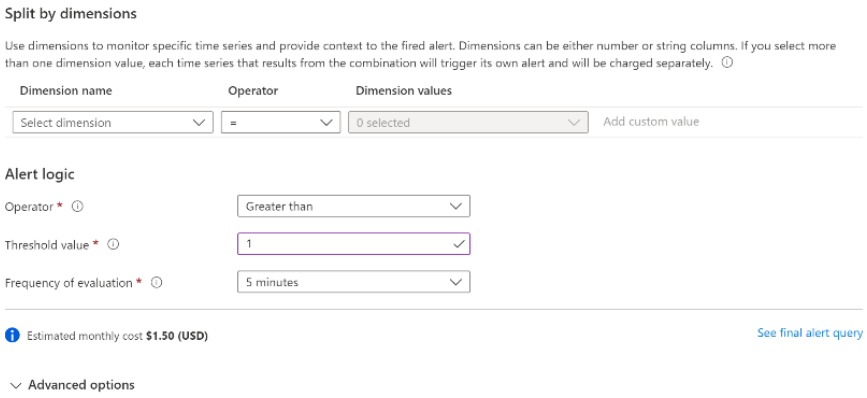
| where Category == "PostgreSQLLogs"

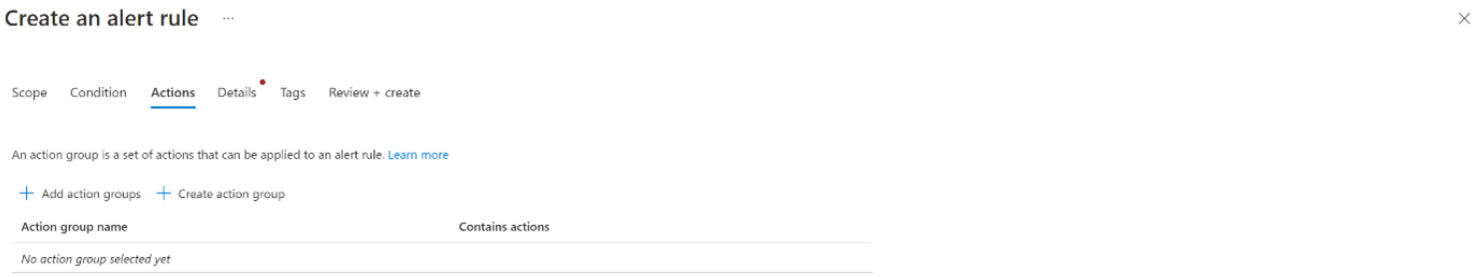
| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s

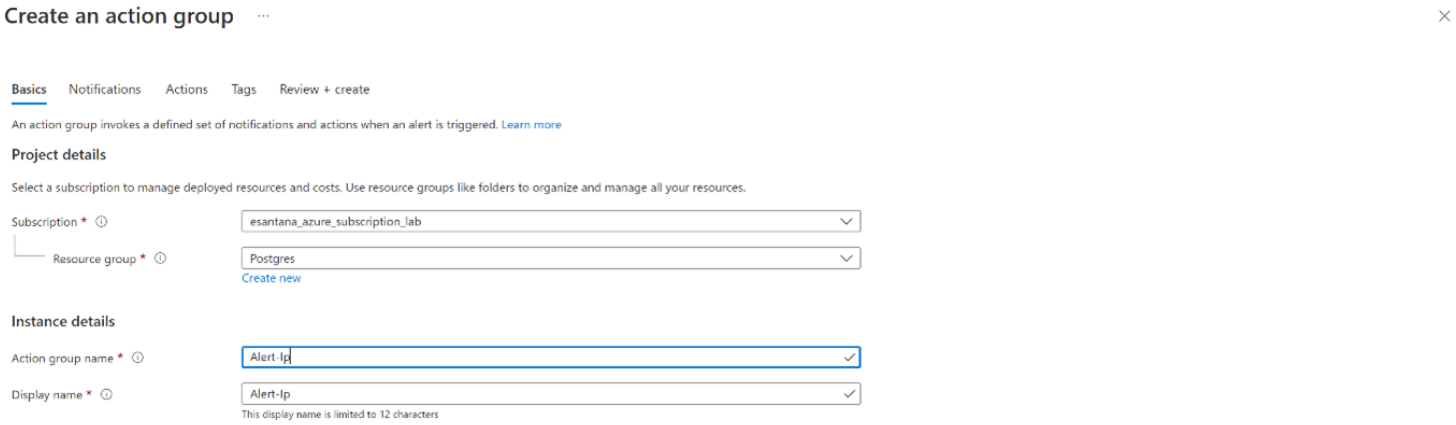
| where Message contains "password authentication failed" or Message contains "no pg_hba.conf entry for host" or Message contains "could not connect to the publisher"

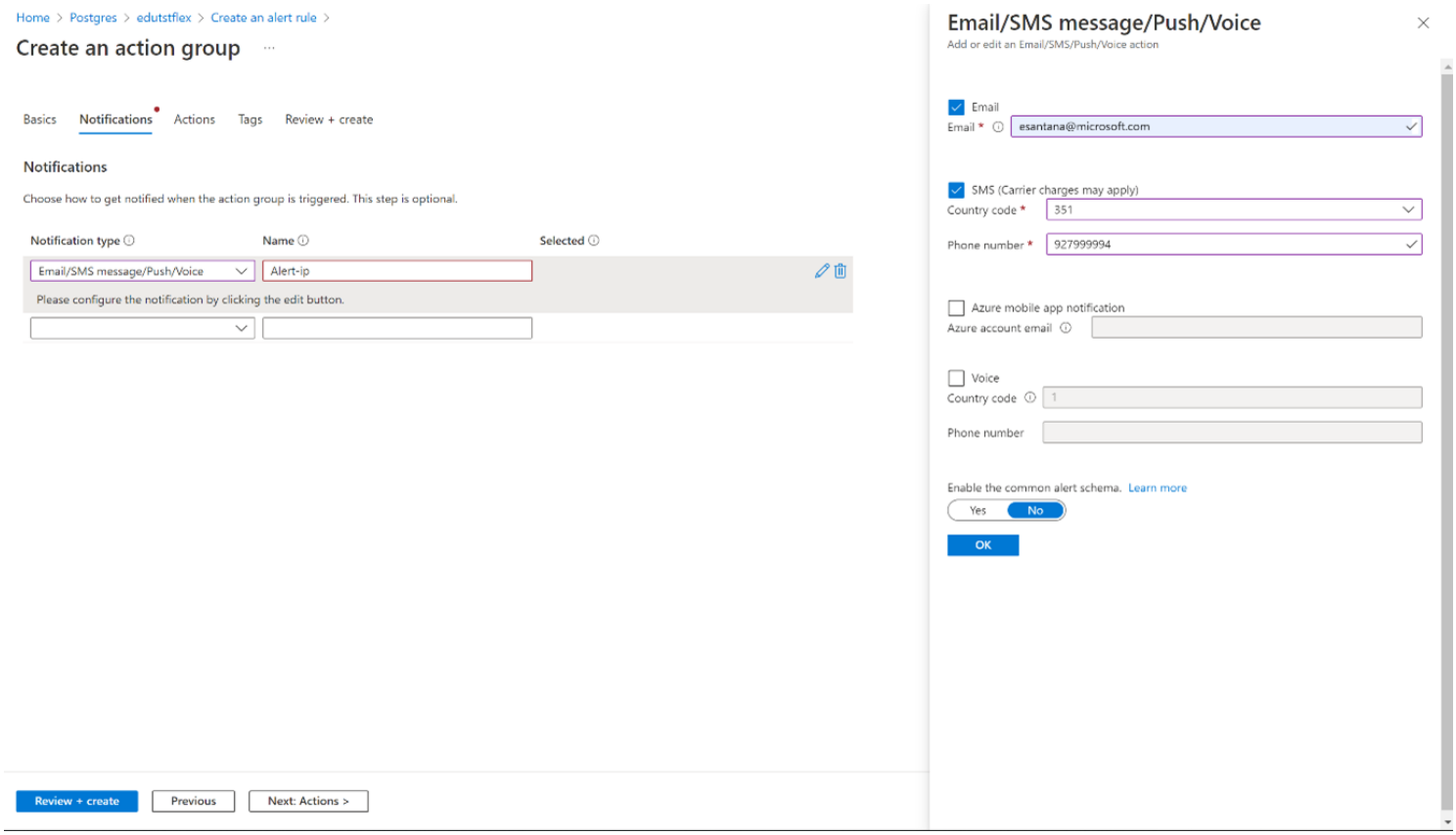

eduenconde | Logs
Azure Database for PostgreSQL single server
Search (Ctrl+/)
Active Directory admin
Pricing tier
Properties
Locks
Security
Microsoft Defender for Cloud
Private endpoint connections
Data encryption
Intelligent Performance
Query Performance Insight
Performance recommendations
Monitoring
Alerts
Metrics
Diagnostic settings
Logs
Server logs
Automation
Tasks (preview)
Export template
Support + troubleshooting
Resource health
New Support Request
New Query 1*
eduenconde
Select scope
Run
Time range : Last 24 hours
Save
Share
New alert rule
Export
Pin to
Format query
Feedback
Queries
Tables
Queries
Functions
Search
Filter
Group by: Resource t...
Collapse all
Favorites
You can add favorites by clicking on the ☆ icon
Azure Database for PostgreSQL S...
AzureActivity
AzureDiagnostics
AzureMetrics
1 AzureDiagnostics
2 | where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"
3 | where Category == "PostgreSQLLogs"
4 | project TimeGenerated, LogicalServerName_s, Message, errorLevel_s
5 | where Message contains "no pg_hba.conf entry for replication connection from host"
6
Results
Chart
Columns
Display time (UTC+00:00)
Group columns
Completed. Showing results from the last 24 hours.
00:01.4
102 records
TimeGenerated [UTC]
LogicalServerName_s
Message
errorLevel_s
2/22/2022, 3:37:33.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:37:38.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:37:43.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:37:48.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:37:54.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:37:59.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:38:04.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:38:09.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:38:14.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:38:19.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:38:25.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
2/22/2022, 3:38:30.000 PM eduenconde no pg_hba.conf entry for replication connection from host "52.150.37.0", user "... FATAL
Page 1 of 3
50 items per page
1 - 50 of 102 items

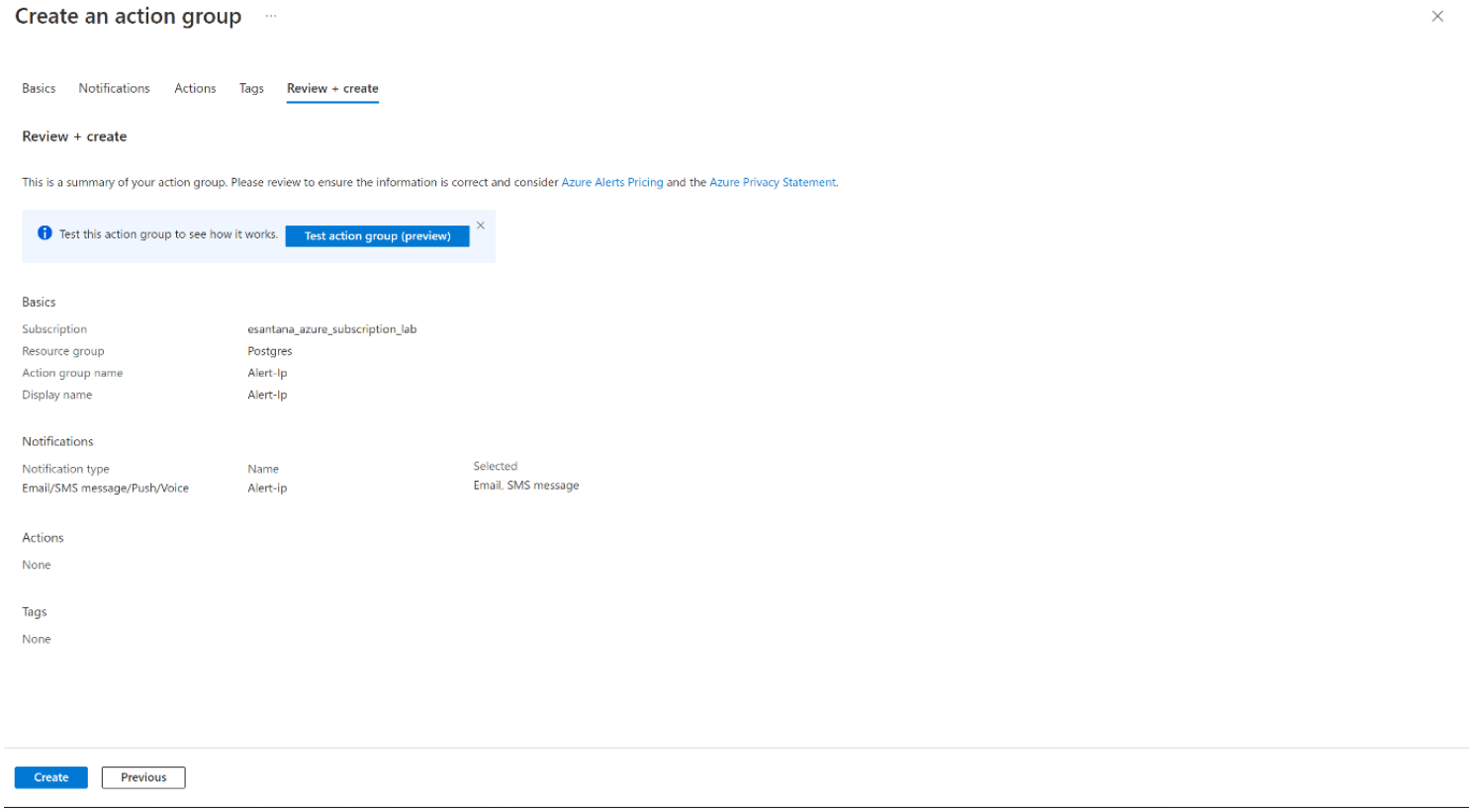

Home > Postgres > eduenconde >
Create an alert rule
Scope
Condition
Actions
Details
Tags
Review + create
Configure when the alert rule should trigger by selecting a signal and defining its logic.
Define the logic for triggering an alert. Use the chart to view trends in the data. Learn more
Log query
The query to run on this resource's logs. The results returned by this query are used to populate the alert definition below.
Search query *
AzureDiagnostics
| where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"
| where Category == "PostgreSQLLogs"
| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s
| where Message contains "no pg_hba.conf entry for replication connection from host"
View result and edit query in Logs
Measurement
Select how to summarize the results. We try to detect summarized data from the query results automatically.
Measure
Table rows
Aggregation type
Count
Aggregation granularity
5 minutes

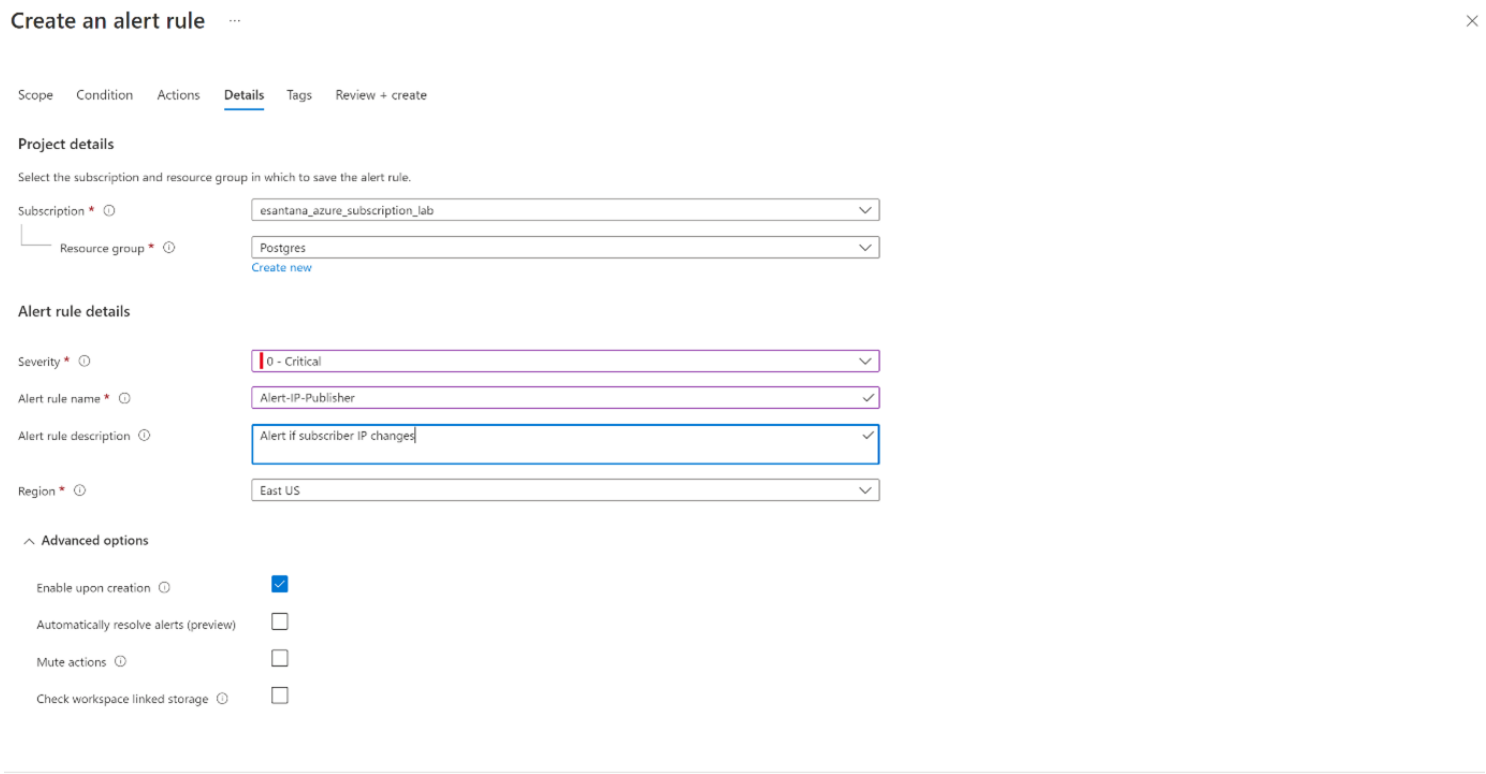

Split by dimensions
Use dimensions to monitor specific time series and provide context to the fired alert. Dimensions can be either number or string columns. If you select more than one dimension value, each time series that results from the combination will trigger its own alert and will be charged separately.
Dimension name
Operator
Dimension values
Select dimension
=
0 selected
Add custom value
Alert logic
Operator *
Greater than
Threshold value *
1
Frequency of evaluation *
5 minutes
Estimated monthly cost $1.50 (USD)
See final alert query
Advanced options

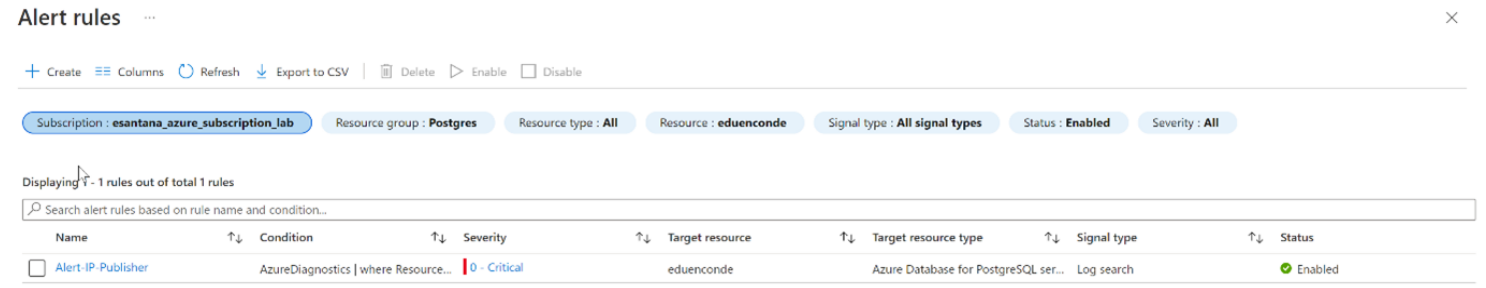

Create an alert rule
Scope
Condition
Actions
Details
Tags
Review + create
An action group is a set of actions that can be applied to an alert rule. Learn more
Add action groups
Create action group
Action group name
Contains actions
No action group selected yet

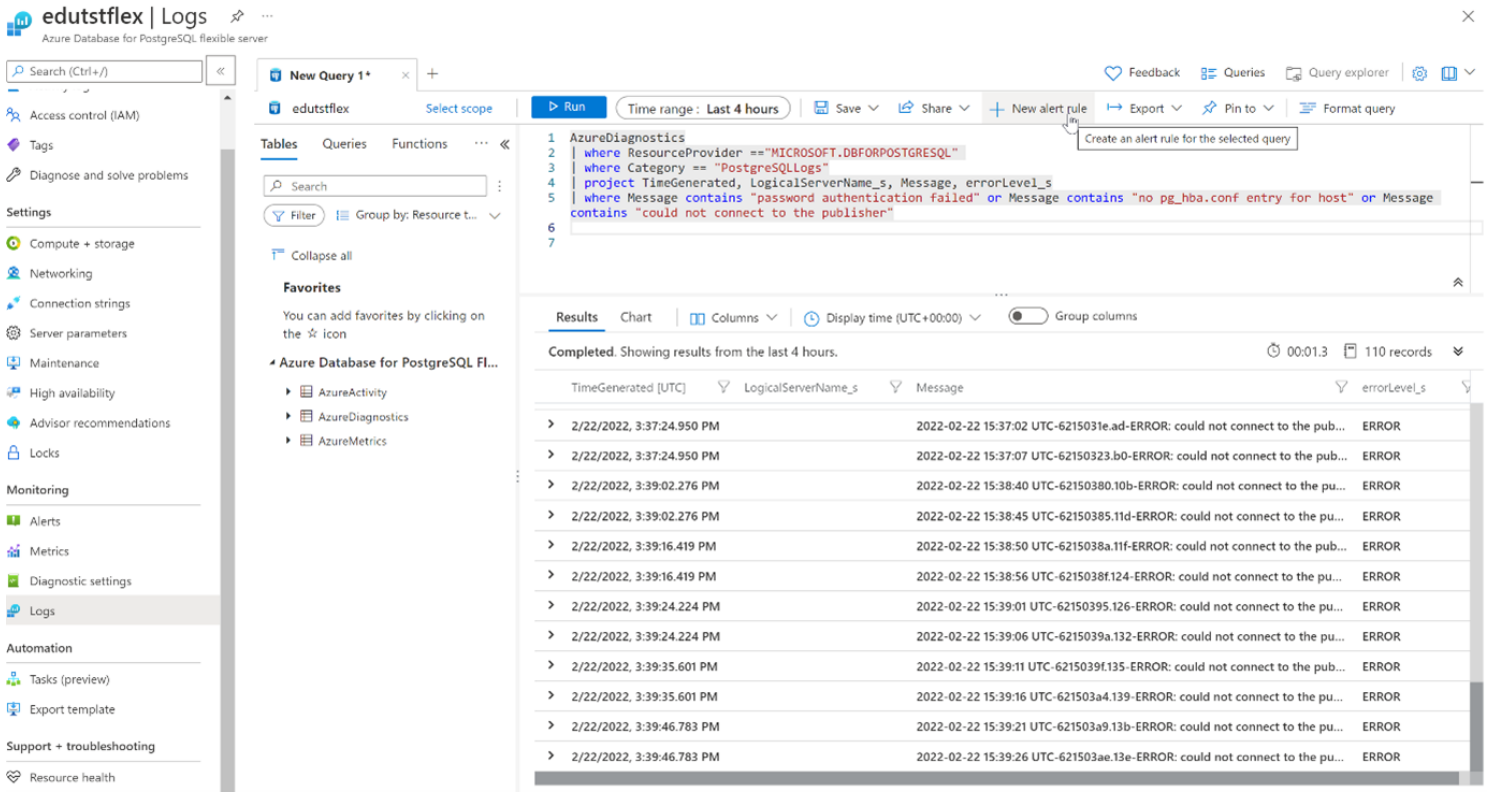

Create an action group
Basics
Notifications
Actions
Tags
Review + create
An action group invokes a defined set of notifications and actions when an alert is triggered. Learn more
Project details
Select a subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.
Subscription *
esantana_azure_subscription_lab
Resource group *
Postgres
Create new
Instance details
Action group name *
Alert-Ip
Display name *
Alert-Ip
This display name is limited to 12 characters

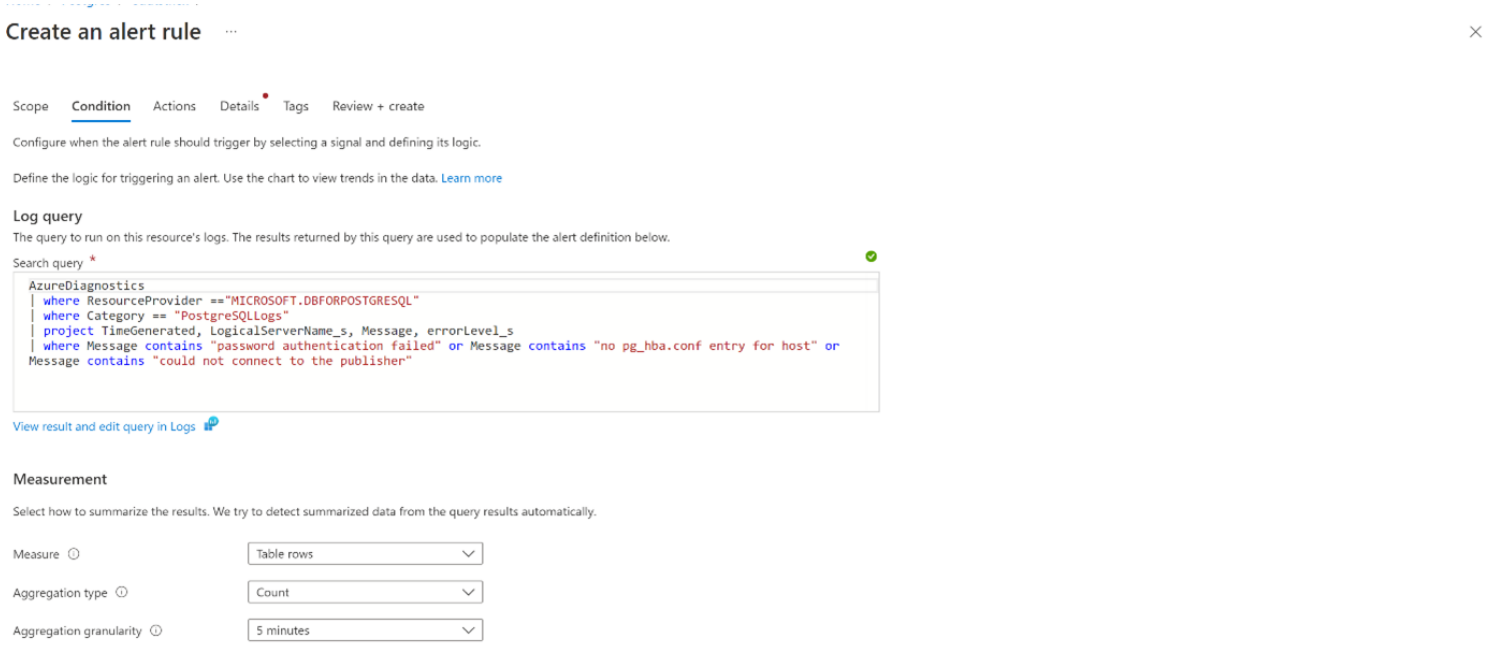

Home > Postgres > edutstflex > Create an alert rule >
Create an action group
Basics
Notifications
Actions
Tags
Review + create
Notifications
Choose how to get notified when the action group is triggered. This step is optional.
Notification type
Name
Selected
Email/SMS message/Push/Voice
Alert-ip
Please configure the notification by clicking the edit button.
Review + create
Previous
Next: Actions >
Email/SMS message/Push/Voice
Add or edit an Email/SMS/Push/Voice action
Email
Email *
esantana@microsoft.com
SMS (Carrier charges may apply)
Country code *
351
Phone number *
927999994
Azure mobile app notification
Azure account email
Voice
Country code
1
Phone number
Enable the common alert schema. Learn more
Yes
No
OK


Create an action group
Basics
Notifications
Actions
Tags
Review + create
Review + create
This is a summary of your action group. Please review to ensure the information is correct and consider Azure Alerts Pricing and the Azure Privacy Statement.
Test this action group to see how it works.
Test action group (preview)
Basics
Subscription
esantana_azure_subscription_lab
Resource group
Postgres
Action group name
Alert-Ip
Display name
Alert-Ip
Notifications
Notification type
Name
Selected
Email/SMS message/Push/Voice
Alert-ip
Email, SMS message
Actions
None
Tags
None
Create
Previous


Create an alert rule
Scope
Condition
Actions
Details
Tags
Review + create
Project details
Select the subscription and resource group in which to save the alert rule.
Subscription *
esantana_azure_subscription_lab
Resource group *
Postgres
Create new
Alert rule details
Severity *
0 - Critical
Alert rule name *
Alert-IP-Publisher
Alert rule description
Alert if subscriber IP changes
Region *
East US
Advanced options
Enable upon creation
Automatically resolve alerts (preview)
Mute actions
Check workspace linked storage


Alert rules
Create
Columns
Refresh
Export to CSV
Delete
Enable
Disable
Subscription : esantana_azure_subscription_lab
Resource group : Postgres
Resource type : All
Resource : eduenconde
Signal type : All signal types
Status : Enabled
Severity : All
Displaying 1 - 1 rules out of total 1 rules
Search alert rules based on rule name and condition...
Name
Condition
Severity
Target resource
Target resource type
Signal type
Status
Alert-IP-Publisher
AzureDiagnostics | where Resource...
0 - Critical
eduenconde
Azure Database for PostgreSQL ser...
Log search
Enabled


edutstflex | Logs
Azure Database for PostgreSQL flexible server
Search (Ctrl+/)
Access control (IAM)
Tags
Diagnose and solve problems
Settings
Compute + storage
Networking
Connection strings
Server parameters
Maintenance
High availability
Advisor recommendations
Locks
Monitoring
Alerts
Metrics
Diagnostic settings
Logs
Automation
Tasks (preview)
Export template
Support + troubleshooting
Resource health
New Query 1*
edutstflex
Select scope
Run
Time range : Last 4 hours
Save
Share
New alert rule
Export
Pin to
Format query
Feedback
Queries
Query explorer
Create an alert rule for the selected query
Tables
Queries
Functions
Search
Filter
Group by: Resource t...
Collapse all
Favorites
You can add favorites by clicking on the ☆ icon
Azure Database for PostgreSQL Fl...
AzureActivity
AzureDiagnostics
AzureMetrics
AzureDiagnostics
| where ResourceProvider =="MICROSOFT.DBFORPOSTGRESQL"
| where Category == "PostgreSQLLogs"
| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s
| where Message contains "password authentication failed" or Message contains "no pg_hba.conf entry for host" or Message contains "could not connect to the publisher"
Results
Chart
Columns
Display time (UTC+00:00)
Group columns
Completed. Showing results from the last 4 hours.
00:01.3
110 records
TimeGenerated [UTC]
LogicalServerName_s
Message
errorLevel_s
2/22/2022, 3:37:24.950 PM 2022-02-22 15:37:02 UTC-6215031e.ad-ERROR: could not connect to the pub... ERROR
2/22/2022, 3:37:24.950 PM 2022-02-22 15:37:07 UTC-62150323.b0-ERROR: could not connect to the pub... ERROR
2/22/2022, 3:39:02.276 PM 2022-02-22 15:38:40 UTC-62150380.10b-ERROR: could not connect to the pu... ERROR
2/22/2022, 3:39:02.276 PM 2022-02-22 15:38:45 UTC-62150385.11d-ERROR: could not connect to the pu... ERROR
2/22/2022, 3:39:16.419 PM 2022-02-22 15:38:50 UTC-6215038a.11f-ERROR: could not connect to the pub... ERROR
2/22/2022, 3:39:16.419 PM 2022-02-22 15:38:56 UTC-6215038f.124-ERROR: could not connect to the pu... ERROR
2/22/2022, 3:39:24.224 PM 2022-02-22 15:39:01 UTC-62150395.126-ERROR: could not connect to the pu... ERROR
2/22/2022, 3:39:24.224 PM 2022-02-22 15:39:06 UTC-6215039a.132-ERROR: could not connect to the pu... ERROR
2/22/2022, 3:39:35.601 PM 2022-02-22 15:39:11 UTC-6215039f.135-ERROR: could not connect to the pub... ERROR
2/22/2022, 3:39:35.601 PM 2022-02-22 15:39:16 UTC-621503a4.139-ERROR: could not connect to the pu... ERROR
2/22/2022, 3:39:46.783 PM 2022-02-22 15:39:21 UTC-621503a9.13b-ERROR: could not connect to the pu... ERROR
2/22/2022, 3:39:46.783 PM 2022-02-22 15:39:26 UTC-621503ae.13e-ERROR: could not connect to the pu... ERROR


Create an alert rule
Scope
Condition
Actions
Details
Tags
Review + create
Configure when the alert rule should trigger by selecting a signal and defining its logic.
Define the logic for triggering an alert. Use the chart to view trends in the data. Learn more
Log query
The query to run on this resource's logs. The results returned by this query are used to populate the alert definition below.
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AzureDiagnostics
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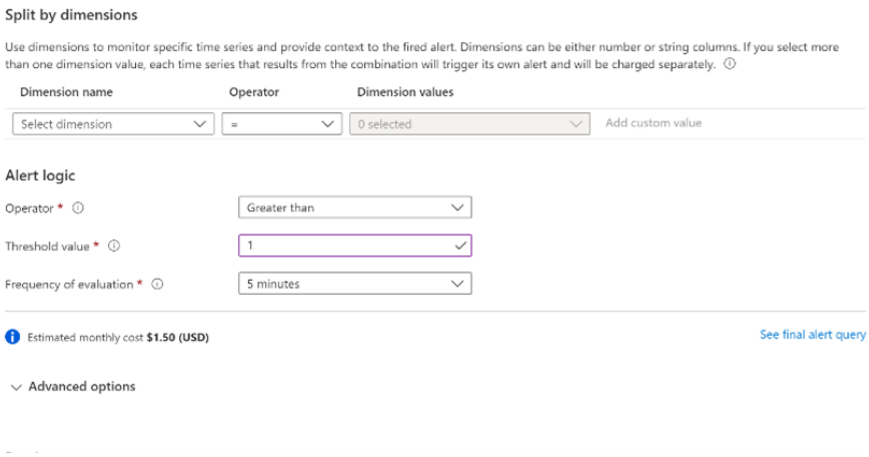
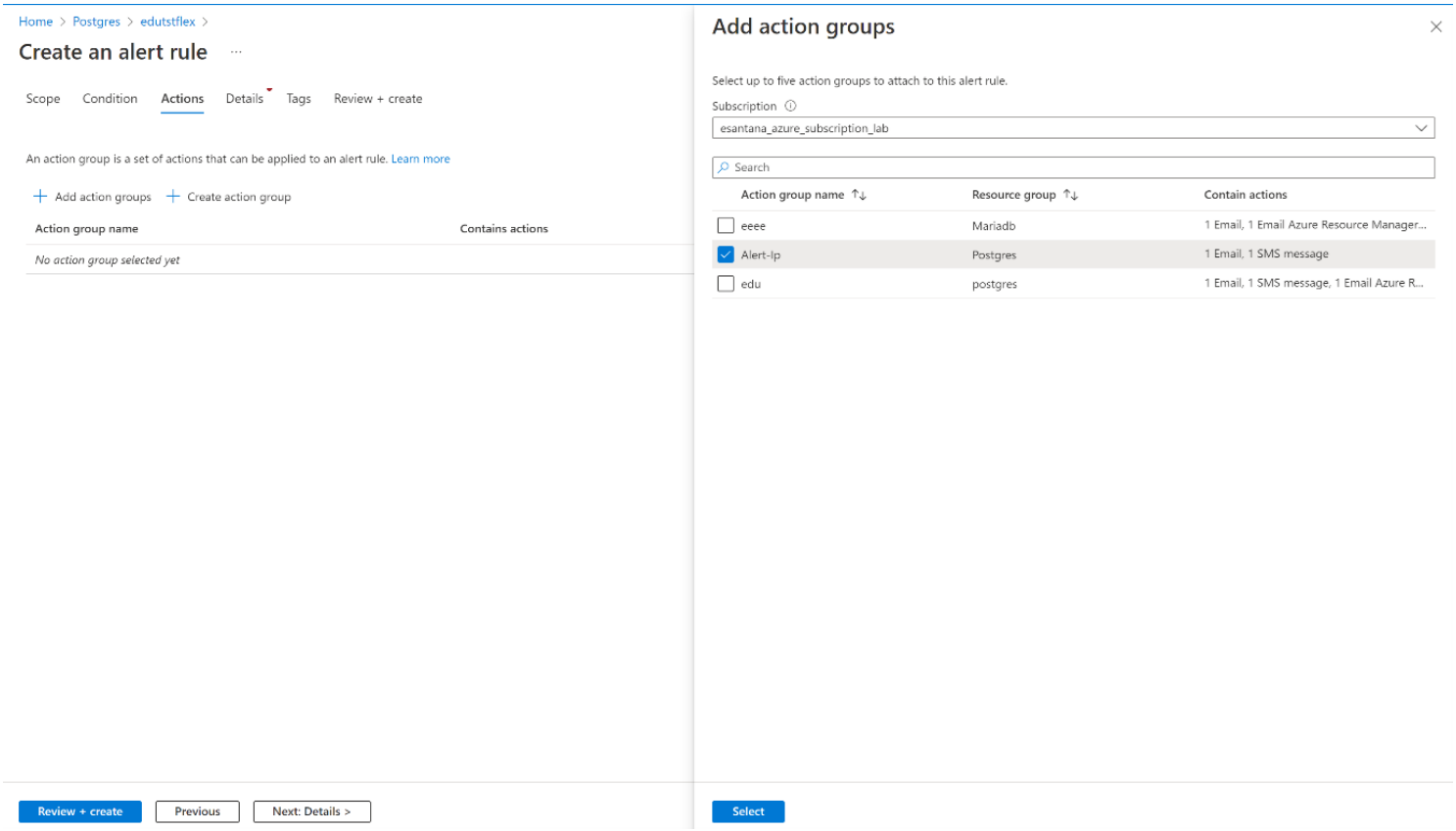
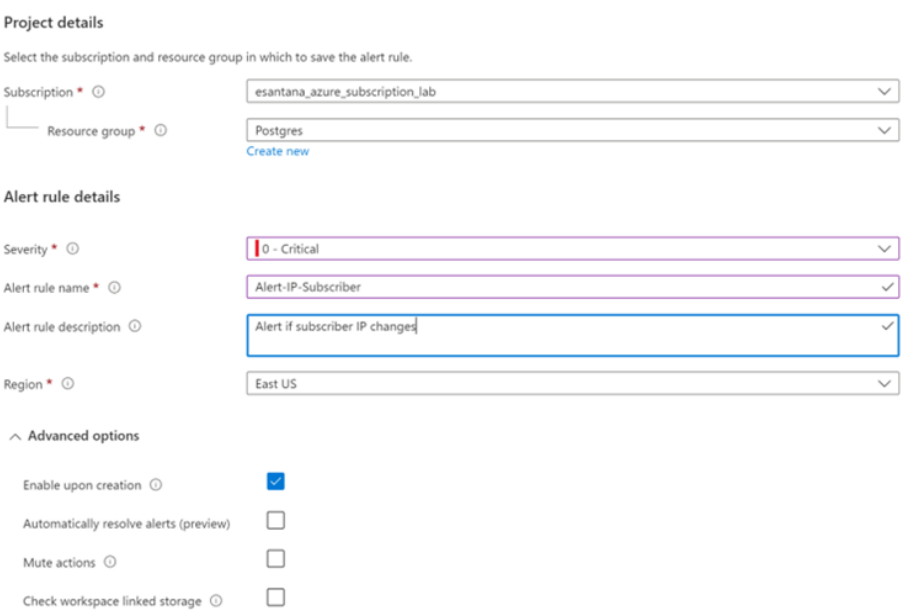
| where Category == "PostgreSQLLogs"
| project TimeGenerated, LogicalServerName_s, Message, errorLevel_s
| where Message contains "password authentication failed" or Message contains "no pg_hba.conf entry for host" or Message contains "could not connect to the publisher"
View result and edit query in Logs
Measurement
Select how to summarize the results. We try to detect summarized data from the query results automatically.
Measure
Table rows
Aggregation type
Count
Aggregation granularity
5 minutes


Split by dimensions
Use dimensions to monitor specific time series and provide context to the fired alert. Dimensions can be either number or string columns. If you select more than one dimension value, each time series that results from the combination will trigger its own alert and will be charged separately.
Dimension name
Operator
Dimension values
Select dimension
=
0 selected
Add custom value
Alert logic
Operator *
Greater than
Threshold value *
1
Frequency of evaluation *
5 minutes
Estimated monthly cost $1.50 (USD)
See final alert query
Advanced options


Home > Postgres > edutstflex >
Create an alert rule
Scope
Condition
Actions
Details
Tags
Review + create
An action group is a set of actions that can be applied to an alert rule. Learn more
Add action groups
Create action group
Action group name
Contains actions
No action group selected yet
Review + create
Previous
Next: Details >
Add action groups
Select up to five action groups to attach to this alert rule.
Subscription
esantana_azure_subscription_lab
Search
Action group name
Resource group
Contain actions
eeee
Mariadb
1 Email, 1 Email Azure Resource Manager...
Alert-lp
Postgres
1 Email, 1 SMS message
edu
postgres
1 Email, 1 SMS message, 1 Email Azure R...
Select


Project details
Select the subscription and resource group in which to save the alert rule.
Subscription *
esantana_azure_subscription_lab
Resource group *
Postgres
Create new
Alert rule details
Severity *
0 - Critical
Alert rule name *
Alert-IP-Subscriber
Alert rule description
Alert if subscriber IP changes
Region *
East US
Advanced options
Enable upon creation
Automatically resolve alerts (preview)
Mute actions
Check workspace linked storage


Alert rules
Create
Columns
Refresh
Export to CSV
Delete
Enable
Disable
Subscription : esantana_azure_subscription_lab
Resource group : Postgres
Resource type : All
Resource : edutstflex
Signal type : All signal types
Status : Enabled
Severity : All
Displaying 1 - 1 rules out of total 1 rules
Search alert rules based on rule name and condition...
Name
Condition
Severity
Target resource
Target resource type
Signal type
Status
Alert-IP-Subscriber
AzureDiagnostics | where Resource...
0 - Critical
edutstflex
Azure Database for PostgreSQL flex...
Log search
Enabled