Hydra

- Overview
- How to Connect
  - Connecting with Node.js
  - Connecting with Python
  - Connecting with PHP
  - Connecting with Go
  - Connecting with Java
  - Connecting with psql
  - Connecting with pgAdmin
- How-To Guides
- Database Migration
- Cluster Management
  - Overview
  - Deploying a New Cluster
  - Node Management
  - Adding a Node
  - Promoting a Node
  - Removing a Node
  - Backups and Restores
  - Restricting Access by IP
  - Cluster Resynchronization
  - Database Migrations
  - Deleting a Cluster

Overview

Hydra is an open-source OAuth2 and OpenID Connect (OIDC) server and identity provider written in Go. Developed by Ory, Hydra acts as a secure, scalable authentication and authorization layer for modern applications. It does not manage user identities directly but integrates with any login system to handle secure token issuance and authorization flows. Hydra is designed to comply with industry standards like OAuth2 and OIDC, making it suitable for microservices, APIs, and large-scale enterprise systems.

Key Features of Hydra:

- **OAuth2 & OpenID Connect Compliance**: Fully supports OAuth2.1 and OIDC standards, including flows like Authorization Code, Implicit, Client Credentials, and Device Code, ensuring compatibility with third-party applications and identity layers.
- **Separation of Concerns**: Delegates authentication to your login system (via Login & Consent endpoints), enabling seamless integration with any identity provider or SSO platform without locking you into a specific user store.
- **Security by Design**: Enforces strong security practices including TLS-by-default, token hashing, PKCE (Proof Key for Code Exchange), and proper consent handling, making it compliant with modern security requirements.
- **Scalability and Performance**: Built in Go with minimal memory footprint and high concurrency capabilities, Hydra scales easily in cloud-native environments using containers or Kubernetes.
- **Extensibility and Integration**: Works with any OAuth2-compatible clients and supports extensive customizations via HTTP hooks for login, consent, and error handling—giving developers full control over user flows.
- **Stateless Architecture**: Does not store sessions on the server, relying instead on JWTs and external session systems. This design ensures horizontal scalability and simplifies distributed deployments.
- **Consent and Login UI Integration**: Hydra allows external web UIs to handle login and consent, offering developers freedom to build fully customized, branded experiences for users.
- **Database Agnostic**: Supports PostgreSQL and MySQL as backend stores, with schema migrations managed via SQL scripts, ensuring compatibility across most relational database environments.
- **Multi-Tenant and Multi-Client Support**: Handles multiple OAuth2 clients and tenant apps securely, making it ideal for SaaS platforms, API gateways, and B2B/B2C authentication needs.
- **Container-Ready and Cloud Native**: Designed for use in DevOps pipelines and cloud deployments, Hydra runs smoothly in Docker, Kubernetes, and serverless environments with minimal setup.

These features make **Hydra** a preferred choice for organizations seeking a secure, standards-compliant authorization server that integrates cleanly with their existing identity infrastructure and scales with their application architecture.

How to Connect

Connecting with Node.js

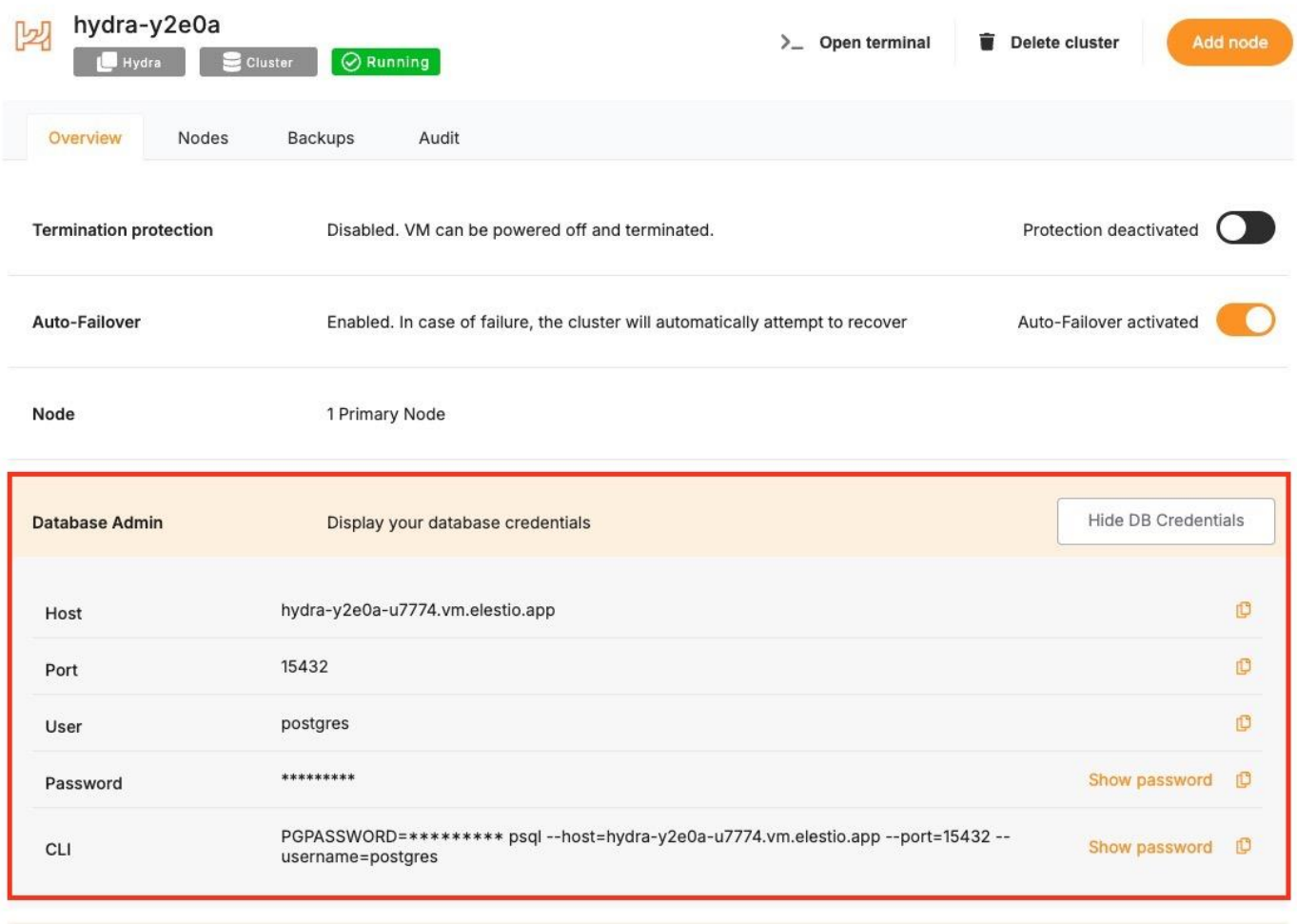
This guide walks you through the process of connecting a Node.js application to a Hydra database using the `pg` package. You'll learn how to set up the environment, configure the connection, and run a simple SQL query.

Variables

To connect to a Hydra database, the following parameters are required. You can find these details in the **Elestio service overview page** of your Hydra service.

Variable	Description	Purpose
USER	Hydra (PostgreSQL) username	Identifies the database user with access privileges
PASSWORD	Hydra password	Authenticates the user against the Hydra database
HOST	Hostname of the Hydra instance	Specifies the server address of the database
PORT	Port for Hydra (usually 5432)	Specifies the network port for connections
DATABASE	Name of the Hydra database	Specifies which database to access

These values can usually be found in the Elestio service overview details as shown in the image below, make sure to take a copy of these details and add it to the code moving ahead.



Prerequisites

- **Install Node.js and NPM**
  - Check if Node.js is installed:

```
node -v
npm -v
```

  - If not, download and install it from https://nodejs.org.
- **Install the pg Package**
  - Hydra is PostgreSQL-compatible, so use the pg package:

```
npm install pg --save
```

Code

Once all prerequisites are set up, create a new file named `hydra.js` and add the following code.

```
const { Client } = require("pg");

// Database connection configuration
const config = {
  host: "HOST",
  user: "USER",
  password: "PASSWORD",
  database: "DATABASE",
  port: PORT,
  ssl: {
    rejectUnauthorized: false, // Only if Hydra requires SSL (check Elestio settings)
  },
};

// Create a new client instance
const client = new Client(config);

// Connect to the Hydra database
client.connect((err) => {
  if (err) {
    console.error("Connection failed:", err.stack);
    return;
  }

  console.log("Connected to Hydra");

  // Run a test query
  client.query("SELECT version()", (err, res) => {
    if (err) {
      console.error("Query failed:", err.stack);
    } else {
      console.log("Hydra/PostgreSQL Version:", res.rows[0].version);
    }

    // Close the connection
    client.end((err) => {
      if (err) console.error("Error closing connection:", err.stack);
    });
  });
});
```

To execute the script, open the terminal or command prompt and navigate to the directory where `hydra.js`. Once in the correct directory, run the script with the command

```
node hydra.js
```

If successful, you'll see:

```
Connected to Hydra
Hydra/PostgreSQL Version: PostgreSQL 14.13 (Debian 14.13-1.pgdg120+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 12.2.0-14) 12.2.0, 64-bit
```

Connecting with Python

This guide explains how to connect a Python application to a Hydra database using the `psycopg2-binary` package. It covers environment setup, configuration, and execution of a simple query to test connectivity.

Variables

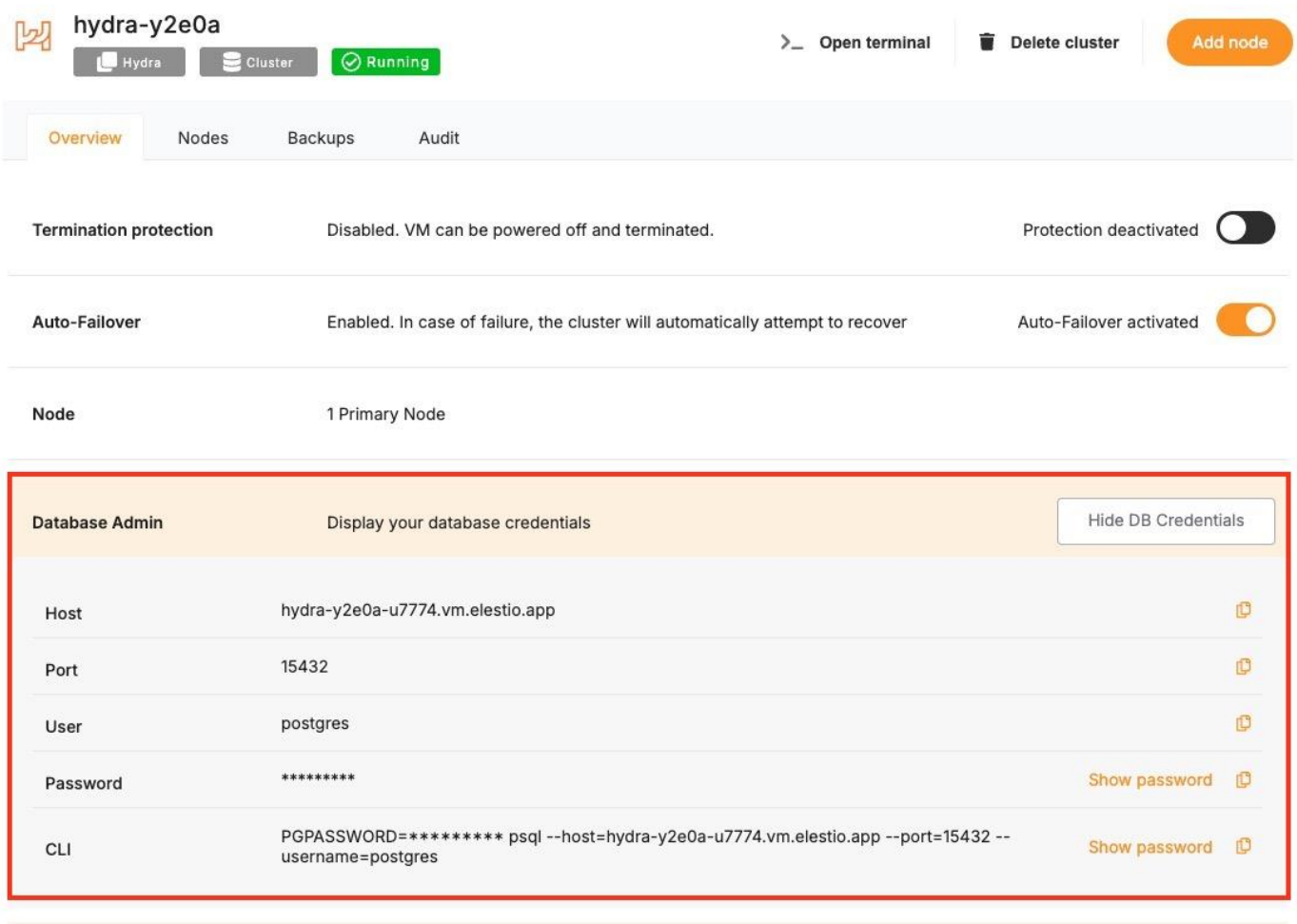
To connect to a Hydra database, you only need **one environment variable** — the connection URI.

Variable	Description	Purpose
`HYDRA_URI`	Full Hydra (PostgreSQL-compatible) connection string from the Elestio service overview	Provides all credentials and connection details in a single URI

A typical URI format looks like:

```
postgresql://<USER>:<PASSWORD>@<HOST>:<PORT>/<DATABASE>
```

You can find the details needed in the URI from the **Elestio service overview** details. Copy and replace the variables carefully in the URI example provided above.



Prerequisites

Install Python

Check if Python is installed:

```
python --version
```

If not installed, download it from https://python.org.

Install `psycopg2-binary`

Install the PostgreSQL driver for Python:

```
pip install psycopg2-binary
```

Code

Once all prerequisites are set up, create a new file named `hydra.py` and add the following code and replace the `HYDRA_URI` with actual link or in environment setup as you wish:

```
import psycopg2
import os

def get_db_version():
    try:
        # Use the Hydra URI from environment variable
        connection_uri = os.getenv('HYDRA_URI', 'POSTGRESQL_URI')
        db_connection = psycopg2.connect(connection_uri)
        db_cursor = db_connection.cursor()
        db_cursor.execute('SELECT VERSION()')
        db_version = db_cursor.fetchone()[0]
        return db_version

    except Exception as e:
        print(f"Database connection error: {e}")
        return None

    finally:
        if 'db_cursor' in locals():
            db_cursor.close()
        if 'db_connection' in locals():
            db_connection.close()

def display_version():
    version = get_db_version()
    if version:
        print(f"Connected to Hydra: {version}")

if __name__ == "__main__":
    display_version()
```

> □□ **Tip:** Save your URI in an .env file or set it in your terminal session like this:

```
export HYDRA_URI=postgresql://user:password@host:port/database
```

To execute the script, open the terminal or command prompt and navigate to the directory where `hydra.py`. Once in the correct directory, run the script with the command

```
python hydra.py
```

If the connection is successful, you’ll see:

```
Connected to Hydra: PostgreSQL 14.13 (Debian 14.13-1.pgdg120+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 12.2.0-14) 12.2.0, 64-bit
```

Connecting with PHP

This guide explains how to connect a PHP application to a Hydra database using the **PDO extension**. It covers setting up prerequisites, configuring the connection URI, and running a test SQL query.

Variables

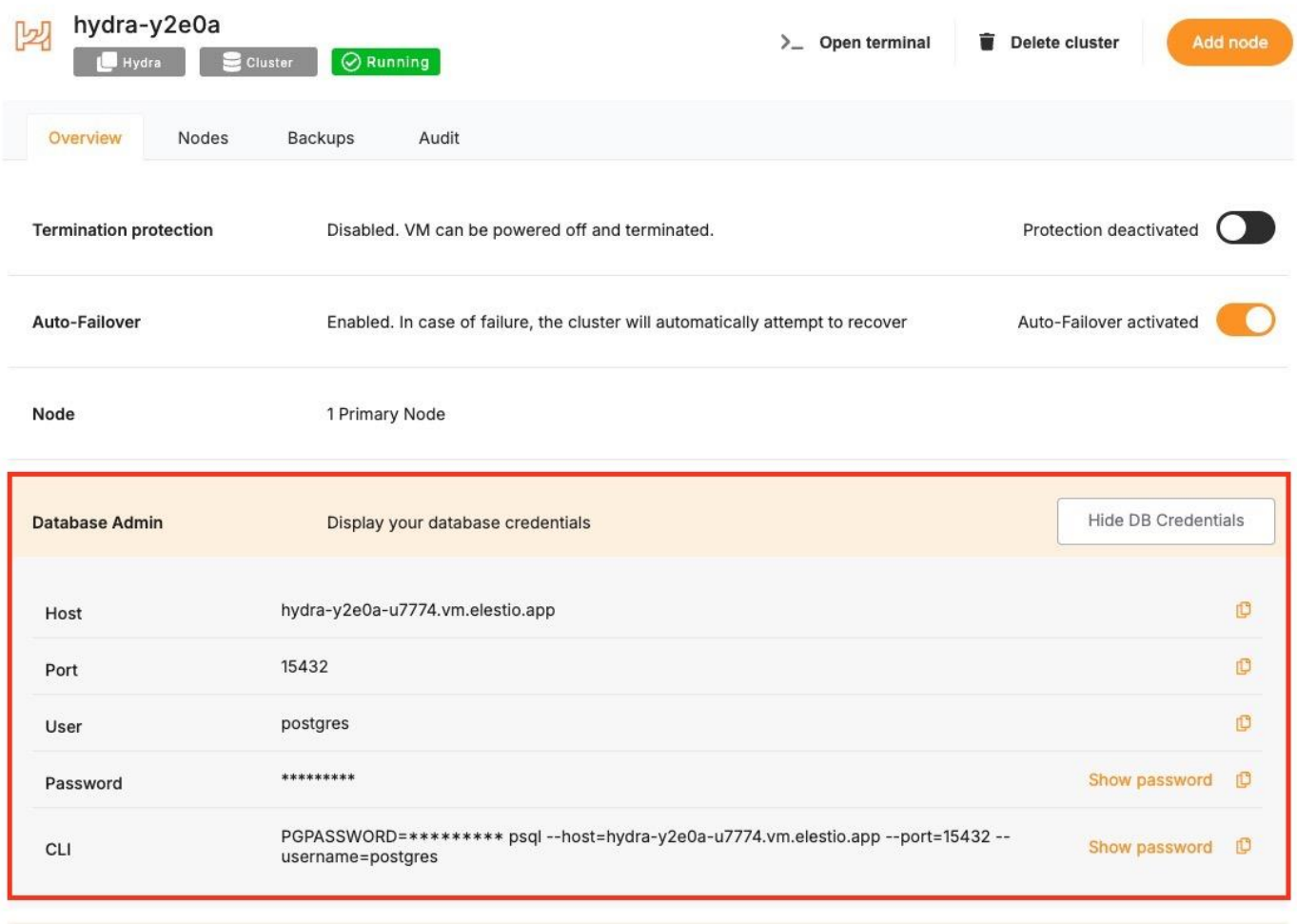
To connect to a Hydra database, you only need **one environment variable** — the connection URI.

Variable	Description	Purpose
`HYDRA_URI`	Full Hydra connection string from Elestio	Encodes all connection info in one URI

A typical URI looks like this:

```
postgresql://<USER>:<PASSWORD>@<HOST>:<PORT>/<DATABASE>
```

You can find the details needed in the URI from the **Elestio service overview** details. Copy and replace the variables carefully in the URI example provided above.



Prerequisites

Install PHP

Check if PHP is installed:

```
php -v
```

If not, download and install PHP from: https://www.php.net/downloads.php

Code

Once all prerequisites are set up, create a new file named `hydra.php` and add the following code and replace the `HYDRA_URI` with actual link or in environment setup as you wish:

```
<?php
$db_url = getenv("HYDRA_URI") ?: "postgresql://user:password@host:port/database";
$db_parts = parse_url($db_url);
$db_name = ltrim($db_parts['path'], '/');
$dsn = "pgsql:host={$db_parts['host']};port={$db_parts['port']};dbname={$db_name}";

try {
    $pdo = new PDO($dsn, $db_parts['user'], $db_parts['pass']);
    $version = $pdo->query("SELECT VERSION()")->fetchColumn();
    echo "Connected to Hydra: " . $version . PHP_EOL;
} catch (PDOException $e) {
    echo "Connection failed: " . $e->getMessage() . PHP_EOL;
}
```

To execute the script, open the terminal or command prompt and navigate to the directory where `hydra.php`. Once in the correct directory, run the script with the command

```
export HYDRA_URI=postgresql://user:password@host:port/database
```

Navigate to the directory containing `hydra.php` and run:

```
php hydra.php
```

If successful, you’ll see output like:

```
Connected to Hydra: PostgreSQL 14.13 (Debian 14.13-1.pgdg120+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 12.2.0-14) 12.2.0, 64-bit
```

Connecting with Go

This guide walks you through setting up a Go application to connect to a Hydra database, using the PostgreSQL-compatible `lib/pq` driver, and running a basic query to verify the connection.

Variables

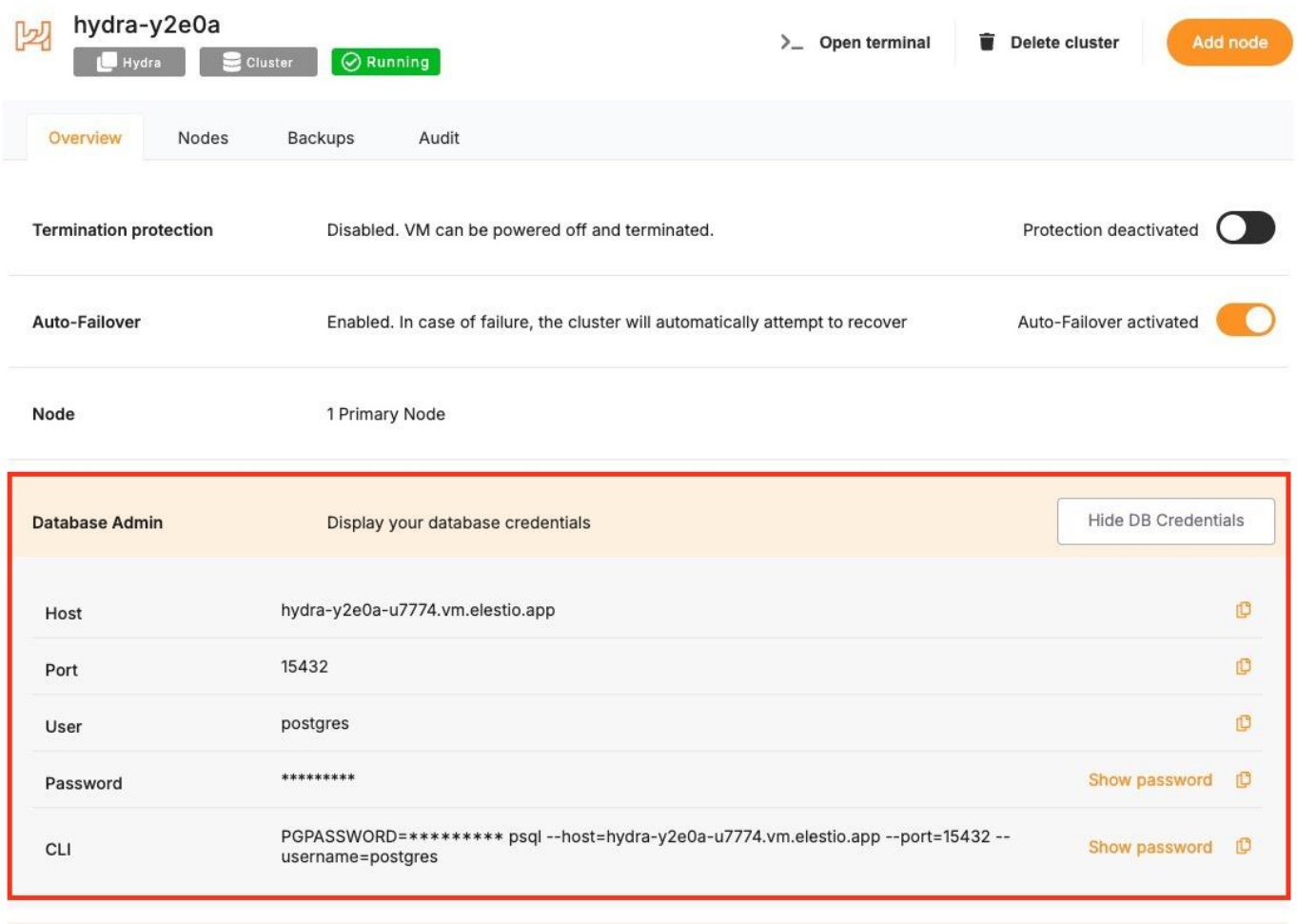
To connect to a Hydra database, you only need **one environment variable** — the connection URI. This URI contains all the necessary information like username, password, host, port, and database name.

Variable	Description	Purpose
`HYDRA_URI`	Full Hydra (PostgreSQL-compatible) connection string from the Elestio service overview	Provides all credentials and connection details in a single URI

A typical URI format looks like:

```
postgresql://<USER>:<PASSWORD>@<HOST>:<PORT>/<DATABASE>
```

You can find the details needed in the URI from the **Elestio service overview** details. Copy and replace the variables carefully in the URI example provided above.



Prerequisites

- **Install Go**
  - Check if Go is installed:

```
go version
```

  - If not, download and install Go: https://go.dev/dl/
- **Install pq Driver**

```
go get github.com/lib/pq
```

Code

Once all prerequisites are set up, create a new file named `main.go` and add the following code, and replace the `HYDRA_URI` with actual link or in environment setup as you wish:

```
package main

import (
	"database/sql"
	"fmt"
	"log"
	"os"

	_ "github.com/lib/pq"
)

func getDBConnection(connStr string) (*sql.DB, error) {
	db, err := sql.Open("postgres", connStr)
	if err != nil {
		return nil, fmt.Errorf("failed to open database connection: %v", err)
	}

	if err := db.Ping(); err != nil {
		return nil, fmt.Errorf("failed to ping database: %v", err)
	}

	return db, nil
}

func main() {
	// Get the Hydra connection string from environment variable
	connStr := os.Getenv("HYDRA_URI")
	if connStr == "" {
		log.Fatal("HYDRA_URI environment variable not set")
	}

	db, err := getDBConnection(connStr)
	if err != nil {
		log.Fatal(err)
	}
	defer db.Close()

	query := "SELECT current_database(), current_user, version()"
	row := db.QueryRow(query)
```

```
    var dbName, user, version string
    if err := row.Scan(&dbName, &user, &version); err != nil {
        log.Fatal("Failed to scan row:", err)
    }

    fmt.Printf("Connected to Hydra\nDatabase: %s\nUser: %s\nVersion: %s\n", dbName, user, version)
}
```

Set your Hydra URI as an environment variable:

```
export HYDRA_URI=postgresql://user:password@host:port/database
```

To execute the script, open the terminal or command prompt and navigate to the directory where `main.go`. Once in the correct directory, run the script with the command

```
go run main.go
```

If successful, you'll see output like:

```
Connected to Hydra
Database: elestio
User: postgres
Version: PostgreSQL 14.13 (Debian 14.13-1.pgdg120+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 12.2.0-14) 12.2.0, 64-bit
```

Connecting with Java

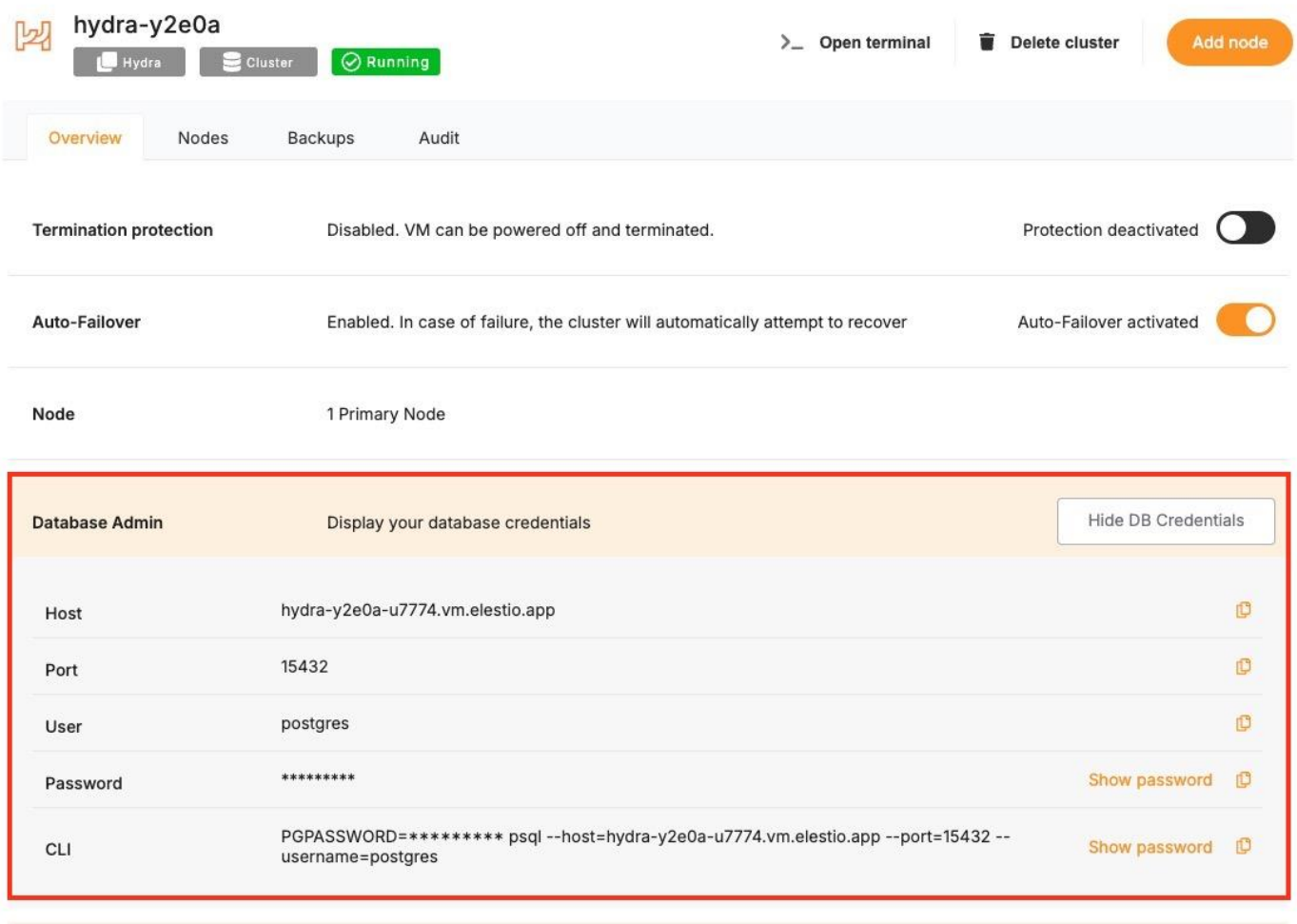
This guide shows how to connect your Java app to a **Hydra database** using the PostgreSQL JDBC driver, parse command-line arguments, and run a basic query.

Variables

To connect to a Hydra database, the following parameters are required. You can find these details in the **Elestio service overview page** of your Hydra service.

Variable	Description	Purpose
`USER`	Hydra (PostgreSQL) username	Identifies the database user with access privileges
`PASSWORD`	Hydra password	Authenticates the user against the Hydra database
`HOST`	Hostname of the Hydra instance	Specifies the server address of the database
`PORT`	Port for Hydra (usually 5432)	Specifies the network port for connections
`DATABASE`	Name of the Hydra database	Specifies which database to access

These values can usually be found in the Elestio service overview details as shown in the image below, make sure to take a copy of these details and add it to the code moving ahead.



Prerequisites

Install Java & JDBC driver

Check if Java is installed by running:

```
java -version
```

If not installed, install it first and then download and install **JDBC** driver from https://jdbc.postgresql.org/download/ or if you have Maven installed, run the following command with updated version of the driver:

```
mvn org.apache.maven.plugins:maven-dependency-plugin:2.8:get \
  -Dartifact=org.postgresql:postgresql:42.7.5:jar \
  -Ddest=postgresql-42.7.5.jar
```

Code

Once all prerequisites are set up, create a new file named `HydraPg.java` and add the following code:

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;
import java.util.HashMap;
import java.util.Map;

public class HydraPg {

    static class Config {
        String host, port, database, username, password;

        Config(String host, String port, String database, String username, String password) {
            this.host = host;
            this.port = port;
            this.database = database;
            this.username = username;
            this.password = password;
        }

        String getJdbcUrl() {
            return String.format("jdbc:postgresql://%s:%s/%s?sslmode=require", host, port, database);
        }

        boolean isComplete() {
            return host != null && port != null && database != null && username != null && password != null;
        }
    }

    static Map<String, String> parseArgs(String[] args) {
        Map<String, String> map = new HashMap<>();
        for (int i = 0; i < args.length - 1; i += 2) {
            map.put(args[i], args[i + 1]);
        }
        return map;
    }
```

```
    public static void main(String[] args) {
        try {
            Class.forName("org.postgresql.Driver");

            Map<String, String> argMap = parseArgs(args);
            Config cfg = new Config(
                argMap.get("-host"),
                argMap.get("-port"),
                argMap.get("-database"),
                argMap.get("-username"),
                argMap.get("-password")
            );

            if (!cfg.isComplete()) {
                System.err.println("Missing required arguments. Example usage:");
                System.err.println("java -cp postgresql-42.7.5.jar:. HydraPg -host <HOST> -port <PORT> -database
<DB> -username <USER> -password <PASS>");
                return;
            }

            try (Connection conn = DriverManager.getConnection(cfg.getJdbcUrl(), cfg.username, cfg.password)) {
                System.out.println("Connected to Hydra database successfully.");

                Statement stmt = conn.createStatement();
                ResultSet rs = stmt.executeQuery("SELECT current_database(), current_user, version()");

                while (rs.next()) {
                    System.out.println("Database: " + rs.getString(1));
                    System.out.println("User: " + rs.getString(2));
                    System.out.println("Version: " + rs.getString(3));
                }

                rs.close();
                stmt.close();
            }

        } catch (ClassNotFoundException e) {
            System.err.println("PostgreSQL JDBC driver not found.");
            e.printStackTrace();
        } catch (SQLException e) {
```

```
            System.err.println("Connection or query error:");
            e.printStackTrace();
        }
    }
}
```

To execute the script, open the terminal or command prompt and navigate to the directory where `HydraPg.java`. Once in the correct directory, run the script with the command (Update the variables with actual values acquired from previous steps).

```
javac HydraPg.java
```

```
java -cp postgresql-42.7.5.jar:. HydraPg -host HOST -port PORT -database DATABASE -username USERNAME -password PASSWORD
```

If the connection is successful, the terminal will display output similar to:

```
Connected to Hydra database successfully.
Database: elestio
User: postgres
Version: PostgreSQL 14.13 (Debian 14.13-1.pgdg120+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 12.2.0-14) 12.2.0, 64-bit
```

Connecting with psql

This guide explains how to connect to a **Hydra** database using the **`psql`** command-line tool. It walks through the necessary setup, connection process, and execution of a simple SQL query.

Variables

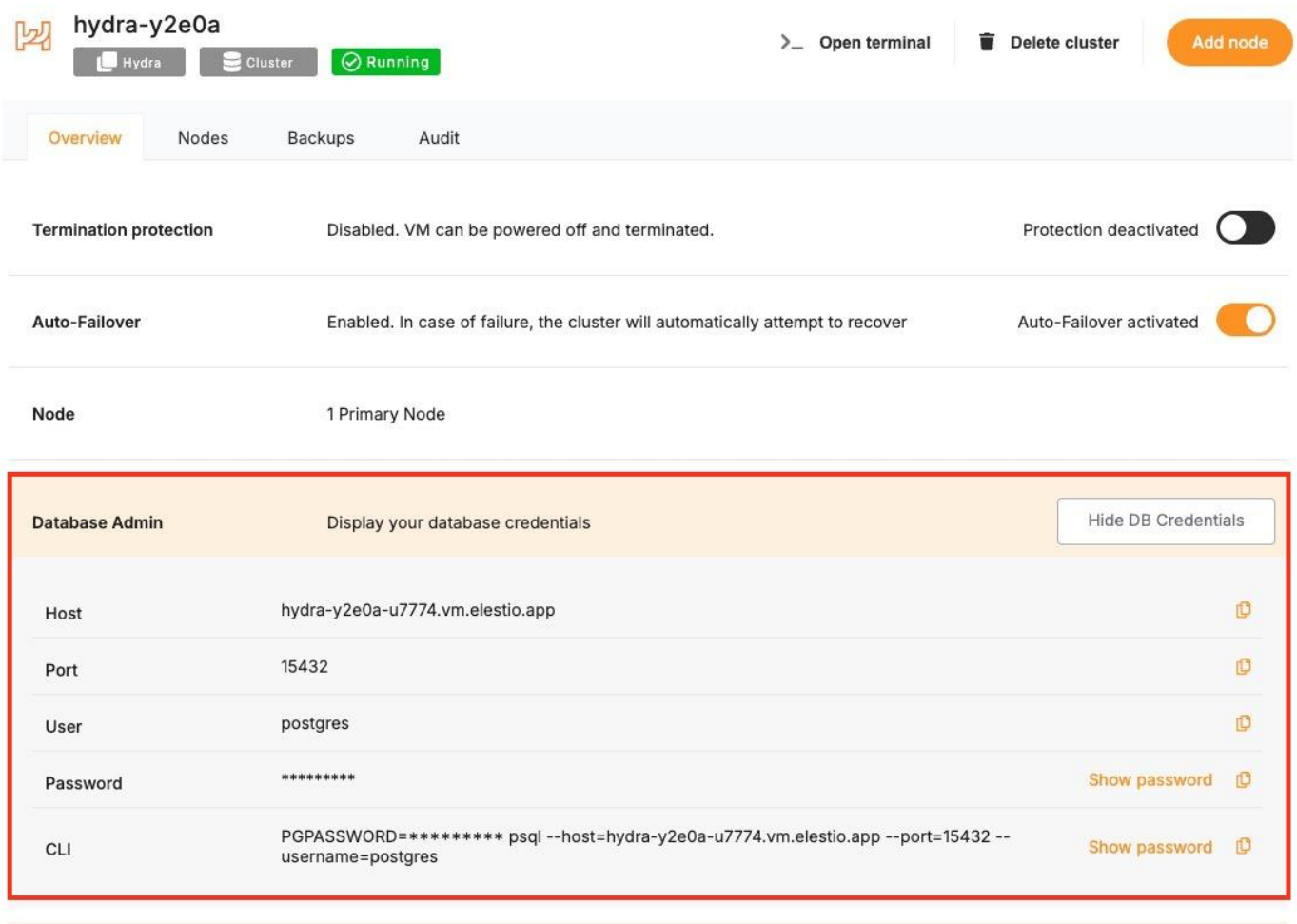
To connect to a Hydra database, you only need **one environment variable** — the connection URI.

Variable	Description	Purpose
`HYDRA_URI`	Full Hydra connection string from Elestio	Encodes all connection info in one URI

A typical URI looks like this:

```
postgresql://<USER>:<PASSWORD>@<HOST>:<PORT>/<DATABASE>
```

You can find the details needed in the URI from the **Elestio service overview** details. Copy and replace the variables carefully in the URI example provided above.



Prerequisites

While following this tutorial, you will need to have **psql** already installed; if not head over to https://www.postgresql.org/download/ and download it first.

Connecting to Hydra

Open your terminal and run the following command to connect to your Hydra database using the full connection URI:

```
psql HYDRA_URI
```

If the connection is successful, you'll see output similar to this. Here it will show you the database you tried to connect to, which in this case is Elestio:

```
psql (17.4, server 14.13 (Debian 14.13-1.pgdg120+1))
SSL connection (protocol: TLSv1.3, cipher: TLS_AES_256_GCM_SHA384, compression: off, ALPN: none)
Type "help" for help.
```

```
elestio=#
```

To ensure you're connected correctly, run this command inside the `psql` prompt:

```
SELECT version();
```

You should receive output like the following:

```
version
----------------------------------------------------------------------------------------------------------------
PostgreSQL 16.8 (Debian 16.8-1.pgdg120+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 12.2.0-14)
12.2.0, 64-bit
(1 row)
```

Connecting with pgAdmin

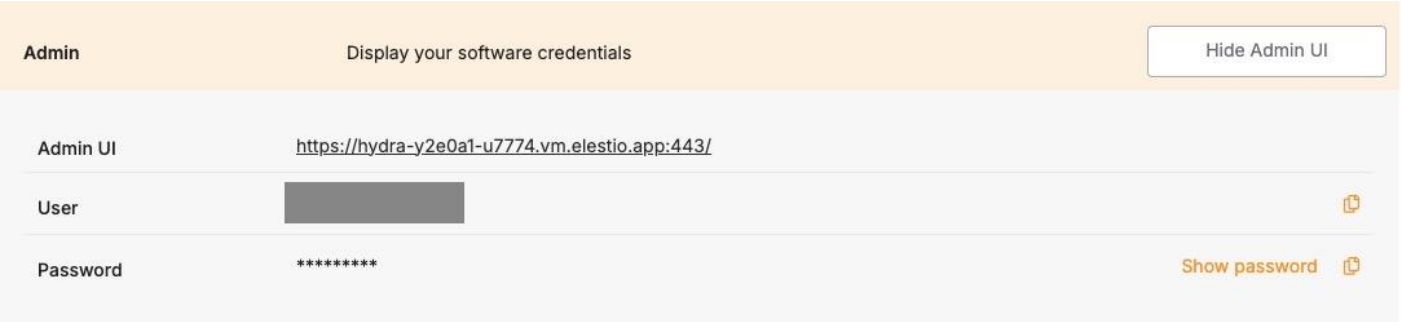
pgAdmin is a widely used graphical interface for Hydra that allows you to manage, connect to, and run queries on your databases with ease.

Variables

To connect using `pgAdmin`, you'll need the following connection parameters. When you deploy a Hydra service on Elestio, you also get a pgAdmin dashboard configured for you to use with these variables. These details are available in the **Elestio service overview page**:

Variable	Description	Purpose
`USER`	pgAdmin username	Identifies the pgAdmin user with access permission.
`PASSWORD`	pgAdmin password	Authentication key for the `USER`.

You can find these values in your Elestio project dashboard under **Admin** section.



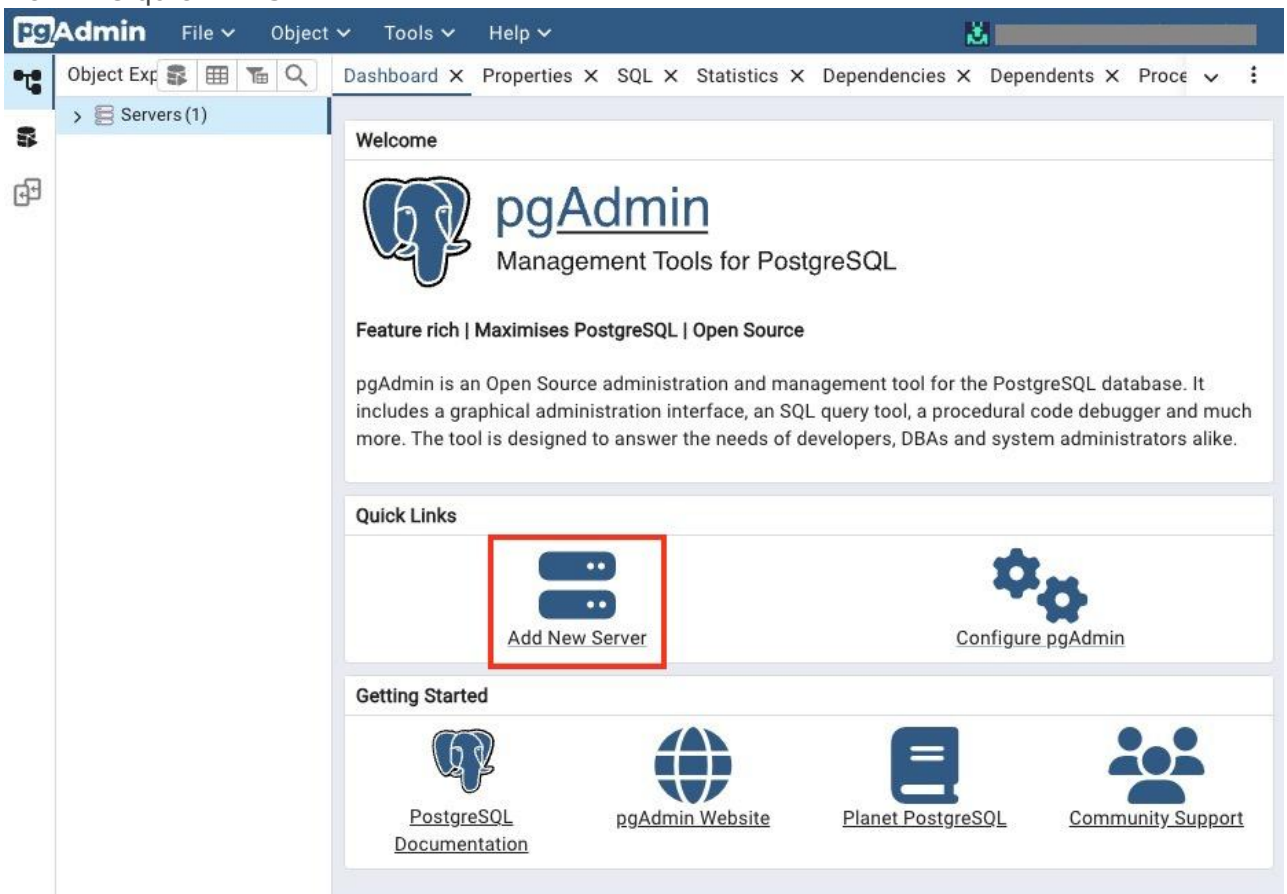
Prerequisites

Make sure the **Hydra** service is correctly deployed on Elestio and you are able to access the Admin section like the one in the image above.

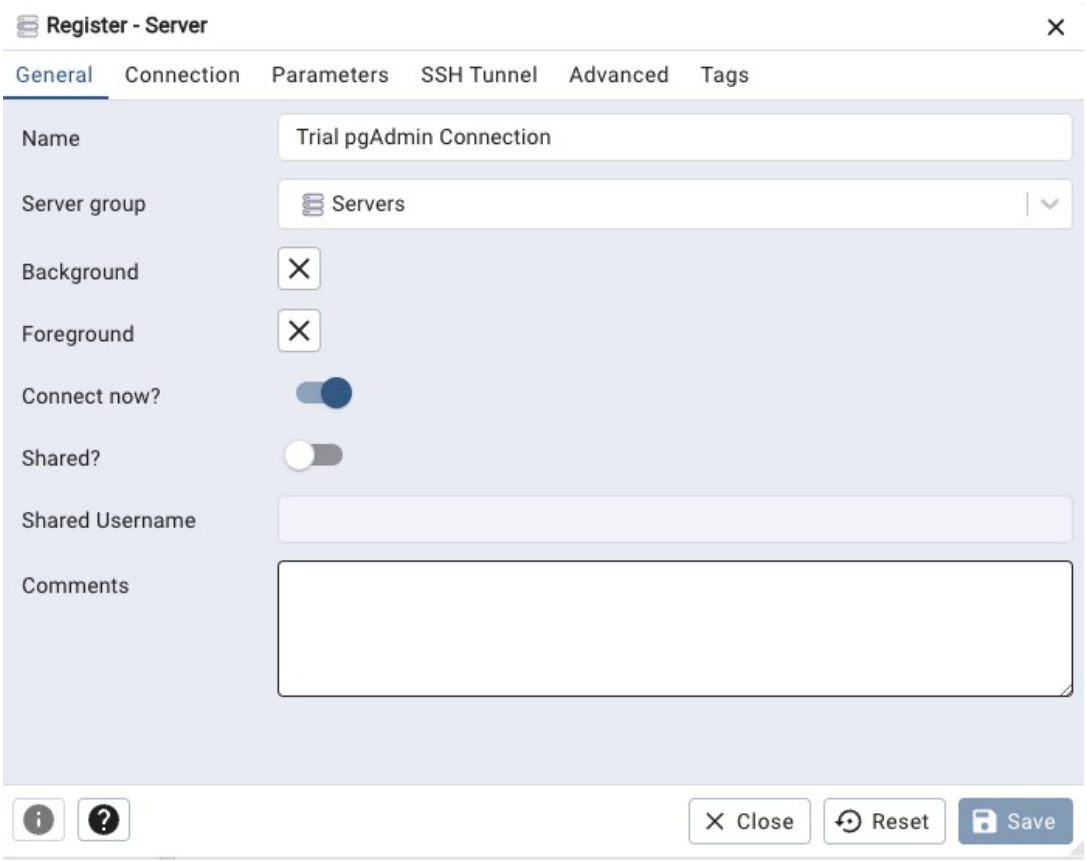
Setting Up the Connection

1. Launch **pgAdmin** from the Admin UI URL and log in with the credentials acquired in the steps before.

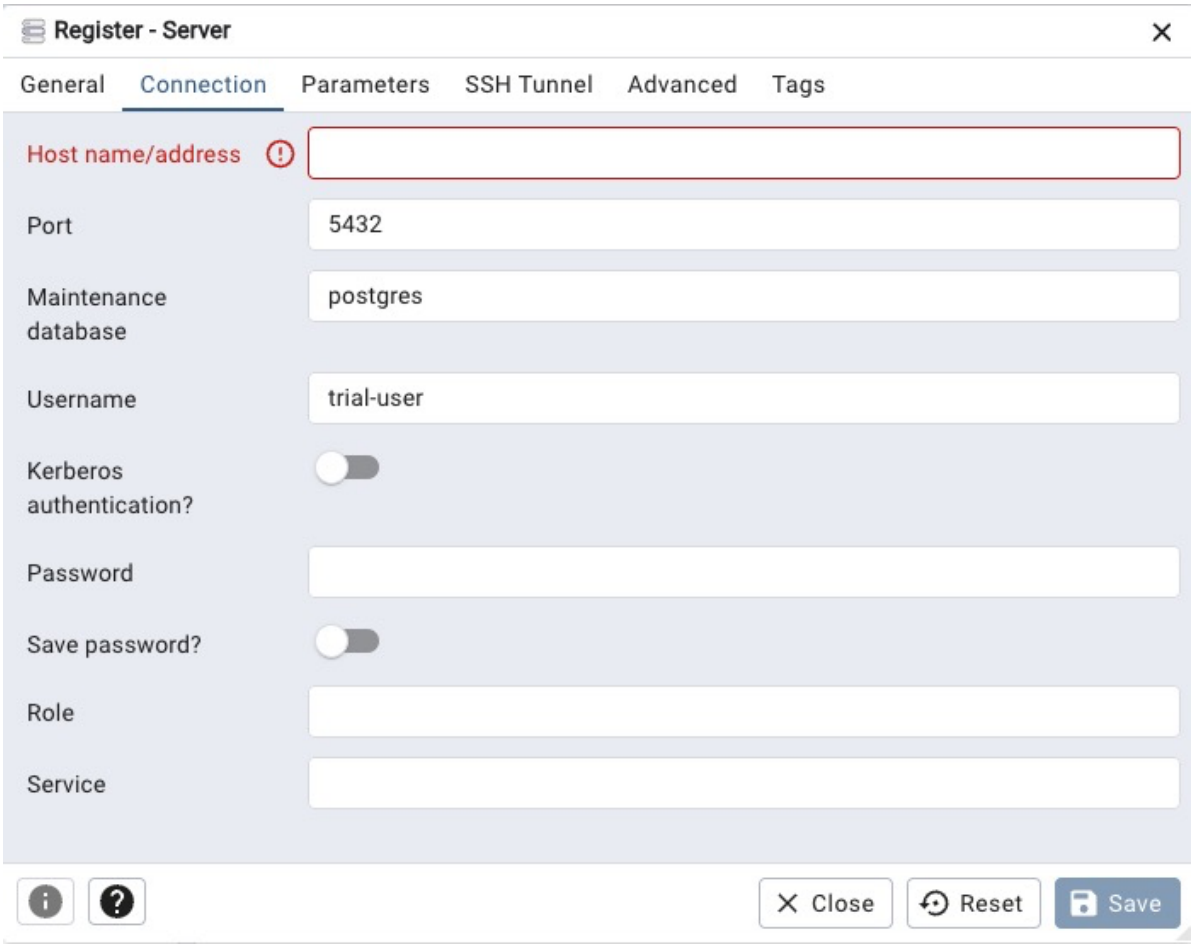
2. Click on **"Create"** and select **"Server..."** from the dropdown, or find **Add New Server** from the quick links



3. In the **General** tab:
   - Enter a name for your connection (e.g., `Trial pgAdmin Connection`).



4. Go to the **Connection** tab and enter the following details:
   - **Host name/address**: `HOSTNAME`
   - **Port**: `PORT`
   - **Maintenance database**: `DATABASE`
   - **Username**: `USERNAME`
   - **Password**: `PASSWORD`


Register - Server
General
Connection
Parameters
SSH Tunnel
Advanced
Tags
Host name/address
Port
5432
Maintenance database
postgres
Username
trial-user
Kerberos authentication?
Password
Save password?
Role
Service
Close
Reset
Save

How-To Guides

Database Migration

Cluster Management

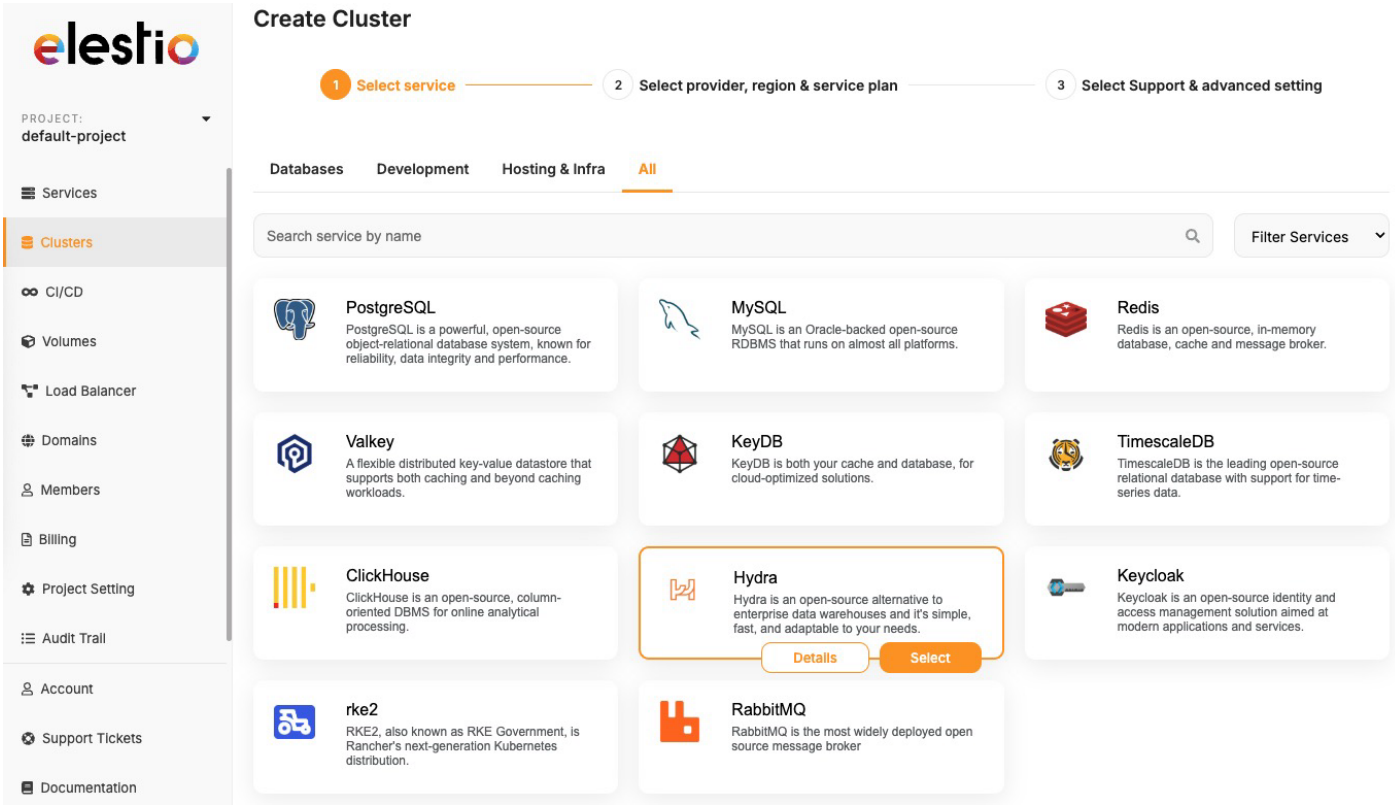
Overview

Elestio provides a complete solution for setting up and managing software clusters. This helps users deploy, scale, and maintain applications more reliably. Clustering improves performance and ensures that services remain available, even if one part of the system fails. Elestio supports different cluster setups to handle various technical needs like load balancing, failover, and data replication.

Supported Software for Clustering:

Elestio supports clustering for a wide range of open-source software. Each is designed to support different use cases like databases, caching, and analytics:

- **MySQL**:
  Supports Single Node, Primary/Replica, and Multi-Master cluster types. These allow users to create simple setups or more advanced ones where reads and writes are distributed across nodes. In a Primary/Replica setup, replicas are updated continuously through replication. These configurations are useful for high-traffic applications that need fast and reliable access to data.
- **PostgreSQL**:
  PostgreSQL clusters can be configured for read scalability and failover protection. Replication ensures that data written to the primary node is copied to replicas. Clustering PostgreSQL also improves query throughput by offloading read queries to replicas. Elestio handles replication setup and node failover automatically.
- **Redis/KeyDB/Valkey**:
  These in-memory data stores support clustering to improve speed and fault tolerance. Clustering divides data across multiple nodes (sharding), allowing horizontal scaling. These tools are commonly used for caching and real-time applications, so fast failover and data availability are critical.
- **Hydra and TimescaleDB**:
  These support distributed and time-series workloads, respectively. Clustering helps manage large datasets spread across many nodes. TimescaleDB, built on PostgreSQL, benefits from clustering by distributing time-based data for fast querying. Hydra uses clustering to process identity and access management workloads more efficiently in high-load environments.



> **Note**: Elestio is frequently adding support for more clustered software like OpenSearch, Kafka, and ClickHouse. Always check the Elestio catalogue for the latest supported services.

Cluster Configurations:

Elestio offers several clustering modes, each designed for a different balance between simplicity, speed, and reliability:

- **Single Node**:
  This setup has only one node and is easy to manage. It acts as a standalone Primary node. It's good for testing, development, or low-traffic applications. Later, you can scale to more nodes without rebuilding the entire setup. Elestio lets you expand this node into a full cluster with just a few clicks.
- **Primary/Replica**:
  One node (Primary) handles all write operations, and one or more Replicas handle read queries. Replication is usually asynchronous and ensures data is copied to all replicas. This improves read performance and provides redundancy if the primary node fails. Elestio manages automatic data syncing and failover setup.

Cluster Management Features:

Elestio's cluster dashboard includes tools for managing, monitoring, and securing your clusters. These help ensure stability and ease of use:

- **Node Management**:
  You can scale your cluster by adding or removing nodes as your app grows. Adding a node increases capacity; removing one helps reduce costs. Elestio handles provisioning and configuring nodes automatically, including replication setup. This makes it easier to scale horizontally without downtime.
- **Backups and Restores**:
  Elestio provides scheduled and on-demand backups for all nodes. Backups are stored securely and can be restored if something goes wrong. You can also create a snapshot before major changes to your system. This helps protect against data loss due to failures, bugs, or human error.
- **Access Control**:
  You can limit access to your cluster using IP allowlists, ensuring only trusted sources can connect. Role-based access control (RBAC) can be applied for managing different user permissions. SSH and database passwords are generated securely and can be rotated easily from the dashboard. These access tools help reduce the risk of unauthorized access.
- **Monitoring and Alerts**:
  Real-time metrics like CPU, memory, disk usage, and network traffic are available through the dashboard. You can also check logs for troubleshooting and set alerts for high resource usage or failure events. Elestio uses built-in observability tools to monitor the health of your cluster and notify you if something needs attention. This allows you to catch problems early and take action.

Deploying a New Cluster

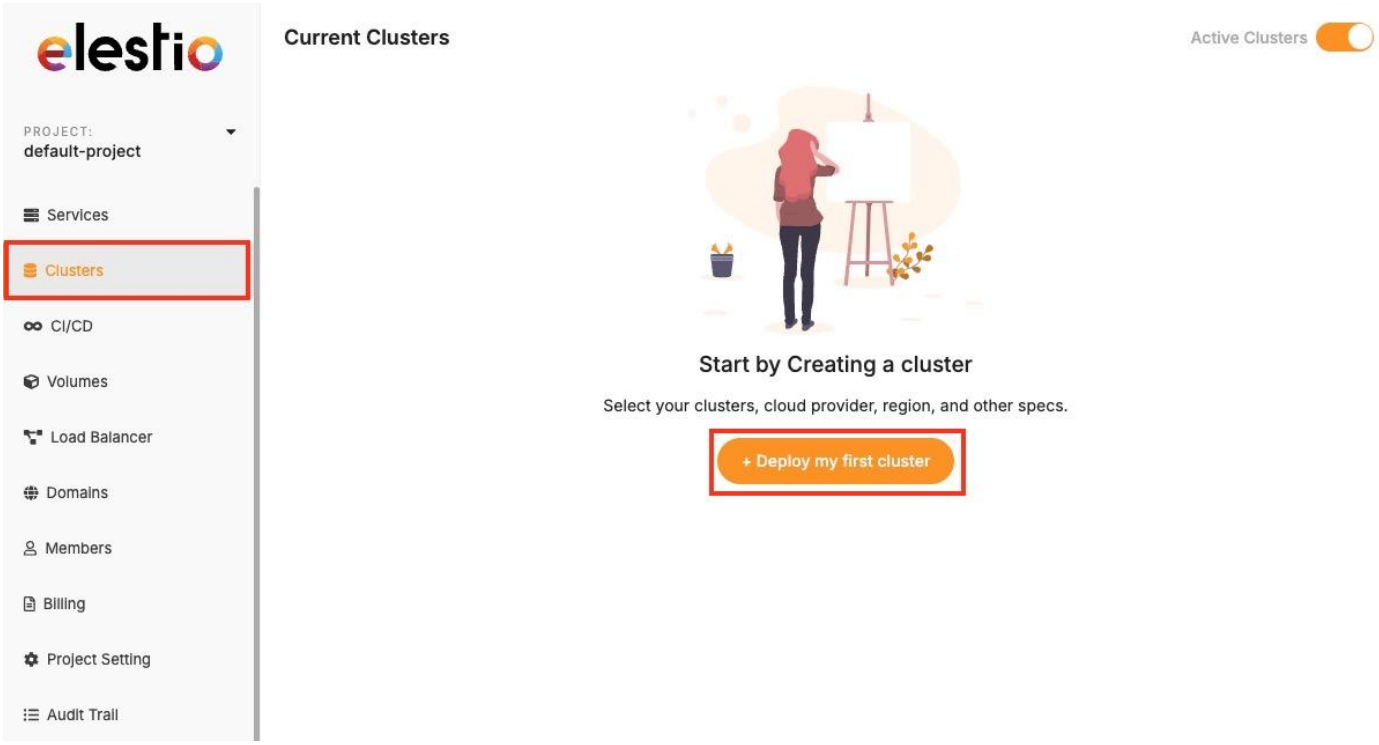
Creating a cluster is a foundational step when deploying services in Elestio. Clusters provide isolated environments where you can run containerized workloads, databases, and applications. Elestio’s web dashboard helps the process, allowing you to configure compute resources, choose cloud providers, and define deployment regions without writing infrastructure code. This guide walks through the steps required to create a new cluster using the Elestio dashboard.

Prerequisites

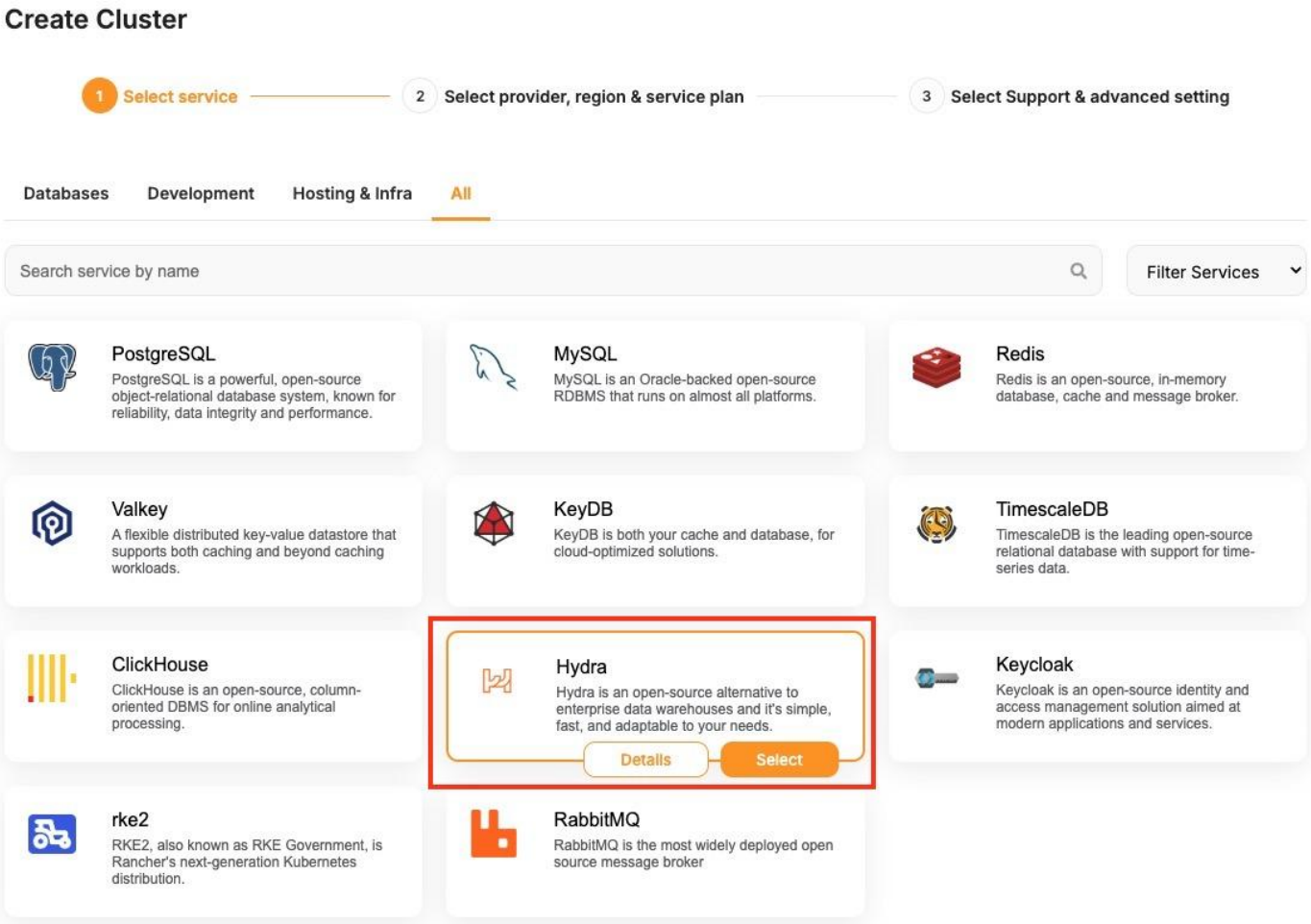
To get started, you’ll need an active Elestio account. If you’re planning to use your own infrastructure, make sure you have valid credentials for your preferred cloud provider (like AWS, GCP, Azure, etc.). Alternatively, you can choose to deploy clusters using Elestio-managed infrastructure, which requires no external configuration.

Creating a Cluster

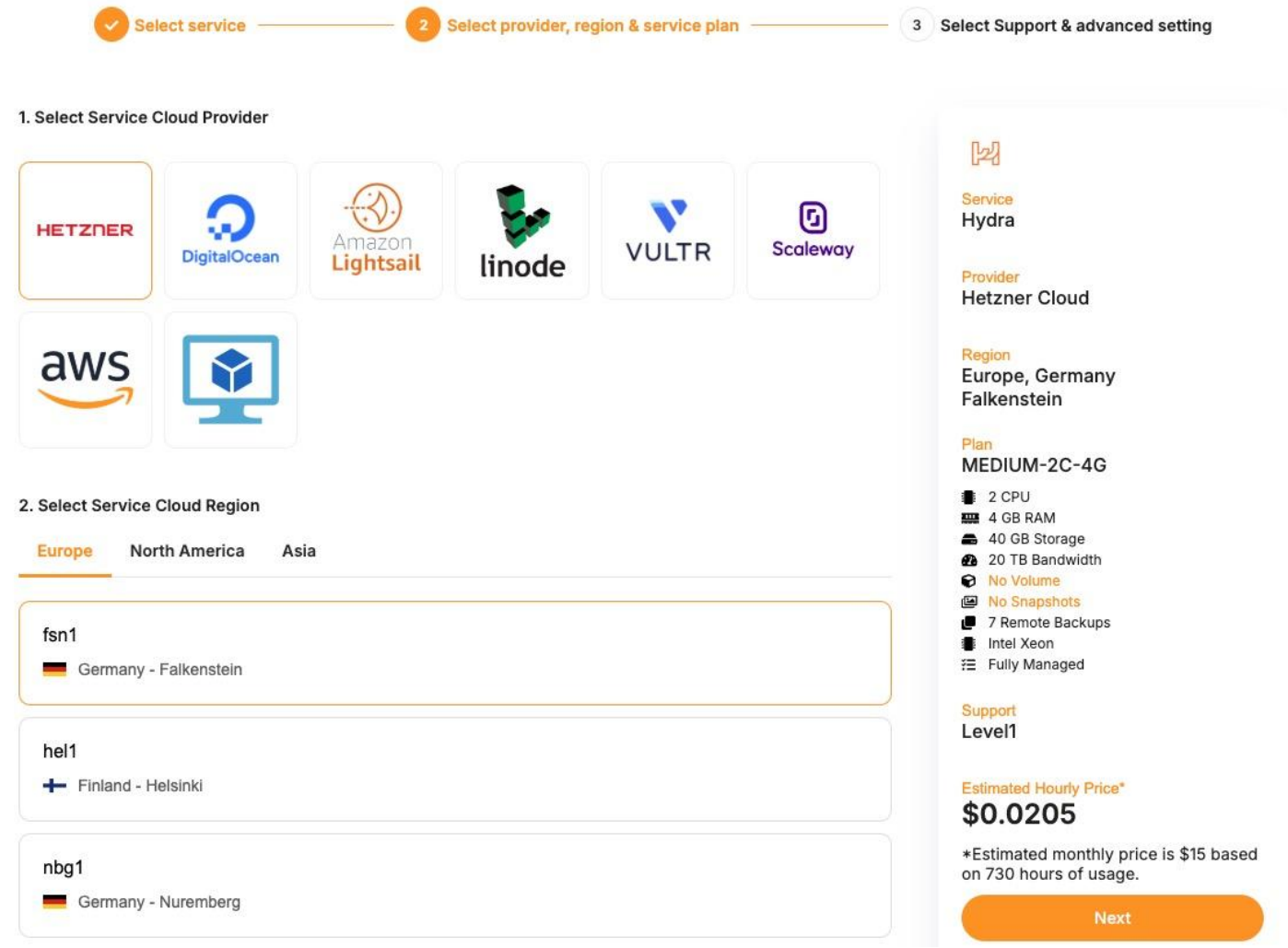
Once you’re logged into the Elestio dashboard, navigate to the **Clusters** section from the sidebar. You’ll see an option to **Create a new cluster**—clicking this will start the configuration process. The cluster creation flow is flexible but simple for defining essential details like provider, region, and resources in one place.



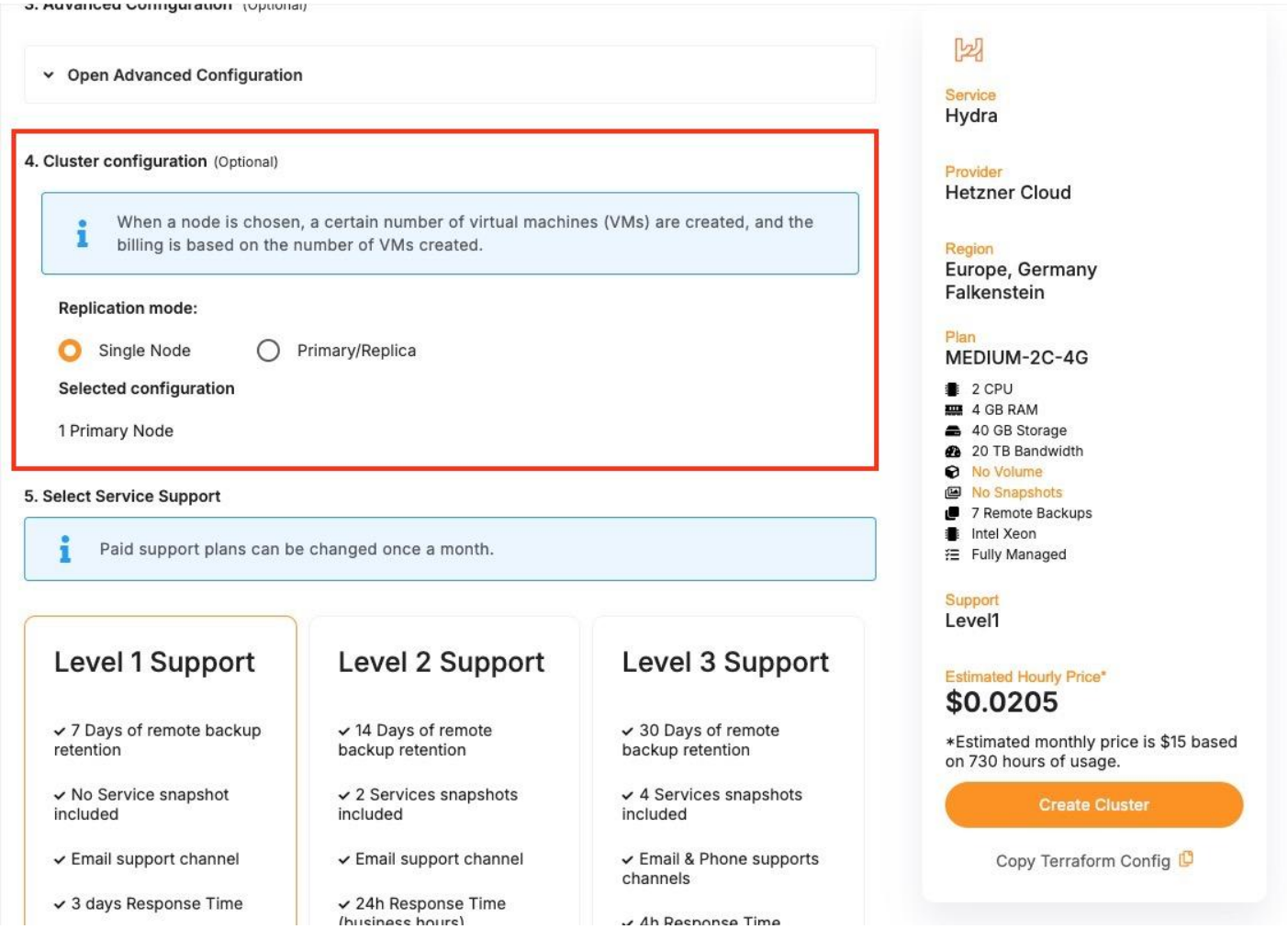
Now, select the database service of your choice that you need to create in a cluster environment. Click on **Select** button as you choose one.



During setup, you'll be asked to choose a hosting provider. Elestio supports both managed and BYOC (Bring Your Own Cloud) deployments, including AWS, DigitalOcean, Hetzner, and custom configurations. You can then select a region based on latency or compliance needs, and specify the number of nodes along with CPU, RAM, and disk sizes per node.



If you're setting up a high-availability cluster, the dashboard also allows you to configure cluster-related details under **Cluster configuration,** where you get to select things like replication modes, number of replicas, etc. After you've configured the cluster, review the summary to ensure all settings are correct. Click the **Create Cluster** button to begin provisioning.



Elestio will start the deployment process, and within a few minutes, the cluster will appear in your dashboard. Once your cluster is live, it can be used to deploy new nodes and additional configurations. Each cluster supports real-time monitoring, log access, and scaling operations through the dashboard. You can also set up automated backups and access control through built-in features available in the cluster settings.

Node Management

Node management plays a critical role in operating reliable and scalable infrastructure on Elestio. Whether you're deploying stateless applications or stateful services like databases, managing the underlying compute units nodes is essential for maintaining stability and performance.

Understanding Nodes

In Elestio, a **node** is a virtual machine that contributes compute, memory, and storage resources to a cluster. Clusters can be composed of a single node or span multiple nodes, depending on workload demands and availability requirements. Each node runs essential services and containers as defined by your deployed applications or databases.

Nodes in Elestio are provider-agnostic, meaning the same concepts apply whether you're using Elestio-managed infrastructure or connecting your own cloud provider (AWS, Azure, GCP, etc.). Each node is isolated at the VM level but participates fully in the cluster's orchestration and networking. This abstraction allows you to manage infrastructure without diving into the complexity of underlying platforms.

Node Operations

The Elestio dashboard allows you to manage the lifecycle of nodes through clearly defined operations. These include:

- **Creating a node**, which adds capacity to your cluster and helps with horizontal scaling of services. This is commonly used when load increases or when preparing a high-availability deployment.
- **Deleting a node**, which removes underutilized or problematic nodes. Safe deletion includes draining workloads to ensure service continuity.
- **Promoting a node**, which changes the role of a node within the cluster—typically used in clusters with redundancy, where certain nodes may need to take on primary or leader responsibilities.

Each of these operations is designed to be safely executed through the dashboard and is validated against the current cluster state to avoid unintended service disruption. These actions are supported by Elestio's backend orchestration, which handles tasks like container rescheduling and

load balancing when topology changes.

Monitoring and Maintenance

Monitoring is a key part of effective node management. Elestio provides per-node visibility through the dashboard, allowing you to inspect **CPU**, **memory**, and **disk utilization** in real time. Each node also exposes **logs**, **status indicators**, and **health checks** to help detect anomalies or degradation early.

In addition to passive monitoring, the dashboard supports active maintenance tasks. You can **reboot a node** when applying system-level changes or troubleshooting, or **drain a node** to safely migrate workloads away from it before performing disruptive actions. Draining ensures that running containers are rescheduled on other nodes in the cluster, minimizing service impact.

For production setups, combining resource monitoring with automation like scheduled reboots, log collection, and alerting can help catch issues before they affect users. While Elestio handles many aspects of orchestration automatically, having visibility at the node level helps teams make informed decisions about scaling, updates, and incident response.

Cluster-wide resource graphs and node-level metrics are also useful for capacity planning. Identifying trends such as memory saturation or disk pressure allows you to preemptively scale or rebalance workloads, reducing the risk of downtime.

Adding a Node

As your application usage grows or your infrastructure requirements change, scaling your cluster becomes essential. In Elestio, you can scale horizontally by adding new nodes to an existing cluster. This operation allows you to expand your compute capacity, improve availability, and distribute workloads more effectively.

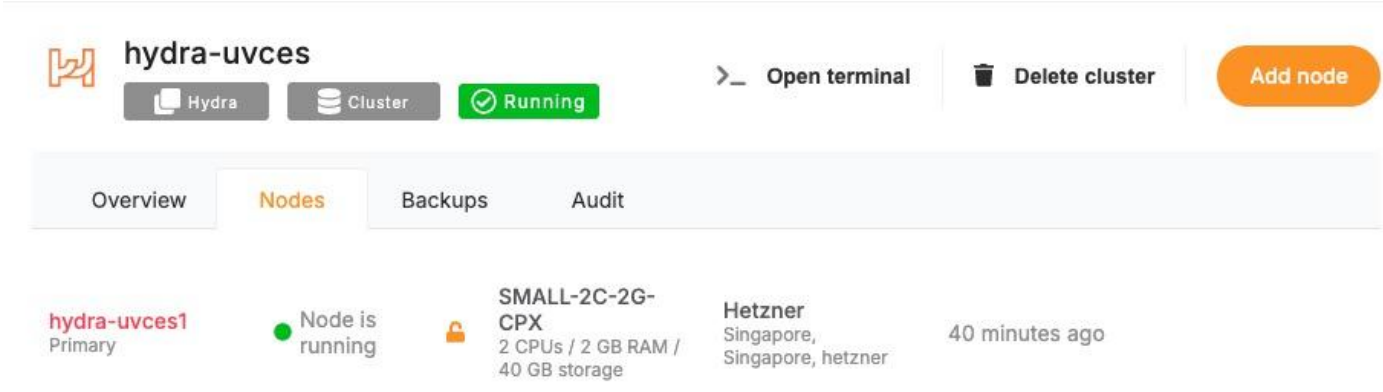
Need to Add a Node

There are several scenarios where adding a node becomes necessary. One of the most common cases is **resource saturation** when existing nodes are fully utilized in terms of CPU, memory, or disk. Adding another node helps distribute the workload and maintain performance under load.

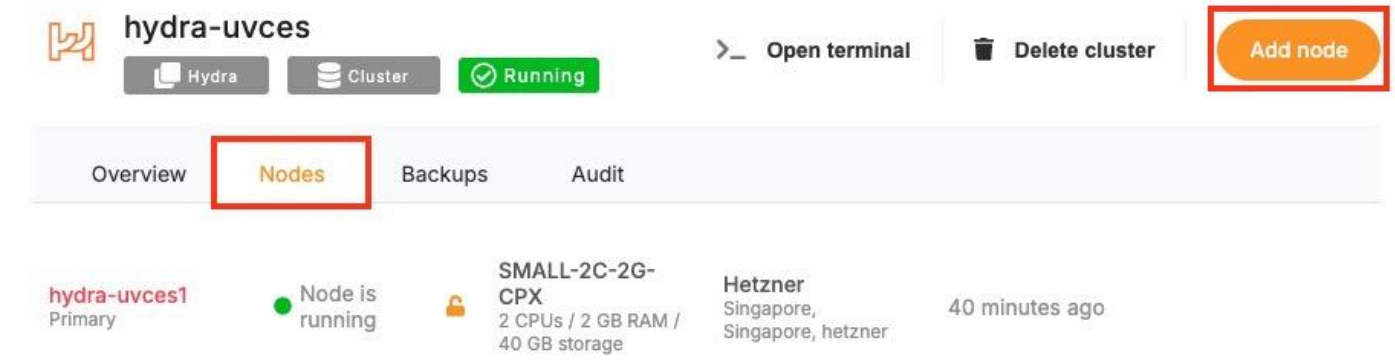
In clusters that run **stateful services** or require **high availability**, having additional nodes ensures that workloads can fail over without downtime. Even in development environments, nodes can be added to isolate environments or test services under production-like load conditions. Scaling out also gives you flexibility when deploying services with different resource profiles or placement requirements.

Add a Node to Cluster

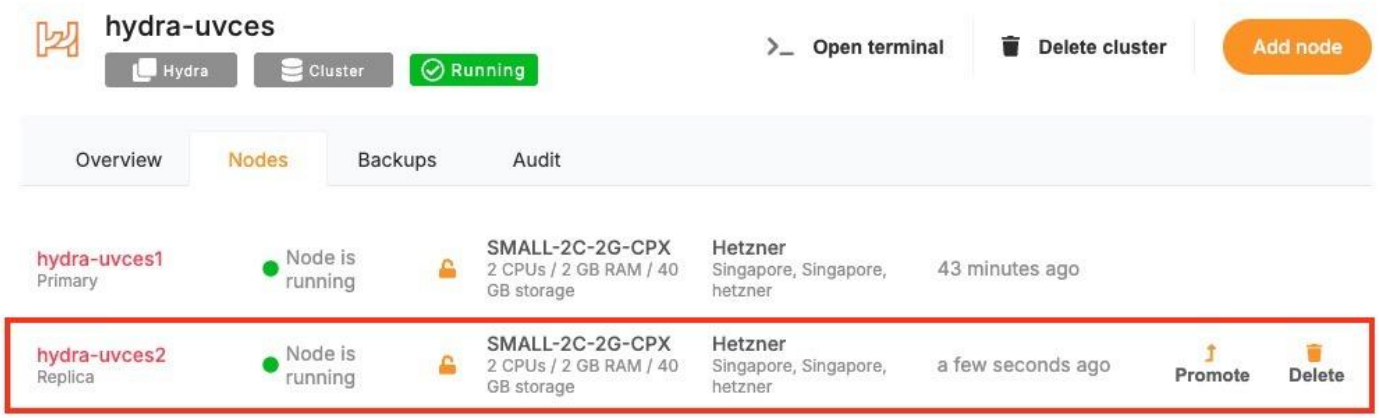
To begin, log in to the Elestio dashboard and navigate to the **Clusters** section from the sidebar. Select the cluster you want to scale. Once inside the cluster view, switch to the **Nodes** tab. This section provides an overview of all current nodes along with their health status and real-time resource usage.



To add a new node, click the **“Add Node”** button. This opens a configuration panel where you can define the specifications for the new node. You’ll be asked to specify the amount of **CPU**, **memory**, and **disk** you want to allocate. If you’re using a bring-your-own-cloud setup, you may also need to confirm or choose the cloud provider and deployment region.



After configuring the node, review the settings to ensure they meet your performance and cost requirements. Click **“Create”** to initiate provisioning. Elestio will begin setting up the new node, and once it’s ready, it will automatically join your cluster.



Once provisioned, the new node will appear in the node list with its own metrics and status indicators. You can monitor its activity, verify that workloads are being scheduled to it, and access its logs directly from the dashboard. From this point onward, the node behaves like any other in the cluster and can be managed using the same lifecycle actions such as rebooting or draining.

Post-Provisioning Considerations

After the node has been added, it becomes part of the active cluster and is available for scheduling workloads. Elestio’s orchestration layer will begin using it automatically, but you can further customize service placement through resource constraints or affinity rules if needed.

For performance monitoring, the dashboard provides per-node metrics, including CPU load, memory usage, and disk I/O. This visibility helps you confirm that the new node is functioning correctly and contributing to workload distribution as expected.

Maintenance actions such as draining or rebooting the node are also available from the same interface, making it easy to manage the node lifecycle after provisioning.

Promoting a Node

Clusters can be designed for high availability or role-based workloads, where certain nodes may take on leadership or coordination responsibilities. In these scenarios, promoting a node is a key administrative task. It allows you to change the role of a node. While not always needed in basic setups, node promotion becomes essential in distributed systems, replicated databases, or services requiring failover control.

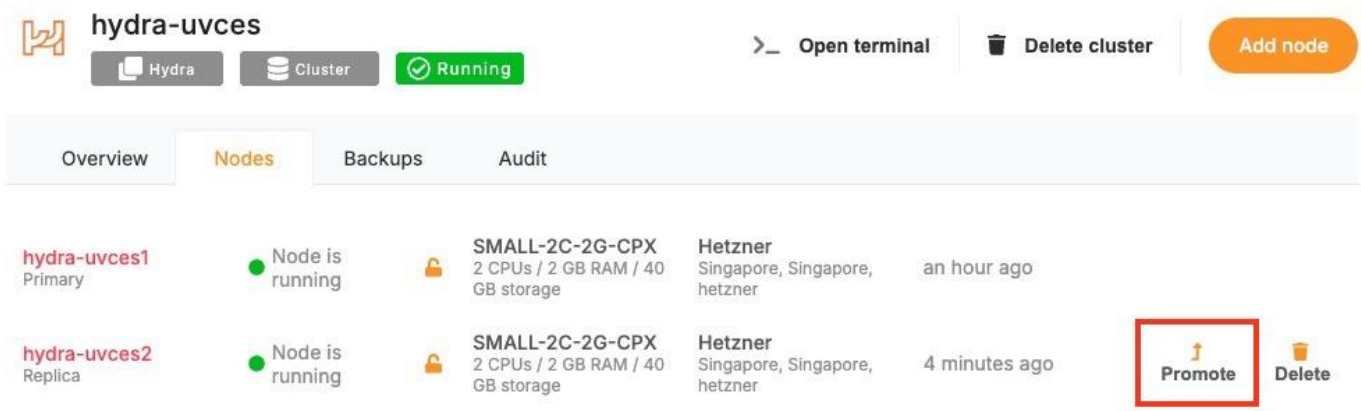
When to Promote a Node?

Promoting a node is typically performed in clusters where role-based architecture is used. In high-availability setups, some nodes may act as leaders while others serve as followers or replicas. If a leader node becomes unavailable or needs to be replaced, you can promote another node to take over its responsibilities and maintain continuity of service.

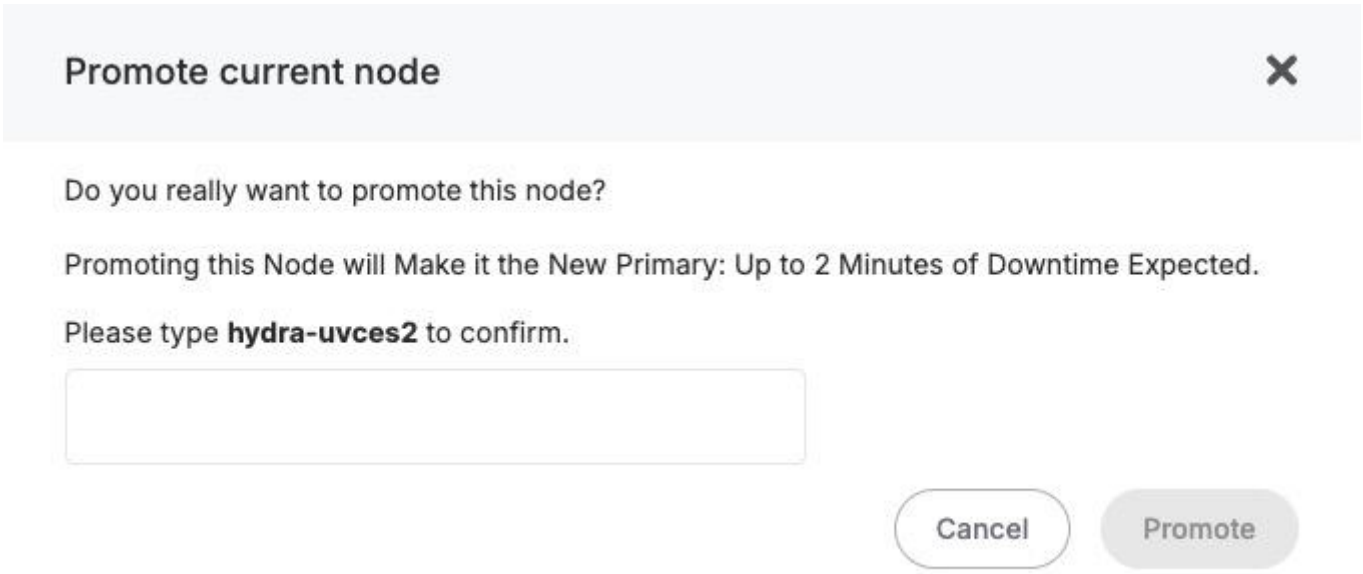
Node promotion is also useful when scaling out and rebalancing responsibilities across a larger cluster. For example, promoting a node to handle scheduling, state tracking, or replication leadership can reduce bottlenecks and improve responsiveness. In cases involving database clusters or consensus-driven systems, promotion ensures a clear and controlled transition of leadership without relying solely on automatic failover mechanisms.

Promote a Node in Elestio

To promote a node, start by accessing the **Clusters** section in the Elestio dashboard. Choose the cluster containing the node you want to promote. Inside the cluster view, navigate to the **Nodes** tab to see the full list of nodes, including their current roles, health status, and resource usage. Locate the node that you want to promote and open its action menu. From here, select the **“Promote Node”** option.



You may be prompted to confirm the action, depending on the configuration and current role of the node. This confirmation helps prevent unintended role changes that could affect cluster behavior.



Once confirmed, Elestio will initiate the promotion process. This involves reconfiguring the cluster's internal coordination state to acknowledge the new role of the promoted node. Depending on the service architecture and the software running on the cluster, this may involve reassigning leadership, updating replication targets, or shifting service orchestration responsibilities.

After promotion is complete, the node's updated role will be reflected in the dashboard. At this point, it will begin operating with the responsibilities assigned to its new status. You can monitor its activity, inspect logs, and validate that workloads are being handled as expected.

Considerations for Promotion

Before promoting a node, ensure that it meets the necessary resource requirements and is in a stable, healthy state. Promoting a node that is under high load or experiencing performance issues can lead to service degradation. It's also important to consider replication and data

synchronization, especially in clusters where stateful components like databases are in use.

Promotion is a safe and reversible operation, but it should be done with awareness of your workload architecture. If your system relies on specific leader election mechanisms, promoting a node should follow the design patterns supported by those systems.

Removing a Node

Over time, infrastructure needs change. You may scale down a cluster after peak load, decommission outdated resources, or remove a node that is no longer needed for cost, isolation, or maintenance reasons. Removing a node from a cluster is a safe and structured process designed to avoid disruption. The dashboard provides an accessible interface for performing this task while preserving workload stability.

Why Remove a Node?

Node removal is typically part of resource optimization or cluster reconfiguration. You might remove a node when reducing costs in a staging environment, when redistributing workloads across fewer or more efficient machines, or when phasing out a node for maintenance or retirement.

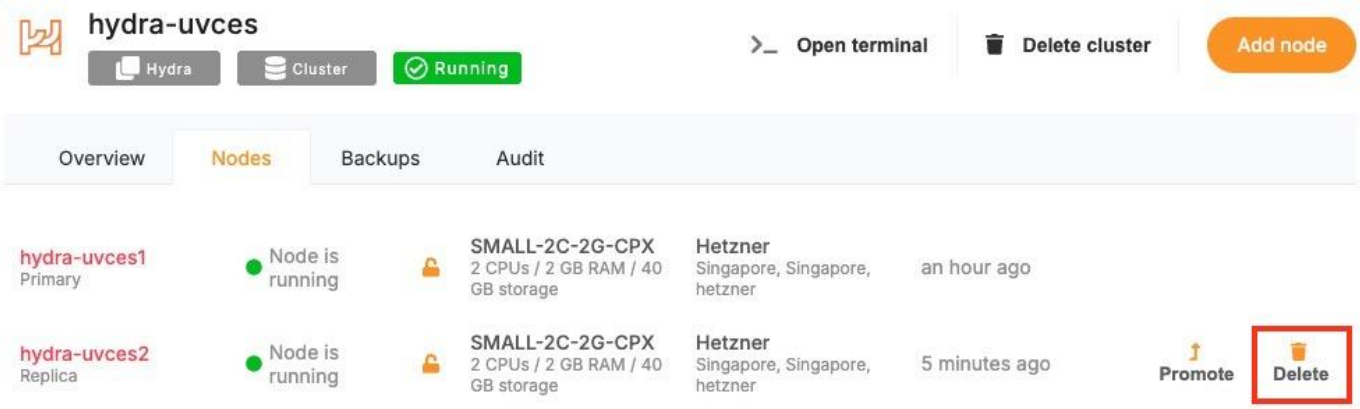
Another common scenario is infrastructure rebalancing, where workloads are shifted to newer nodes with better specs or different regions. Removing an idle or underutilized node can simplify management and reduce noise in your monitoring stack. It also improves scheduling efficiency by removing unneeded targets from the orchestration engine.

In high-availability clusters, node removal may be preceded by data migration or role reassignment (such as promoting a replica). Proper planning helps maintain system health while reducing reliance on unnecessary compute resources.

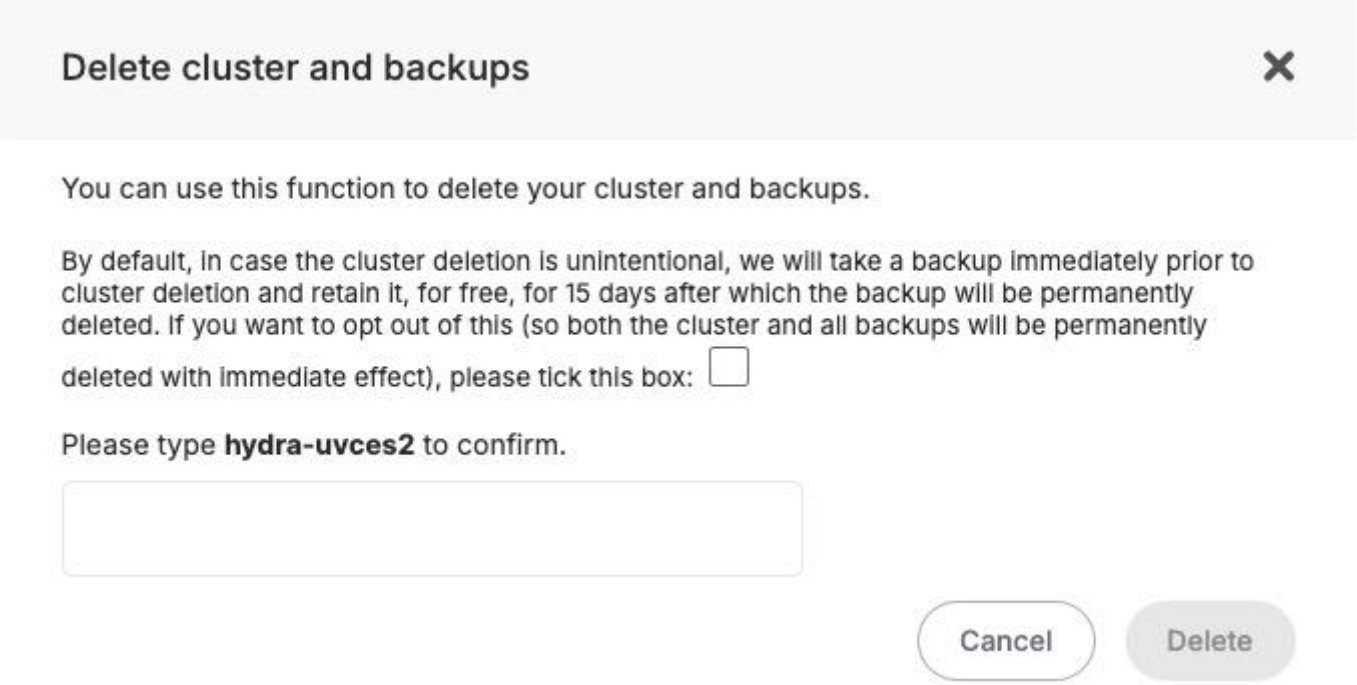
Remove a Node

To begin the removal process, open the Elestio dashboard and navigate to the **Clusters** section. Select the cluster that contains the node you want to remove. From within the cluster view, open the **Nodes** tab to access the list of active nodes and their statuses.

Find the node you want to delete from the list. If the node is currently running services, ensure that those workloads can be safely rescheduled to other nodes or are no longer needed. Since Elestio does not have a built-in drain option, any workload redistribution needs to be handled manually, either by adjusting deployments or verifying that redundant nodes are available. Once the node is drained and idle, open the action menu for that node and select **“Delete Node”**.



The dashboard may prompt you to confirm the operation. After confirmation, Elestio will begin the decommissioning process. This includes detaching the node from the cluster, cleaning up any residual state, and terminating the associated virtual machine.



Once the operation completes, the node will no longer appear in the cluster's node list, and its resources will be released.

Considerations for Safe Node Removal

Before removing a node in Elestio, it's important to review the services and workloads currently running on that node. Since Elestio does not automatically redistribute or migrate workloads during

node removal, you should ensure that critical services are either no longer in use or can be manually rescheduled to other nodes in the cluster. This is particularly important in multi-node environments running stateful applications, databases, or services with specific affinity rules.

You should also verify that your cluster will have sufficient capacity after the node is removed. If the deleted node was handling a significant portion of traffic or compute load, removing it without replacement may lead to performance degradation or service interruption. In high-availability clusters, ensure that quorum-based components or replicas are not depending on the node targeted for deletion. Additionally, confirm that the node is not playing a special role such as holding primary data or acting as a manually promoted leader before removal. If necessary, reconfigure or promote another node prior to deletion to maintain cluster integrity.

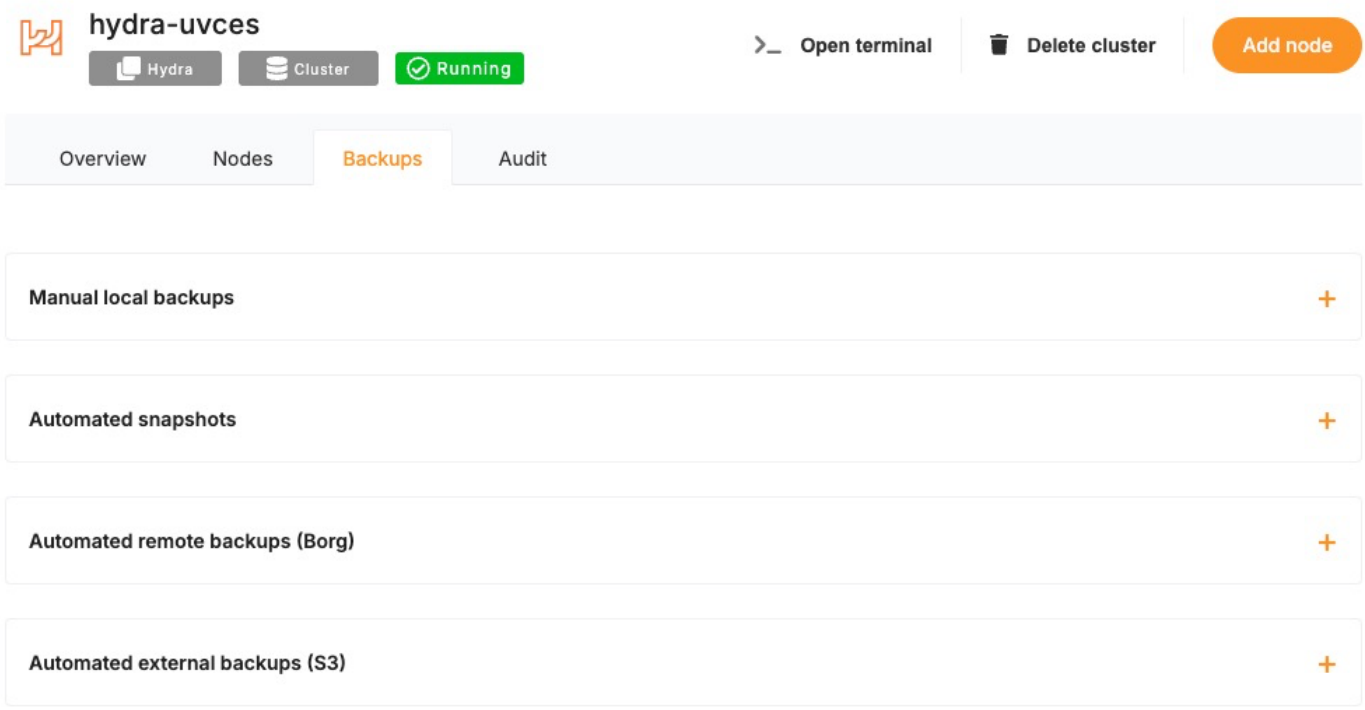
Backups and Restores

Reliable backups are essential for data resilience, recovery, and business continuity. Elestio provides built-in support for managing backups across all supported services, ensuring that your data is protected against accidental loss, corruption, or infrastructure failure. The platform includes an automated backup system with configurable retention policies and a straightforward restore process, all accessible from the dashboard. Whether you're operating a production database or a test environment, understanding how backups and restores work in Elestio is critical for maintaining service reliability.

Cluster Backups

Elestio provides multiple backup mechanisms designed to support various recovery and compliance needs. Backups are created automatically for most supported services, with consistent intervals and secure storage in managed infrastructure. These backups are performed in the background to ensure minimal performance impact and no downtime during the snapshot process. Each backup is timestamped, versioned, and stored securely with encryption. You can access your full backup history for any given service through the dashboard and select any version for restoration.

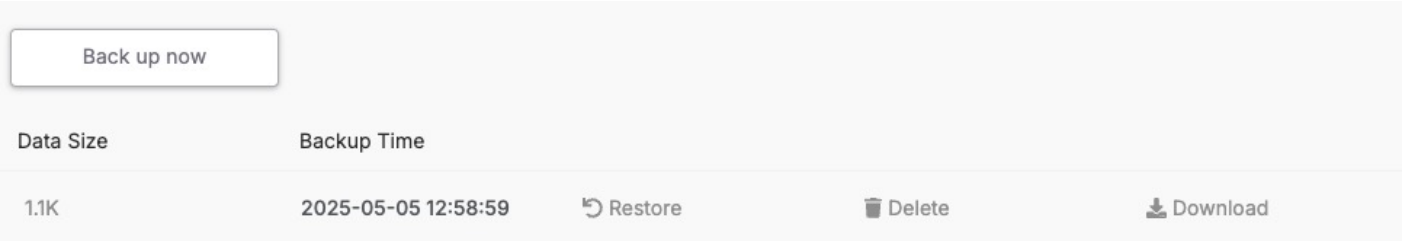
You can utilize different backup options depending on your preferences and operational requirements. Elestio supports **manual local backups** for on-demand recovery points, **automated snapshots** that capture the state of the service at fixed intervals, and **automated remote backups using Borg**, which securely stores backups on external storage volumes managed by Elestio. In addition, you can configure **automated external backups to S3-compatible storage**, allowing you to maintain full control over long-term retention and geographic storage preferences.



Restoring from a Backup

Restoring a backup in Elestio is a user-initiated operation, available directly from the service dashboard. Once you're in the dashboard, select the service you'd like to restore. Navigate to the **Backups** section, where you'll find a list of all available backups along with their creation timestamps.

To initiate a restore, choose the desired backup version and click on the **"Restore"** option. You will be prompted to confirm the operation. Depending on the type of service, the restore can either overwrite the current state or recreate the service as a new instance from the selected backup.



The restore process takes a few minutes, depending on the size of the backup and the service type. Once completed, the restored service is immediately accessible. In the case of databases, you can validate the restore by connecting to the database and inspecting the restored data.

Considerations for Backup & Restore

- Before restoring a backup, it’s important to understand the impact on your current data. Restores may **overwrite existing service state**, so if you need to preserve the current environment, consider creating a manual backup before initiating the restore. In critical environments, restoring to a new instance and validating the data before replacing the original is a safer approach.
- Keep in mind that restore operations are not instantaneous and may temporarily affect service availability. It’s best to plan restores during maintenance windows or periods of low traffic, especially in production environments.
- For services with high-frequency data changes, be aware of the backup schedule and retention policy. Elestio’s default intervals may not capture every change, so for high-volume databases, consider exporting incremental backups manually or using continuous replication where supported.

Monitoring Backup Health

Elestio provides visibility into your backup history directly through the dashboard. You can monitor the **status**, **timestamps**, and **success/failure** of backup jobs. In case of errors or failed backups, the dashboard will display alerts, allowing you to take corrective actions or contact support if necessary.

It’s good practice to periodically verify that backups are being generated and that restore points are recent and complete. This ensures you’re prepared for unexpected failures and that recovery options remain reliable.

Restricting Access by IP

Securing access to services is a fundamental part of managing cloud infrastructure. One of the most effective ways to reduce unauthorized access is by restricting connectivity to a defined set of IP addresses. Elestio supports IP-based access control through its dashboard, allowing you to explicitly define which IPs or IP ranges are allowed to interact with your services. This is particularly useful when exposing databases, APIs, or web services over public endpoints.

Need to Restrict Access by IP

Restricting access by IP provides a first layer of network-level protection. Instead of relying solely on application-layer authentication, you can control who is allowed to even initiate a connection to your service. This approach reduces the surface area for attacks such as brute-force login attempts, automated scanning, or unauthorized probing.

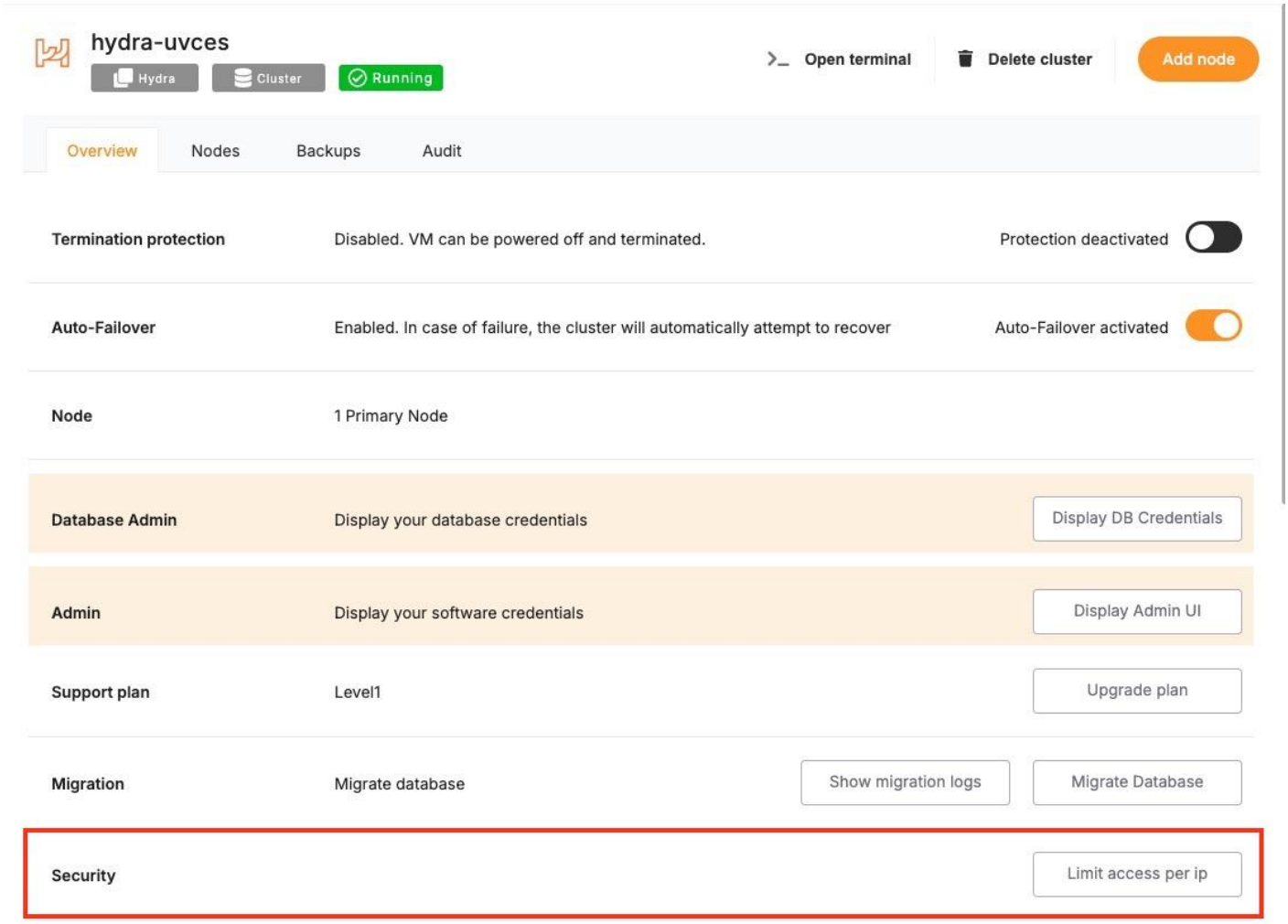
Common use cases include:

- Limiting access to production databases from known office networks or VPNs.
- Allowing only CI/CD pipelines or monitoring tools with static IPs to connect.
- Restricting admin dashboards or internal tools to internal teams.

By defining access rules at the infrastructure level, you gain more control over who can reach your services, regardless of their authentication or API access status.

Restrict Access by IP

To restrict access by IP in Elestio, start by logging into the Elestio dashboard and navigating to the **Clusters** section. Select the cluster that hosts the service you want to protect. Once inside the **Cluster Overview** page, locate the **Security** section.



Within this section, you'll find a setting labeled **"Limit access per IP"**. This is where you can define which IP addresses or CIDR ranges are permitted to access the services running in the cluster. You can add a specific IPv4 or IPv6 address (e.g., 203.0.113.5) or a subnet in CIDR notation (e.g., 203.0.113.0/24) to allow access from a range of IPs.

After entering the necessary IP addresses, save the configuration. The changes will apply to all services running inside the cluster, and only the defined IPs will be allowed to establish network

connections. All other incoming requests from unlisted IPs will be blocked at the infrastructure level.

Considerations When Using IP Restrictions

- When applying IP restrictions, it’s important to avoid locking yourself out. Always double-check that your own IP address is included in the allowlist before applying rules, especially when working on remote infrastructure.
- For users on dynamic IPs (e.g., home broadband connections), consider using a VPN or a static jump host that you can reliably allowlist. Similarly, if your services are accessed through cloud-based tools, make sure to verify their IP ranges and update your rules accordingly when those IPs change.
- In multi-team environments, document and review IP access policies regularly to avoid stale rules or overly permissive configurations. Combine IP restrictions with secure authentication and encrypted connections (such as HTTPS or SSL for databases) for layered security.

Cluster Resynchronization

In distributed systems, consistency and synchronization between nodes are critical to ensure that services behave reliably and that data remains accurate across the cluster. Elestio provides built-in mechanisms to detect and resolve inconsistencies across nodes using a feature called **Cluster Resynchronization**. This functionality ensures that node-level configurations, data replication, and service states are properly aligned, especially after issues like node recovery, temporary network splits, or service restarts.

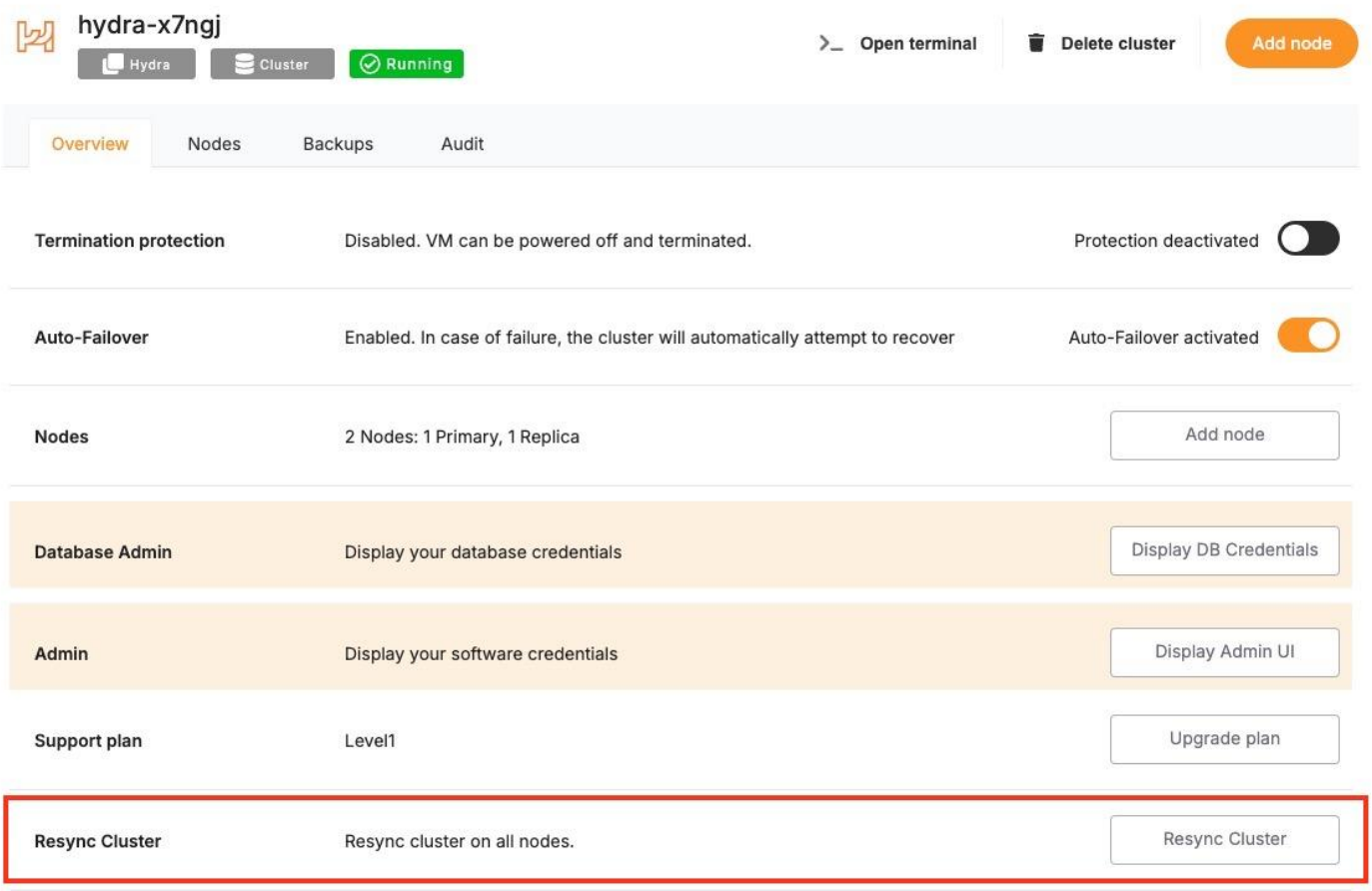
Need for Cluster Resynchronization

Resynchronization is typically required when secondary nodes in a cluster are no longer consistent with the primary node. This can happen due to temporary network failures, node restarts, replication lag, or partial service interruptions. In such cases, secondary nodes may fall behind or store incomplete datasets, which could lead to incorrect behavior if a failover occurs or if read operations are directed to those nodes. Unresolved inconsistencies can result in data divergence, serving outdated content, or failing health checks in load-balanced environments. Performing a resynchronization ensures that all secondary nodes are forcibly aligned with the current state of the primary node, restoring a clean and unified cluster state.

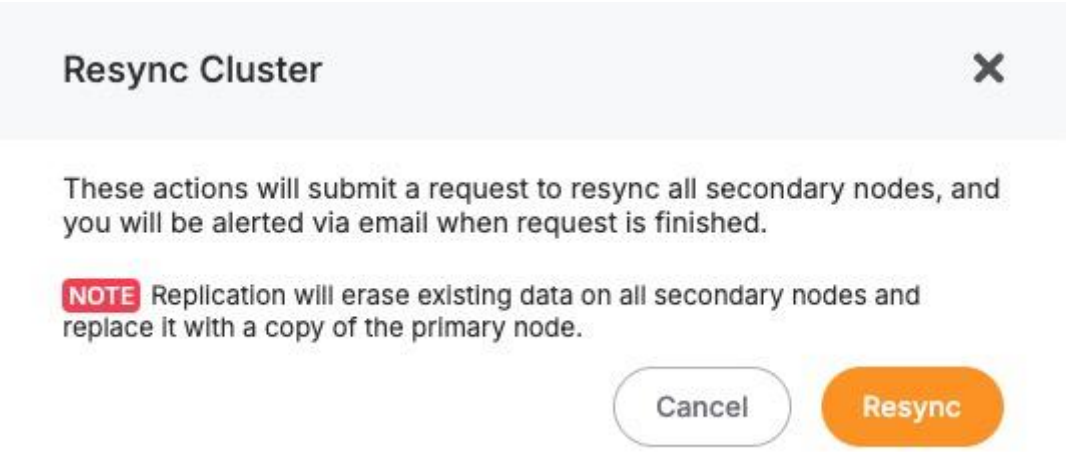
It may also be necessary to perform a resync after restoring a service from backup, during infrastructure migrations, or after recovering a previously offline node. In each of these cases, resynchronization acts as a corrective mechanism to ensure that every node is operating with the same configuration and dataset, reducing the risk of drift and maintaining data integrity across the cluster.

Cluster Resynchronization

To perform a resynchronization, start by accessing the Elestio dashboard and navigating to the **Clusters** section. Select the cluster where synchronization is needed. On the **Cluster Overview** page, scroll down slightly until you find the **“Resync Cluster”** option. This option is visible as part of the cluster controls and is available only in clusters with multiple nodes and a defined primary node.



Clicking the **Resync** button opens a confirmation dialog. The message clearly explains that this action will initiate a request to resynchronize **all secondary nodes**. During the resync process, **existing data on all secondary nodes will be erased and replaced with a copy of the data from the primary node**. This operation ensures full consistency across the cluster but should be executed with caution, especially if recent changes exist on any of the secondaries that haven't yet been replicated.



You will receive an email notification once the resynchronization is complete. During this process, Elestio manages the replication safely, but depending on the size of the data, the operation may take a few minutes. It's advised to avoid making further changes to the cluster while the resync is

in progress.

Considerations Before Resynchronizing

- Before triggering a resync, it’s important to verify that the primary node holds the desired state and that the secondary nodes do not contain any critical unsynced data. Since the resync **overwrites** the secondary nodes completely, any local changes on those nodes will be lost.
- This action is best used when you’re confident that the primary node is healthy, current, and stable. Avoid initiating a resync if the primary has recently experienced errors or data issues. Additionally, consider performing this operation during a low-traffic period, as synchronization may temporarily impact performance depending on the data volume.
- If your application requires high consistency guarantees, it’s recommended to monitor your cluster closely during and after the resync to confirm that services are functioning correctly and that the replication process completed successfully.

Database Migrations

When managing production-grade services, the ability to perform reliable and repeatable database migrations is critical. Whether you're applying schema changes, updating seed data, or managing version-controlled transitions, Elestio provides a built-in mechanism to execute migrations safely from the dashboard. This functionality is especially relevant when running containerized database services like PostgreSQL, MySQL, or similar within a managed cluster.

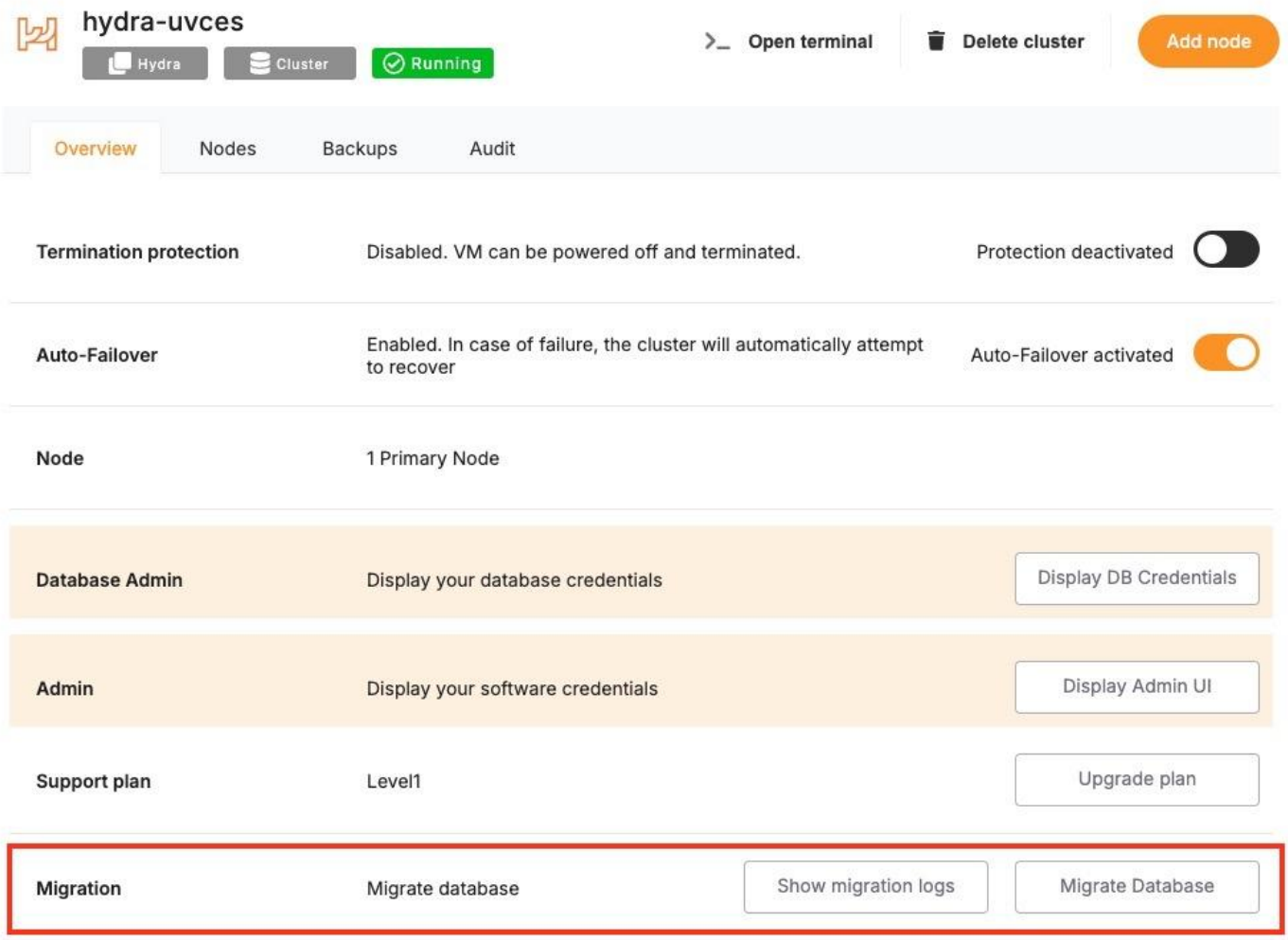
Need for Migrations

Database migrations are commonly required when updating your application's data model or deploying new features. Schema updates such as adding columns, modifying data types, creating indexes, or introducing new tables need to be synchronized with the deployment lifecycle of your application code.

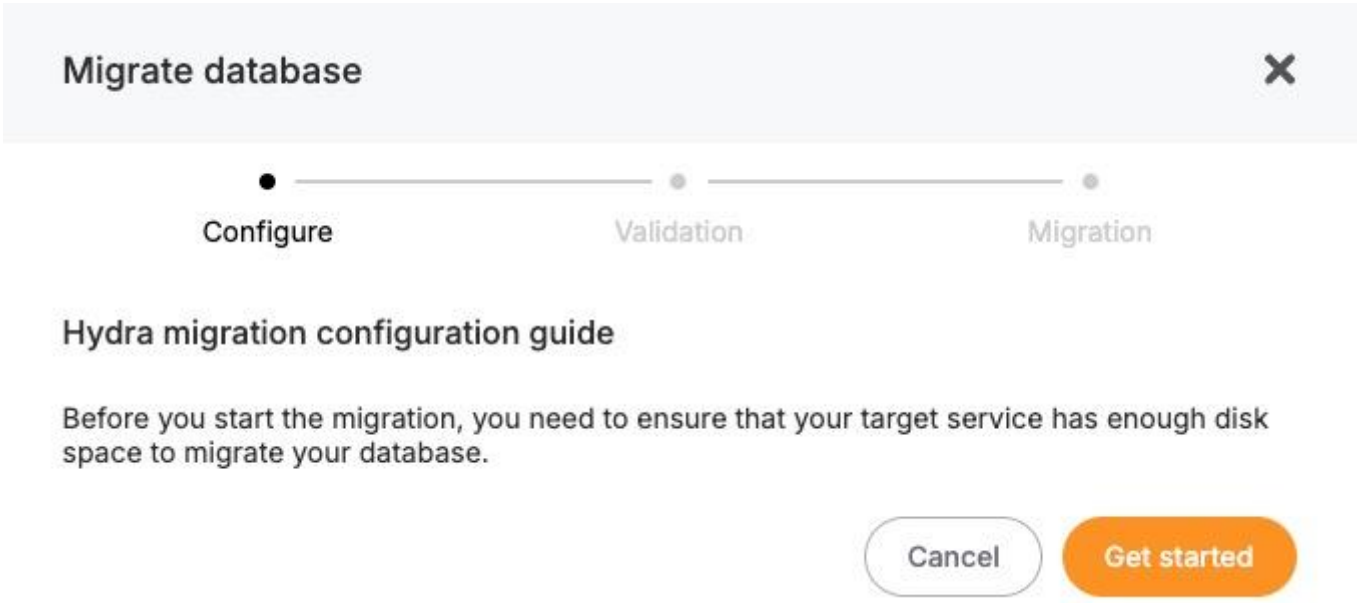
Migrations may also be needed during version upgrades to introduce structural or configuration changes required by newer database engine versions. In some cases, teams use migrations to apply baseline datasets, adjust permissions, or clean up legacy objects. Running these changes through a controlled migration system ensures consistency across environments and helps avoid untracked manual changes.

Running Database Migration

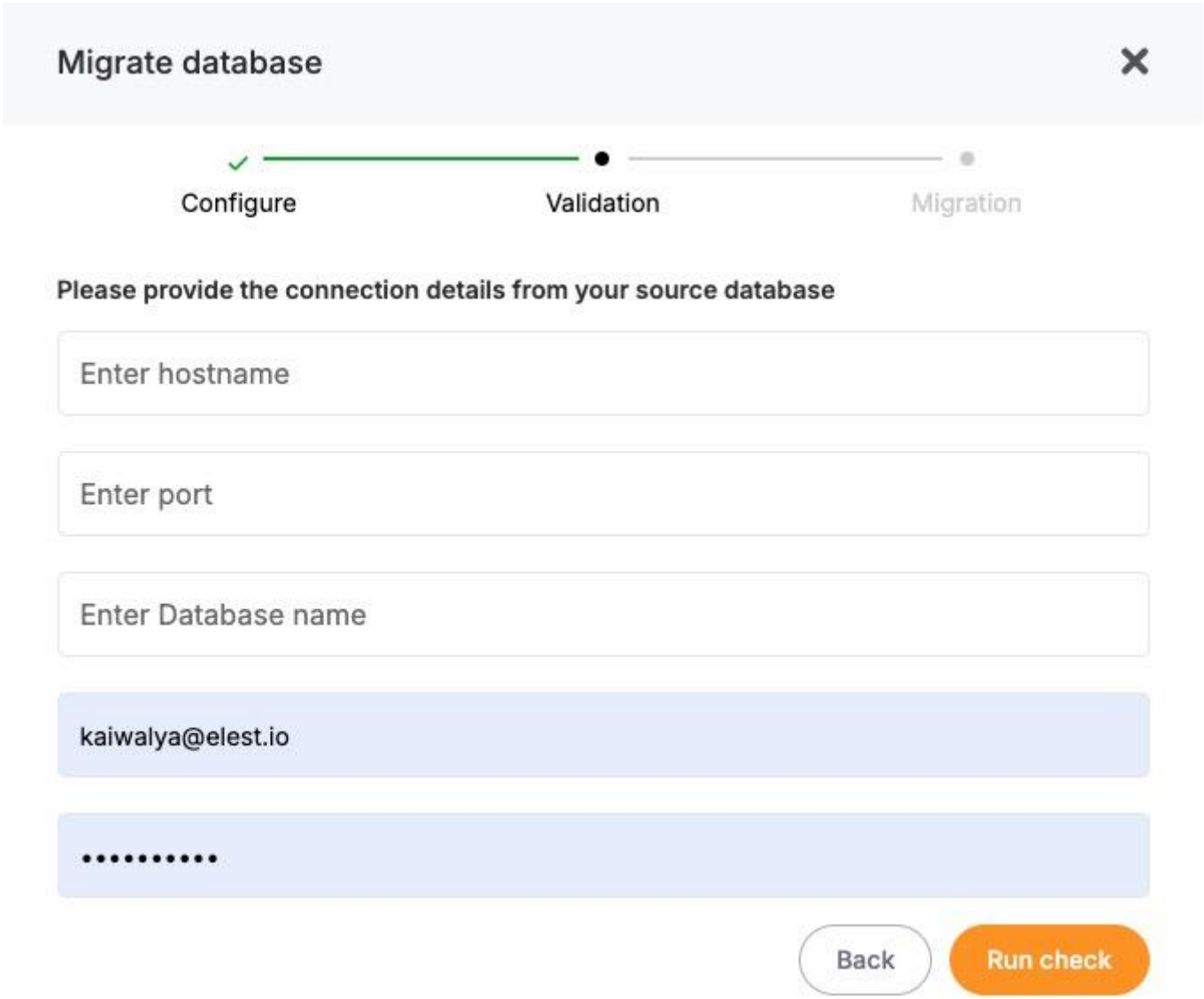
To run a database migration in Elestio, start by logging into the Elestio dashboard and navigating to the **Clusters** section. Select the cluster that contains the target database service. From the **Cluster Overview** page, scroll down until you find the **"Migration"** option.



Clicking this option will open the migration workflow, which follows a **three-step process**: **Configure**, **Validation**, and **Migration**. In the **Configure** step, Elestio provides a migration configuration guide specific to the database type, such as MySQL. At this point, you must ensure that your target service has sufficient **disk space** to complete the migration. If there is not enough storage available, the migration may fail midway, so it’s strongly recommended to review storage utilization beforehand.



Once configuration prerequisites are met, you can proceed to the **Validation** step. Elestio will check the secondary database details you have provided for the migration.



If the validation passes, the final **Migration** step will become active. You can then initiate the migration process. Elestio will handle the actual data transfer, schema replication, and state synchronization internally. The progress is tracked, and once completed, the migrated database will be fully operational on the target service.

Considerations Before Running Migrations

- Before running any migration, it’s important to validate the script or changes in a staging environment. Since migrations may involve irreversible changes—such as dropping columns, altering constraints, or modifying data—careful review and version control are essential.
- In production environments, plan migrations during maintenance windows or low-traffic periods to minimize the impact of any schema locks or temporary unavailability. If you’re using replication or high-availability setups, confirm that the migration is compatible with your architecture and will not disrupt synchronization between primary and secondary nodes.
- You should also ensure that proper backups are in place before applying structural changes. In Elestio, the backup feature can be used to create a restore point that allows rollback in case the migration introduces issues.

Deleting a Cluster

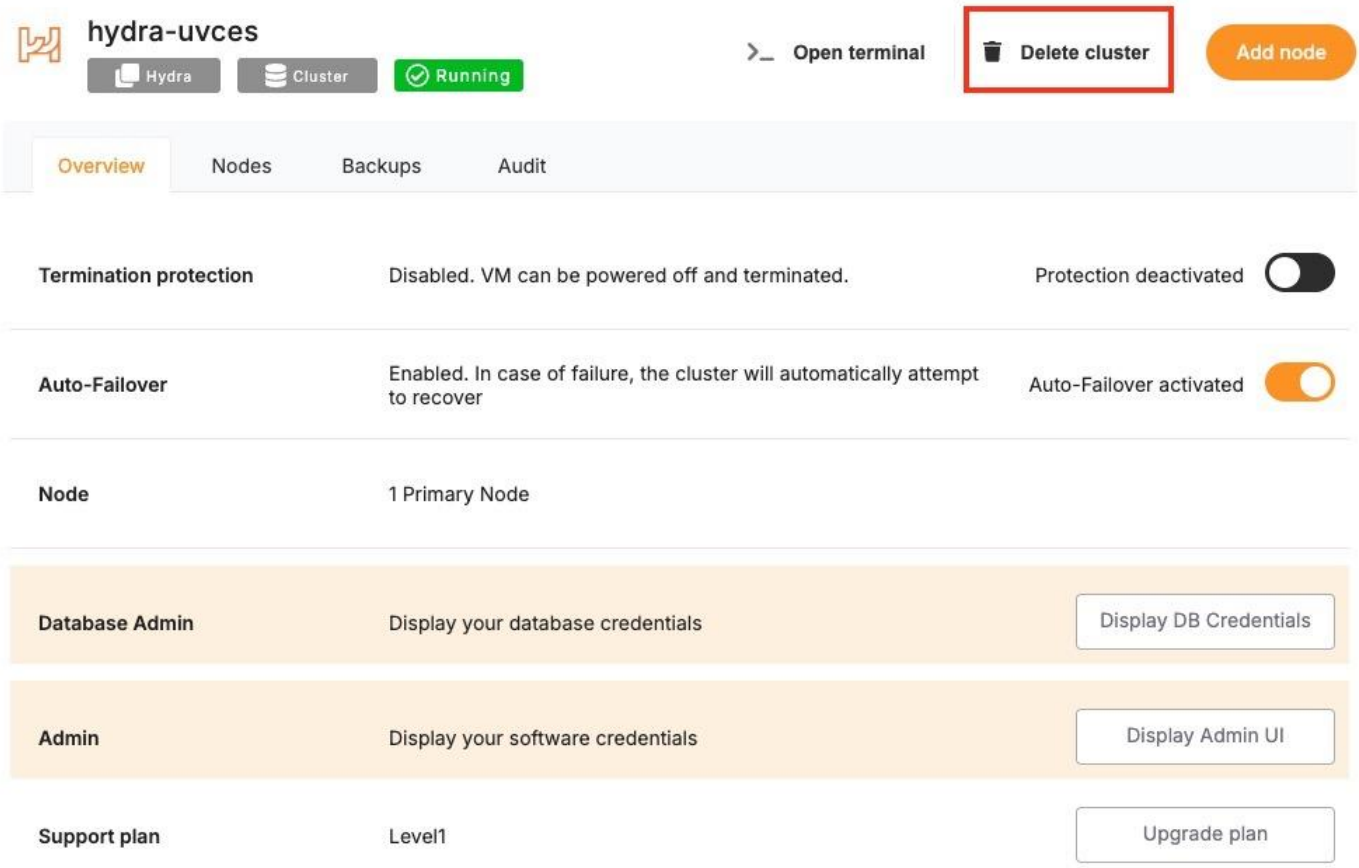
When a cluster is no longer needed—whether it was created for testing, staging, or an obsolete workload—deleting it helps free up resources and maintain a clean infrastructure footprint. Elestio provides a straightforward and secure way to delete entire clusters directly from the dashboard. This action permanently removes the associated services, data, and compute resources tied to the cluster.

When to Delete a Cluster

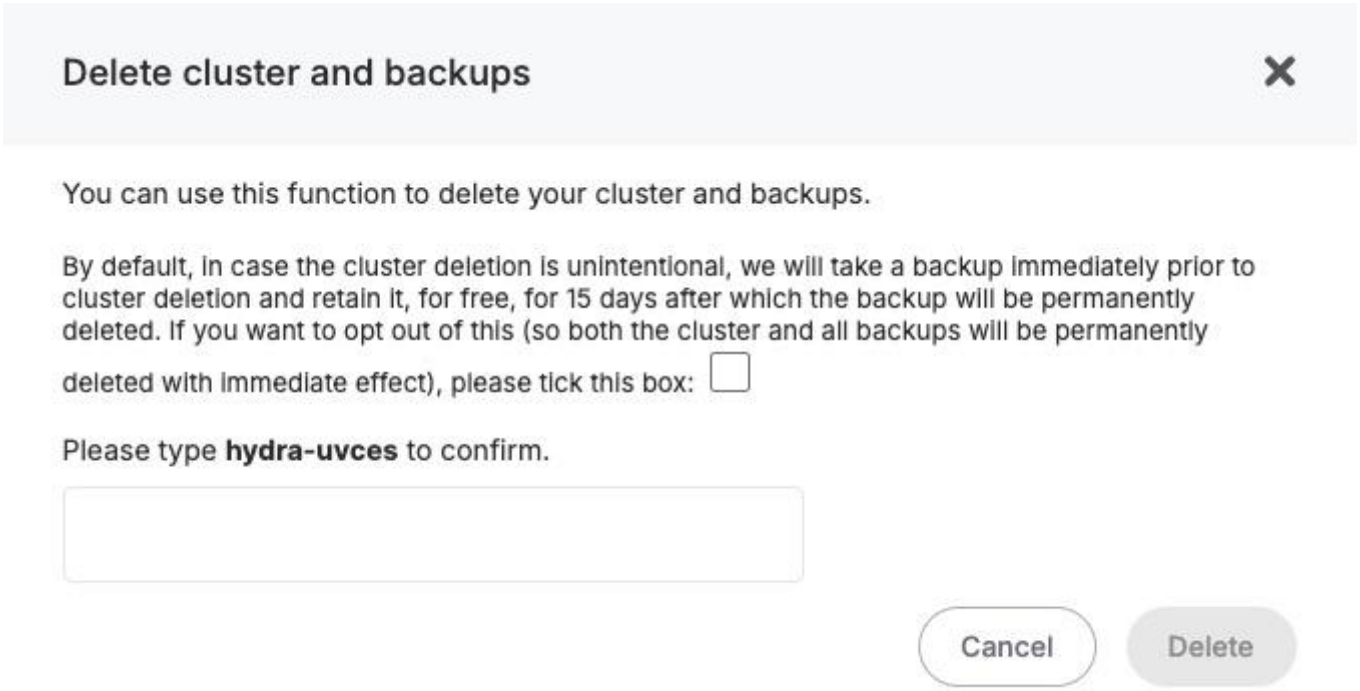
Deleting a cluster is a final step often performed when decommissioning an environment. This could include shutting down a test setup, replacing infrastructure during migration, or retiring an unused production instance. In some cases, users also delete and recreate clusters as part of major version upgrades or architectural changes. It is essential to confirm that all data and services tied to the cluster are no longer required or have been backed up or migrated before proceeding. Since cluster deletion is irreversible, any services, volumes, and backups associated with the cluster will be permanently removed.

Delete a Cluster

To delete a cluster, log in to the Elestio dashboard and navigate to the **Clusters** section. From the list of clusters, select the one you want to remove. Inside the selected cluster, you'll find a **navigation bar** at the top of the page. One of the available options in this navigation bar is **"Delete Cluster."**



Clicking this opens a confirmation dialog that outlines the impact of deletion. It will clearly state that deleting the cluster will **permanently remove** all associated services, storage, and configurations. By acknowledging a warning or typing in the cluster name, depending on the service type. Once confirmed, Elestio will initiate the deletion process, which includes tearing down all resources associated with the cluster. This typically completes within a few minutes, after which the cluster will no longer appear in your dashboard.



Considerations Before Deleting

Deleting a cluster also terminates any linked domains, volumes, monitoring configurations, and scheduled backups. These cannot be recovered once deletion is complete, so plan accordingly before confirming the action. If the cluster was used for production workloads, consider archiving data to external storage (e.g., S3) or exporting final snapshots for compliance and recovery purposes.

Before deleting a cluster, verify that:

- All required data has been backed up externally (e.g., downloaded dumps or exports).
- Any active services or dependencies tied to the cluster have been reconfigured or shut down.
- Access credentials, logs, or stored configuration settings have been retrieved if needed for auditing or migration.