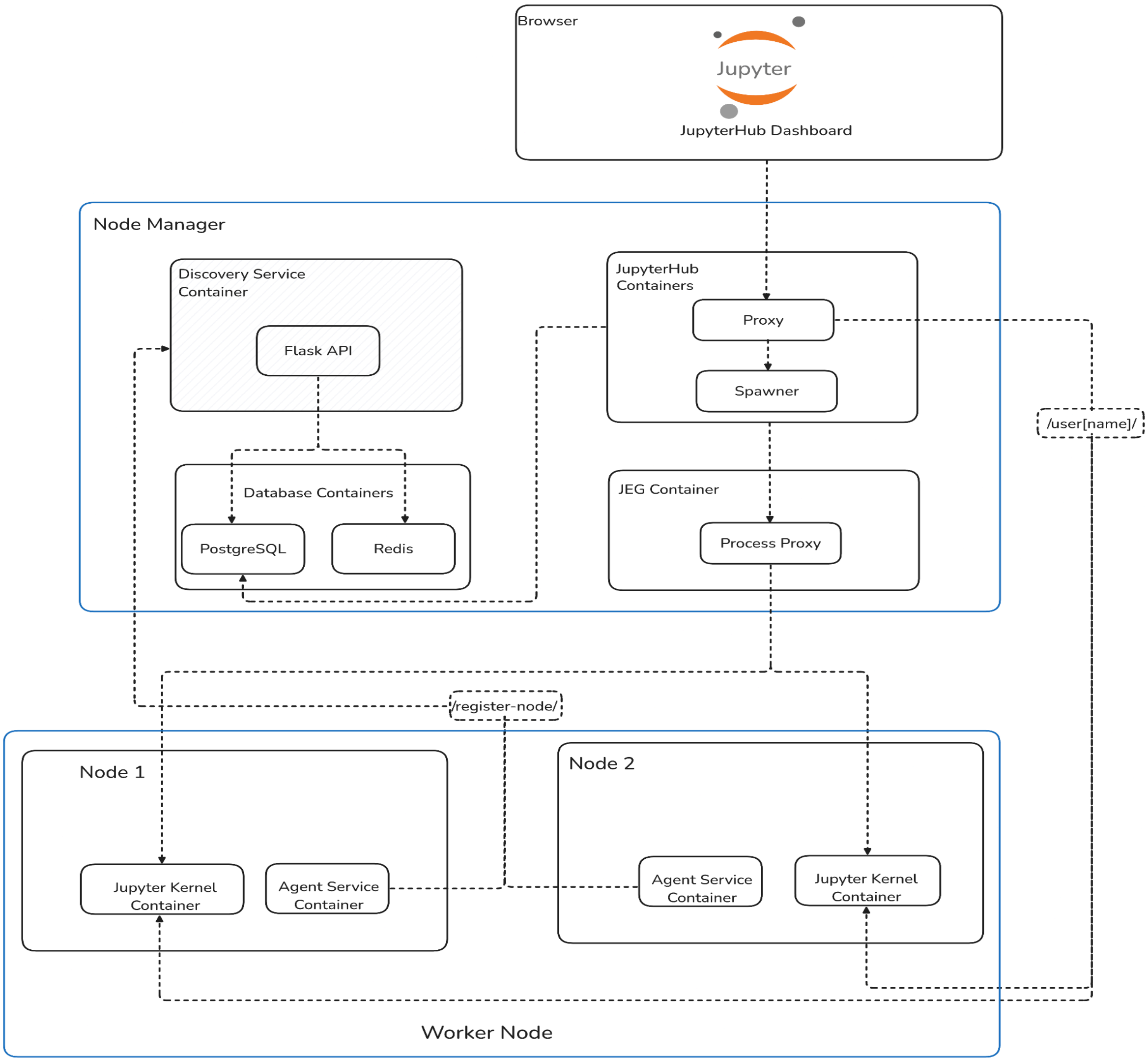
# GUIDELINES

## A. Arsitektur



## B. Prasyarat

- Python3.10, 3.11
- Instal Docker dan Docker Compose di setiap node
- NVIDIA Driver & nvidia-container-toolkit (untuk akses GPU)
- 2 atau lebih node dalam jaringan lokal (1 control node, sisanya worker)
- Clone project: https://github.com/danielcristho/jupyterhub-jeg-cluster.git di control node, di worker opsional.
- Edit `/lib/systemd/system/docker.service` di setiap node untuk mengaktifkan akses Docker via jaringan (port 2375):
  - Cari baris `ExecStart`:

    ```
    $ sudo nano /lib/systemd/system/docker.service
    ExecStart=/usr/bin/dockerd -H fd:// -H tcp://0.0.0.0:2375
    ```
  - Reload dan restart Docker service:

    ```
    sudo systemctl daemon-reload
    sudo systemctl daemon-reexec
    sudo systemctl restart docker.service
    ```

1. **Konfigurasi Service Discovery**

   a. Konfigurasi environment, ubah sesuai kebutuhan:

   ```
   $ cd service-discovery
   $ cp .env.example .env
   $ cat .env
   # Application Configuration
   API_HOST=0.0.0.0
   API_PORT=15002
   FLASK_DEBUG=True
   SECRET_KEY=secret-service111111

   # Database Configuration
   POSTGRES_HOST=postgres
   POSTGRES_PORT=5432
   POSTGRES_DB=voyager
   POSTGRES_USER=postgres
   POSTGRES_PASSWORD=postgres

   REDIS_HOST=redis
   REDIS_PASSWORD=redis@pass
   REDIS_PORT=16379
   REDIS_EXPIRE_SECONDS=45

   SQLALCHEMY_TRACK_MODIFICATIONS=False
   SQLALCHEMY_ECHO=False
   ```

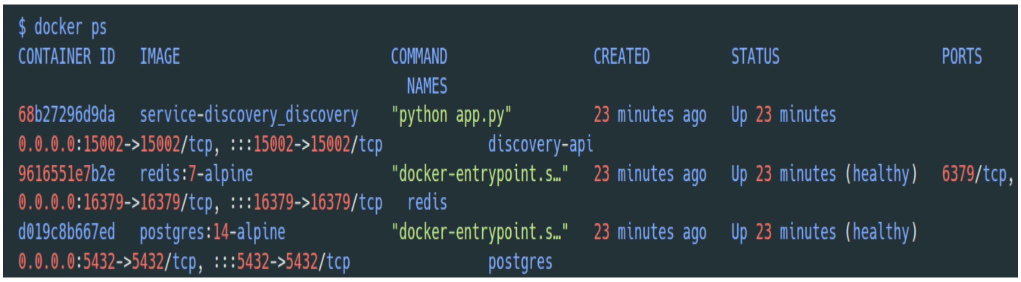
   b. Ubah file init.sql (postgresql) dan redis.conf (redis) untuk mengatur username dan password:

   ```
   -- DB Service Discovery
   CREATE DATABASE voyager;
   -- DB JupyterHub
   CREATE DATABASE apollo;
   GRANT ALL PRIVILEGES ON DATABASE voyager TO postgres;
   GRANT ALL PRIVILEGES ON DATABASE apollo TO postgres;

   CREATE EXTENSION IF NOT EXISTS "uuid-ossp";
   SET client_encoding = 'UTF8';
   ```

   c. Setelah menjalankan Docker Compose, pastikan terdapat tiga container yang running (discovery-api, redis, dan postgres):

   ```
   $ docker compose up -d –build
   ```



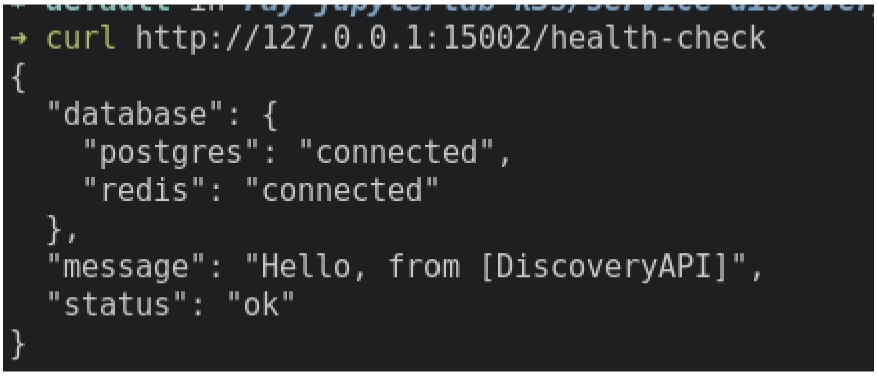
```
$ docker ps
CONTAINER ID   IMAGE                         COMMAND                  CREATED          STATUS                    PORTS
                                               NAMES
68b27296d9da   service-discovery_discovery   "python app.py"          23 minutes ago   Up 23 minutes
0.0.0.0:15002->15002/tcp, :::15002->15002/tcp            discovery-api
9616551e7b2e   redis:7-alpine                "docker-entrypoint.s…"   23 minutes ago   Up 23 minutes (healthy)   6379/tcp,
0.0.0.0:16379->16379/tcp, :::16379->16379/tcp   redis
d019c8b667ed   postgres:14-alpine            "docker-entrypoint.s…"   23 minutes ago   Up 23 minutes (healthy)
0.0.0.0:5432->5432/tcp, :::5432->5432/tcp                postgres
```

d. Migrasi database dan upgrade skema, pastikan prosesnya berhasil:

```
$ docker exec -it  discovery-api flask db init
$ docker exec -it  discovery-api flask db migrate -m
"START MIGRATION"
$ docker exec -it  discovery-api flask db upgrade
```

e. Akses API service discovery:

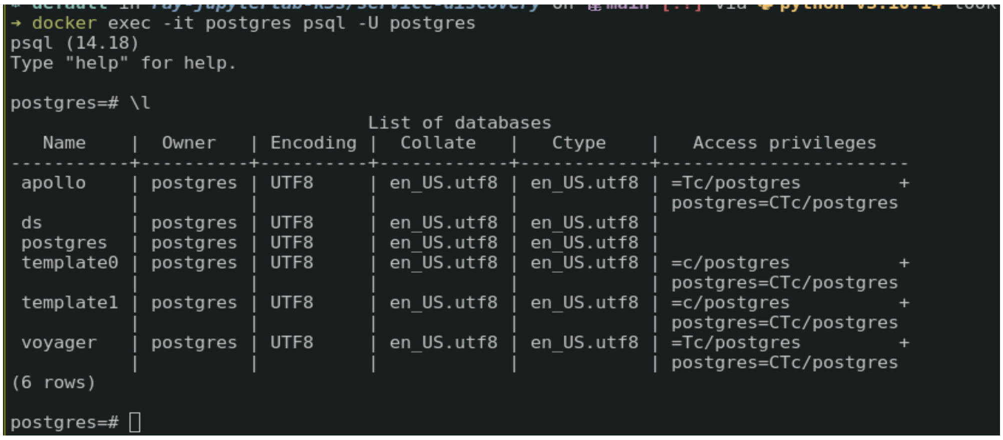
```
$ curl http://<CONTROL_NODE_IP>:15002/health-check
```



```
→ curl http://127.0.0.1:15002/health-check
{
  "database": {
    "postgres": "connected",
    "redis": "connected"
  },
  "message": "Hello, from [DiscoveryAPI]",
  "status": "ok"
}
```

f. Akses postgresql dan redis:

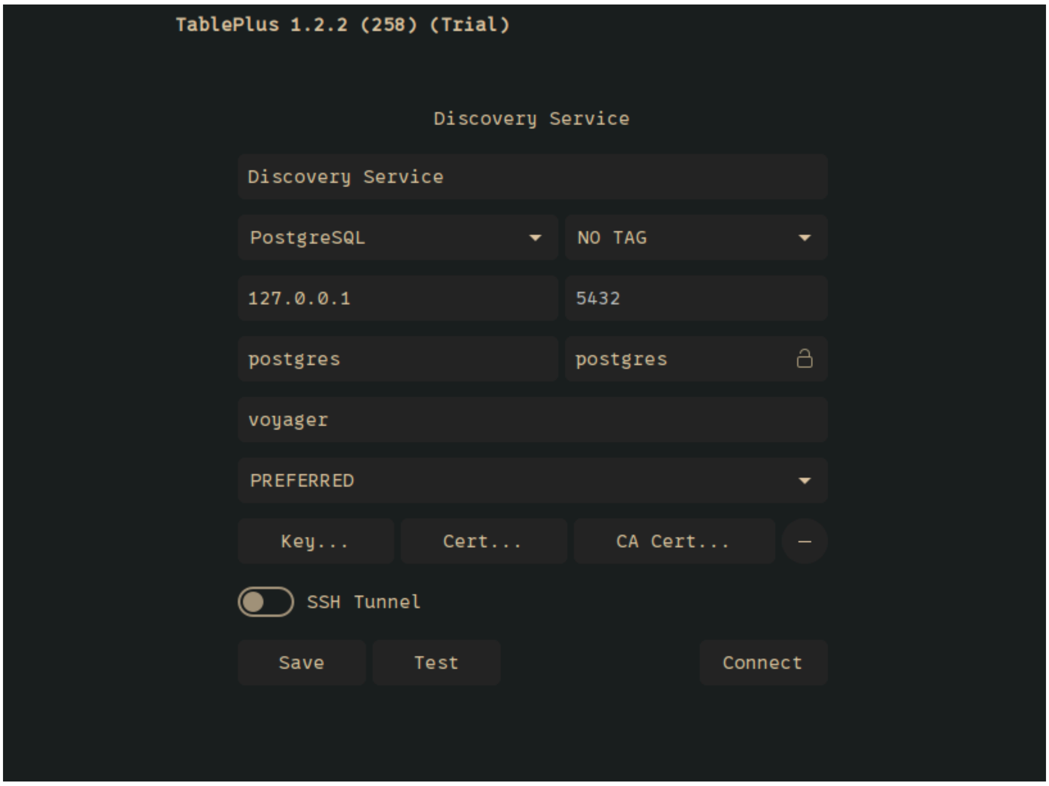
```
$ docker exec -it postgres psql -U postgres
```



```
→ docker exec -it postgres psql -U postgres
psql (14.18)
Type "help" for help.

postgres=# \l
                                List of databases
   Name    |  Owner   | Encoding |  Collate   |   Ctype    |   Access privileges
-----------+----------+----------+------------+------------+-----------------------
 apollo    | postgres | UTF8     | en_US.utf8 | en_US.utf8 | =Tc/postgres         +
           |          |          |            |            | postgres=CTc/postgres
 ds        | postgres | UTF8     | en_US.utf8 | en_US.utf8 |
 postgres  | postgres | UTF8     | en_US.utf8 | en_US.utf8 |
 template0 | postgres | UTF8     | en_US.utf8 | en_US.utf8 | =c/postgres          +
           |          |          |            |            | postgres=CTc/postgres
 template1 | postgres | UTF8     | en_US.utf8 | en_US.utf8 | =c/postgres          +
           |          |          |            |            | postgres=CTc/postgres
 voyager   | postgres | UTF8     | en_US.utf8 | en_US.utf8 | =Tc/postgres         +
           |          |          |            |            | postgres=CTc/postgres
(6 rows)

postgres=# 
```



TablePlus 1.2.2 (258) (Trial)

Discovery Service

Discovery Service

PostgreSQL

NO TAG

127.0.0.1

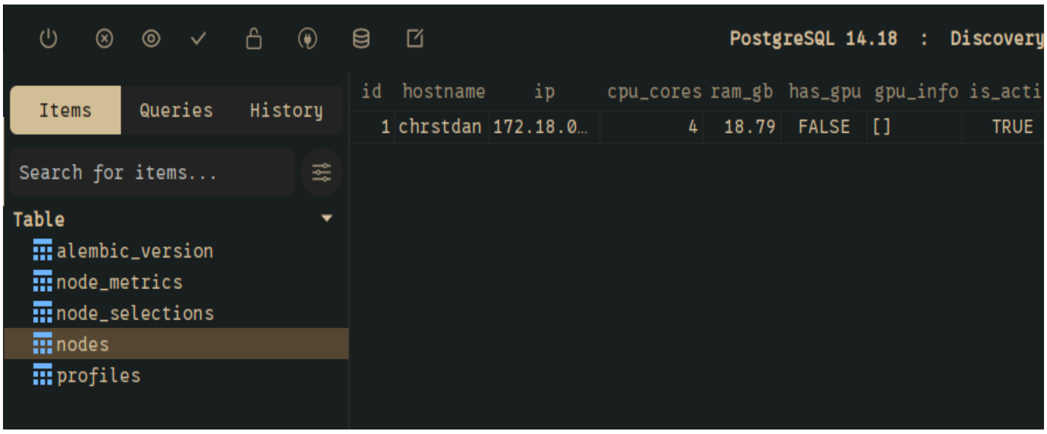
5432

postgres

postgres

voyager

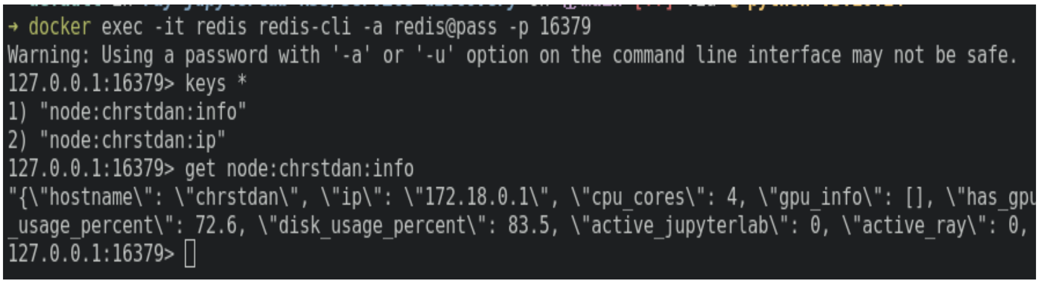
PREFERRED



PostgreSQL 14.18 : Discovery

| id | hostname | ip | cpu_cores | ram_gb | has_gpu | gpu_info | is_acti |
|---|---|---|---|---|---|---|---|
| 1 | chrstdan | 172.18.0… | 4 | 18.79 | FALSE | [] | TRUE |

```
$ docker exec -it redis redis-cli -a redis@pass -p
16379
```



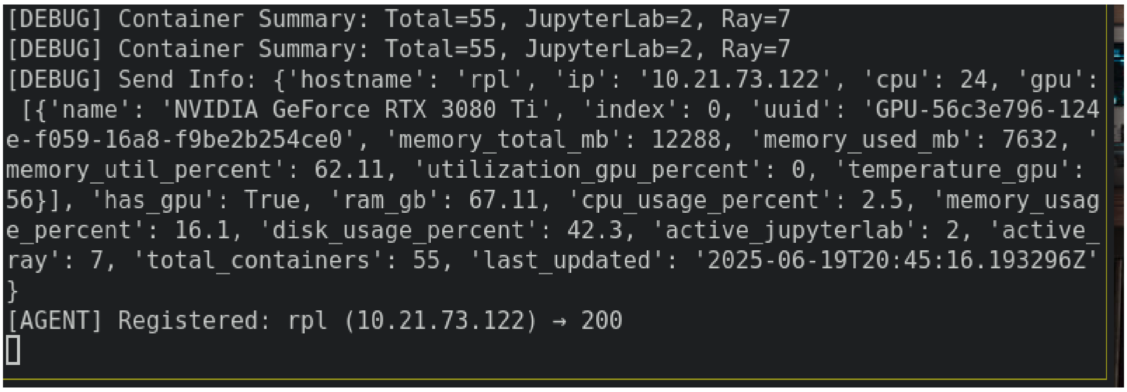
```
→ docker exec -it redis redis-cli -a redis@pass -p 16379
Warning: Using a password with '-a' or '-u' option on the command line interface may not be safe.
127.0.0.1:16379> keys *
1) "node:chrstdan:info"
2) "node:chrstdan:ip"
127.0.0.1:16379> get node:chrstdan:info
"{\"hostname\": \"chrstdan\", \"ip\": \"172.18.0.1\", \"cpu_cores\": 4, \"gpu_info\": [], \"has_gpu
_usage_percent\": 72.6, \"disk_usage_percent\": 83.5, \"active_jupyterlab\": 0, \"active_ray\": 0,
127.0.0.1:16379> 
```

## 2. Konfigurasi Service Agent

a. Akses node worker, gunakan command docker run untuk menjalankan service agent:

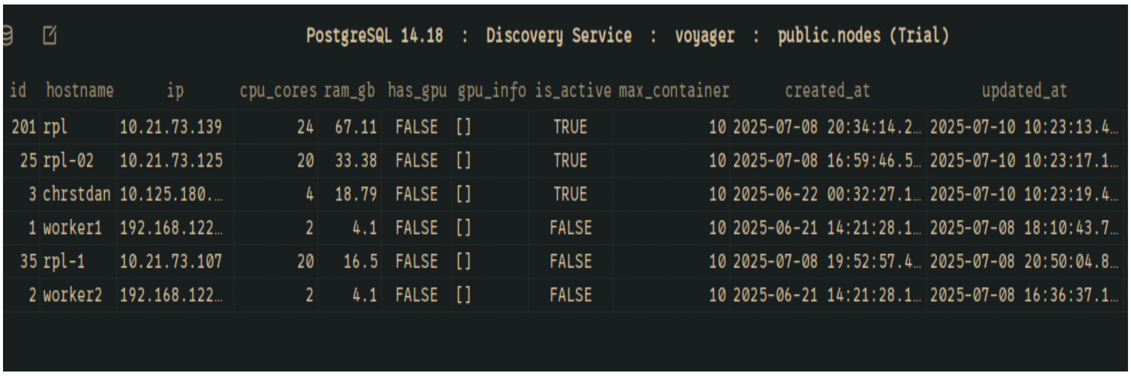
```
# Menjalankan agent di setiap node
docker run --name agent -d \
--net=host \
-e DISCOVERY_URL=http://<CONTROL_NODE_IP>:15002/register-node \
-v /var/run/docker.sock:/var/run/docker.sock \
danielcristh0/agent:1.1

# Tambahkan "--gpus all" di node yang memiliki GPU
docker run --name agent -d \
--net=host \
-e DISCOVERY_URL=http://<CONTROL_NODE_IP>:15002/register-node \
-v /var/run/docker.sock:/var/run/docker.sock \
--gpus all \
danielcristh0/agent:1.1
```



```
[DEBUG] Container Summary: Total=55, JupyterLab=2, Ray=7
[DEBUG] Container Summary: Total=55, JupyterLab=2, Ray=7
[DEBUG] Send Info: {'hostname': 'rpl', 'ip': '10.21.73.122', 'cpu': 24, 'gpu':
 [{'name': 'NVIDIA GeForce RTX 3080 Ti', 'index': 0, 'uuid': 'GPU-56c3e796-124
e-f059-16a8-f9be2b254ce0', 'memory_total_mb': 12288, 'memory_used_mb': 7632, '
memory_util_percent': 62.11, 'utilization_gpu_percent': 0, 'temperature_gpu':
56}], 'has_gpu': True, 'ram_gb': 67.11, 'cpu_usage_percent': 2.5, 'memory_usag
e_percent': 16.1, 'disk_usage_percent': 42.3, 'active_jupyterlab': 2, 'active_
ray': 7, 'total_containers': 55, 'last_updated': '2025-06-19T20:45:16.193296Z'
}
[AGENT] Registered: rpl (10.21.73.122) → 200
```

b. Cek database service discovery untuk memastikan apakah node telah berhasil didaftarkan:

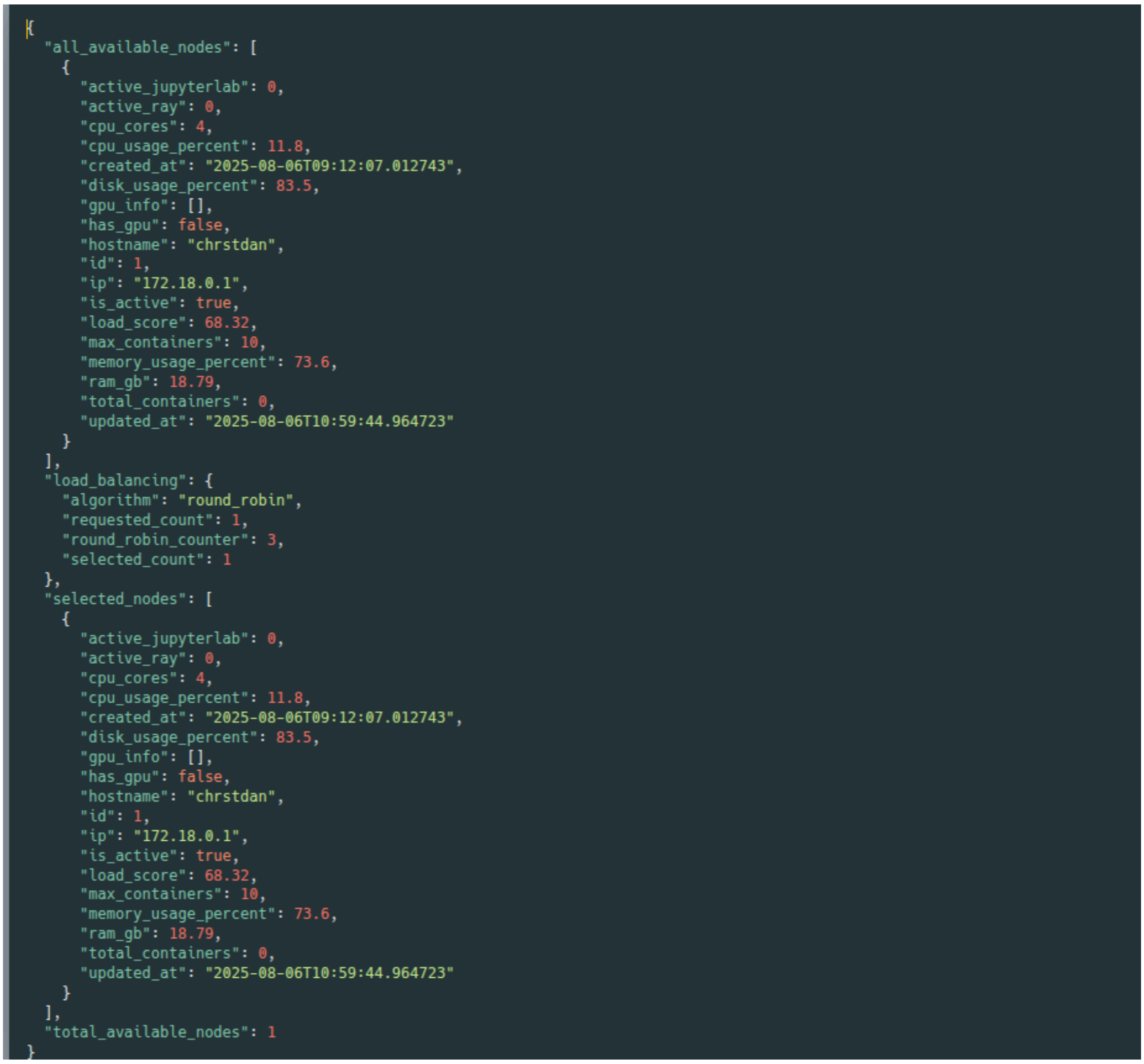


PostgreSQL 14.18 : Discovery Service : voyager : public.nodes (Trial)

| id | hostname | ip | cpu_cores | ram_gb | has_gpu | gpu_info | is_active | max_container | created_at | updated_at |
|---|---|---|---|---|---|---|---|---|---|---|
| 201 | rpl | 10.21.73.139 | 24 | 67.11 | FALSE | [] | TRUE | 10 | 2025-07-08 20:34:14.2… | 2025-07-10 10:23:13.4… |
| 25 | rpl-02 | 10.21.73.125 | 20 | 33.38 | FALSE | [] | TRUE | 10 | 2025-07-08 16:59:46.5… | 2025-07-10 10:23:17.1… |
| 3 | chrstdan | 10.125.180.… | 4 | 18.79 | FALSE | [] | TRUE | 10 | 2025-06-22 00:32:27.1… | 2025-07-10 10:23:19.4… |
| 1 | worker1 | 192.168.122… | 2 | 4.1 | FALSE | [] | FALSE | 10 | 2025-06-21 14:21:28.1… | 2025-07-08 18:10:43.7… |
| 35 | rpl-1 | 10.21.73.107 | 20 | 16.5 | FALSE | [] | FALSE | 10 | 2025-07-08 19:52:57.4… | 2025-07-08 20:50:04.8… |
| 2 | worker2 | 192.168.122… | 2 | 4.1 | FALSE | [] | FALSE | 10 | 2025-06-21 14:21:28.1… | 2025-07-08 16:36:37.1… |

c. Cek node yang tersedia di service discovery, dari endpoint `available-nodes`:

`curl http://127.0.0.1:15002/available-nodes`



```
{
  "all_available_nodes": [
    {
      "active_jupyterlab": 0,
      "active_ray": 0,
      "cpu_cores": 4,
      "cpu_usage_percent": 11.8,
      "created_at": "2025-08-06T09:12:07.012743",
      "disk_usage_percent": 83.5,
      "gpu_info": [],
      "has_gpu": false,
      "hostname": "chrstdan",
      "id": 1,
      "ip": "172.18.0.1",
      "is_active": true,
      "load_score": 68.32,
      "max_containers": 10,
      "memory_usage_percent": 73.6,
      "ram_gb": 18.79,
      "total_containers": 0,
      "updated_at": "2025-08-06T10:59:44.964723"
    }
  ],
  "load_balancing": {
    "algorithm": "round_robin",
    "requested_count": 1,
    "round_robin_counter": 3,
    "selected_count": 1
  },
  "selected_nodes": [
    {
      "active_jupyterlab": 0,
      "active_ray": 0,
      "cpu_cores": 4,
      "cpu_usage_percent": 11.8,
      "created_at": "2025-08-06T09:12:07.012743",
      "disk_usage_percent": 83.5,
      "gpu_info": [],
      "has_gpu": false,
      "hostname": "chrstdan",
      "id": 1,
      "ip": "172.18.0.1",
      "is_active": true,
      "load_score": 68.32,
      "max_containers": 10,
      "memory_usage_percent": 73.6,
      "ram_gb": 18.79,
      "total_containers": 0,
      "updated_at": "2025-08-06T10:59:44.964723"
    }
  ],
  "total_available_nodes": 1
}
```

## 3. Konfigurasi Jupyter

a. Konfigurasi  Jupyter Enterprise Gateway

- Konfigurasi SSH Passwordless:

  ```
  $ ssh-keygen -t rsa -b 4096 -N "" -f ./jeg/ssh_keys/id_rsa
  ```

- Tambahkan public key ke node target, ulangi langkah ini di setiap node yang ada:

  ```
  $ ssh-copy-id -i ~/.ssh/id_rsa.pub user@<ip_node_worker>
  ```

- Agar JEG tidak gagal karena verifikasi host SSH, tambahkan fingerprint dari node ke `known_hosts`:

  ```
  $ ssh-keyscan -H <ip_node_worker> >> ./jeg/ssh_keys/known_hosts
  ```

- Verifikasi, jika tidak diminta password, maka konfigurasi berhasil:

  ```
  $ ssh user@<ip_node_worker>
  ```

b. Konfigurasi environment, ubah sesuai kebutuhan:

```
$ cd jupyterlab
$ cp .env.example .env
```

```
$ cat .env
$ cd jupyterlab
# JupyterHub Admin
JUPYTERHUB_ADMIN=admin

# Docker Image Default (optional)
DOCKER_NOTEBOOK_IMAGE=danielcristh0/jupyterlab:cpu

# Proxy Auth Token
CONFIGPROXY_AUTH_TOKEN=abc123

# Database Config
POSTGRES_HOST=<IP_CONTROL_NODE>
POSTGRES_PORT=5432
POSTGRES_DB=apollo
POSTGRES_USER=postgres
POSTGRES_PASSWORD=postgres

# JEG Config
EG_LOG_LEVEL=DEBUG
EG_AUTH_TOKEN=jeg-jeg-an
EG_REMOTE_USER=<SSH_REMOTE_USER>
EG_RESPONSE_IP=<IP_CONTROL_NODE>

# Grafana
GRAFANA_ADMIN_PASSWORD=monitoring
```

c. Update nilai dari **API_URL** di file `jupyterlab/hub/form/main.js` dengan IP control node. Tujuannya adalah untuk mengintegrasikan JupyterHub dengan Service Discovery:

```
const API_URL = "http://<IP_CONTROL_NODE>:15002";
```

d. Pull Docker image JupyterLab di setiap node worker untuk mempercepat proses spawn di JupyterHub. Tujuannya agar image sudah tersedia, sehingga proses spawn container dapat berjalan lebih cepat dan tanpa delay.:

- Semua node wajib pull image CPU:

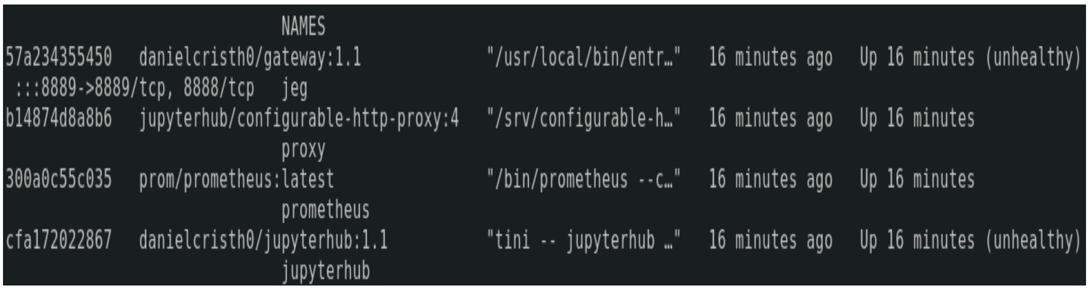
  ```
  $ docker pull danielcristh0/jupyterlab:cpu
  ```

- Jika node memiliki GPU, pull juga image GPU:

  ```
  $ docker pull danielcristh0/jupyterlab:gpu
  ```

e. Jalankan Docker Compose Jupyter, pastikan ada 3 container yang running (jeg, proxy & jupyterhub):

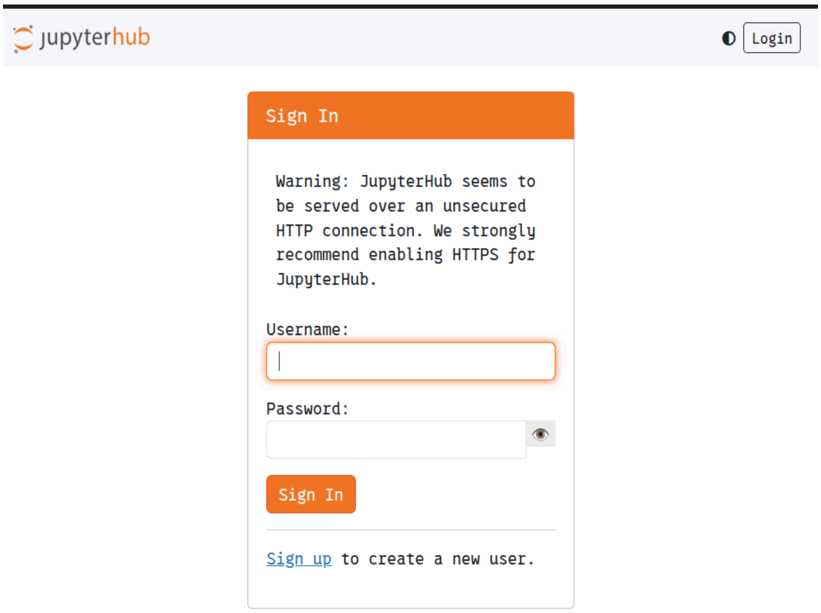
```
$ cd jupyterlab
$ docker compose up -d –build
```



```
                      NAMES
57a234355450   danielcristh0/gateway:1.1            "/usr/local/bin/entr…"   16 minutes ago   Up 16 minutes (unhealthy)
 :::8889->8889/tcp, 8888/tcp   jeg
b14874d8a8b6   jupyterhub/configurable-http-proxy:4   "/srv/configurable-h…"   16 minutes ago   Up 16 minutes
                      proxy
300a0c55c035   prom/prometheus:latest               "/bin/prometheus --c…"   16 minutes ago   Up 16 minutes
                      prometheus
cfa172022867   danielcristh0/jupyterhub:1.1         "tini -- jupyterhub …"   16 minutes ago   Up 16 minutes (unhealthy)
                      jupyterhub
```

f. Akses halaman JupyterHub di http://<IP_CONTROL_NODE>:18000:

- Lakukan sign up terlebih dahulu. Untuk akun admin, gunakan username: admin dan password bebas (minimal 8 karakter). Setelah sign up sebagai admin, akun akan otomatis memiliki hak akses admin
- Jika sudah, lalu login kemudia klik “Start My Server” untuk memilih node yang digunakan untuk menjalankan JupyterLab.



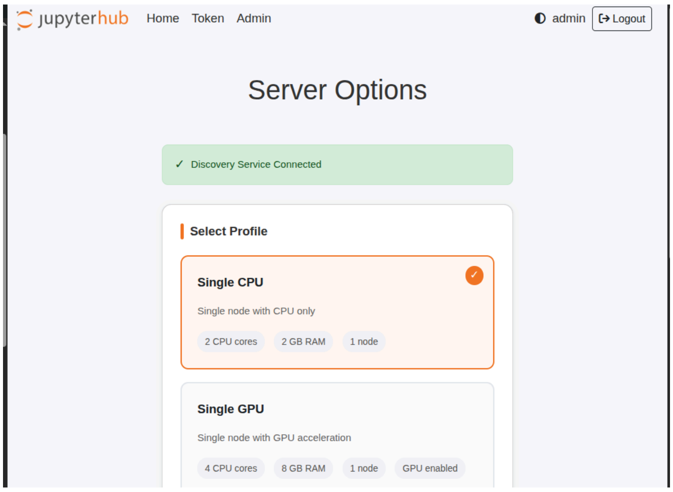
Warning: JupyterHub seems to be served over an unsecured HTTP connection. We strongly recommend enabling HTTPS for JupyterHub.

Username:

Password:

Sign up to create a new user.

.



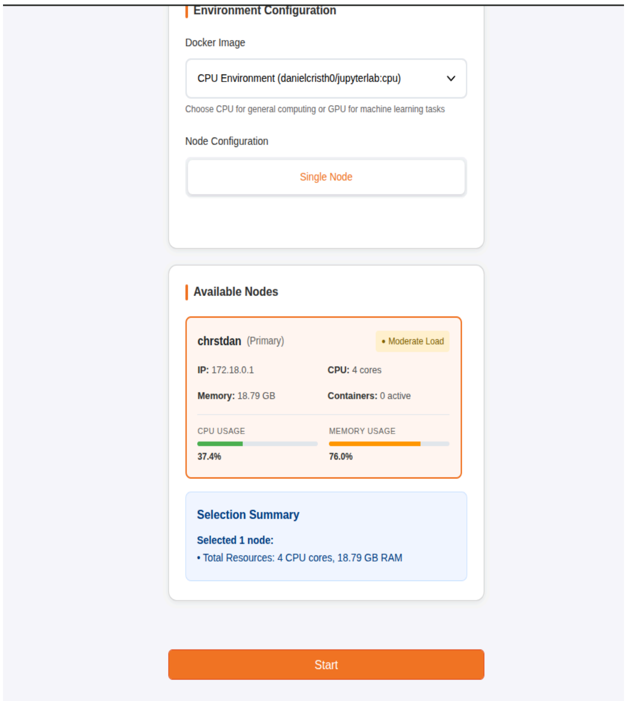
Server Options

✓ Discovery Service Connected

Select Profile

Single CPU ✓
Single node with CPU only
2 CPU cores | 2 GB RAM | 1 node

Single GPU
Single node with GPU acceleration
4 CPU cores | 8 GB RAM | 1 node | GPU enabled



Environment Configuration

Docker Image

CPU Environment (danielcristh0/jupyterlab:cpu)

Choose CPU for general computing or GPU for machine learning tasks

Node Configuration

Single Node

Available Nodes

**chrstdan** (Primary) • Moderate Load

**IP:** 172.18.0.1 **CPU:** 4 cores

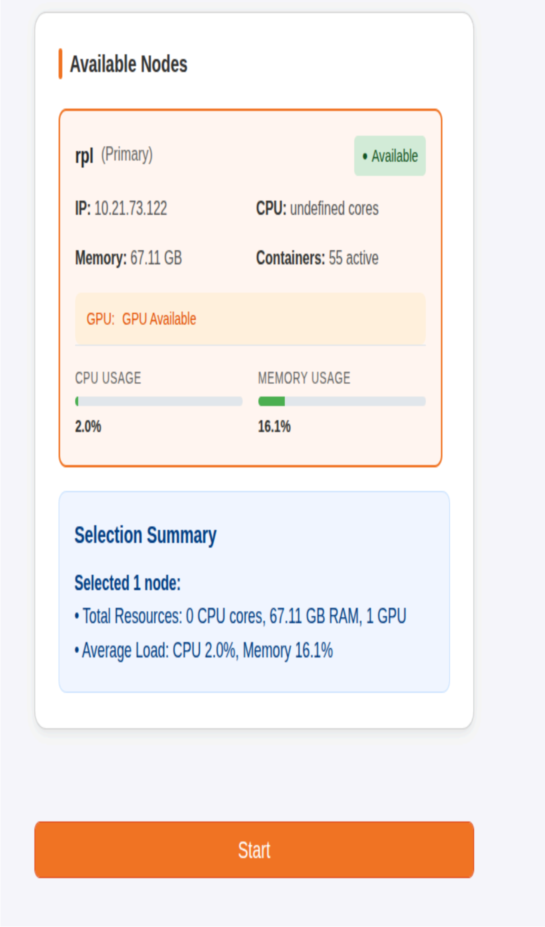
**Memory:** 18.79 GB **Containers:** 0 active

CPU USAGE 37.4% MEMORY USAGE 76.0%

Selection Summary

**Selected 1 node:**

• Total Resources: 4 CPU cores, 18.79 GB RAM



Available Nodes

**rpl** (Primary) • Available

**IP:** 10.21.73.122 **CPU:** undefined cores

**Memory:** 67.11 GB **Containers:** 55 active

GPU: GPU Available

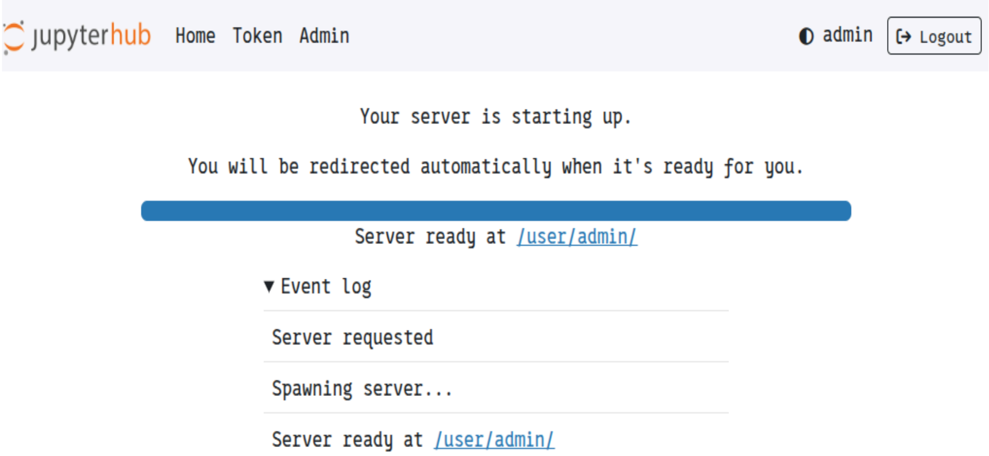
CPU USAGE 2.0% MEMORY USAGE 16.1%

Selection Summary

**Selected 1 node:**

• Total Resources: 0 CPU cores, 67.11 GB RAM, 1 GPU

• Average Load: CPU 2.0%, Memory 16.1%



Your server is starting up.

You will be redirected automatically when it's ready for you.

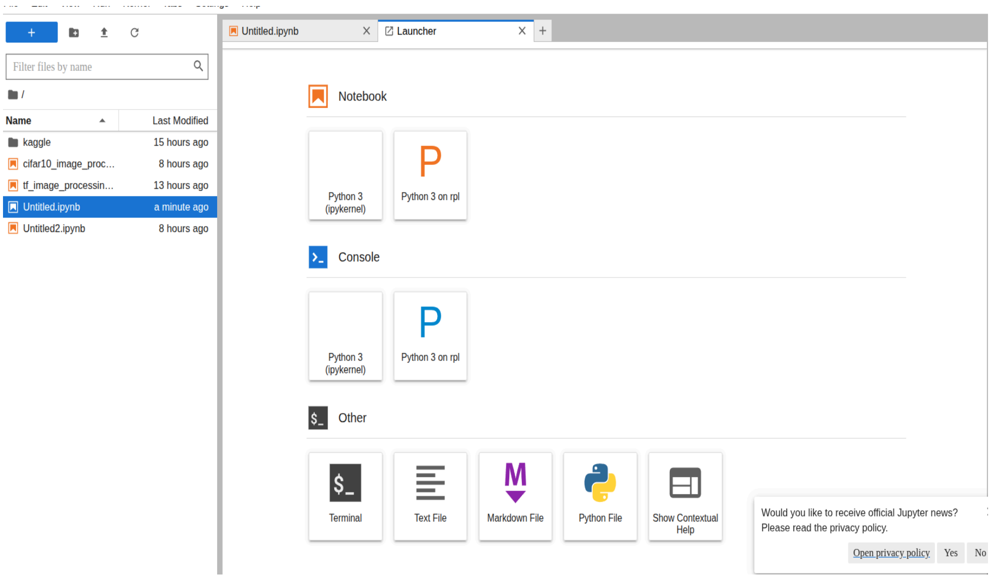
Server ready at /user/admin/

▼ Event log

Server requested

Spawning server...

Server ready at /user/admin/



| Name | Last Modified |
|---|---|
| kaggle | 15 hours ago |
| cifar10_image_proc... | 8 hours ago |
| tf_image_processin... | 13 hours ago |
| Untitled.ipynb | a minute ago |
| Untitled2.ipynb | 8 hours ago |

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