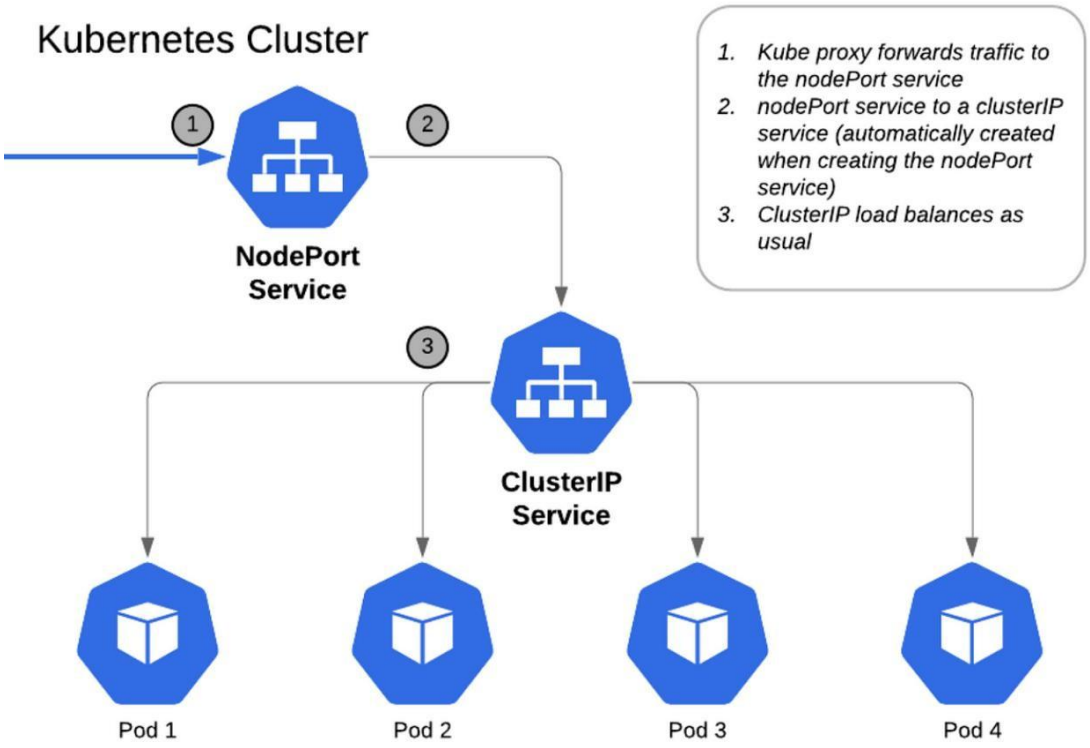
KUBERNETES PROJECT WITH NODEPORT SERVICE



Files and Configurations Used in This Project

1. NGINX Configuration

- NGINX Deployment with 3 Replicas
- Expose in NodePort Service at Port 30007

2. Database Configuration

- MySQL Headless
- MySQL Persistent Volume (PV)
- MySQL StatefulSet

3. Secrets and Configurations

- MySQL Secrets
- MySQL ConfigMaps
- Service Account for Secrets and ConfigMaps
- Read-Only Roles for Secrets and ConfigMaps
- Read-Only Role-Binding for Secrets and ConfigMaps

4. Monitoring and Logging

- DaemonSet (Prometheus)
- Prometheus RBAC
- Prometheus NodePort Exposed on Port 30090
- Promtail DaemonSet
- Loki DaemonSet
- Loki NodePort Exposed on Port 30091
- Grafana Daemon with Exposed Port 30080

Project Summary

1. NGINX Deployment and Services

- Sabse pehle NGINX web server ko 3 replicas ke saath deploy karna.
- Phir, NodePort service ka use karke expose karna.

2. Database Configuration

- MySQL StatefulSet deploy karna.
- Persistent Volume (PV) configure karna taake data storage manage ho sake.

3. Secrets & ConfigMaps

- Security ke liye Secrets (MYSQL Database ka password aur username store karne ke liye
- ConfigMaps (port, hostname, database name ke liye) ka use.

4. Security Enhancements

- Service Accounts create karna.
- RBAC roles aur RoleBindings configure karna jo Secrets aur ConfigMaps ke liye read-only access provide karein.

5. Monitoring & Logging

- Prometheus DaemonSet deploy karna, RBAC configure karna aur port 30090 par expose karte hue read-write permissions dena.
- Promtail ka use karna logs collect karne ke liye.
- Loki ko logging backend banakar port 30091 par expose karna.
- Grafana deploy karna jo metrics visualize karega aur port 30080 par expose hoga.

Understanding Each File

Is project me hum har YAML aur Configuration file ko samjhenge ki kaise ye Deployment, Networking ko Manage karne, Security implement karne, aur Monitoring Setup karne me madad kar rahi hai.

Achievements:

1. Successfully Deployed NGINX with NodePort Service

NGINX web server ko 3 replicas ke saath deploy kiya aur NodePort service ka use karke expose kiya, jo direct access allow karta hai specific nodes ke through.

2. Persistent & Secure MySQL Database

StatefulSet aur Persistent Volumes (PV) ka use karke MySQL database ko secure aur reliable banaya, taake data loss na ho.

3. Secrets & ConfigMaps Implementation

Sensitive information jaise database credentials, hostname, aur configuration settings securely manage kiye.

4. RBAC-based Access Control

Service Accounts, RBAC roles, aur RoleBindings implement kiye jo Secrets aur ConfigMaps ke liye read-only access provide karte hain, taake security maintain ho.

5. Monitoring & Logging Setup

Prometheus, Loki, aur Grafana ka use karke complete observability stack setup kiya jo system ki health aur performance track karne me madad karta hai.

Note: Sabse pehle Minikube ki installation and Setup karni hai, jaise hum pehle Installation part mein kar chuke hain. Agar tumne Minikube setup nahi kiya hai, toh neeche diye gaye URL ko kholo aur Minikube Cluster ka setup complete karo.

URL :

https://github.com/Faikhan147/Kubernetes/blob/main/03-Installations/01-Minikube-Installation.pdf

Part 1: Minikube Cluster Creation and Setup

Step 1: Windows search bar se PowerShell ko 'Run as administrator' ke through open karo aur Minikube start karo.

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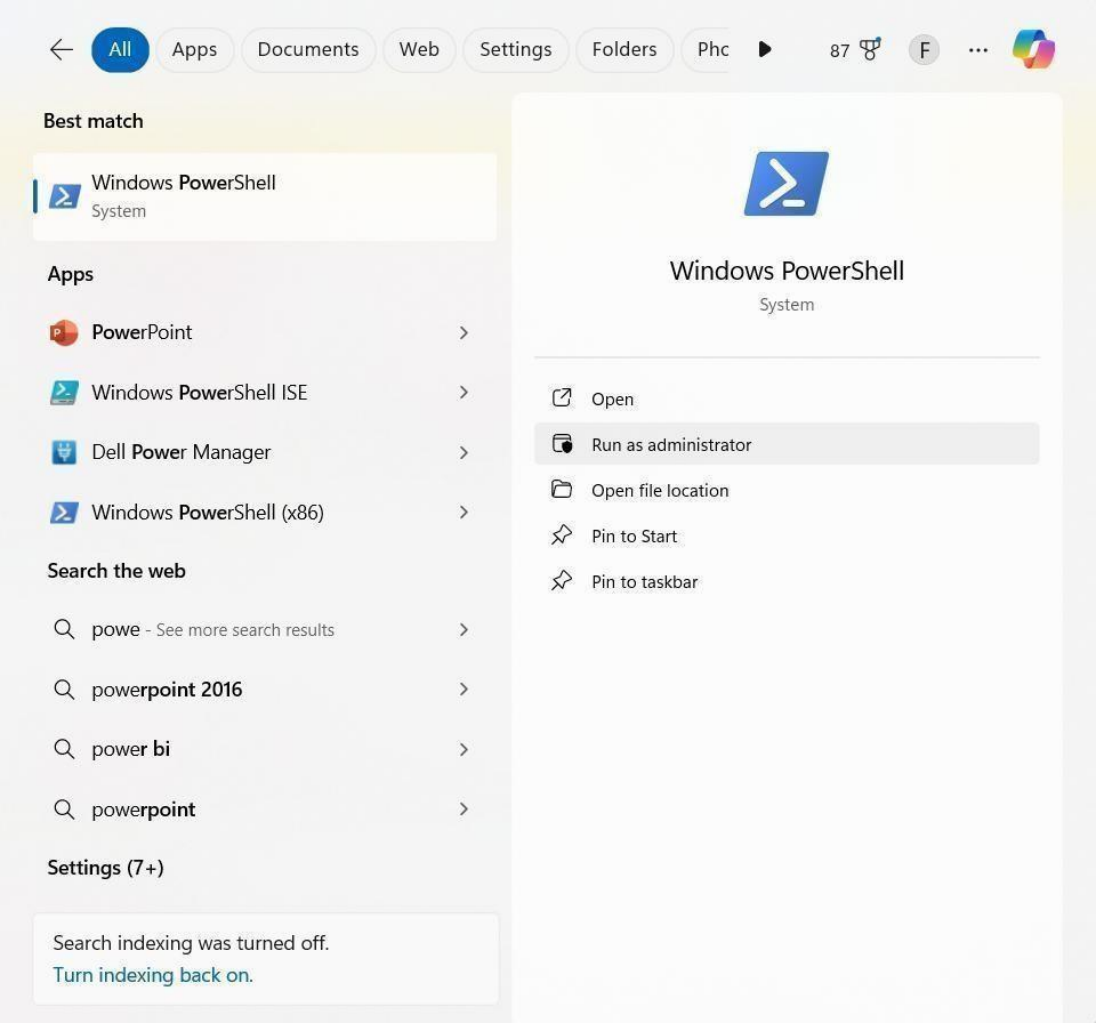

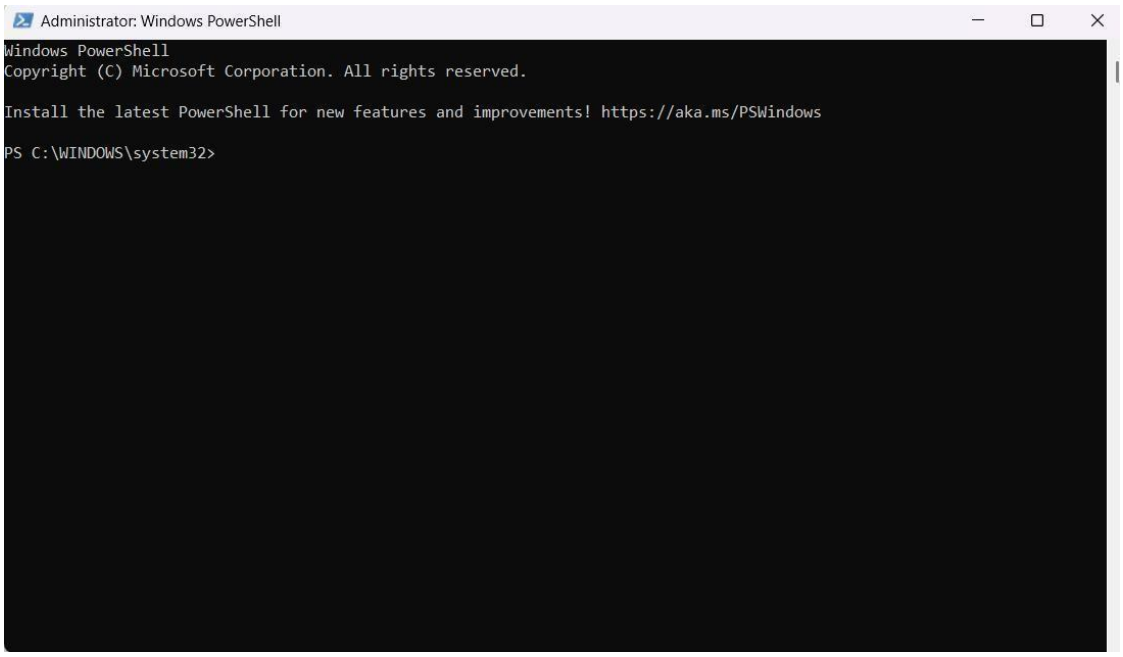

1. Minikube ko start karne ke liye ye command run kariye

minikube start --driver=virtualbox --memory=4000 --cpus=2 --force

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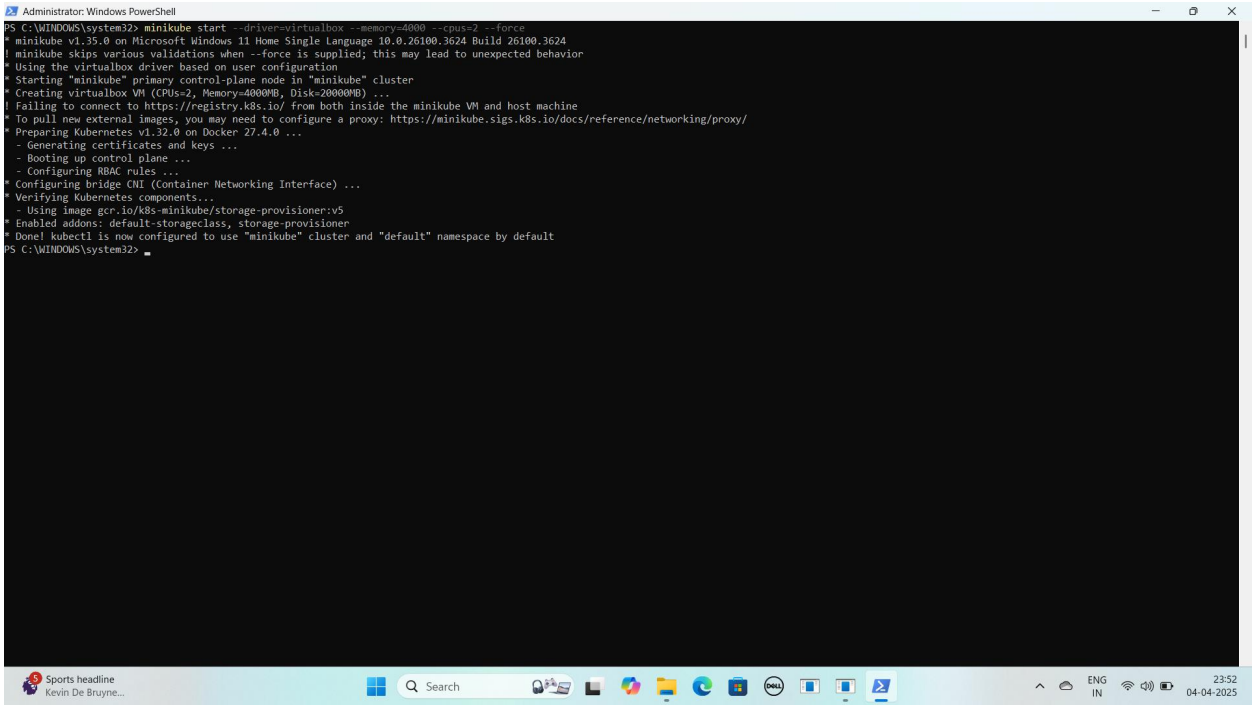
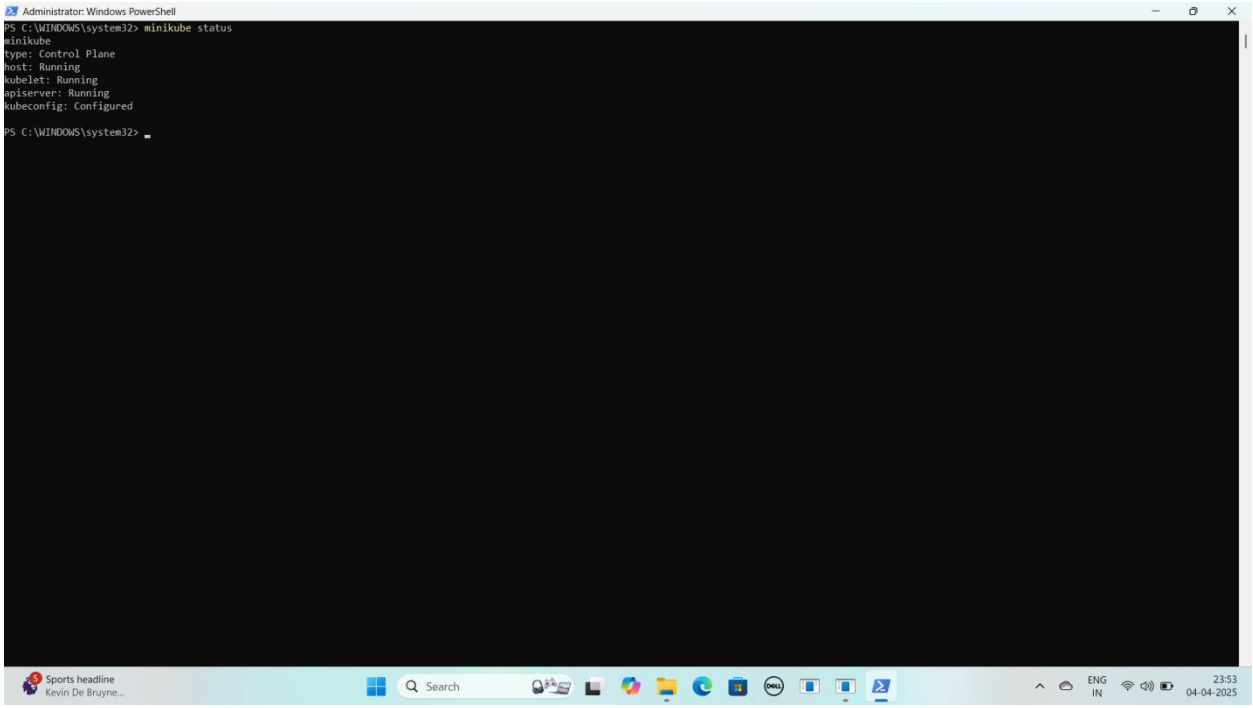


2. Ab Minikube ka status check karne ke liye ye command run kariye

minikube status

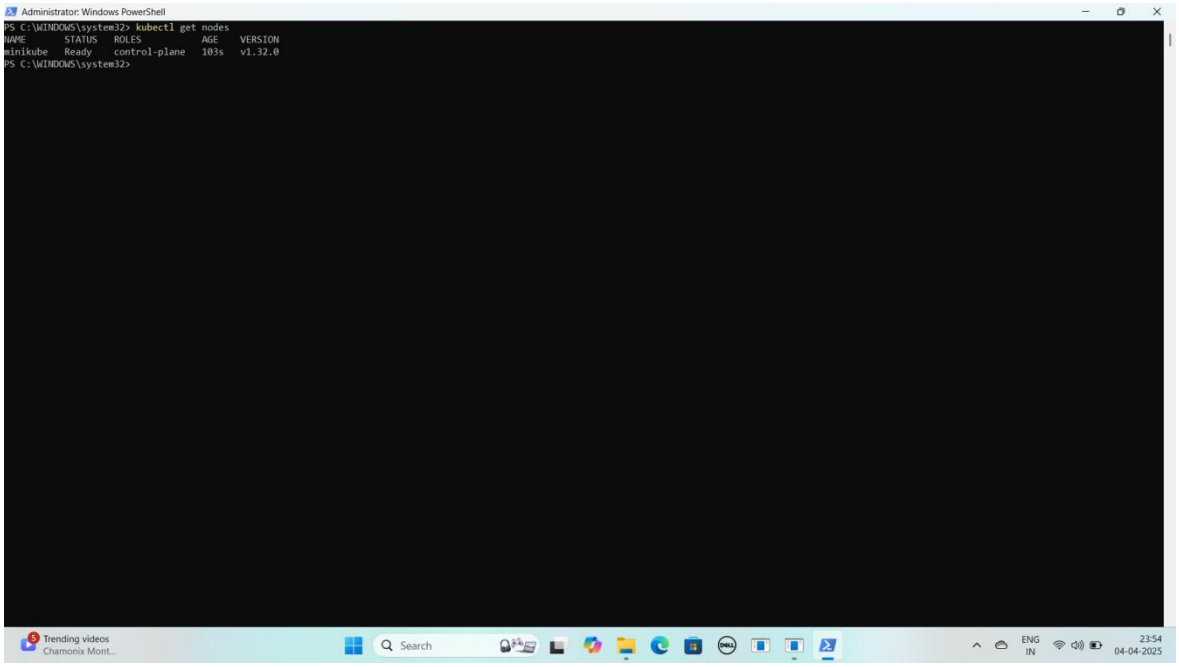
YE KUCH ISTARHA LAGEGA



3. Ab Cluster Nodes check karne ke liye ye command run kare

kubectl get nodes

YE KUCH ISTARHA LAGEGA

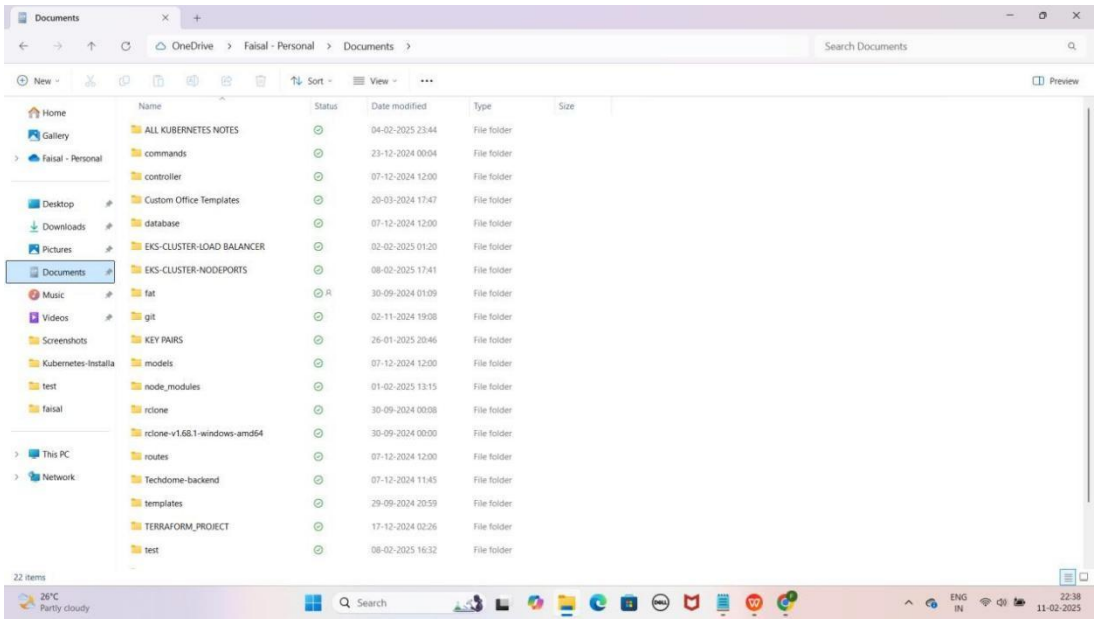


NOTE: Agar STATUS Ready show kar raha hao to sab sahi hai ab aap deployment kar sakte hai

Step 2: Project Ki GitHub Repository Clone Karein

1. **Laptop Mein Documents Folder Mein Jao**

YE KUCH ISTARHA LEGAGA



2. **PowerShell Ko "Run as Administrator" Open Karo**

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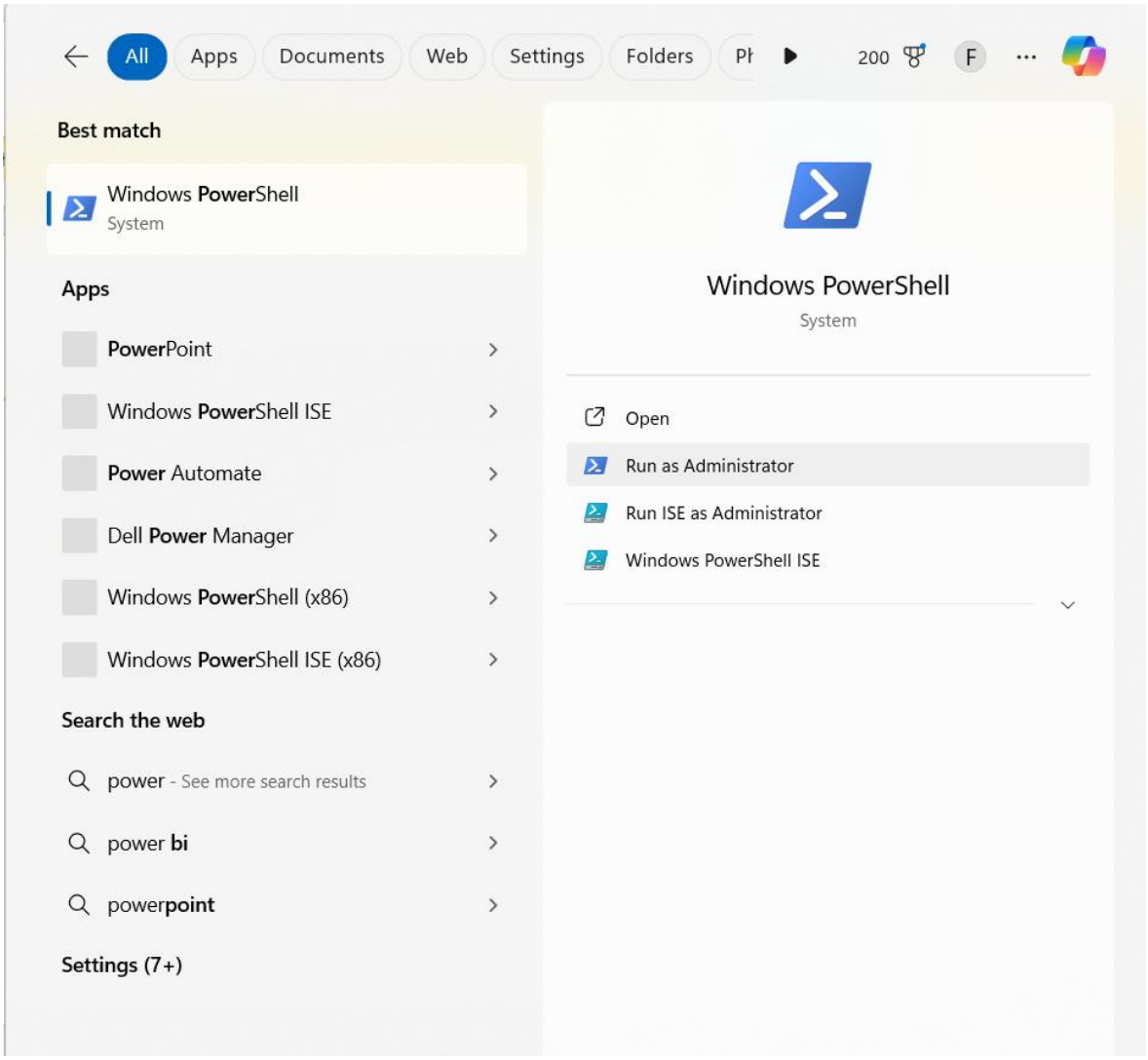
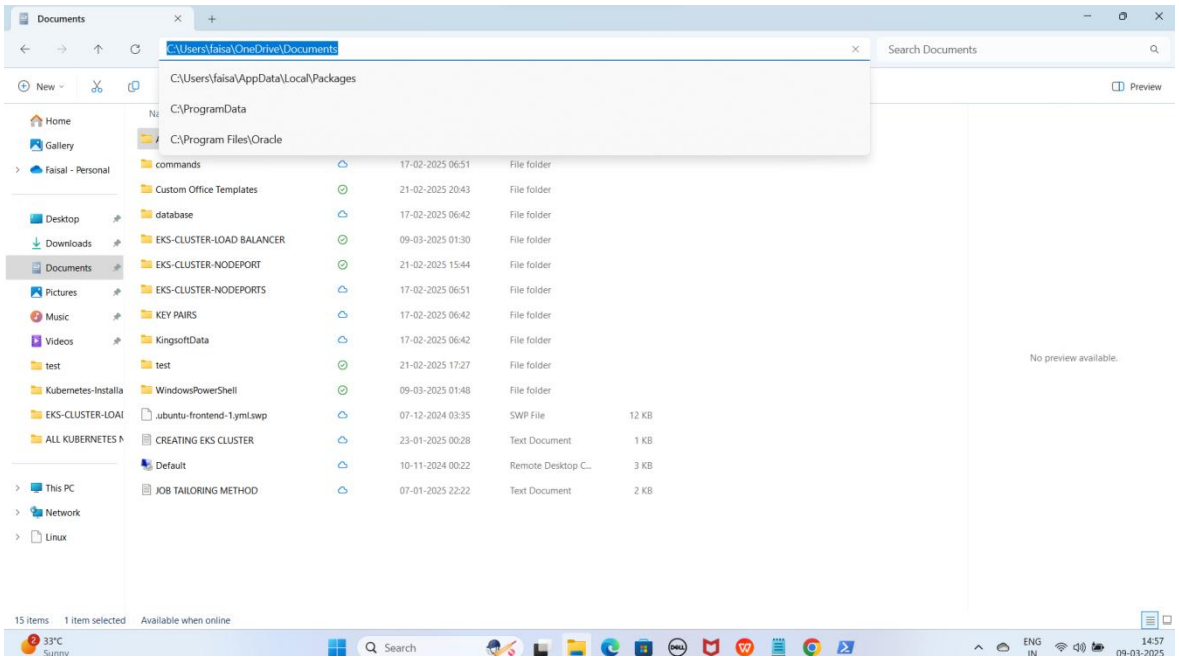


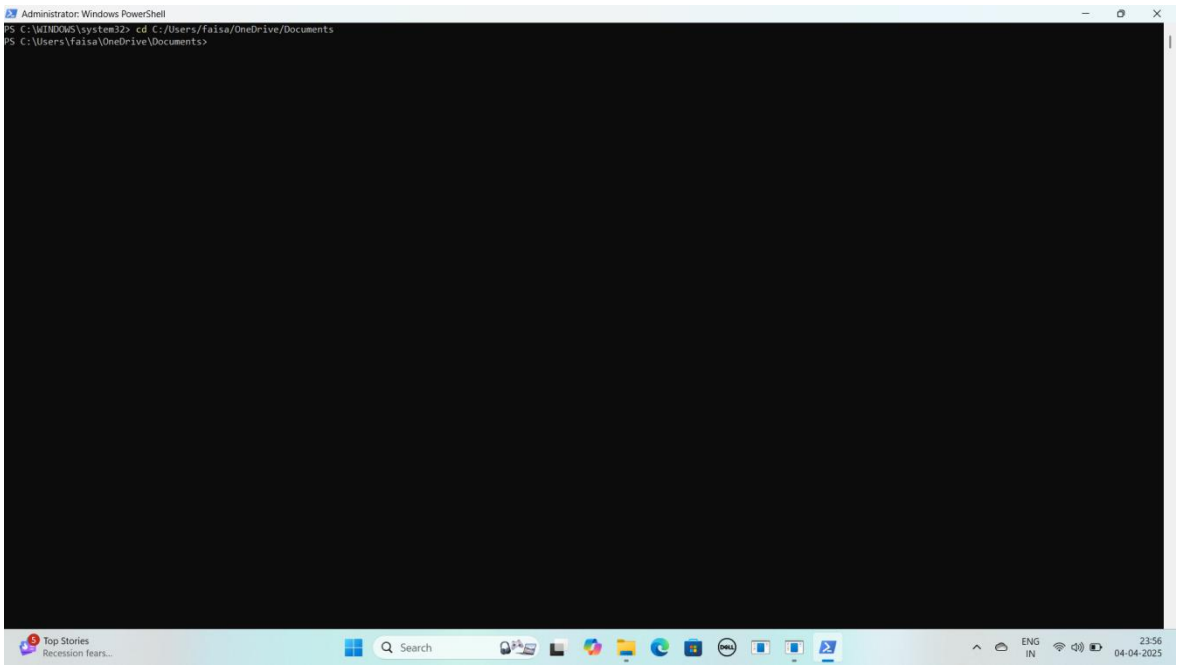
3. **PowerShell me cd command ka use karke Documents folder ka path paste karein.**

   Jaisa ki mere case me, path kuch aisa hai

   cd C:/Users/faisa/OneDrive/Documents

YE KUCH ISTARHA LAGEGA





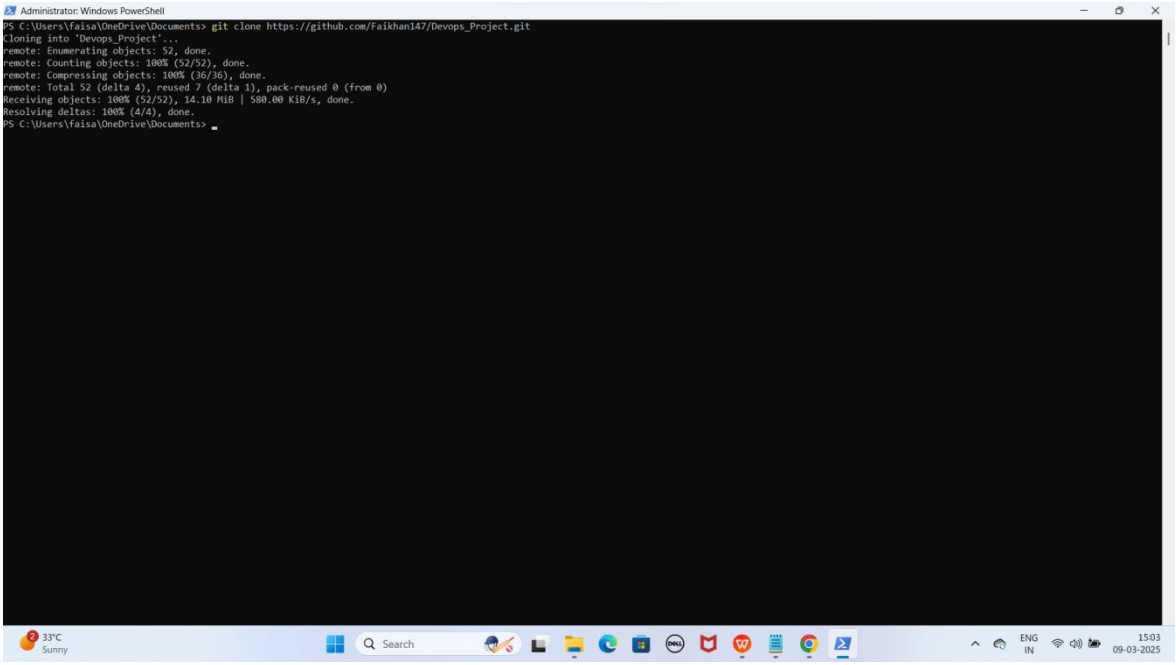
NOTE: Isse aap Documents folder me Navigate ho jaoge."

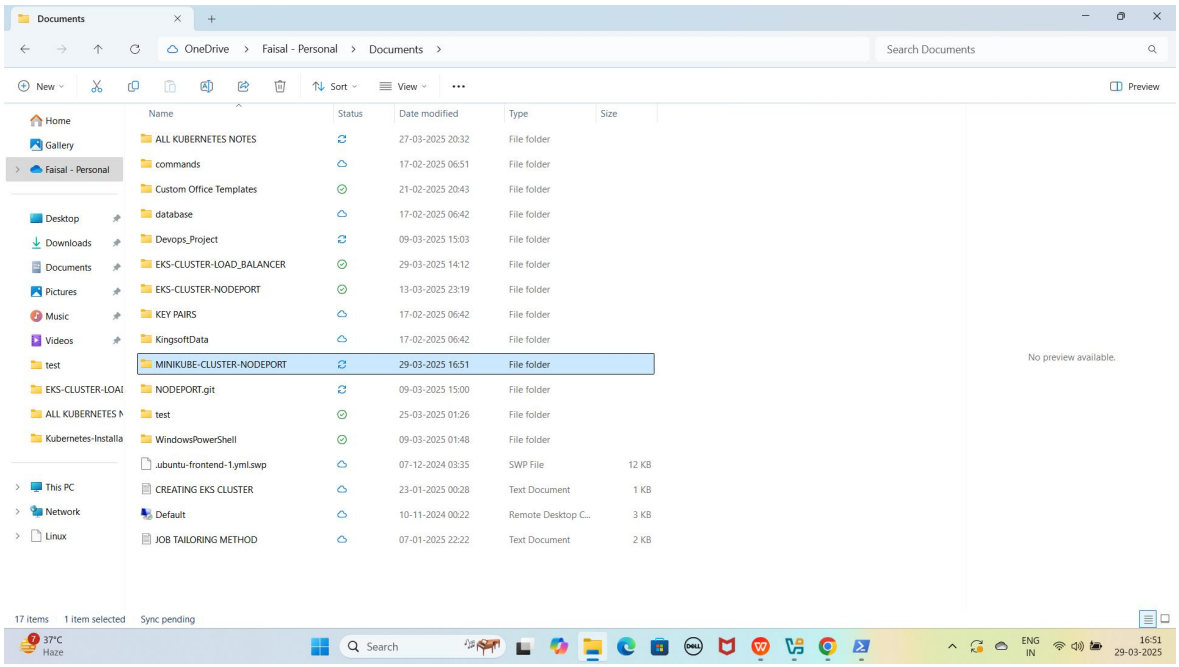
4. GitHub Repository Clone Karo

As it is niche diya gaya URL copy karo aur PowerShell me paste karo

git clone https://github.com/Faisalkhan45/MINIKUBE-CLUSTER-NODEPORT.git

YE KUCH ISTARHA LAGEGA





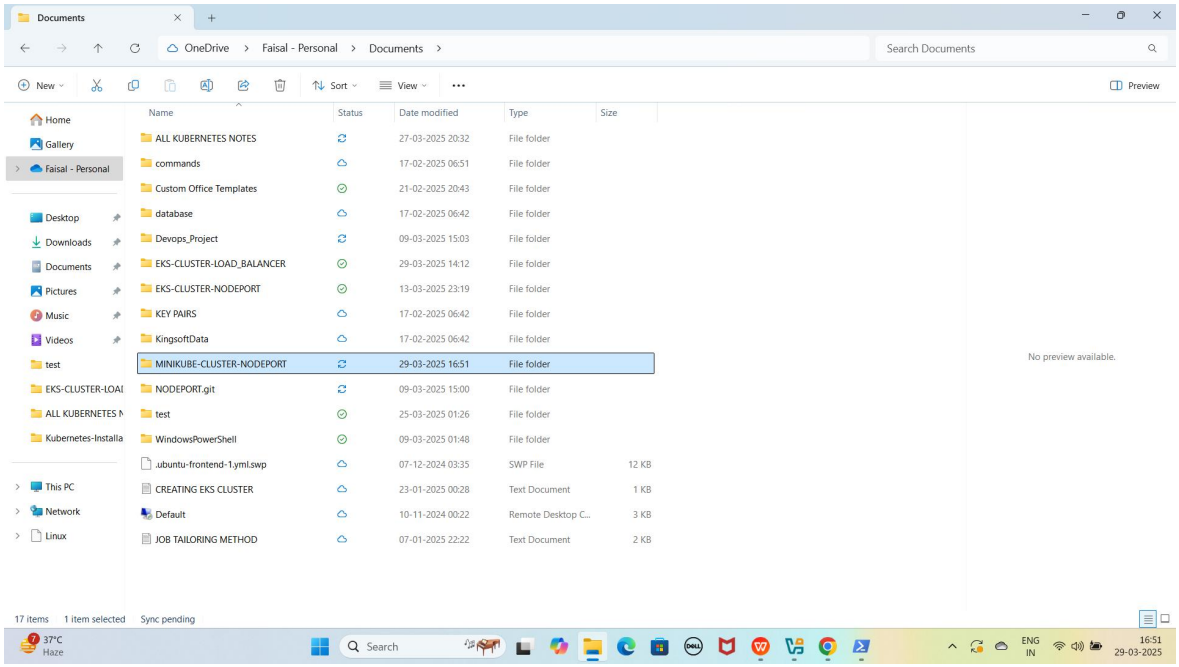
NOTE: Repository clone hone ke baad, aapko "MINIKUBE-CLUSTER-NODEPORT" naam ka folder Documents me dikhega

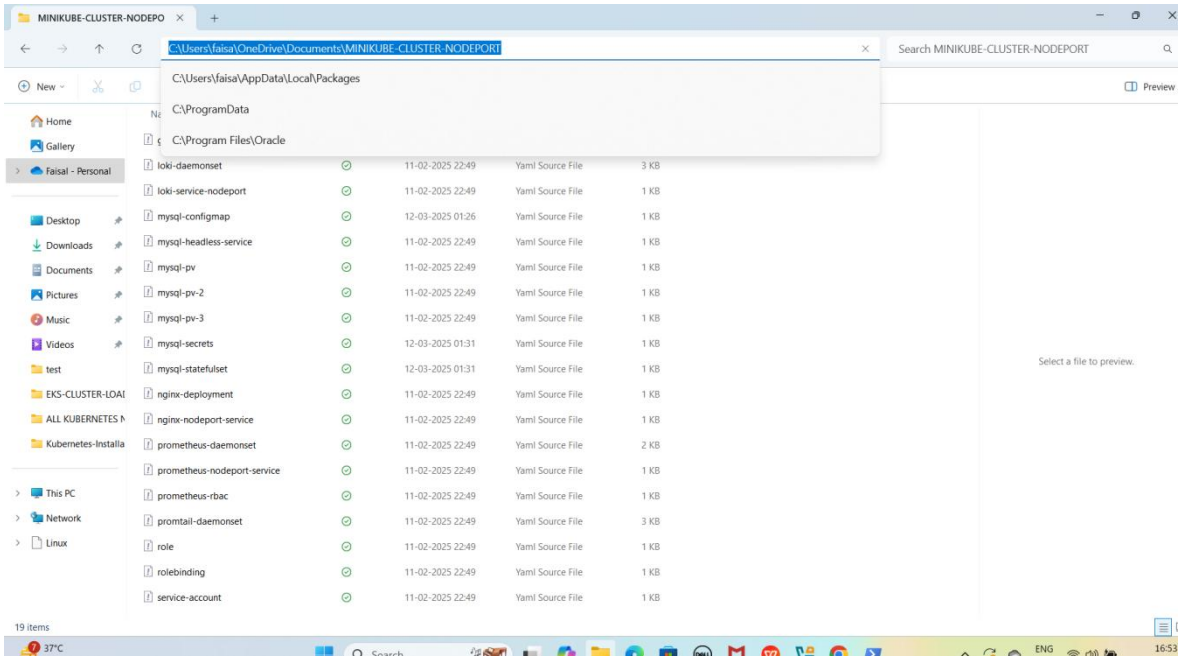
5. **EKS-CLUSTER-NODEPORT Folder Me Jao PowerShell me cd command ka use karo aur apna path paste karo**

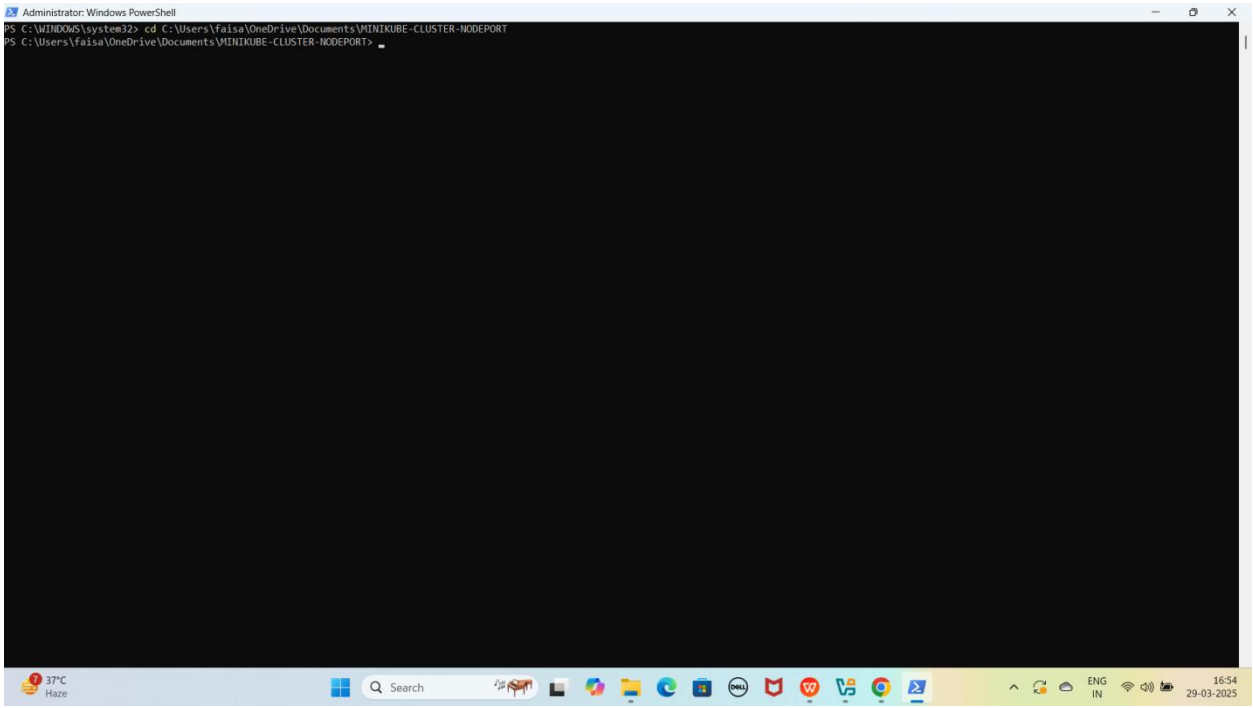
Jaise ki mere case me path kuch aisa hoga

cd C:\Users\faisa\OneDrive\Documents\MINIKUBE-CLUSTER-NODEPORT

YE KUCH ISTARHA LAGEGA







NOTE: Is command se aap PowerShell me MINIKUBE-CLUSTER-NODEPORT folder me Navigate ho jaoge.

Part 2: Nginx pods and Service Deployment

Step 1: nginx-deployment.yaml File Ka Kaam

Yeh **file NGINX ke 3 replicas create** karne ke liye use hoti hai. Isko **Kubernetes Deployment** ke andar likha jata hai.

JAISE KI:-

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-deployment
spec:
  replicas: 3  # 3 replicas for high availability
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
        - name: nginx
          image: nginx:latest  # Latest Nginx image
          ports:
            - containerPort: 80  # Expose port 80 in the container
```

Deployment Apply Karo

kubectl apply -f nginx-deployment.yaml

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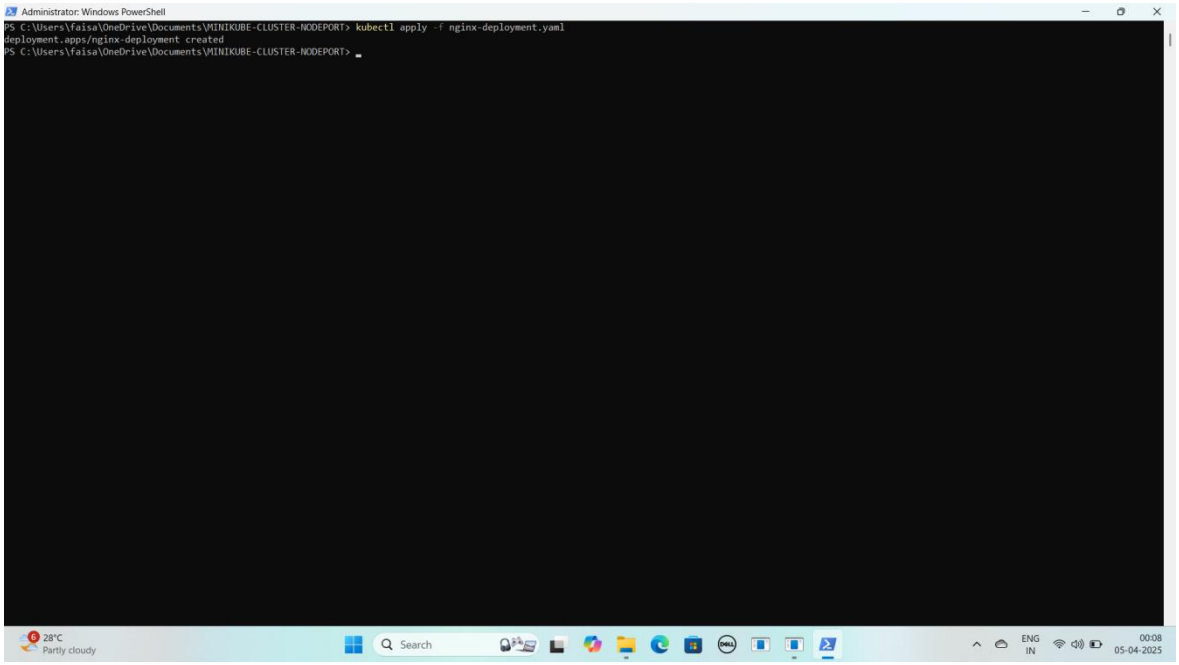

Step 2: nginx-nodeport-service.yaml File Ka Kaam

Yeh **file NGINX pods** ko **expose** karne ke liye use hoti hai. Isme **NodePort service** define ki jati hai jo **NGINX pods** ko port **30007** par **access** karne ki ijazat deti hai.

JAISE KI:-

```yaml
apiVersion: v1
kind: Service
metadata:
  name: nginx-service
spec:
  selector:
    app: nginx
  ports:
    - port: 80  # Port inside the cluster
      targetPort: 80  # Port to forward traffic to in the container
      nodePort: 30007  # External port on which the service will be accessible
  type: NodePort  # Type set to NodePort to expose externally
```

Nginx Service Apply Karo

kubectl apply -f nginx-nodeport-service.yaml

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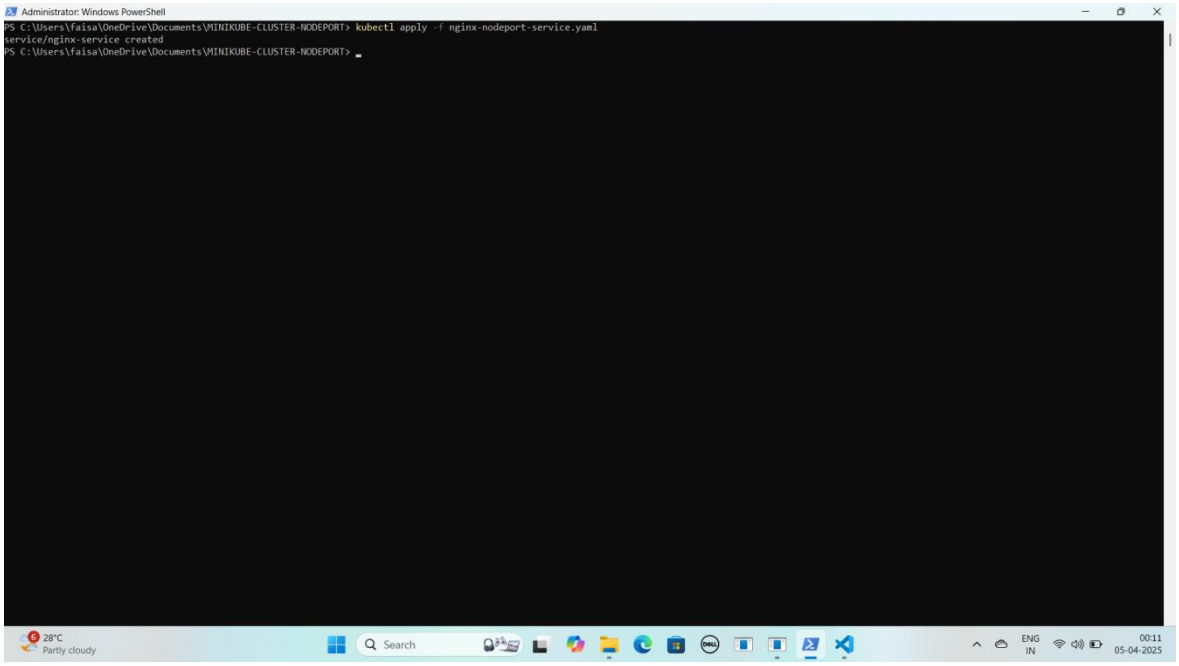
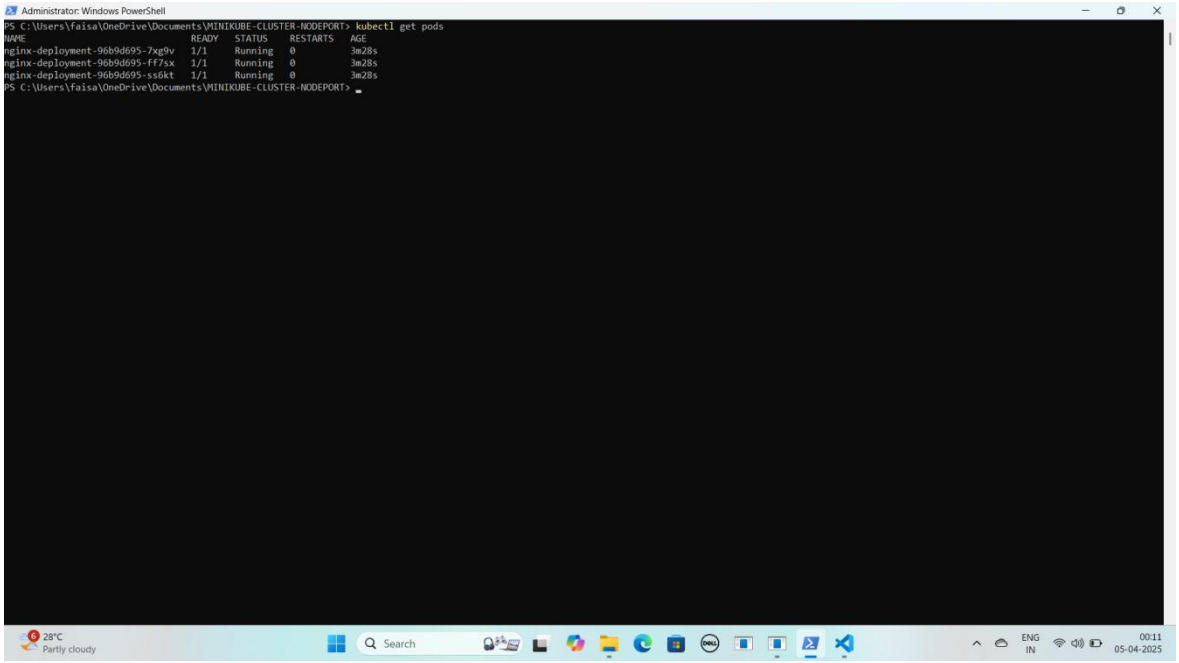


1. Pods check karne ke liye ye command run kariye

kubectl get pods

YE KUCH ISTARHA LAGEGA

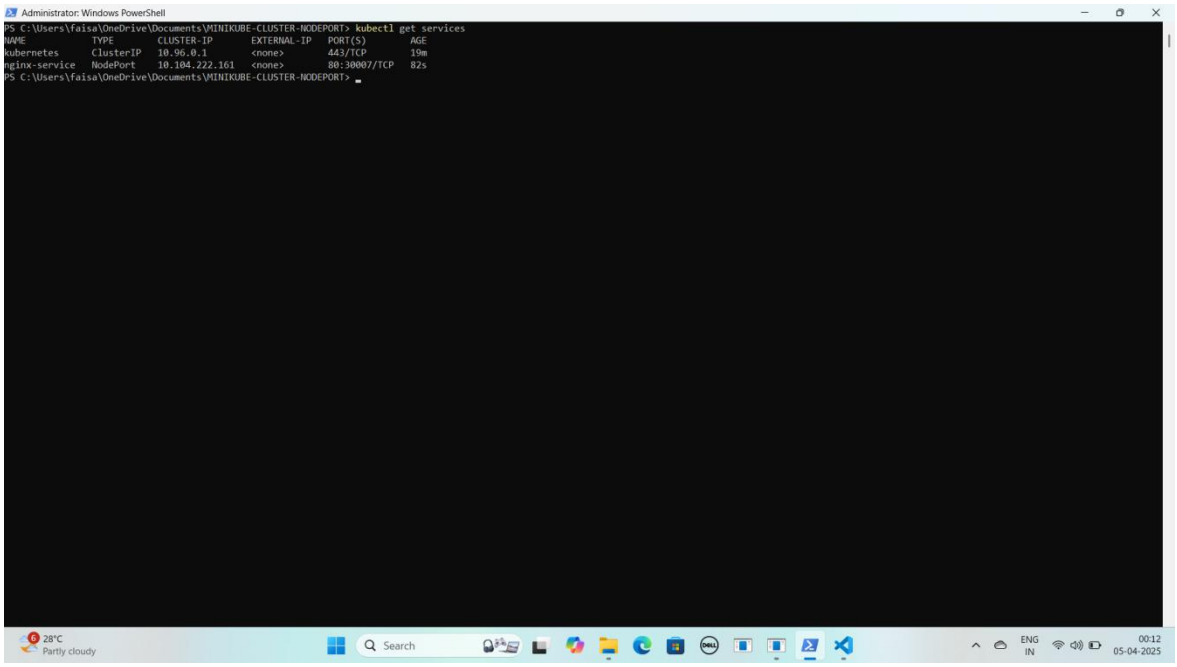


NOTE: Agar STATUS Running show karraha hai to sab kuch sahi hai

2. Serives check karne ke liye ye commad run kariye

kubectl get services

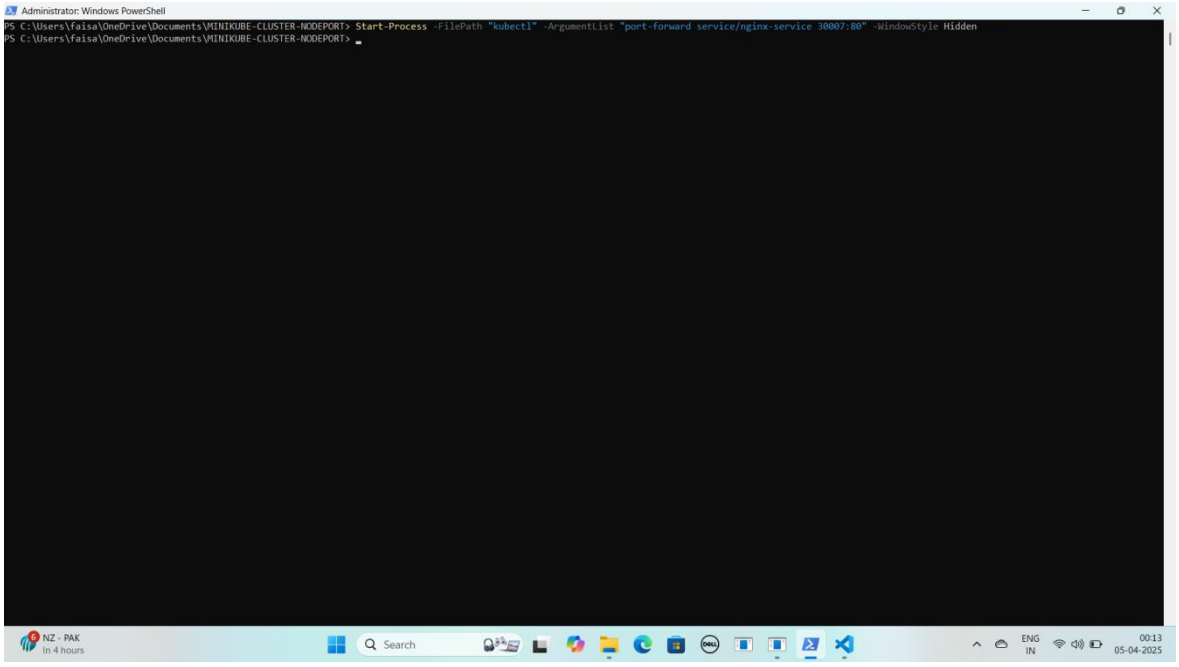
YE KUCH ISTARHA LAGEGA



3. Port Forwarding Karne ke liye ye command run karein

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/nginx-service 30007:80" -WindowStyle Hidden

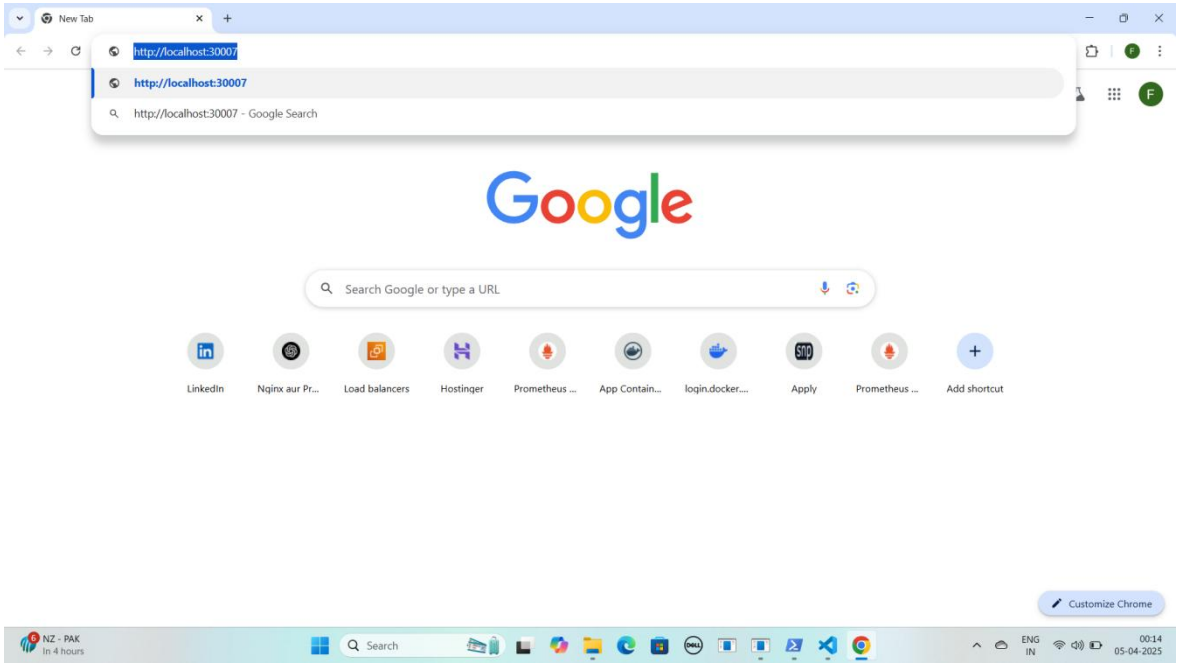
YE KUCH ISTARHA LAGEGA

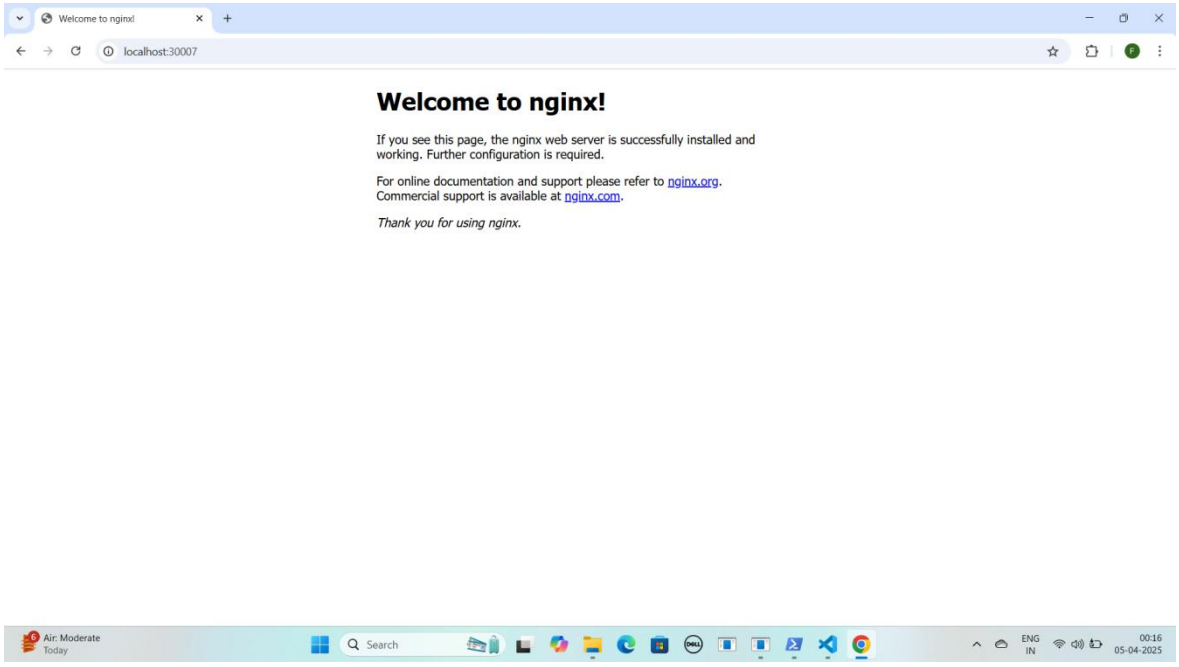


NOTE: Ab aapka Nginx expose ho chuka hai. Ab apne local system par Nginx ko NodePort ke saath browser me run kariye.

NGINX Localhost NodePort Address :
http://localhost:30007

YE KUCH ISTARHA LAGEGA





Part 3: MySQL Secrets and ConfigMap Configuration

Step 1: mysql-secrets.yaml File Ka Kaam

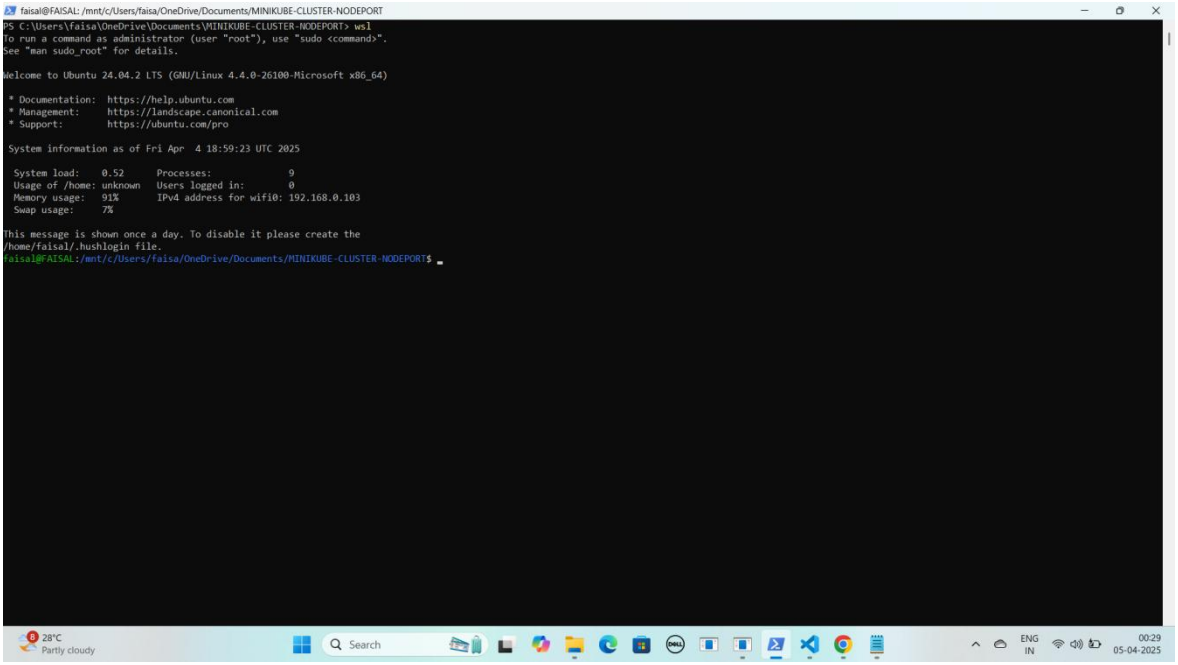
Ye **file username aur password ko securely store** karne ke liye use hoti hai. Kyunki **Secrets secure hoti hain**, is wajah se hum **Base64 encoding** ka use karke **username aur password** ko **encrypt** kar dete hain.

MYSQL ka username aur password encode karna:-

1. Windows ke WSL (Windows Subsystem for Linux) ka use kar ke hum Base64 encoding kar sakte hain. wsl type karein aur yeh commands run karein

wsl

YE KUCH ISTARHA LAGEGA



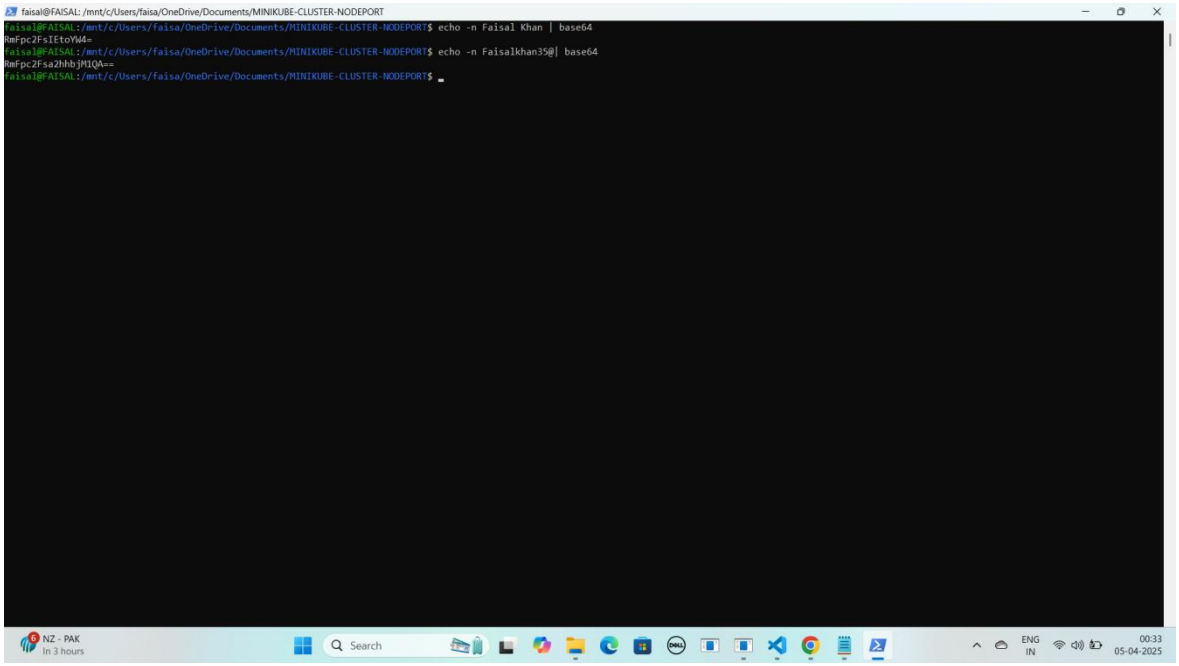
2. Username encode karein

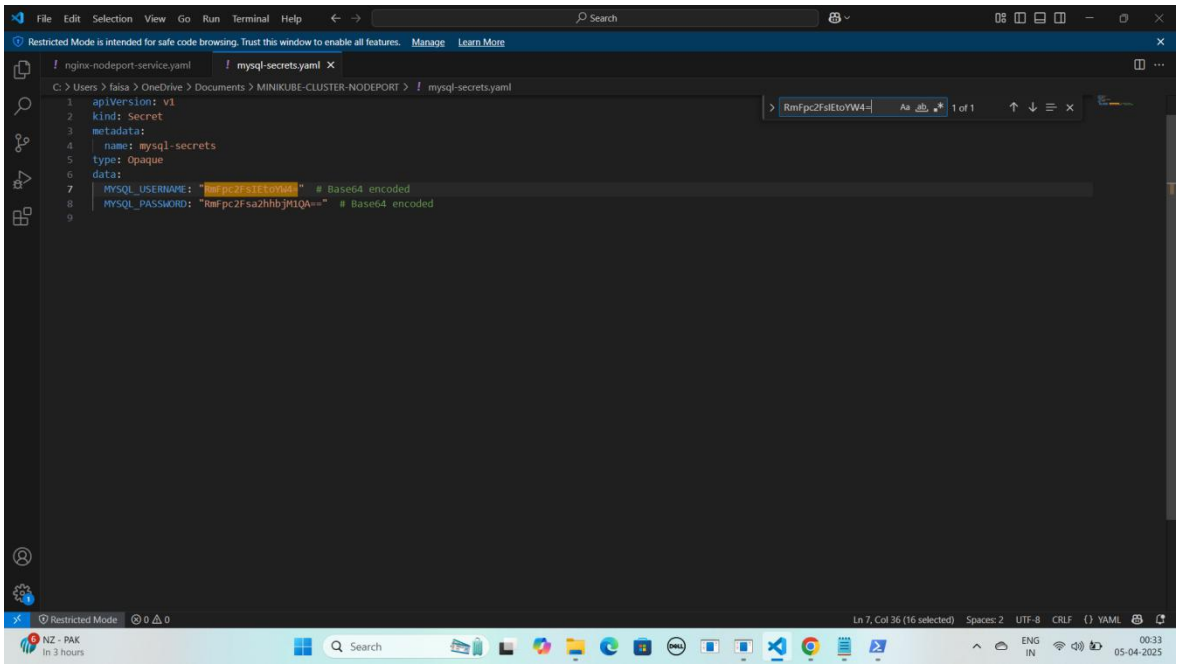
- echo -n Faisal Khan | base64

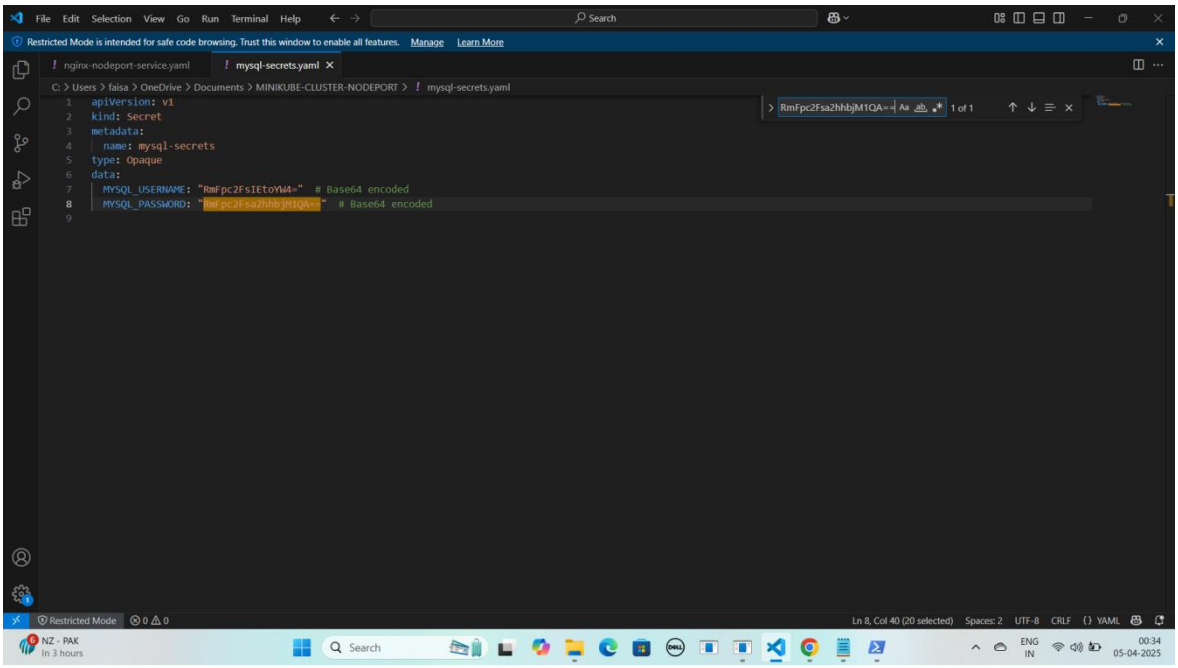
3. Password encode karein

- echo -n Faisalkhan35@| base64

YE KUCH ISTARHA LAGEGA







NOTE: Ye command aapko Base64 encoded values degi, jo hum mysql-secrets.yaml file me store karenge. Lekin aapko apne Username aur Password ke hisaab se mysql-secrets.yaml file update karni hogi.

JAISE KI:-

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: mysql-secrets
type: Opaque
data:
  MYSQL_USERNAME: "RmFpc2FsIEtoYW4="  # Base64 encoded
  MYSQL_PASSWORD: "RmFpc2Fsa2hhbjM1QA=="  # Base64 encoded
```

Agar aap encoded username aur password ko wapas original form me laana chahte hain, toh WSL me yeh commands run karein

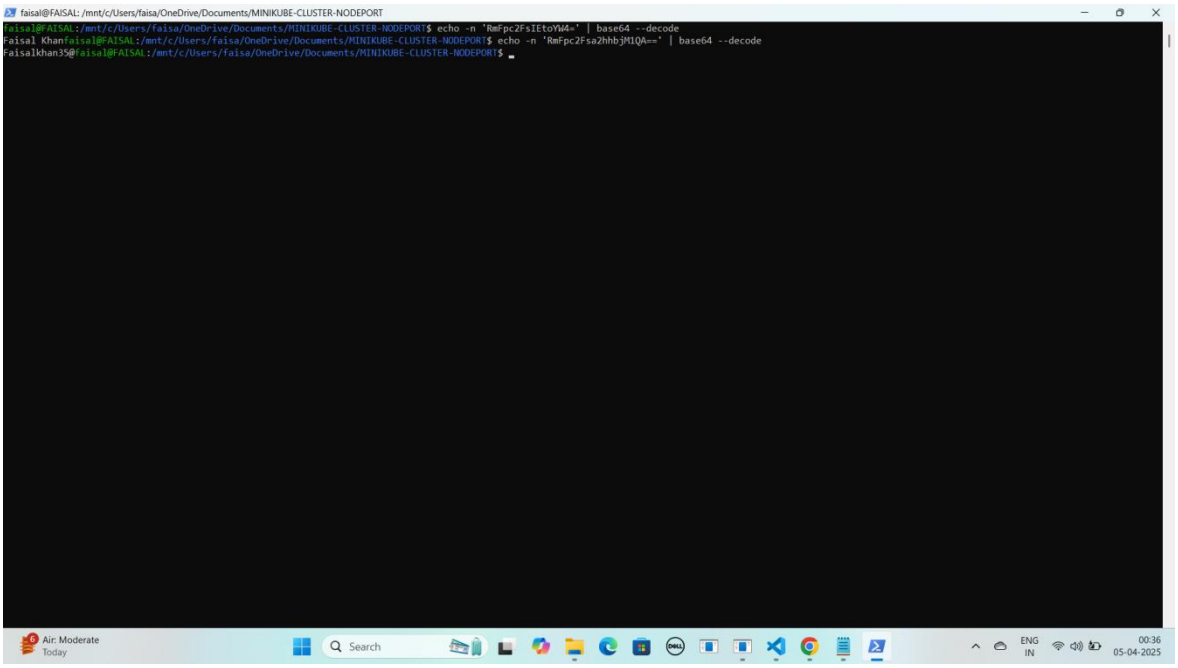
4. Username decode karein

- echo -n 'RmFpc2FsIEtoYW4=' | base64 --decode

5. Password decode karein

- echo -n 'RmFpc2Fsa2hhbjM1QA==' | base64 --decode

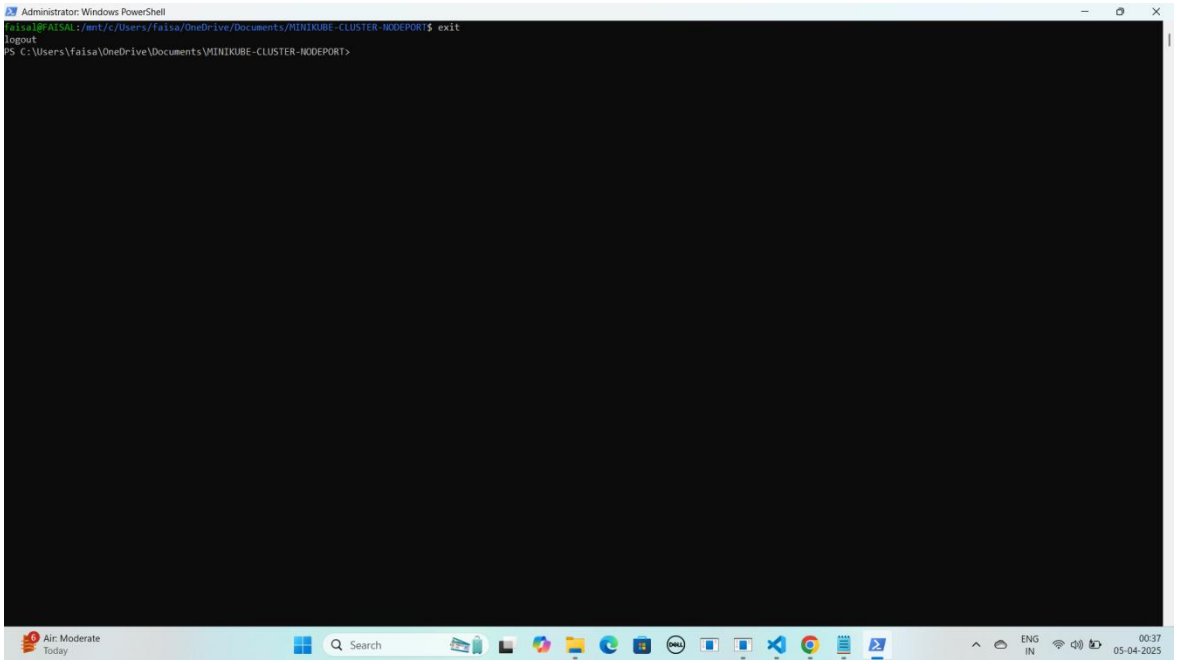
YE KUCH ISTARHA LAGEGA



6. Ab WSL se exit hogao exit hone ke liye exit type karo

exit

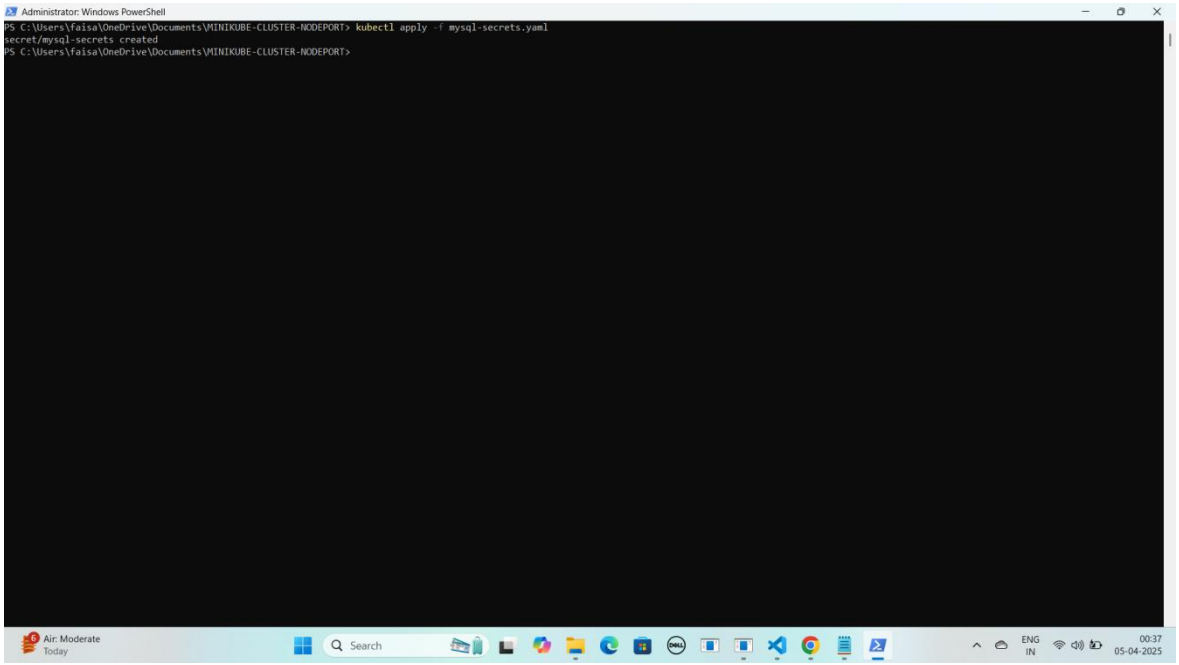
YE KUCH ISTARHA LAGEGA



Secret Apply Karo

kubectl apply -f mysql-secrets.yaml

YE KUCH ISTARHA LAGEGA



Step 2: mysql-configmap.yaml File Ka Kaam

Yeh **file non-sensitive data** store karne ke liye use hoti hai, jaise

- **Database ka naam**
- **Host ka naam (hostname)**
- **Port number**

Isko **Kubernetes ConfigMap** ke andar likha jata hai.

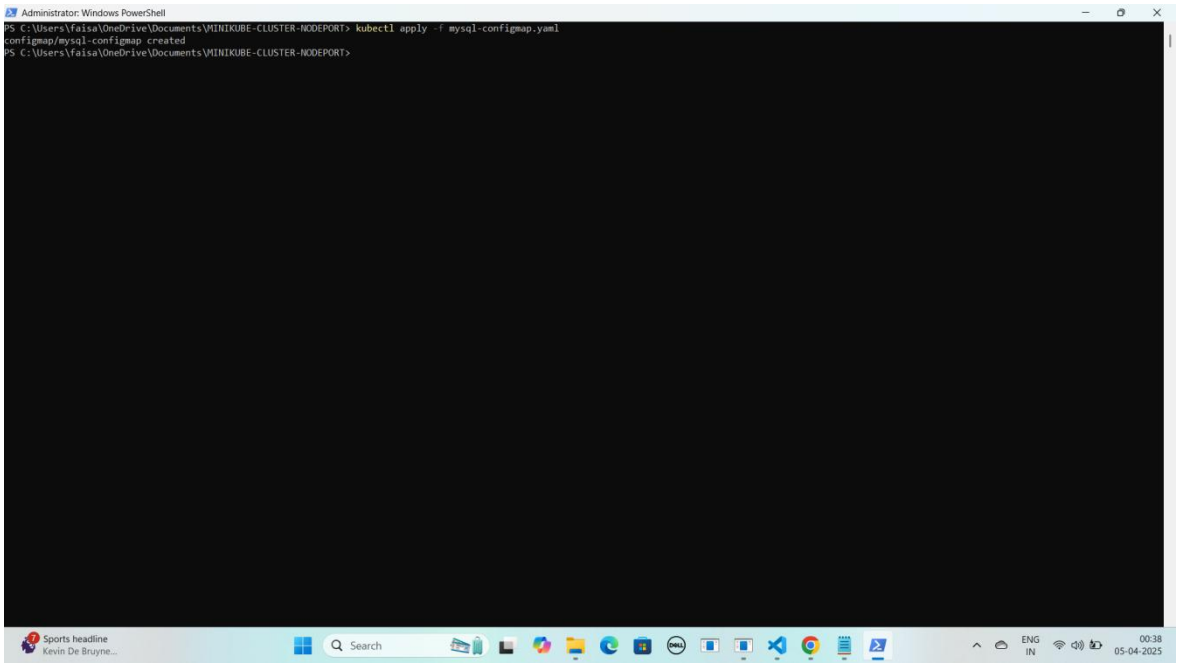
JAISE KI:-

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: mysql-configmap
data:
  MYSQL_DATABASE: "faisal-db"
  MYSQL_HOST: "mysql-headless-service"
  MYSQL_PORT: "3306"
```

ConfigMap Apply Karo

kubectl apply -f mysql-configmap.yaml

YE KUCH ISTARHA LAGEGA



Step 3: service-account.yaml File Ka Kaam

Yeh **file Secrets aur ConfigMaps** ko **access** karne ke liye **permissions** dene ke liye use hoti hai. Isko **Kubernetes Service Account** banane ke liye likha jata hai.

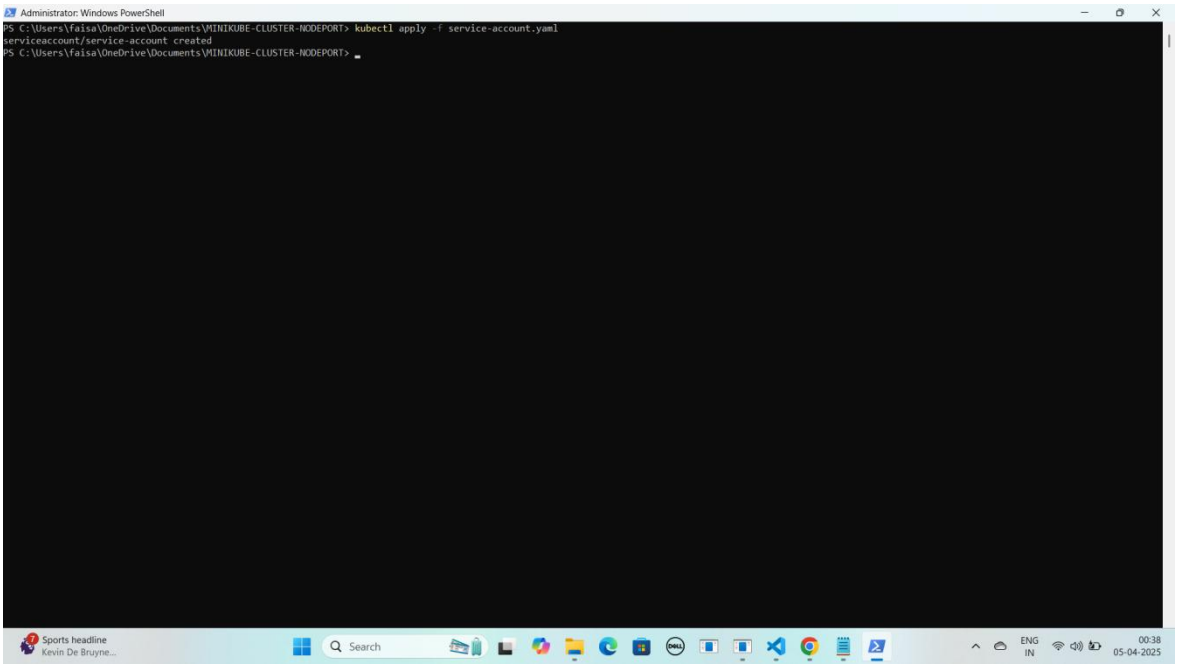
JAISE KI:-

```yaml
apiVersion: v1
kind: ServiceAccount
metadata:
  name: service-account
```

Service Account Apply Karo

kubectl apply -f service-account.yaml

YE KUCH ISTARHA LAGEGA



Step 4: role.yaml File Ka Kaam

Yeh **file Secrets aur ConfigMaps** ke liye **read-only permissions** define karne ke liye use hoti hai. Isko **Kubernetes Role** banane ke liye likha jata hai.

JAISE KI:-

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: read-role
rules:
  - apiGroups: [""]
    resources: ["secrets", "configmaps"]
    verbs: ["get", "list"]
  - apiGroups: [""]
    resources: ["pods"]
    verbs: ["get", "list"]
  - apiGroups: [""]
    resources: ["events"]
    verbs: ["get", "list"]
  - apiGroups: [""]
    resources: ["endpoints"]
    verbs: ["get", "list"]
```

Role Apply Karo

kubectl apply -f role.yaml

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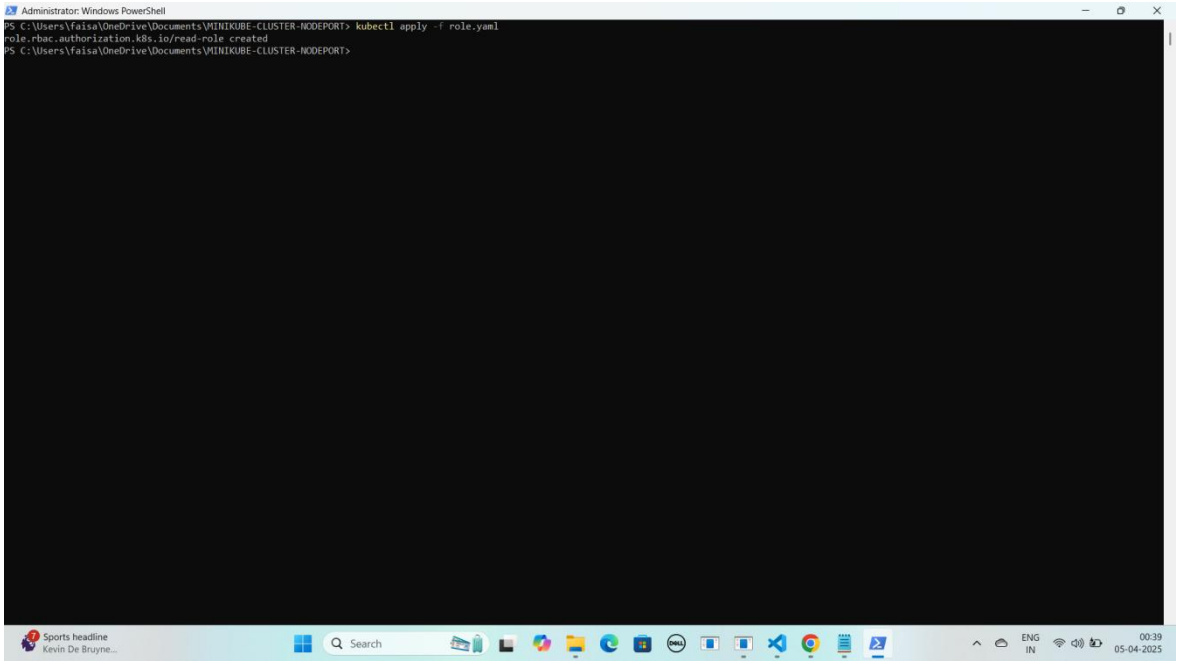

Step 5: rolebinding.yaml File Ka Kaam

Yeh **file Service Account** ko **Secrets aur ConfigMaps** ke liye **read-only permissions** assign karne ke liye use hoti hai. Isko **Kubernetes RoleBinding** banane ke liye likha jata hai.

JAISE KI:-

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: read-write-only-binding
subjects:
  - kind: ServiceAccount
    name: service-account
    namespace: default
roleRef:
  kind: Role
  name: read-role
  apiGroup: rbac.authorization.k8s.io
```

RoleBinding Apply Karo

kubectl apply -f rolebinding.yaml

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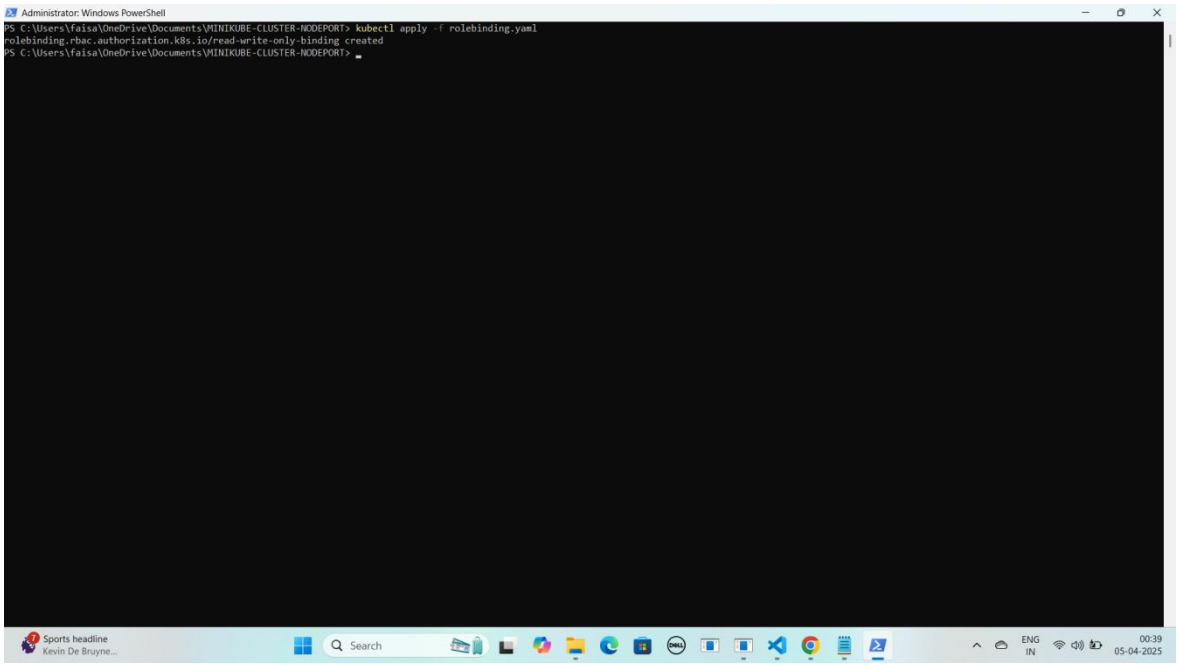


Part 4: MYSQL Database Pods and Services Deployment

Step 1: mysql-headless-service.yaml File Ka Kaam

Yeh **file MySQL pods** ke beech **data synchronization** aur sharing ke liye use hoti hai. Isko **Kubernetes Headless Service** ke taur par define kiya jata hai.

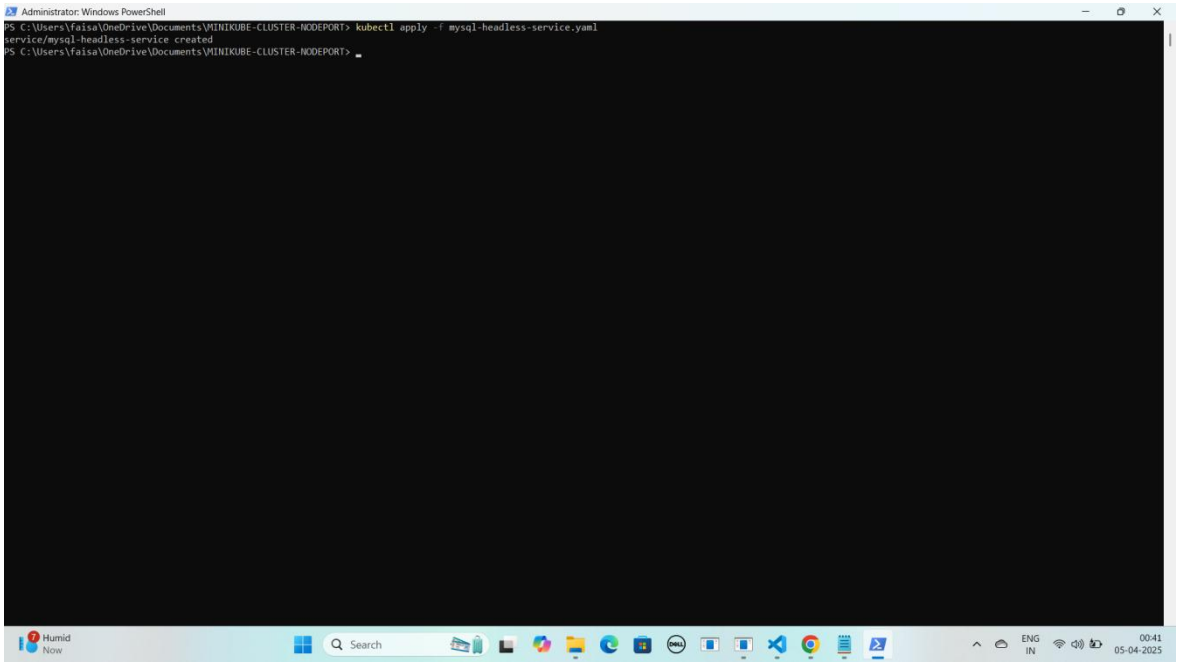
JAISE KI:-

```yaml
apiVersion: v1
kind: Service
metadata:
  name: mysql-headless-service
spec:
  clusterIP: None  # Makes it a headless service
  selector:
    app: mysql
  ports:
    - name: mysql
      port: 3306
      targetPort: 3306
```

Headless Service Apply Karo

kubectl apply -f mysql-headless-service.yaml

YE KUCH ISTARHA LAGEGA



Step 2: mysql-pv.yaml File Ka Kaam

Yeh **file cluster** mein ek **static volume** banane ke liye use hoti hai. Isko **Kubernetes Persistent Volume (PV)** create karne ke liye likha jata hai. Hum **3 PV** create karenge kyunki next step mein **StatefulSet 3 database pods** banayega, jinko **storage** ki zaroorat hogi.

JAISE KI:-

```yaml
apiVersion: v1
kind: PersistentVolume
metadata:
  name: mysql-pv
spec:
  capacity:
    storage: 5Gi
  accessModes:
    - ReadWriteOnce
  persistentVolumeReclaimPolicy: Retain
  hostPath:
    path: "/mnt/mysql-data"
```

```yaml
apiVersion: v1
kind: PersistentVolume
metadata:
  name: mysql-pv-2
```

```yaml
spec:
  capacity:
    storage: 5Gi
  accessModes:
    - ReadWriteOnce
  persistentVolumeReclaimPolicy: Retain
  hostPath:
    path: /mnt/data/mysql2
```

```yaml
apiVersion: v1
kind: PersistentVolume
metadata:
  name: mysql-pv-3
spec:
  capacity:
    storage: 5Gi
  accessModes:
    - ReadWriteOnce
  persistentVolumeReclaimPolicy: Retain
  hostPath:
    path: /mnt/data/mysql-3
```

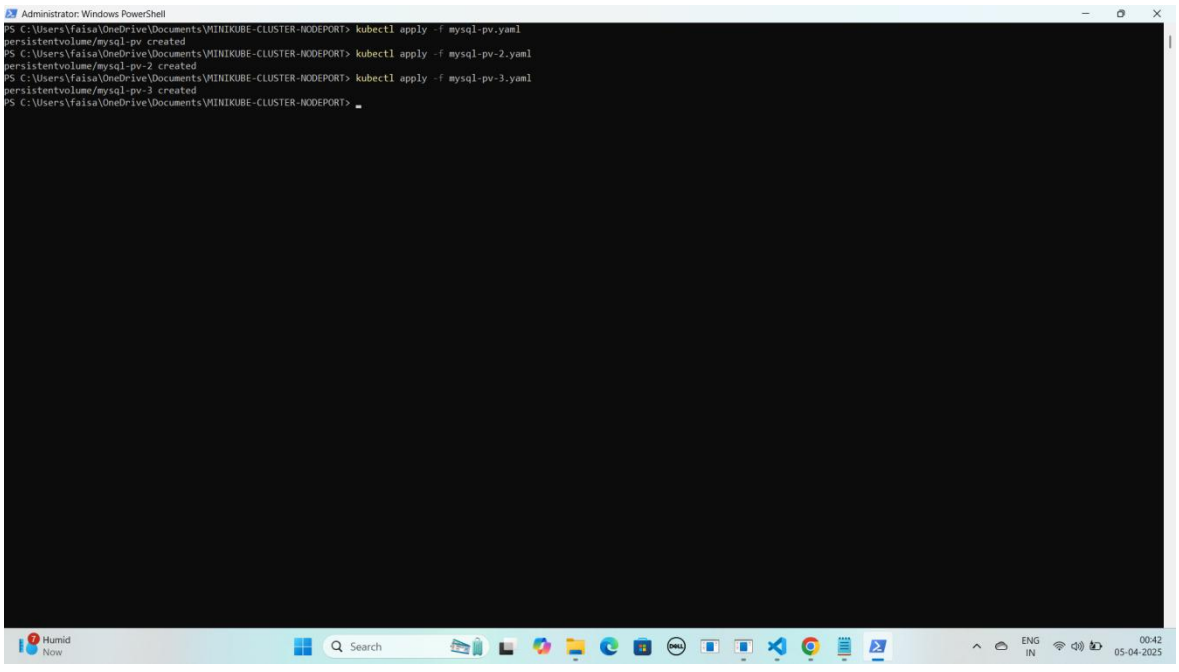
Persistent Volumes Apply Karo

kubectl apply -f mysql-pv.yaml

kubectl apply -f mysql-pv-2.yaml

kubectl apply -f mysql-pv-3.yaml

YE KUCH ISTARHA LAGEGA



Step 3: mysql-statefulset.yaml File Ka Kaam

Yeh **file database** ke liye use hoti hai jisme hum **MySQL ke 3 replicas** define karte hain. Isme **Persistent Volume Claim (PVC)** use hoti hai jo **StatefulSet** ke **deployments** ko **Persistent Volume (PV)** se connect karti hai.

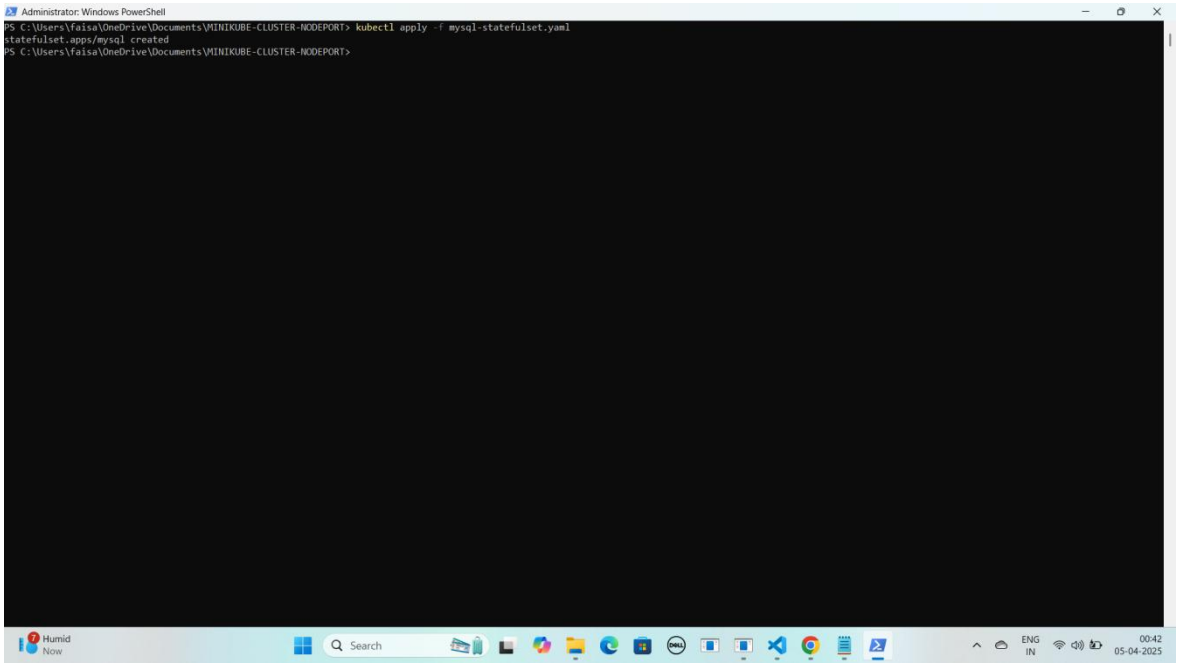
JAISE KI:-

```yaml
apiVersion: apps/v1
kind: StatefulSet
metadata:
  name: mysql
spec:
  serviceName: "mysql-headless-service"  # Links to the headless service
  replicas: 3 # Number of MySQL replicas
  selector:
    matchLabels:
      app: mysql
  template:
    metadata:
      labels:
        app: mysql
    spec:
      containers:
        - name: mysql
          image: mysql:8.0 # MySQL 8.0 image
          ports:
            - containerPort: 3306
          env:
            - name: MYSQL_ROOT_PASSWORD
              valueFrom:
                secretKeyRef:
                  name: mysql-secrets
                  key: MYSQL_PASSWORD
          volumeMounts:
            - name: mysql-data
              mountPath: /var/lib/mysql
  volumeClaimTemplates:
  - metadata:
      name: mysql-data
    spec:
      accessModes:
        - ReadWriteOnce
      resources:
        requests:
          storage: 5Gi
```

StatefulSet Apply Karo

kubectl apply -f mysql-statefulset.yaml

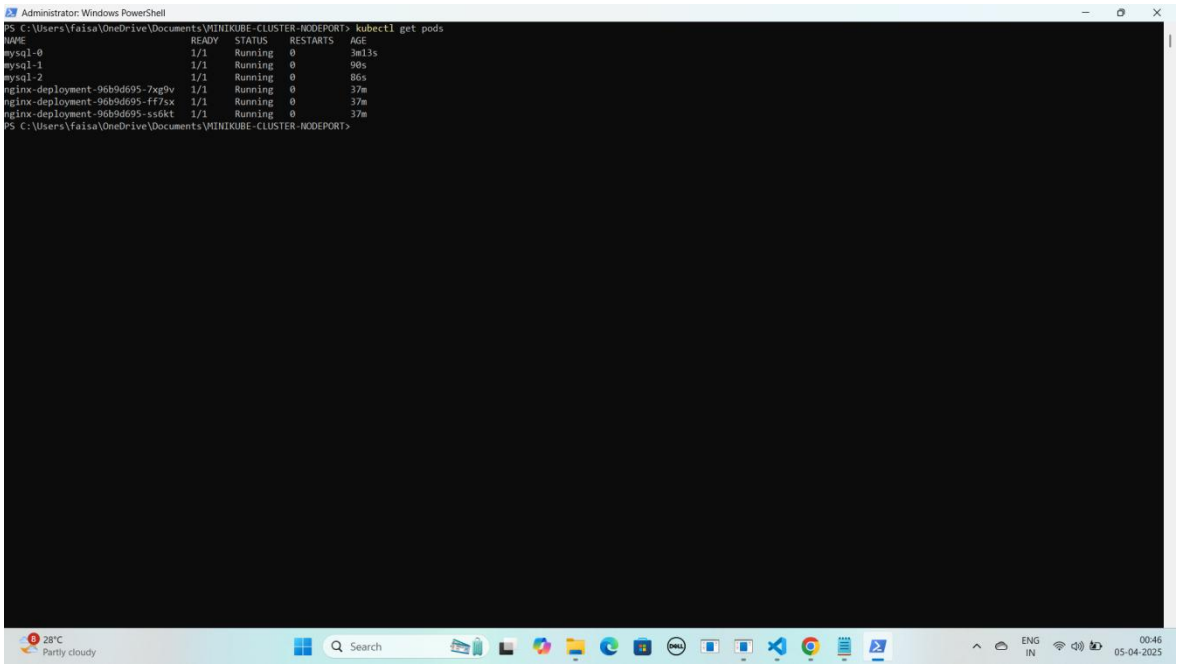
YE KUCH ISTARHA LAGEGA



1. Pods check karne ke liye ye command run kariye

kubectl get pods

YE KUCH ISTARHA LAGEGA

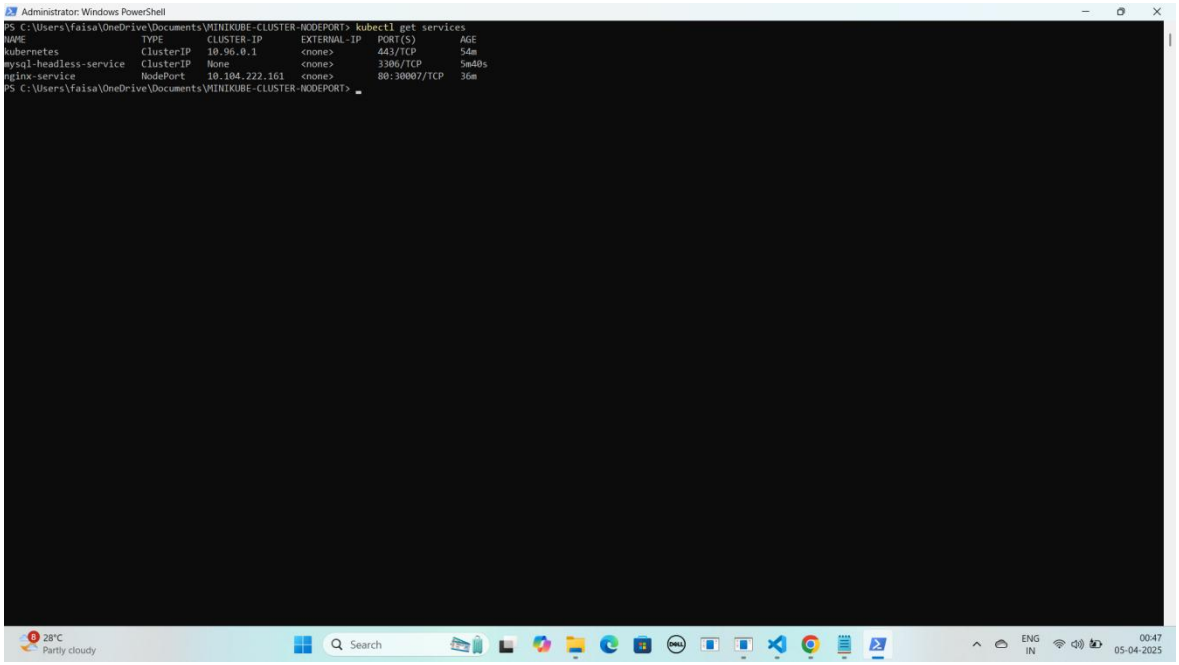


NOTE: Agar sabhi Pods ka STATUS Running show karraha hai to sab kuch sahi hai

2. Serives check karne ke liye ye commad run kariye

kubectl get services

YE KUCH ISTARHA LAGEGA



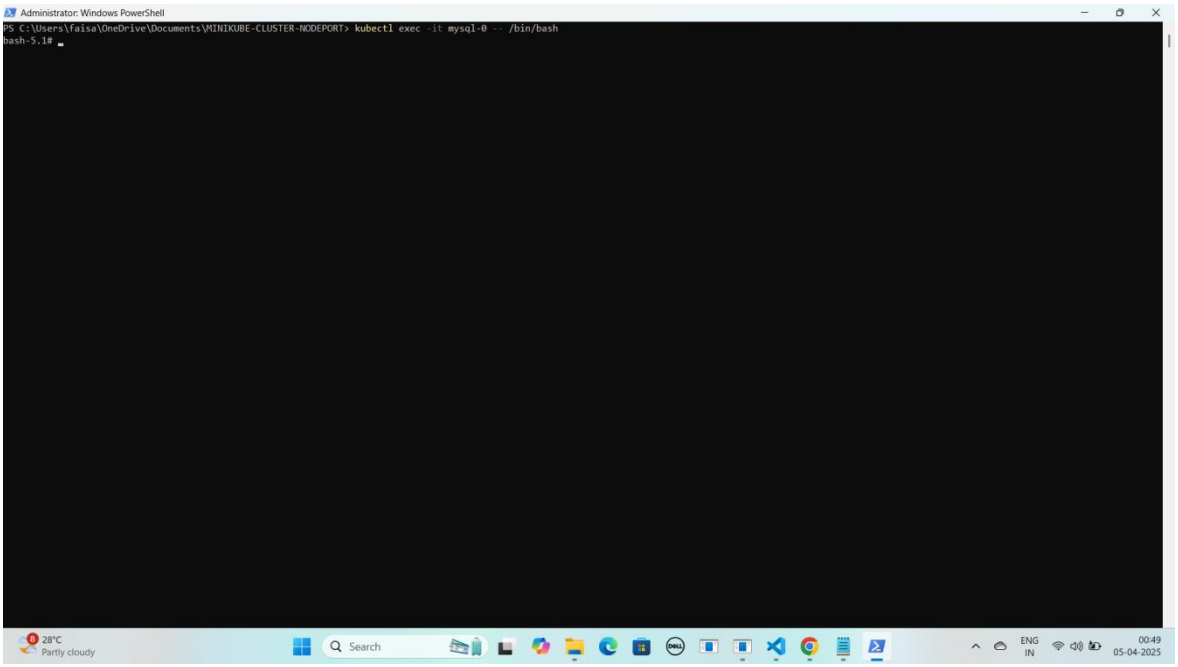
Part 5: Accessing MySQL Database in Minikube Cluster

Step 1: MySQL Database Access Karo

1. Pod ke andar jane ke liye ye command run karo

kubectl exec -it mysql-0 -- /bin/bash

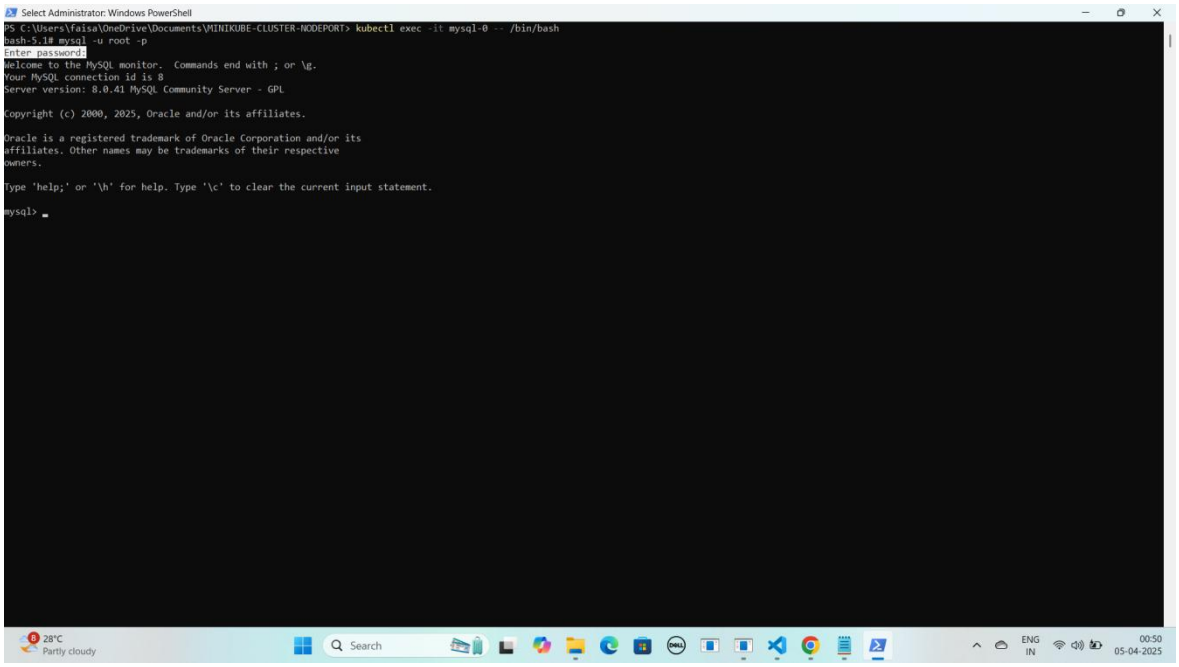
YE KUCH ISTARHA LAGEGA



2. MySQL database se connect karne ke liye ye command kuch istarha hogi

mysql -u root -p

YE KUCH ISTARHA LAGEGA

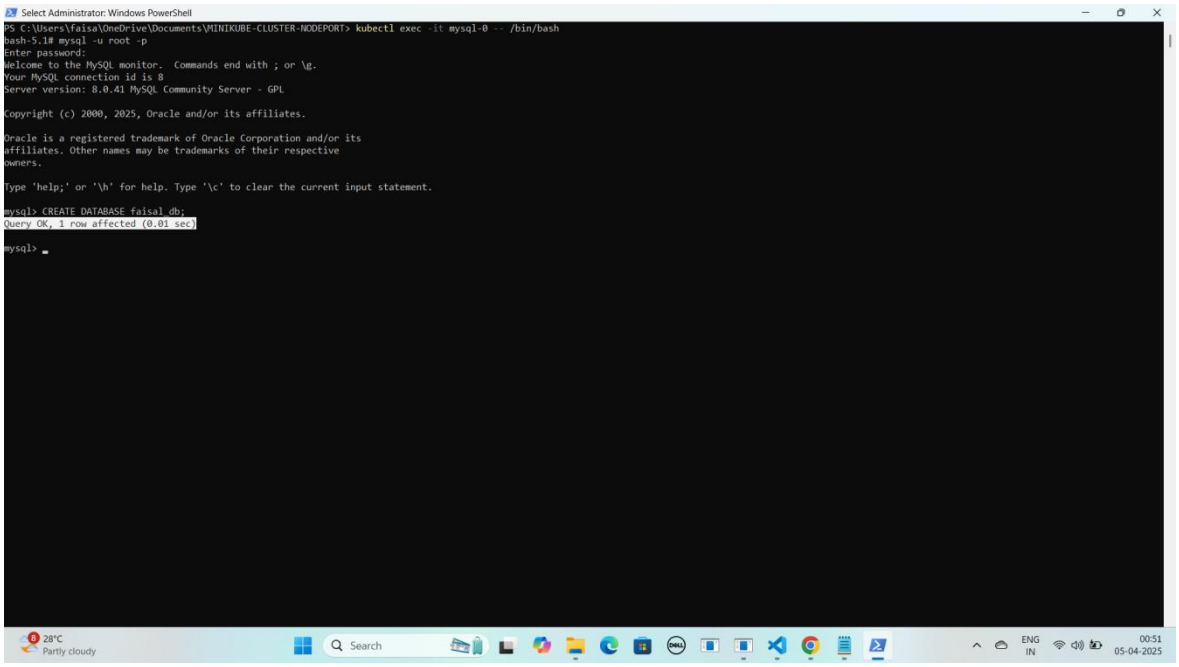


Note: Jab aap se password maanga jaaye, to wahi password use karein jo pehle Base64 encode karke mysql-secrets.yaml file me store kiya gaya tha. Maine 'Faisalkhan35@' diya tha, lekin password enter karte waqt yeh screen par show nahi hoga.

3. Database create karne keliye ye command run karo

CREATE DATABASE faisal_db;

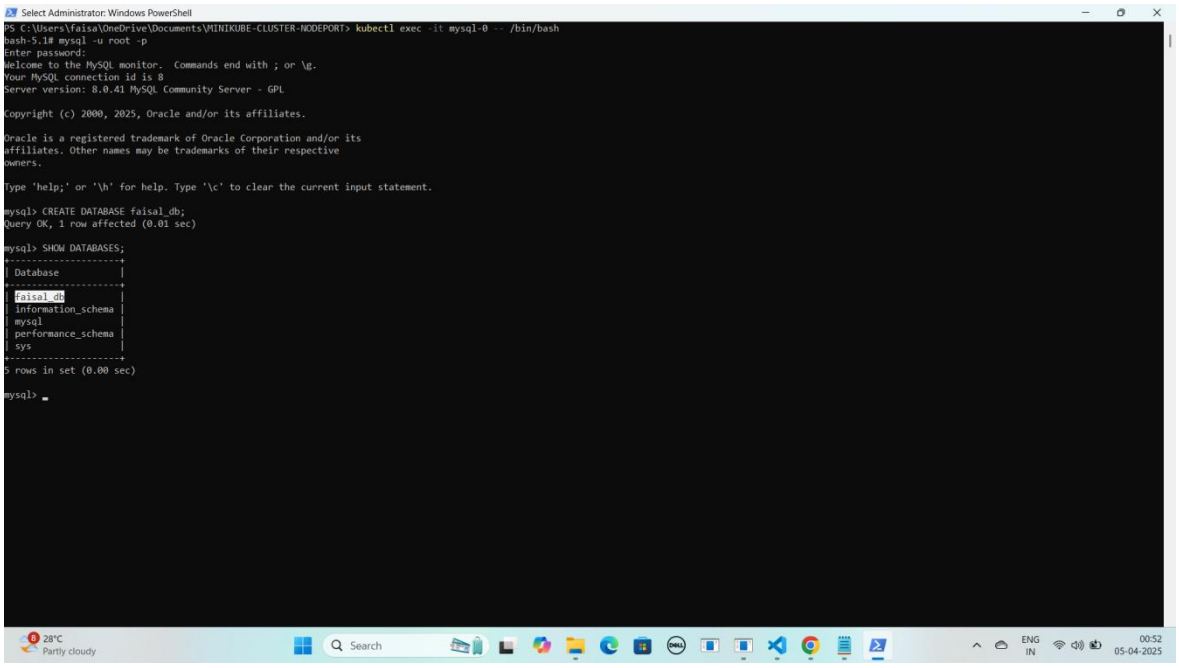
YE KUCH ISTARHA LAGEGA



4. Databases check karne ke liye ye command run kariye

SHOW DATABASES;

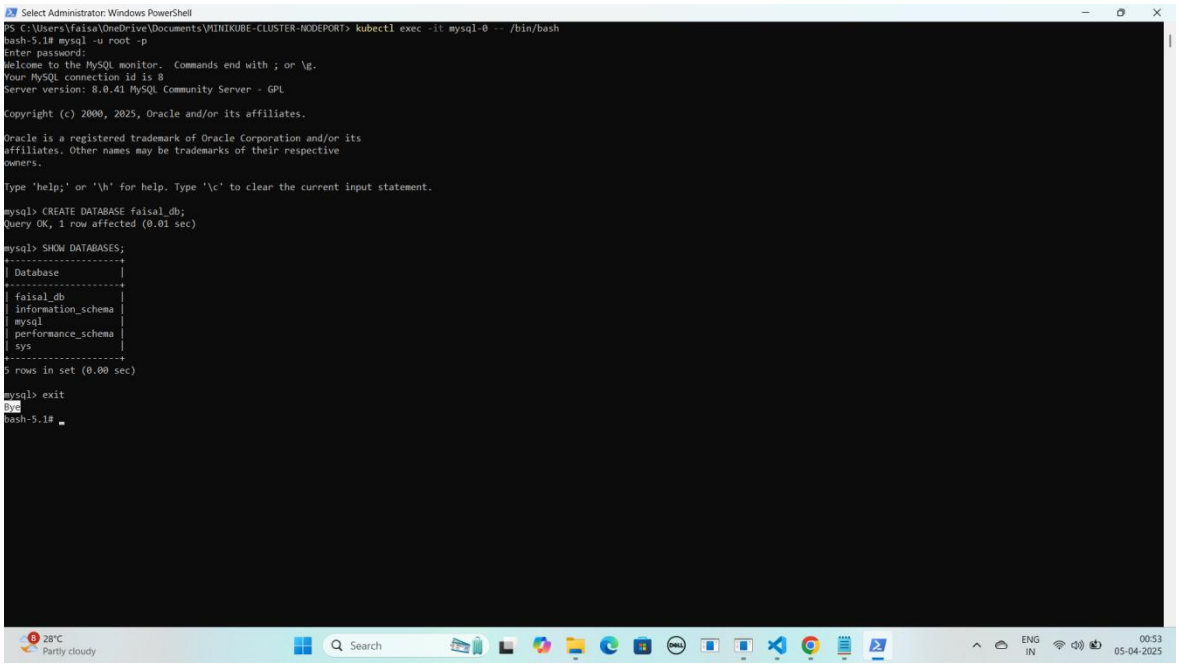
YE KUCH ISTARHA LAGEGA



5. Ab MYSQL database se exit hoagaye exit hone ke liye exit type kariye

exit

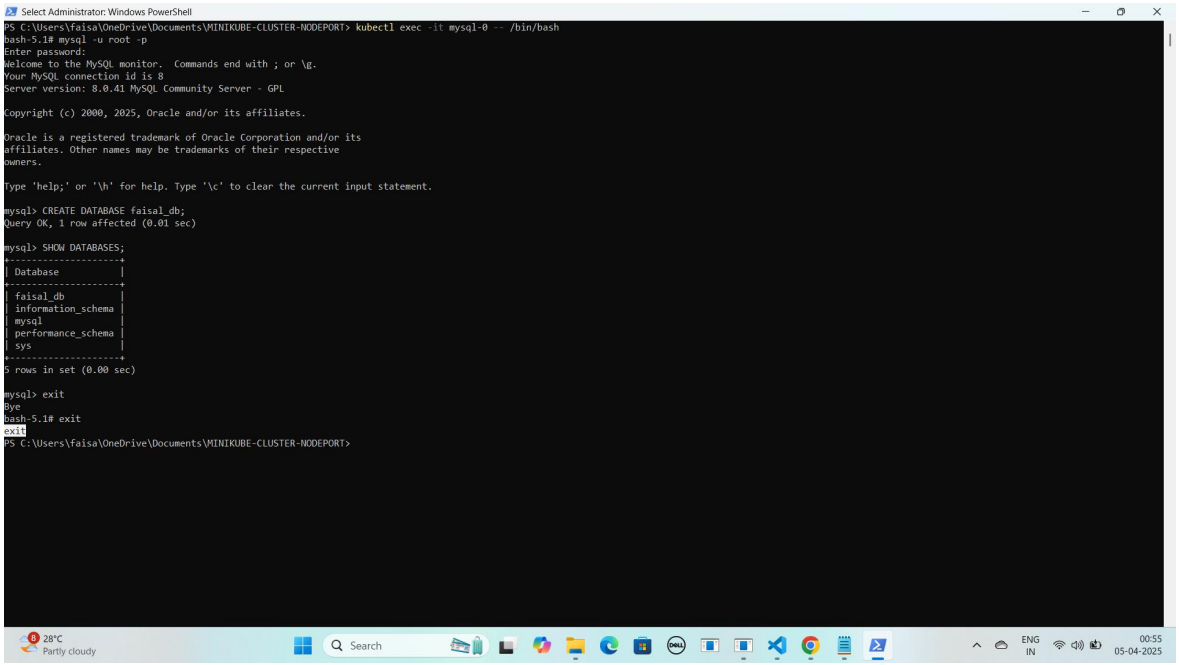
YE KUCH ISTARHA LAGEGA



6. Ab MYSQL database Pod se bhi exit hoagaye exit hone ke liye exit type kariye

exit

YE KUCH ISTARHA LAGEGA



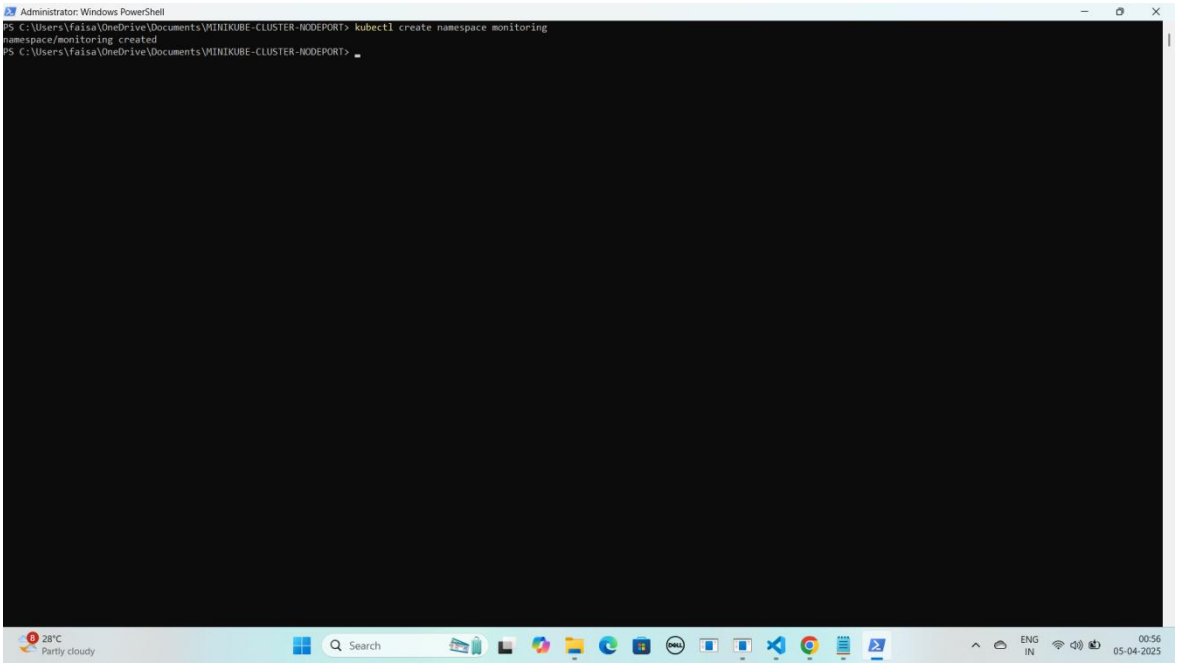
NOTE : Aapko faisal_db naam ka database dikhega, aur isi tarah aap mysql-1 aur mysql-2 ke liye bhi access kar sakte hain.

Part 6: Monitoring Using Prometheus and Loki With Grafana

Kubernetes me ek naya namespace 'monitoring' create karna hoga. Namespace create karne ke liye ye command run kariye:

kubectl create namespace monitoring

YE KUCH ISTARHA LAGEGA



Step 1: prometheus-daemonset.yaml File Ka Kaam

Yeh **file Prometheus monitoring tool deploy** karne ke liye use hoti hai. Isko **cluster ka CPU usage, memory, aur network monitor** karne ke liye **Kubernetes DaemonSet** ke andar likha jata hai.

JAISE KI:-

```yaml
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: prometheus
  namespace: monitoring
spec:
  selector:
    matchLabels:
      app: prometheus
  template:
    metadata:
      labels:
        app: prometheus
    spec:
      containers:
        - name: prometheus
          image: prom/prometheus:v2.31.1
          args:
            - "--config.file=/etc/prometheus/prometheus.yml"
            - "--storage.tsdb.path=/prometheus"
            - "--web.enable-lifecycle"
          volumeMounts:
            - name: prometheus-config
              mountPath: /etc/prometheus
            - name: prometheus-storage
              mountPath: /prometheus
      volumes:
        - name: prometheus-config
          configMap:
            name: prometheus-config
        - name: prometheus-storage
          emptyDir: {}

---
apiVersion: v1
kind: ConfigMap
metadata:
  name: prometheus-config
  namespace: monitoring
data:
  prometheus.yml: |
    global:
      scrape_interval: 15s  # Default scrape interval for all jobs
```

```yaml
    scrape_configs:
      # Kubernetes Nodes Service Discovery for Node Exporters
      - job_name: 'kubernetes-nodes'
        kubernetes_sd_configs:
          - role: node  # Specify the role as 'node'
        relabel_configs:
          - source_labels: [__meta_kubernetes_node_name]  # Scrape metrics from nodes
            target_label: kubernetes_node
```

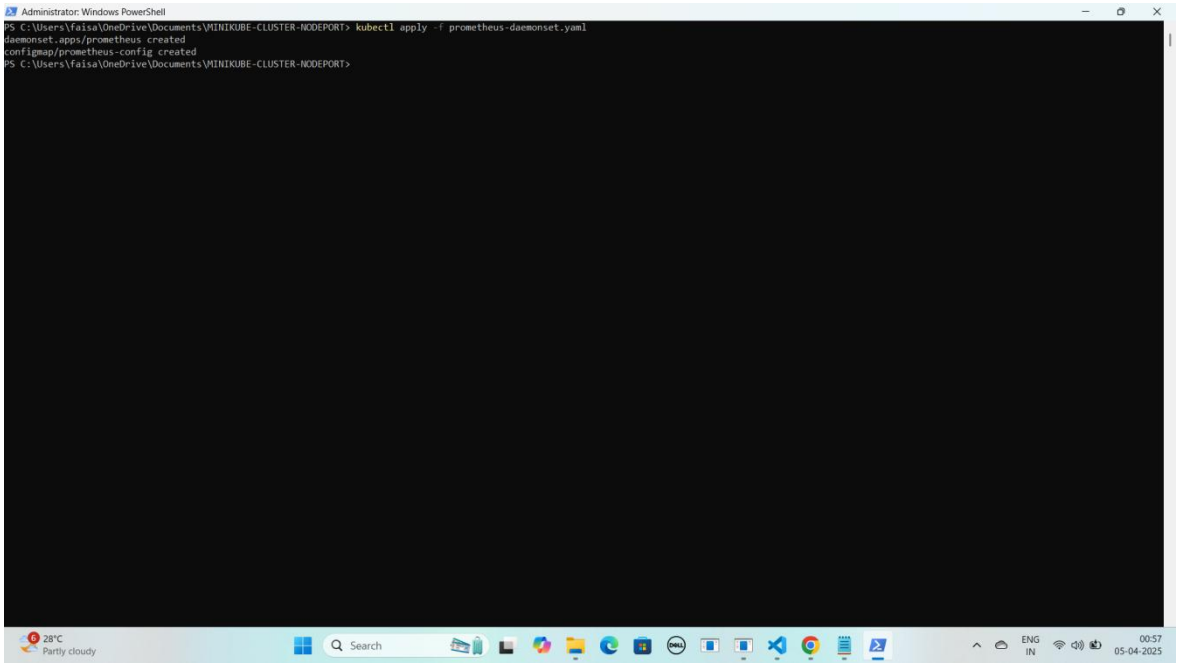
```
        - source_labels: [__meta_kubernetes_node_label_kubernetes_io_hostname]  # Include the
node hostname as a label
          target_label: kubernetes_hostname
```

```
    # Kubernetes Pods Service Discovery (for scraping Kubernetes pods)
    - job_name: 'kubernetes-pods'
      kubernetes_sd_configs:
        - role: pod  # Scrape all pods (can be further refined with relabeling)
      relabel_configs:
        - source_labels: [__meta_kubernetes_pod_label_app]  # Use pod labels for further
filtering
          target_label: app
```

Prometheus DaemonSet Apply Karo

kubectl apply -f prometheus-daemonset.yaml

YE KUCH ISTARHA LAGEGA



Step 2: prometheus-rbac.yaml File Ka Kaam

Yeh **file Prometheus** ko **required permissions** dene ke liye use hoti hai, taake woh **cluster** ke **resources** ko **access** kar sake.

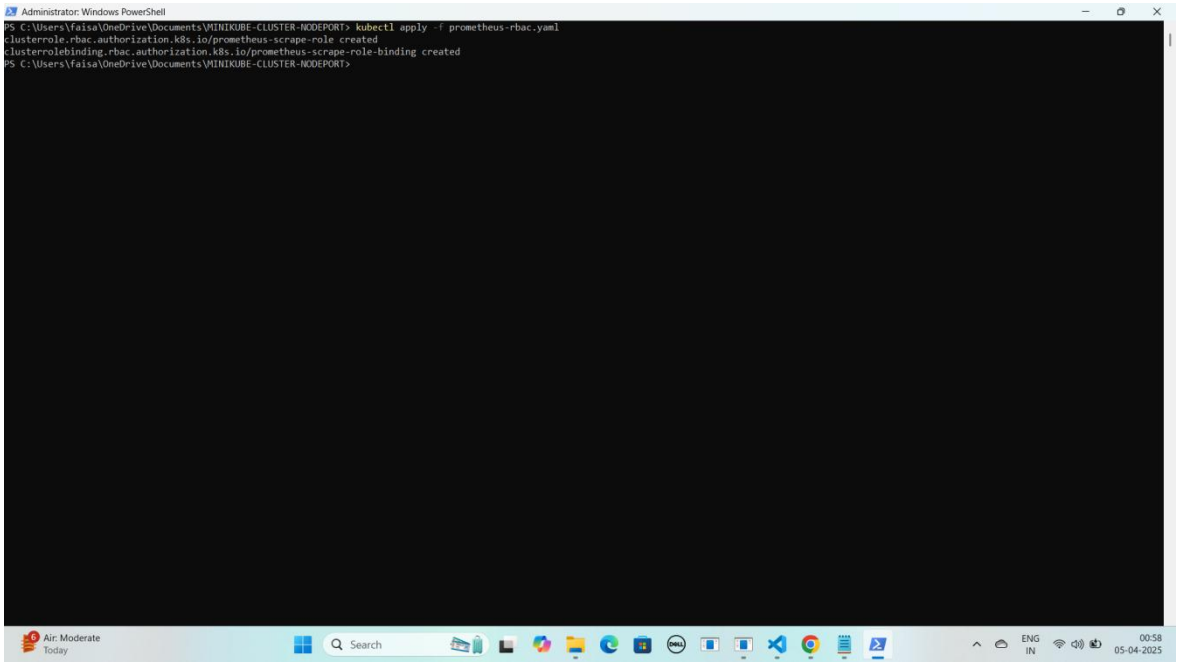
JAISE KI:-

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: prometheus-scrape-role
rules:
  - apiGroups: [""]
    resources: ["pods", "nodes"]
    verbs: ["get", "list", "watch"]
  - apiGroups: ["metrics.k8s.io"]
    resources: ["nodes", "pods"]
    verbs: ["get", "list", "watch"]
  - apiGroups: ["apps"]
    resources: ["deployments", "replicasets", "daemonsets"]
    verbs: ["get", "list", "watch"]
  - apiGroups: ["extensions"]
    resources:  ["ingresses"]
    verbs: ["get", "list", "watch"]
  - apiGroups: [""]
    resources: ["services", "endpoints"]
    verbs: ["get", "list", "watch"]
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: prometheus-scrape-role-binding
subjects:
  - kind: ServiceAccount
    name: default
    namespace: monitoring
roleRef:
  kind: ClusterRole
  name: prometheus-scrape-role
  apiGroup: rbac.authorization.k8s.io
```

Prometheus RBAC Apply Karo

kubectl apply -f prometheus-rbac.yaml

YE KUCH ISTARHA LAGEGA



Step 3: prometheus-nodeport-service.yaml File Ka Kaam

Yeh **file Prometheus** ko port **30090** par **NodePort service** ke zariye **expose** karne ke liye use hoti hai, taake hum usko **browser** me **access** kar sakein.

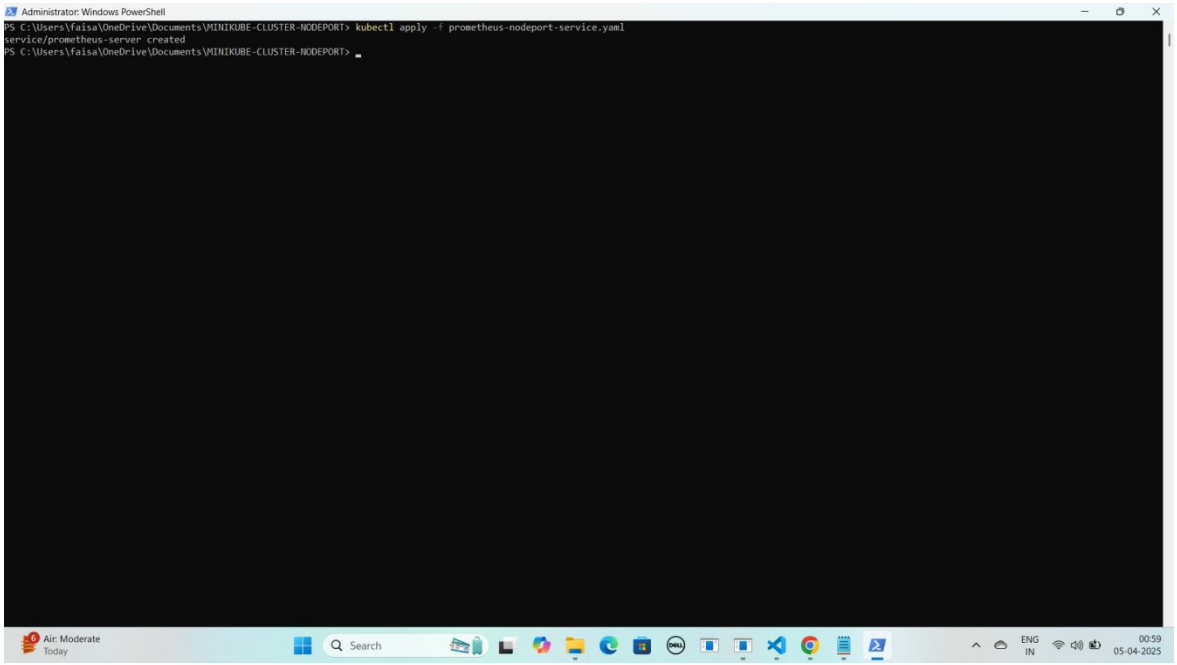
JAISE KI:-

```yaml
apiVersion: v1
kind: Service
metadata:
  name: prometheus-server
  namespace: monitoring
spec:
  ports:
    - port: 80
      targetPort: 9090
      nodePort: 30090
  selector:
    app: prometheus
  type: NodePort
```

Prometheus Service Apply Karo

kubectl apply -f prometheus-nodeport-service.yaml

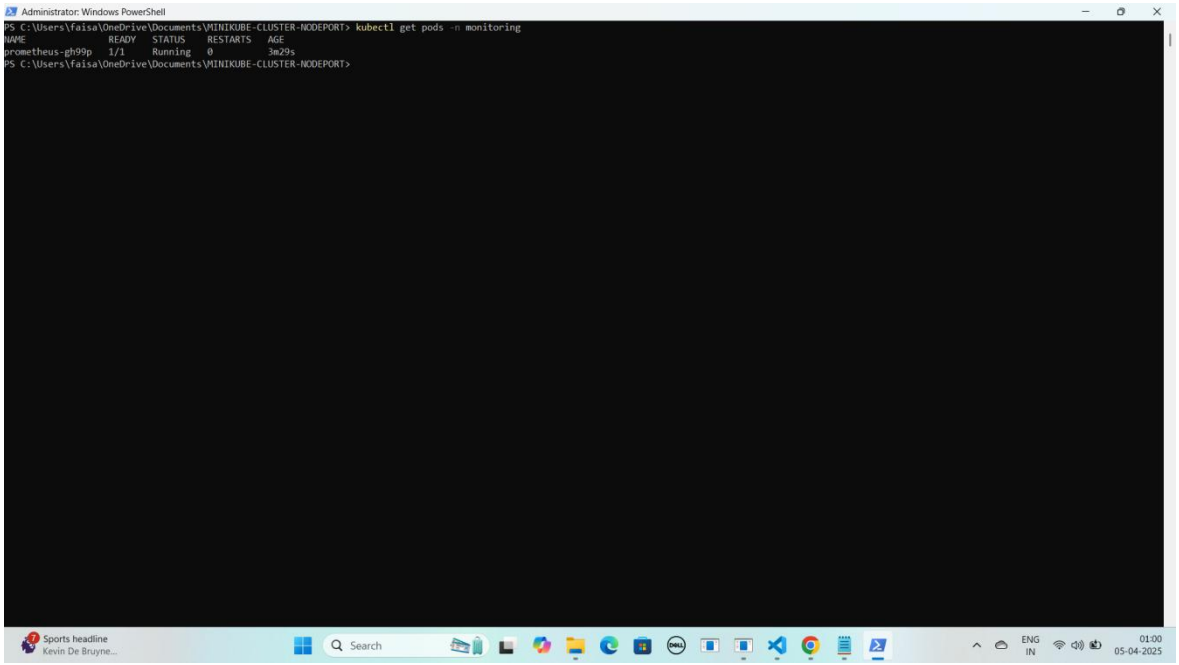
YE KUCH ISTARHA LAGEGA



1. Pods check karne ke liye ye command run kariye

kubectl get pods -n monitoring

YE KUCH ISTARHA LAGEGA

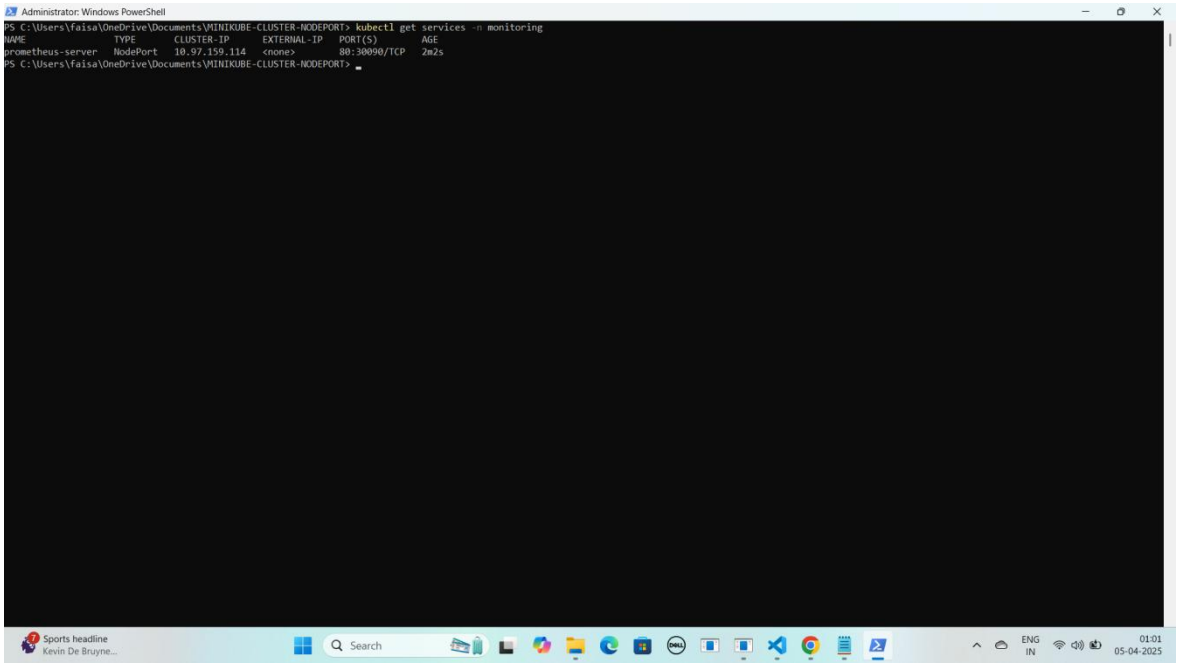


NOTE: Agar STATUS Running show karraha hai to sab kuch sahi hai

2. Serives check karne ke liye ye commad run kariye

kubectl get services -n monitoring

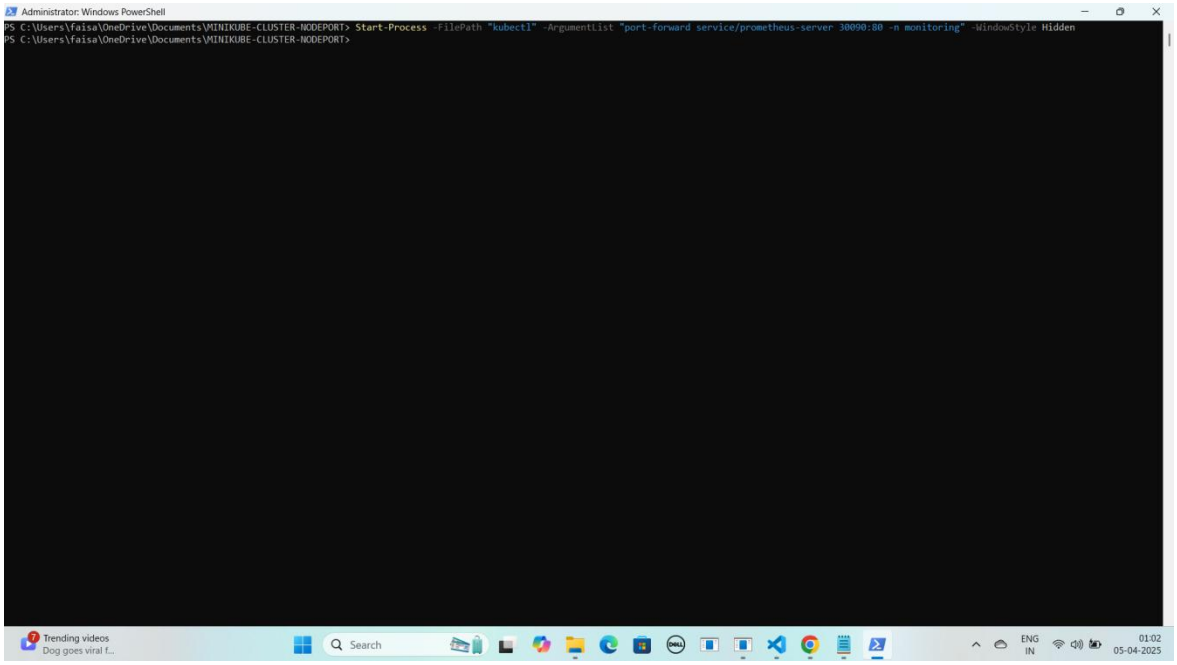
YE KUCH ISTARHA LAGEGA



3. Port Forwarding Karne ke liye ye command run karein

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/prometheus-server 30090:80 -n monitoring" -WindowStyle Hidden

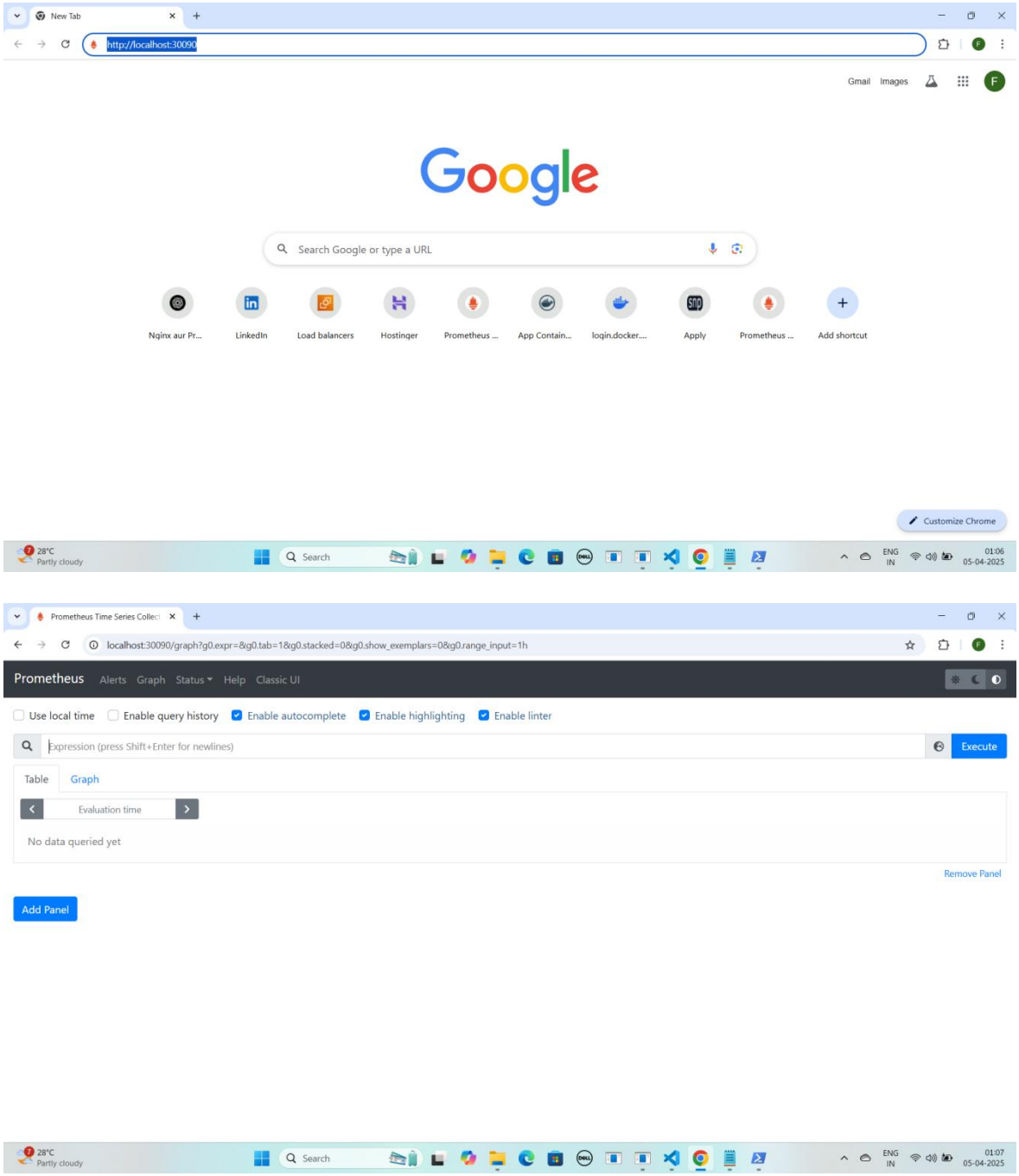
YE KUCH ISTARHA LAGEGA



NOTE: Ab aapka Prometheus expose ho chuka hai. Ab apne local system par Prometheus ko NodePort ke saath browser me run kariye. Jaise ki mere case me kuch aisa hoga

Prometheus: http://localhost:30090

YE KUCH ISTARHA LAGEGA

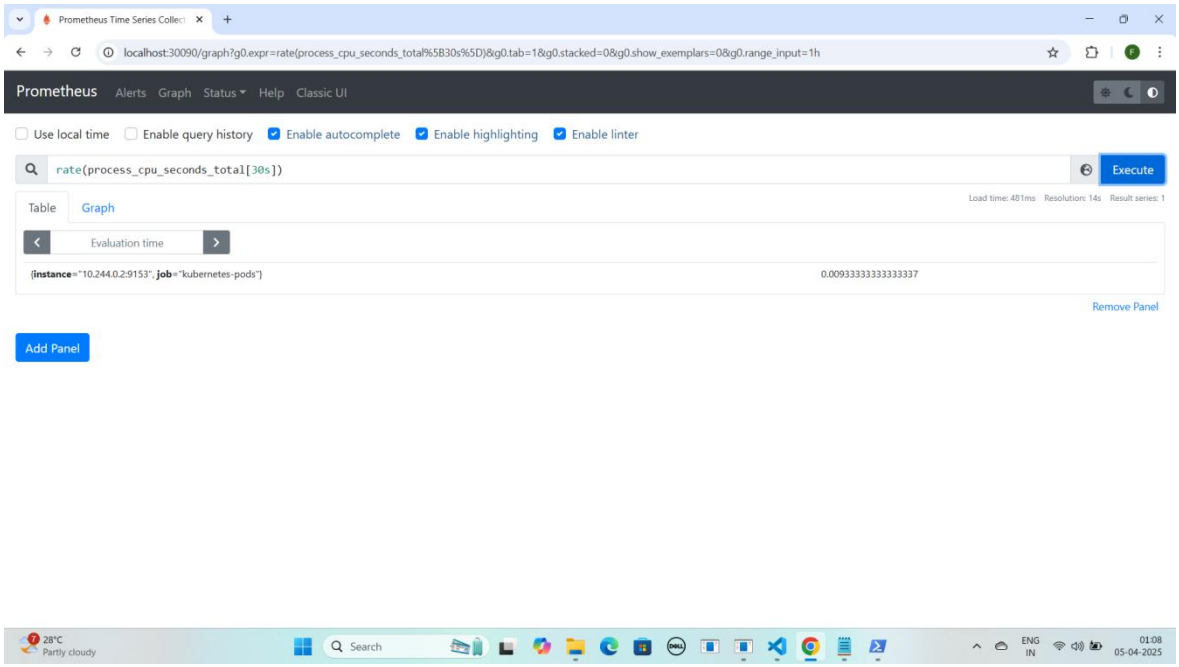


4. CPU usage check karne ke liye Prometheus me ye command run karein:

rate(process_cpu_seconds_total[30s])

Note: Command Prometheus me paste karne ke baad Execute pe click karein.

YE KUCH ISTARHA LAGEGA

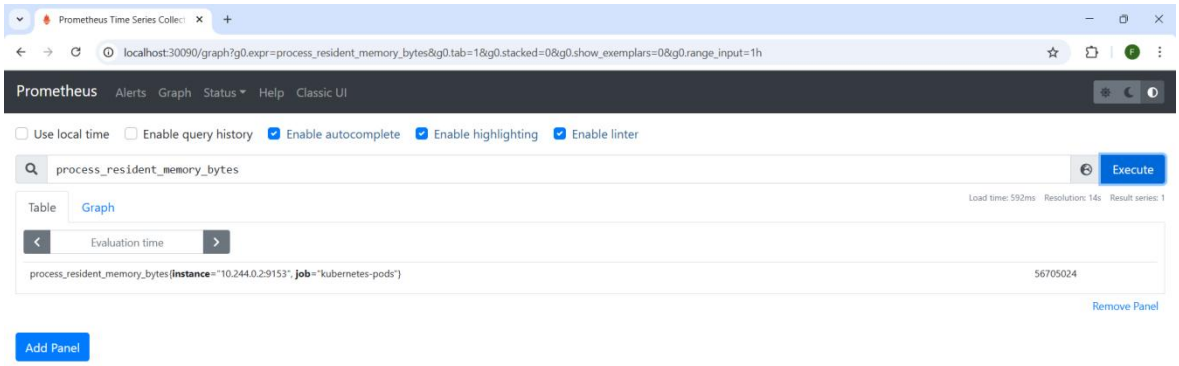


5. Memory usage check karne ke liye Prometheus me ye command run karein

process_resident_memory_bytes

Note: Command Prometheus me paste karne ke baad Execute pe click karein.

YE KUCH ISTARHA LAGEGA



Step 4: promtail-daemonset.yaml File Ka Kaam

Yeh **file cluster** se **logs collect** karne aur unhe **Loki** par bhejne ke liye use hoti hai.

JAISE KI:-

```yaml
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: promtail
  namespace: monitoring
  labels:
    app: promtail
spec:
  selector:
    matchLabels:
      app: promtail
  template:
    metadata:
      labels:
        app: promtail
    spec:
      serviceAccountName: promtail
      containers:
        - name: promtail
          image: grafana/promtail:2.3.0
          args:
            - -config.file=/etc/promtail/promtail.yaml
          volumeMounts:
            - name: config
              mountPath: /etc/promtail
            - name: varlog
              mountPath: /var/log
            - name: containers
              mountPath: /var/log/containers
              readOnly: true
            - name: docker
              mountPath: /var/lib/docker/containers
              readOnly: true
      volumes:
        - name: config
          configMap:
            name: promtail-config
        - name: varlog
          hostPath:
            path: /var/log
        - name: containers
          hostPath:
            path: /var/log/containers
        - name: docker
          hostPath:
            path: /var/lib/docker/containers

---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: promtail
rules:
- apiGroups: [""]
  resources:
  - pods
  - nodes
```

```
  - namespaces
  verbs:
  - get
  - watch
  - list
```

```
---
```

```
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: promtail
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: promtail
subjects:
- kind: ServiceAccount
  name: promtail
  namespace: monitoring
```

```
---
apiVersion: v1
kind: ServiceAccount
metadata:
  name: promtail
  namespace: monitoring
```

```
---
apiVersion: v1
kind: ConfigMap
metadata:
  name: promtail-config
  namespace: monitoring
data:
  promtail.yaml: |
    server:
      http_listen_port: 9080
      grpc_listen_port: 0
```

```
    positions:
      filename: /tmp/positions.yaml
```

```
    clients:
      - url: http://loki:3100/loki/api/v1/push
```

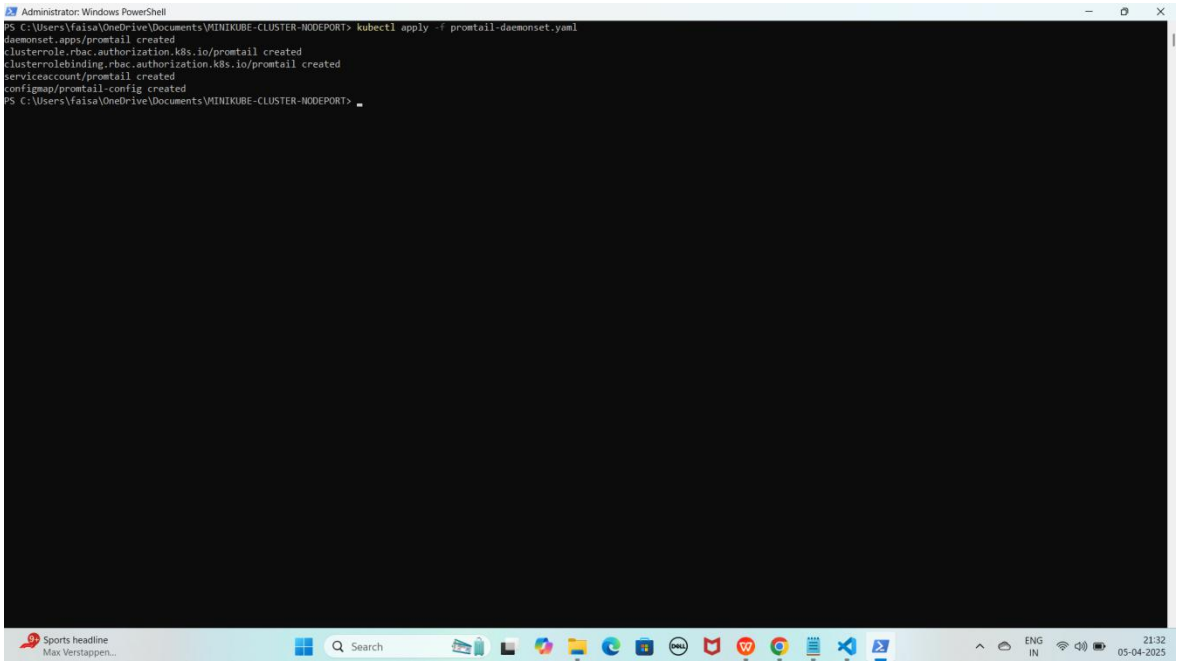
```
    scrape_configs:
      - job_name: system
        static_configs:
          - targets:
              - localhost
            labels:
              job: varlogs
              __path__: /var/log/**/*.log
```

```
      - job_name: containers
        static_configs:
          - targets:
              - localhost
            labels:
              job: containers
              __path__: /var/log/containers/*.log
```

Promtail DaemonSet Apply Karo

kubectl apply -f promtail-daemonset.yaml

YE KUCH ISTARHA LAGEGA



Step 5: loki-daemonset.yaml File Ka Kaam

Yeh **file Loki** ko ek **logs database** ke taur par **setup** karne ke liye use hoti hai, jo **Promtail** se **logs collect** karke **store** karta hai.

JAISE KI:-

```yaml
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name:  loki
  namespace: monitoring
spec:
  selector:
    matchLabels:
      app: loki
  template:
    metadata:
      labels:
        app: loki
    spec:
      serviceAccountName: loki
      containers:
        - name: loki
          image: grafana/loki:2.3.0
          args:
            - "-config.file=/etc/loki/loki-config.yaml"
          ports:
            - containerPort: 3100
              name: http
          resources:
```

```
          requests:
            cpu: "500m"
            memory: "512Mi"
          limits:
            cpu: "1"
            memory: "1Gi"
        volumeMounts:
          - name: loki-config
            mountPath: /etc/loki/loki-config.yaml
            subPath: loki-config.yaml
    volumes:
      - name: loki-config
        configMap:
          name: loki-config
          items:
            - key: loki-config.yaml
              path: loki-config.yaml

---
```

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: loki-config
  namespace: monitoring
data:
  loki-config.yaml: |
    auth_enabled: false  # Disable authentication explicitly
```

```
    server:
      http_listen_port: 3100
```

```
    distributor:
      ring:
        kvstore:
          store: inmemory
```

```
    ingester:
      lifecycler:
        ring:
          kvstore:
            store: inmemory
          replication_factor: 1
      chunk_idle_period: 5m
      chunk_retain_period: 30s
      max_transfer_retries: 0
```

```
    schema_config:
      configs:
        - from: 2020-10-24
          store: boltdb-shipper
          object_store: filesystem
          schema: v11
          index:
            prefix: index_
            period: 24h
```

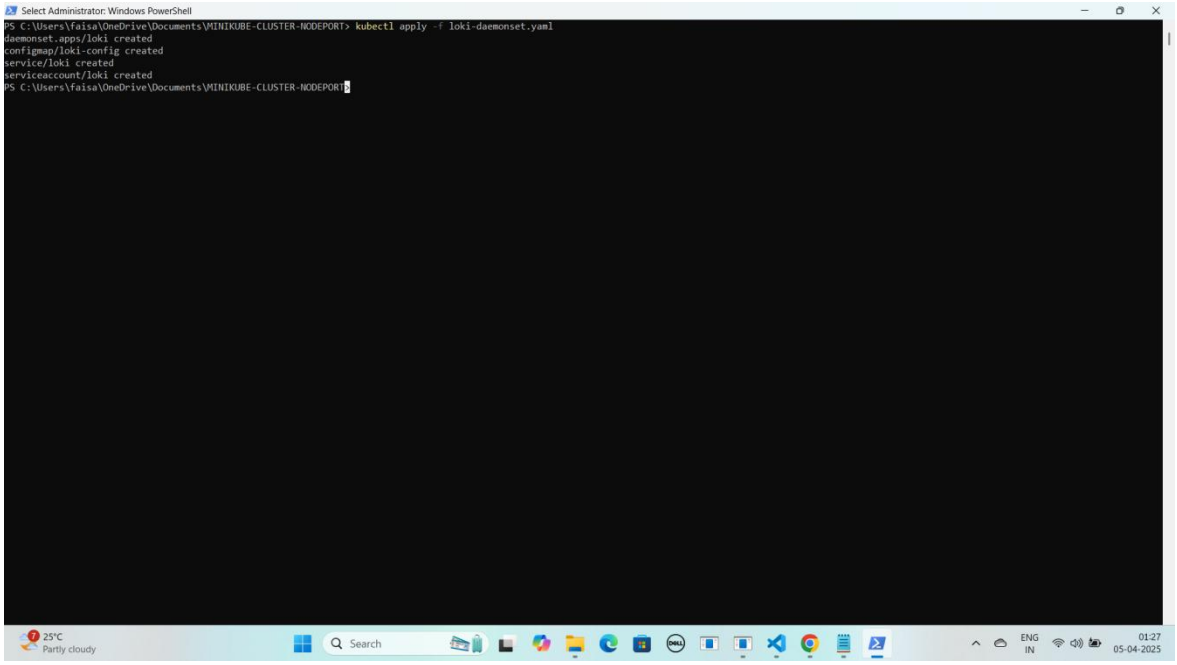
```
    storage_config:
      boltdb_shipper:
        active_index_directory: /loki/index
```

```
        cache_location: /loki/cache
        shared_store: filesystem
      filesystem:
        directory: /loki/chunks

    compactor:
      working_directory: /loki/compactor
      shared_store: filesystem
      compaction_interval: 5m

    limits_config:
      enforce_metric_name: false
      reject_old_samples: true
      reject_old_samples_max_age: 168h

    chunk_store_config:
      max_look_back_period: 0s

    table_manager:
      retention_deletes_enabled: true
      retention_period: 168h

---

apiVersion: v1
kind: Service
metadata:
  name:  loki
  namespace: monitoring
spec:
  type: ClusterIP
  ports:
    - port: 3100
      targetPort: 3100
  selector:
    app: loki

---

apiVersion: v1
kind: ServiceAccount
metadata:
  name: loki
  namespace: monitoring
```

Loki DaemonSet Apply Karo

kubectl apply -f loki-daemonset.yaml

YE KUCH ISTARHA LAGEGA



Step 6: loki-nodeport-service.yaml File Ka Kaam

Yeh **file Loki** ko **expose** karne ke liye use hoti hai, taake hum **port 30091** ke zariye usko **access** kar sakein. Isko **Kubernetes NodePort Service** ke andar likha jata hai.

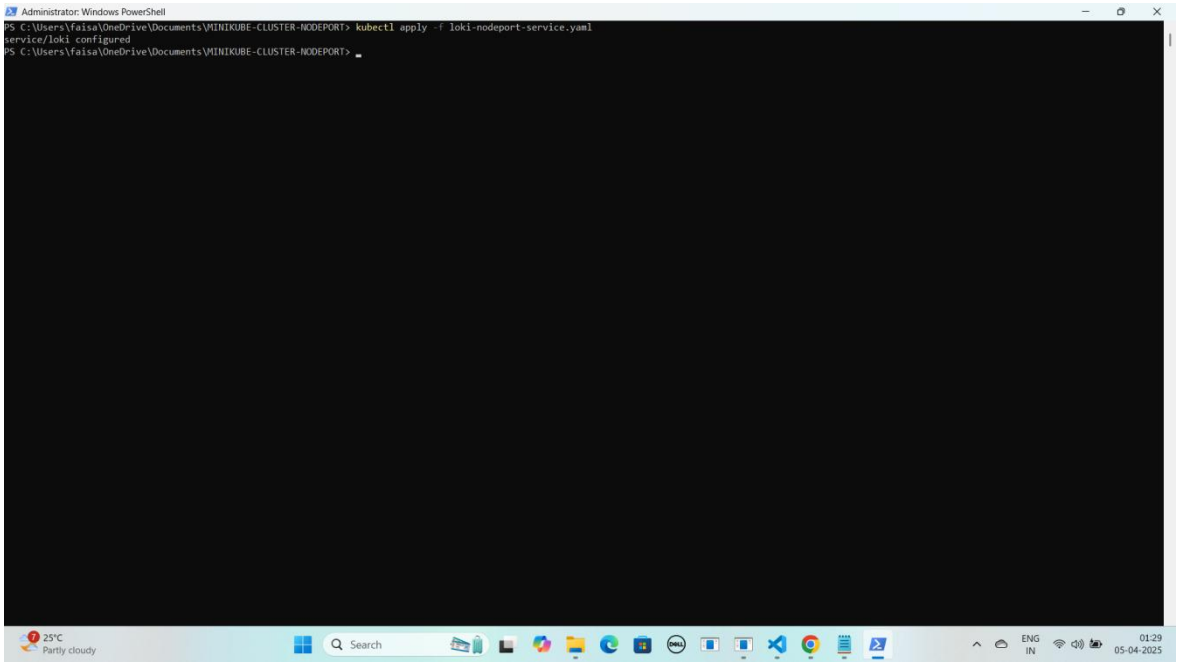
JAISE KI:-

```yaml
apiVersion: v1
kind: Service
metadata:
  name:  loki
  namespace: monitoring
spec:
  ports:
    - port: 3100
      targetPort: 3100
      nodePort: 30091  # This exposes Loki on port 30091
  selector:
    app: loki
  type: NodePort
```

Loki Service Apply Karo

kubectl apply -f loki-nodeport-service.yaml

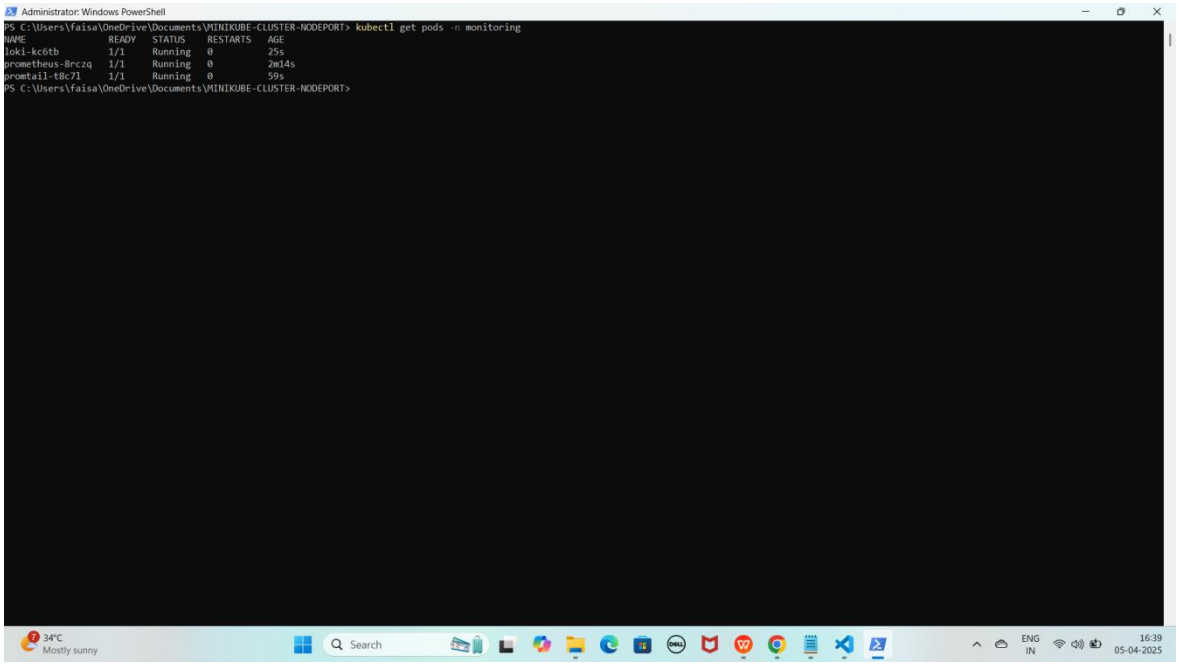
YE KUCH ISTARHA LAGEGA



1. Pods check karne ke liye ye command run kariye

kubectl get pods -n monitoring

YE KUCH ISTARHA LAGEGA

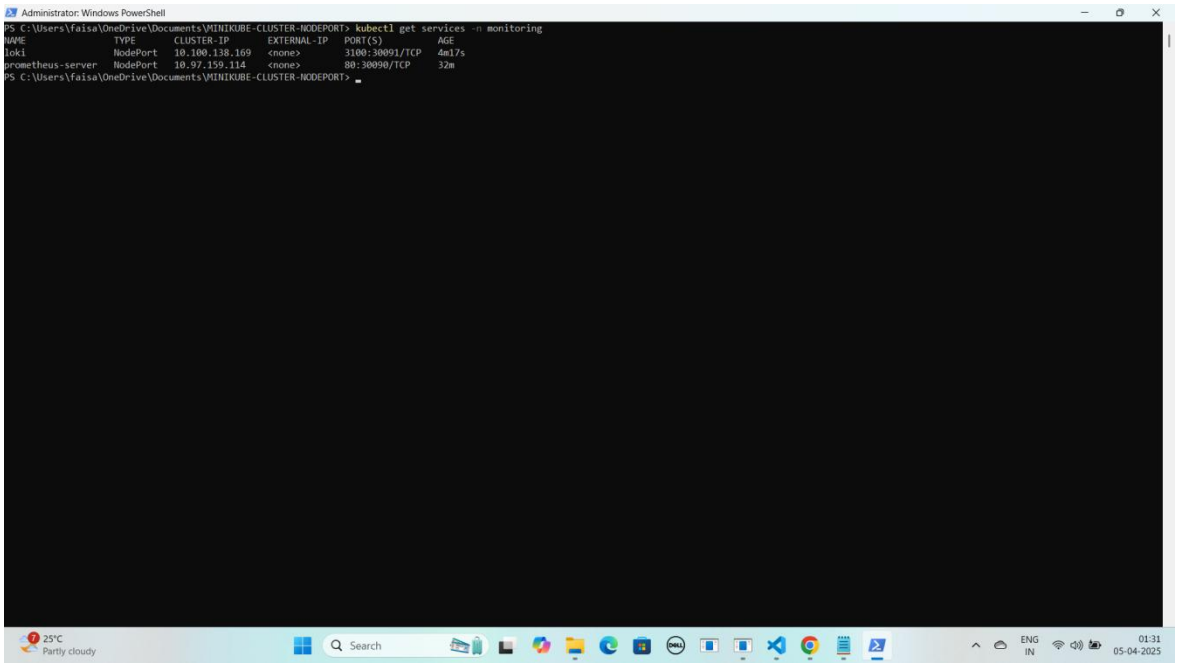


NOTE: Agar STATUS Running show karraha hai to sab kuch sahi hai

2. Serives check karne ke liye ye commad run kariye

kubectl get services -n monitoring

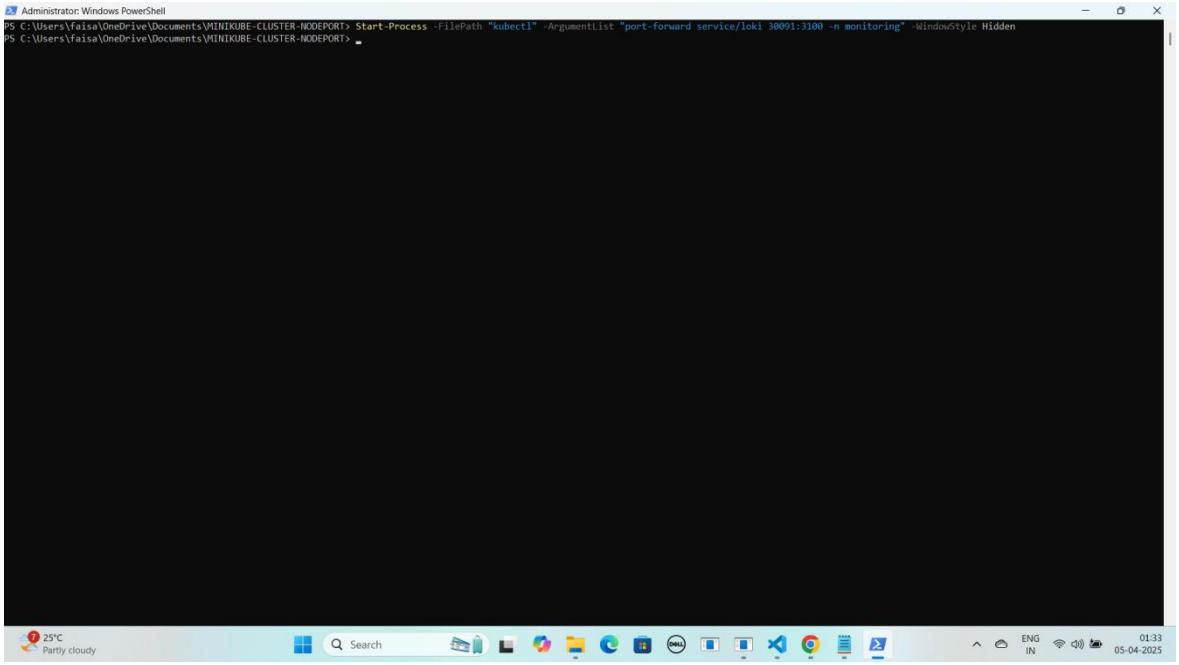
YE KUCH ISTARHA LAGEGA



3. Port Forwarding Karne ke liye ye command run karein

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/loki 30091:3100 -n monitoring" -WindowStyle Hidden

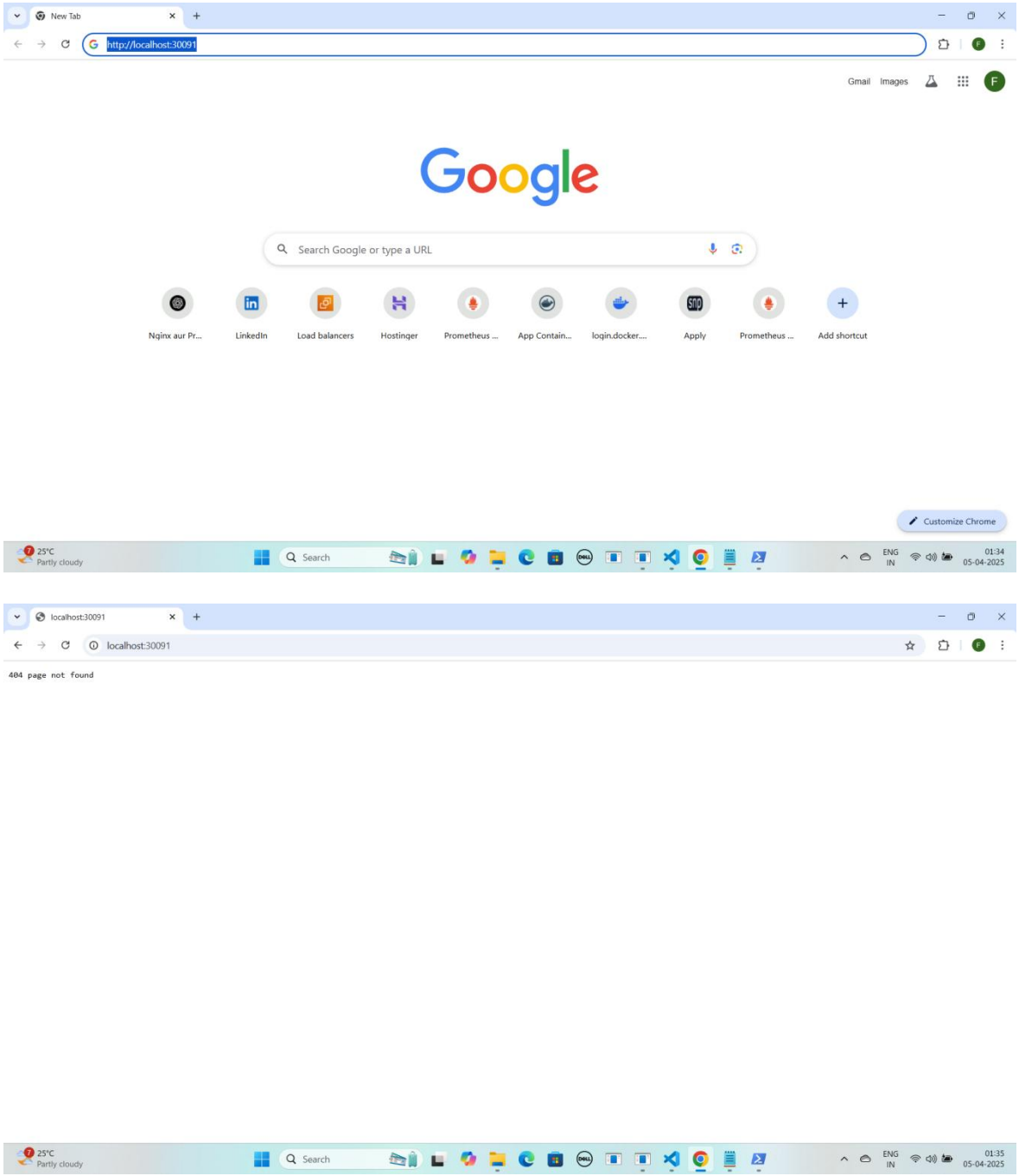
YE KUCH ISTARHA LAGEGA



NOTE: Ab aapka Loki expose ho chuka hai. Ab apne local system par Loki ko NodePort ke saath browser me run kariye. Jaise ki mere case me kuch aisa hoga

Loki: http://localhost:30091

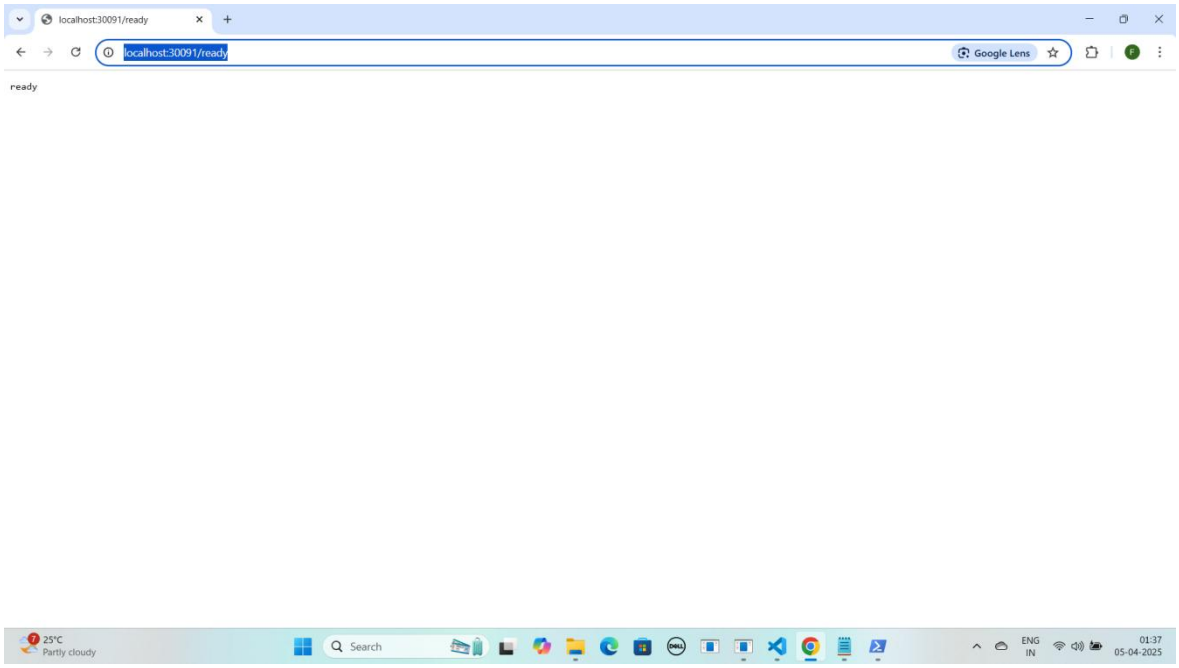
YE KUCH ISTARHA LAGEGA



4. Lekin aapko **404 page not found** dikhayga to **/ready** se **check** kariye **loki** ko jaise ki mere case kuch asisa hoga.

http://localhost:30091/ready

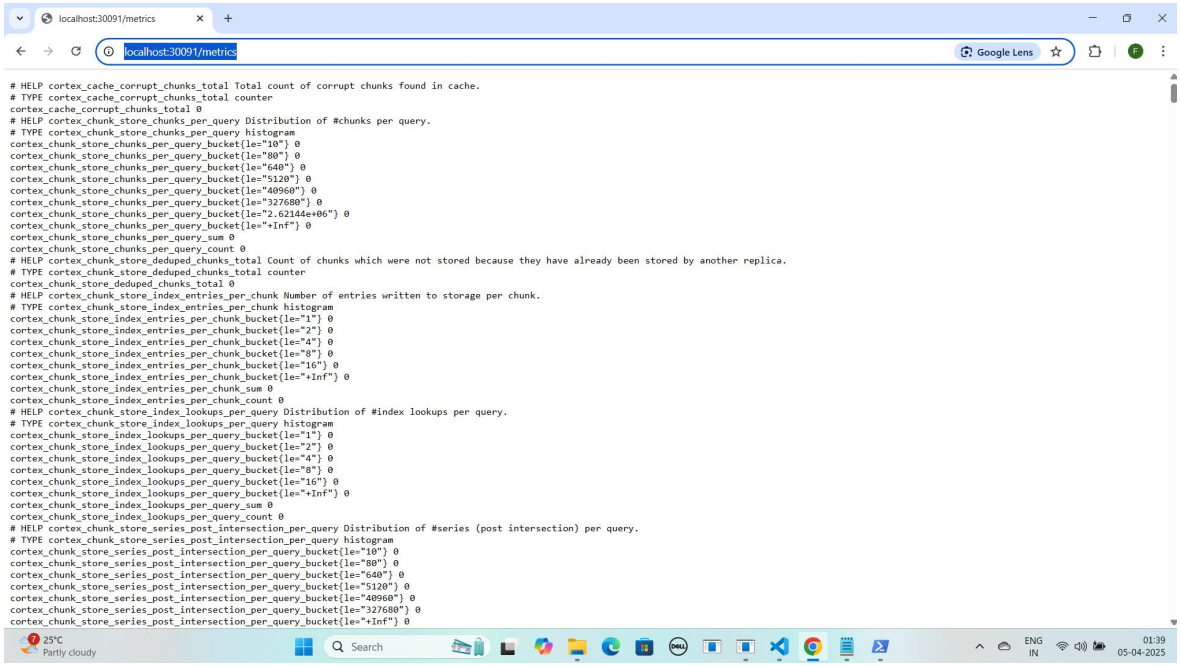
YE KUCH ISTARHA LAGEGA



5. Agar aapko **ready** show karraha hai to iska matlab **loki successfully** run horaha hai ab **loki metrics loggs** collect karraha hai **check** karne ke liye **/metrics** run kariye jaise ki mere case me kuch aisa hoga.

http://localhost:30091/metrics

YE KUCH ISTARHA LAGEGA



Step 7: grafana-deployment.yaml File Ka Kaam

Yeh **file Grafana** ko deploy karne ke liye use hoti hai, taake hum **Prometheus metrics** aur **Loki logs** ko **visualize** kar sakein. Isme **NodePort Service** bhi use ki gayi hai, jisse **Grafana port 30080** par **expose** hoga.

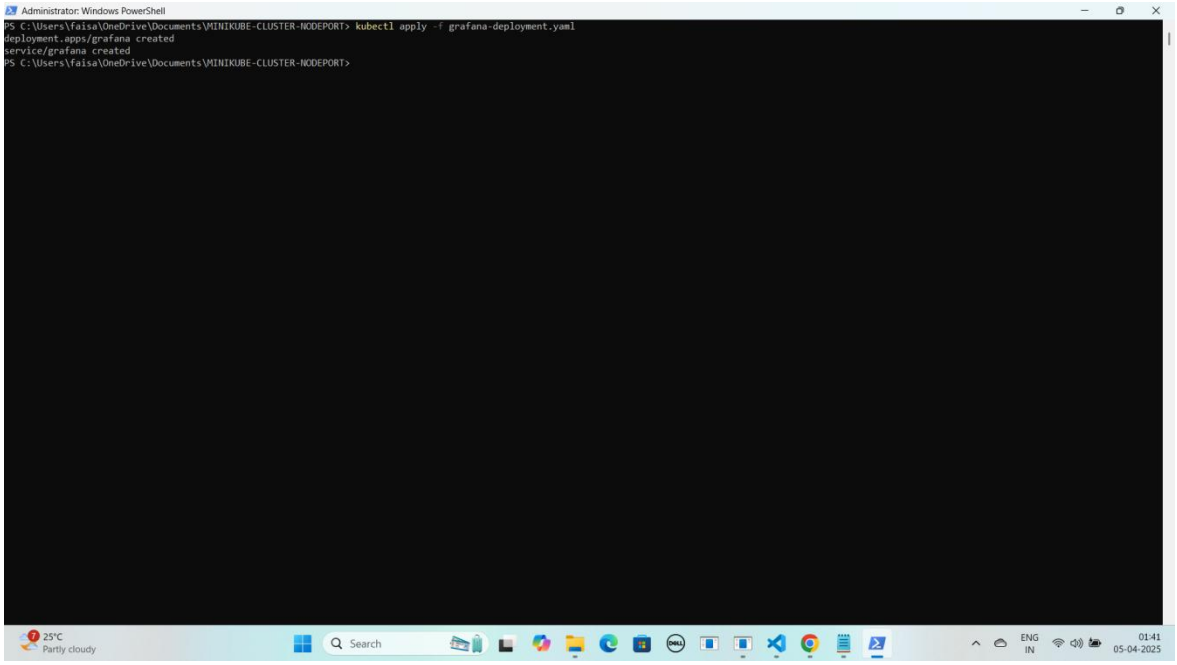
JAISE KI:-

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: grafana
  namespace: monitoring
spec:
  replicas: 1
  selector:
    matchLabels:
      app: grafana
  template:
    metadata:
      labels:
        app: grafana
    spec:
      containers:
        - name: grafana
          image: grafana/grafana:8.3.0
          ports:
            - containerPort: 3000
          env:
            - name: GF_SECURITY_ADMIN_PASSWORD
              value: "admin"
---
apiVersion: v1
kind: Service
metadata:
  name: grafana
  namespace: monitoring
spec:
  type: NodePort   # Change the type from ClusterIP to NodePort
  ports:
    - port: 80
      targetPort: 3000
      nodePort: 30080   # Specify the NodePort (e.g., 30080, any unused port in the range
30000-32767)
  selector:
    app: grafana
```

Grafana Deployment Apply Karo

kubectl apply -f grafana-deployment.yaml

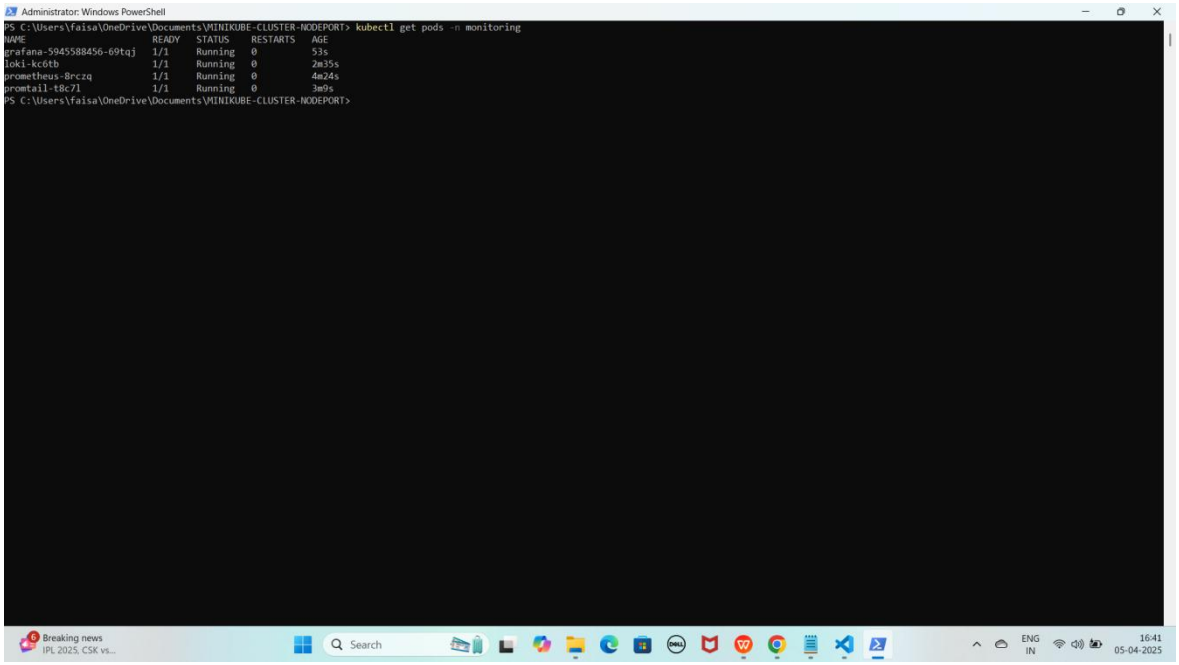
YE KUCH ISTARHA LAGEGA



1. Pods check karne ke liye ye command run kariye

kubectl get pods -n monitoring

YE KUCH ISTARHA LAGEGA

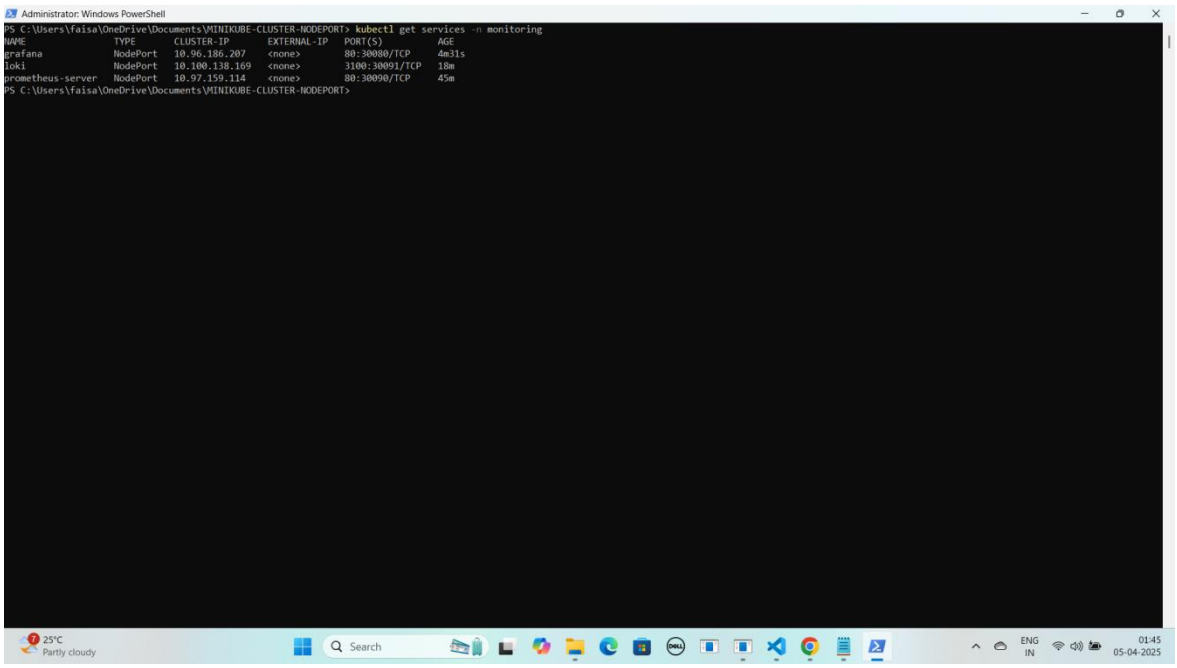


NOTE: Agar STATUS Running show karraha hai to sab kuch sahi hai

2. Serives check karne ke liye ye commad run kariye

kubectl get services -n monitoring

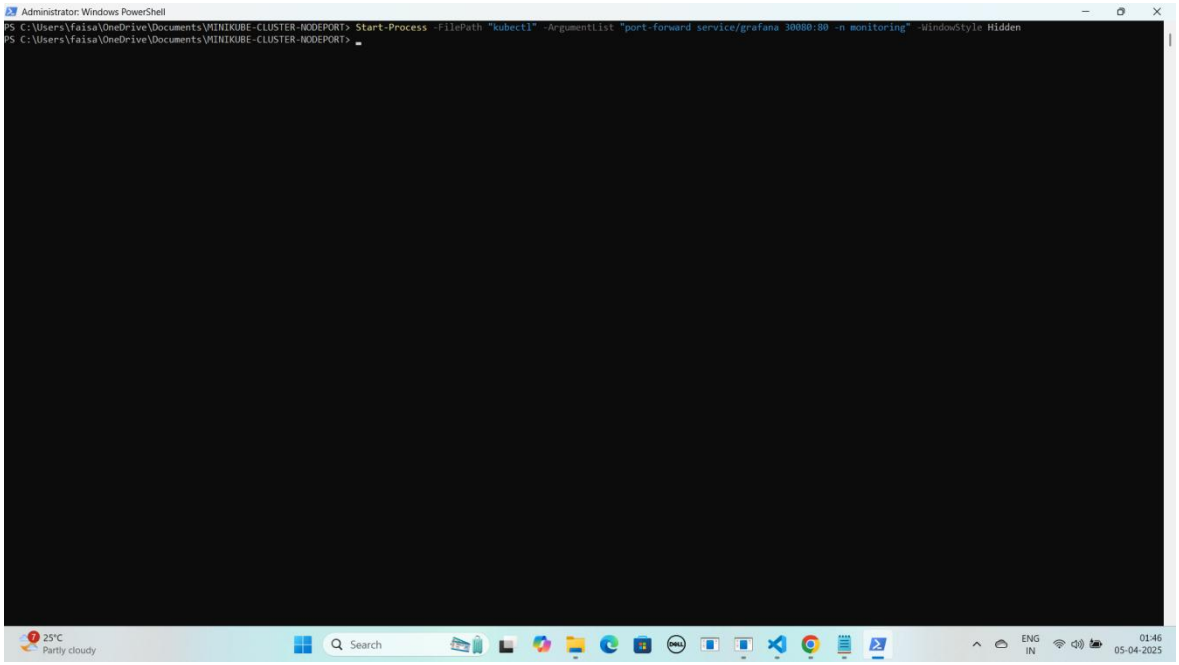
YE KUCH ISTARHA LAGEGA



3. Port Forwarding Karne ke liye ye command run karein

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/grafana 30080:80 -n monitoring" -WindowStyle Hidden

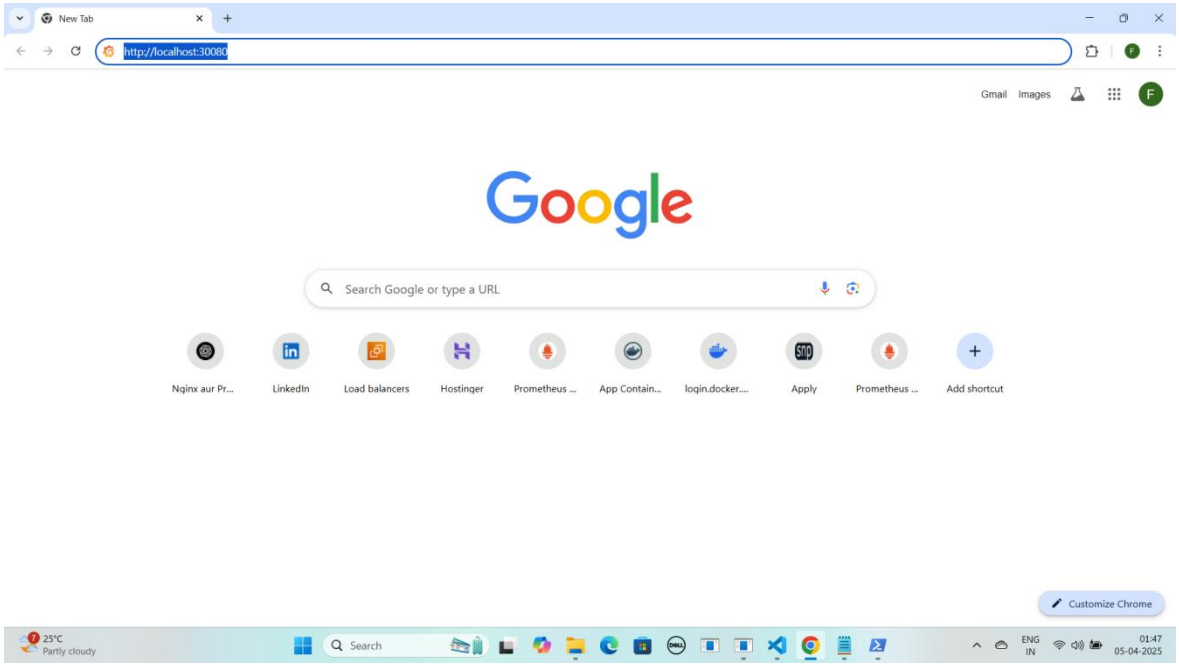
YE KUCH ISTARHA LAGEGA

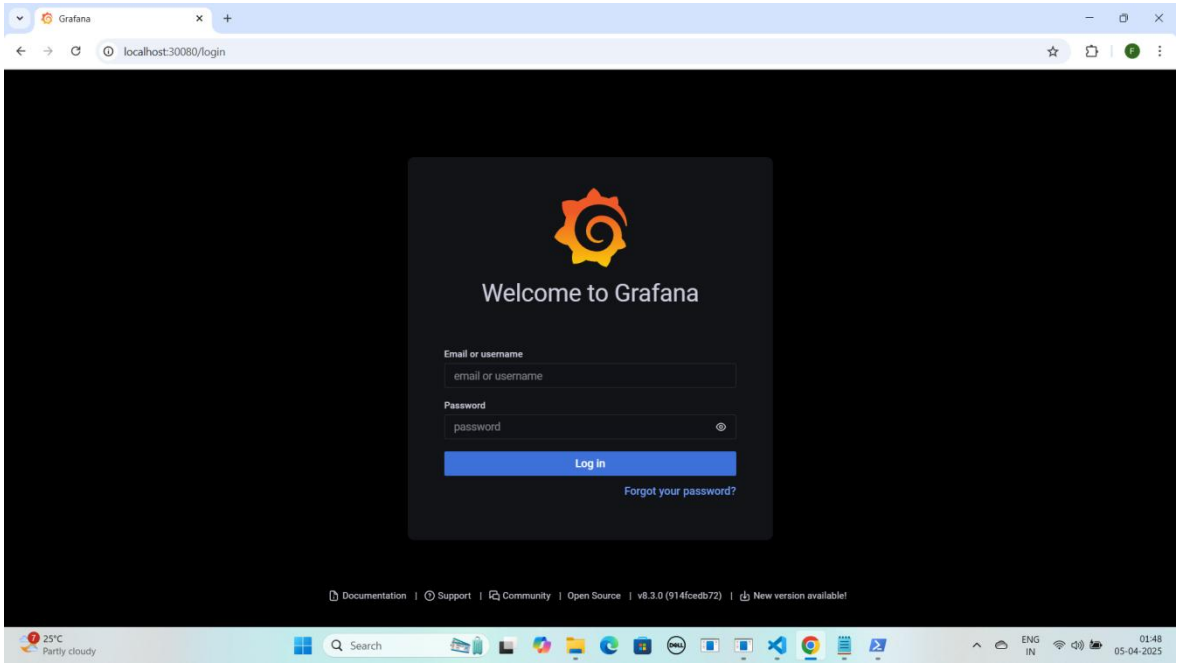


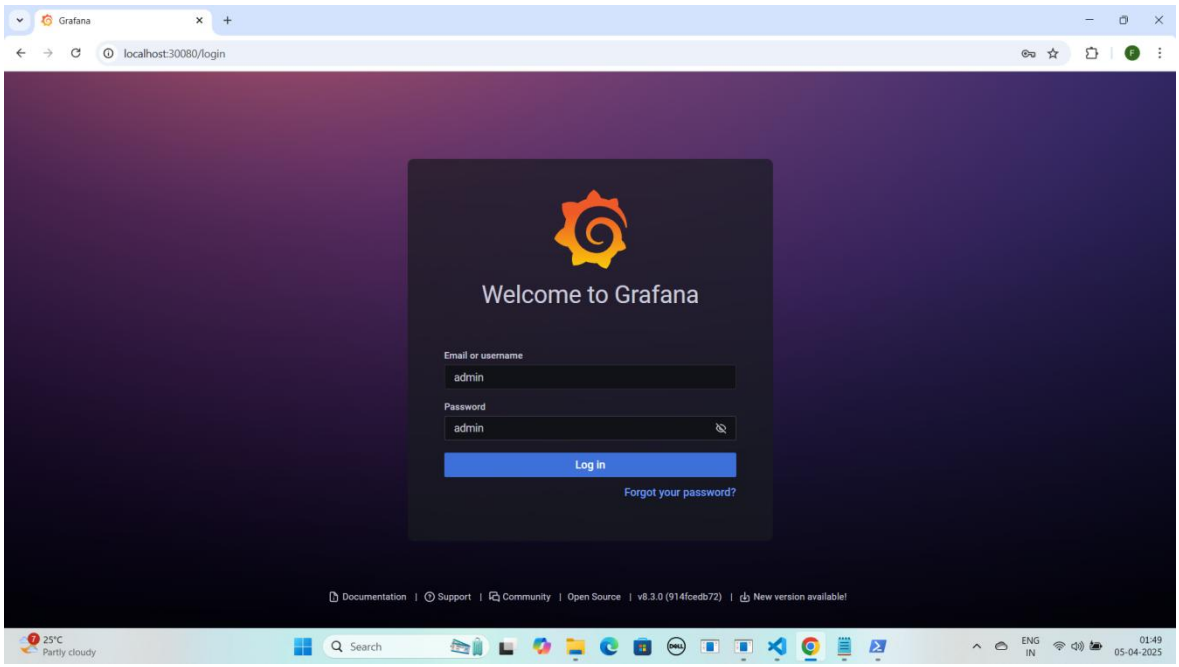
NOTE: Ab aapka Grafana expose ho chuka hai. Ab apne local system par Grafana ko NodePort ke saath browser me run kariye. Jaise ki mere case me kuch aisa hoga

Grafana: http://localhost:30080

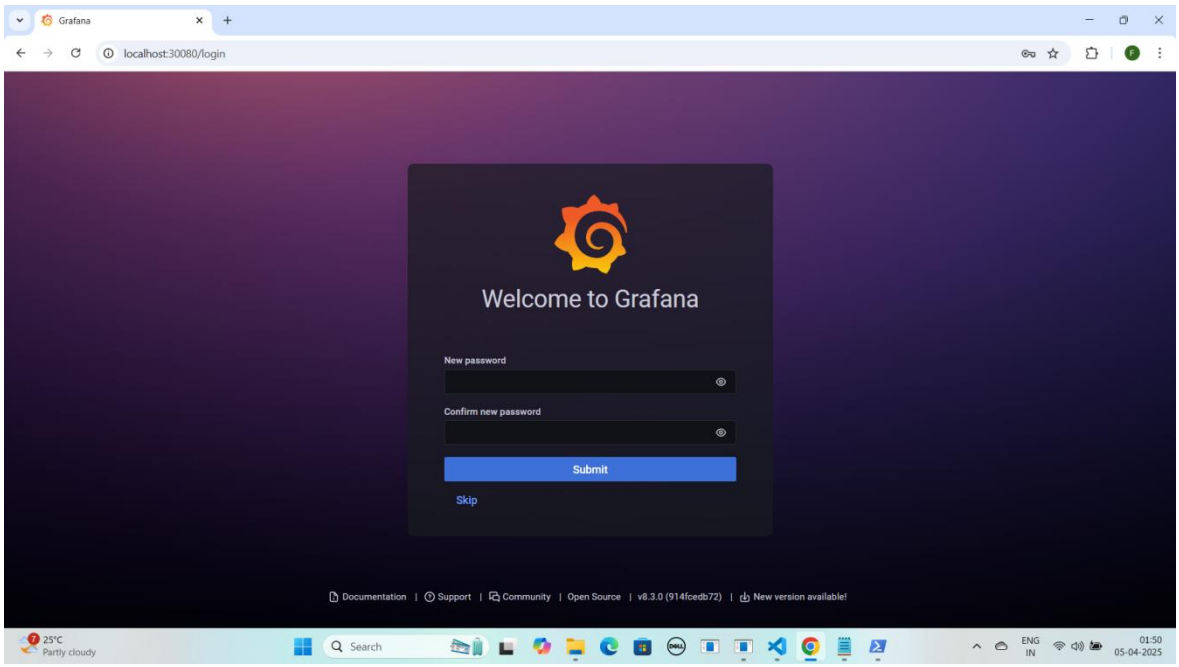
YE KUCH ISTARHA LAGEGA

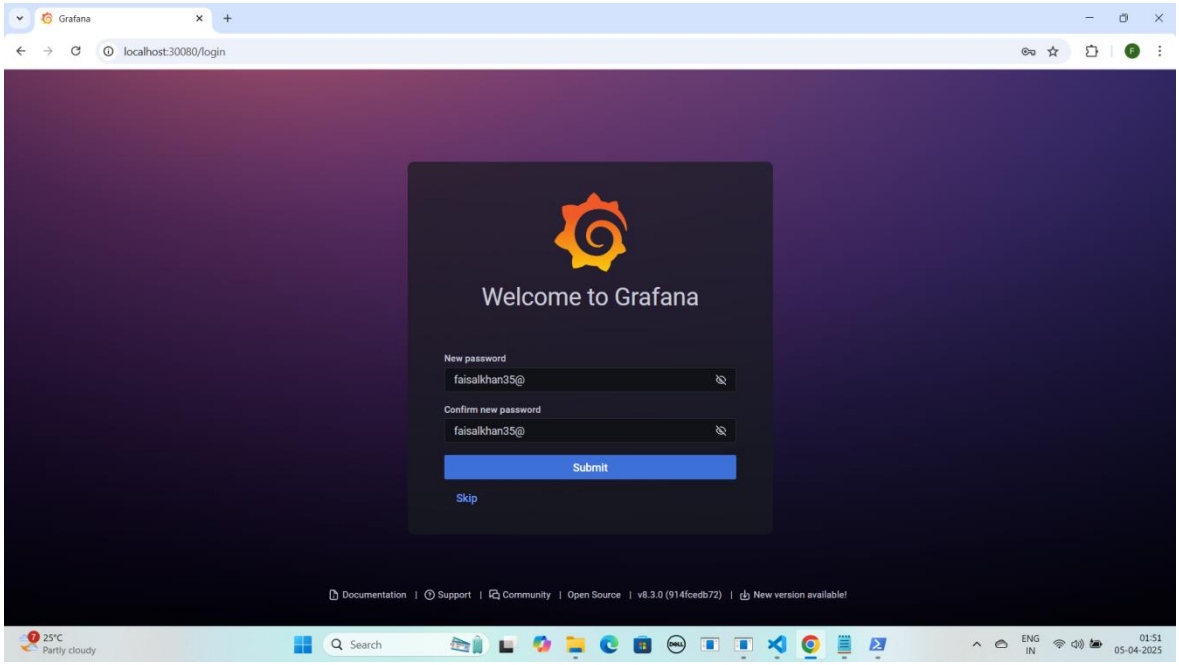




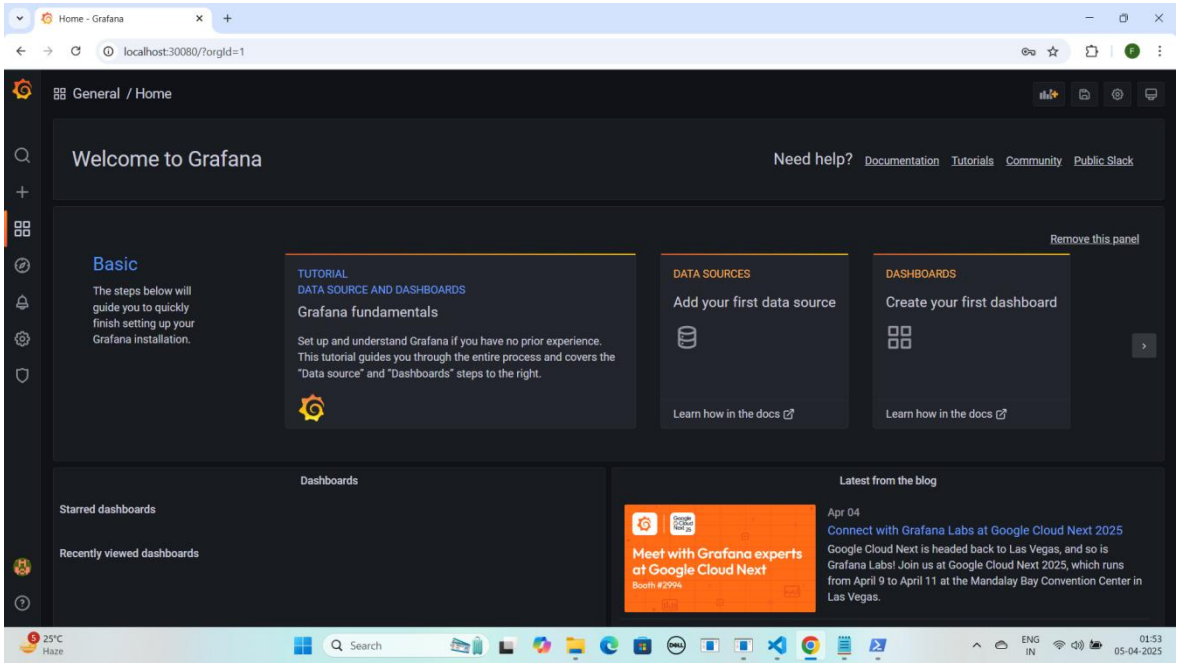


NOTE : Grafana browser me run hone ke baad aapse login ke liye username aur password maangega. Default username aur password admin hota hai. Login ke baad aap apna password change kar sakte hain.





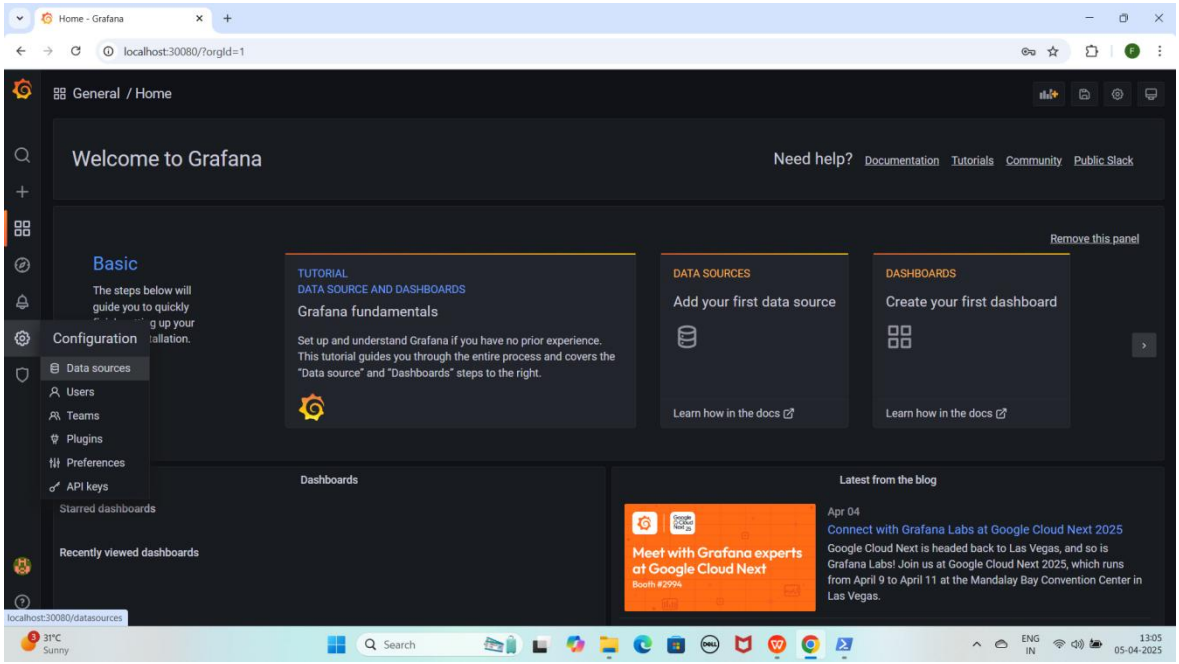
NOTE : Is step par aapko apne pasand ka naya password set karsakte hai. Yaha mai faisalkhan35@ password set kar raha hoon.Password type karne ke baad Submit par click kariye

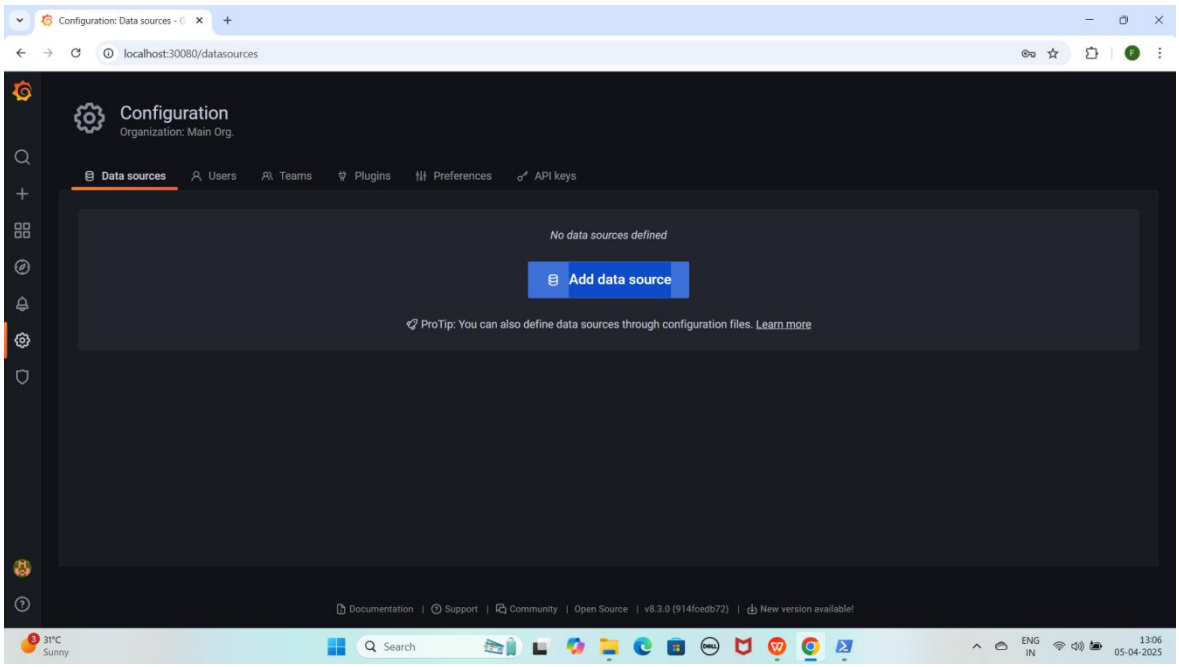

Home - Grafana
localhost:30080/?orgId=1
General / Home
Welcome to Grafana
Need help? Documentation Tutorials Community Public Slack
Remove this panel
Basic
The steps below will guide you to quickly finish setting up your Grafana installation.
TUTORIAL
DATA SOURCE AND DASHBOARDS
Grafana fundamentals
Set up and understand Grafana if you have no prior experience. This tutorial guides you through the entire process and covers the "Data source" and "Dashboards" steps to the right.
DATA SOURCES
Add your first data source
Learn how in the docs
DASHBOARDS
Create your first dashboard
Learn how in the docs
Dashboards
Starred dashboards
Recently viewed dashboards
Latest from the blog
Meet with Grafana experts at Google Cloud Next
Booth #2994
Apr 04
Connect with Grafana Labs at Google Cloud Next 2025
Google Cloud Next is headed back to Las Vegas, and so is Grafana Labs! Join us at Google Cloud Next 2025, which runs from April 9 to April 11 at the Mandalay Bay Convention Center in Las Vegas.
25°C
Haze
Search
ENG
IN
01:53
05-04-2025

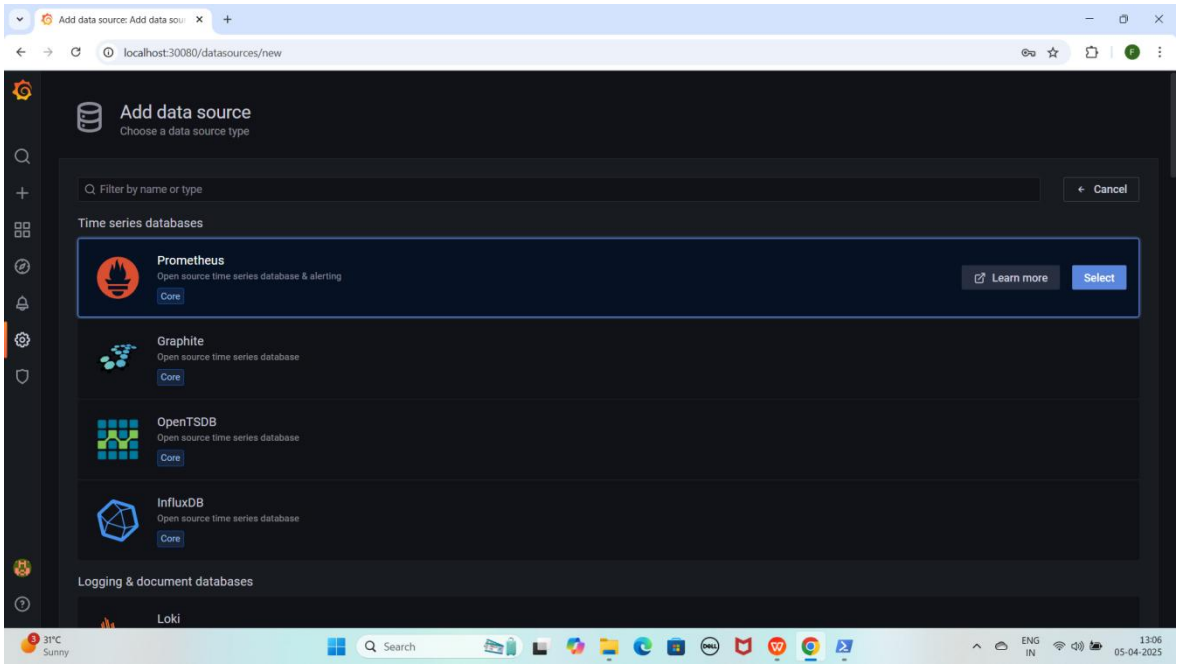
Step 8: Grafana Mein Prometheus Data Source Add Karna, Queries Add Karna Aur Dashboard Create Karna

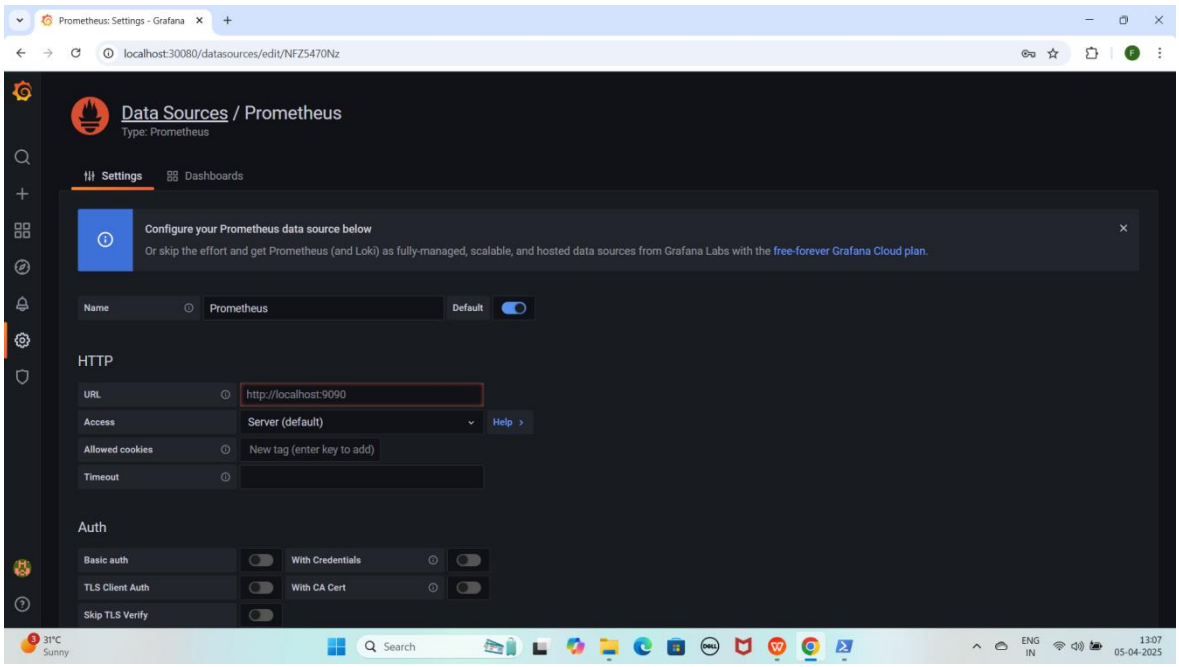
- **Grafana dashboard** open karo.
- **Configuration** pe **click** karo, phir **Data Sources select** karo.
- **Add data source** pe **click** karo.
- **Prometheus** select karo.
- minikube service prometheus-server -n monitoring --url command **Minikube VM** ki **IP** deta hai, Is **IP** ko **Grafana** me **datasource URL** me use karo.
    - **Mere case me yeh kuch is tarah hogi** **http://192.168.59.118:30090**
    - **Aapke case me IP different ho sakti hai.**
- **HTTPS section** me **URL** box me **paste** karo.
- Neeche scroll karo aur **"Save & Test"** pe **click** karo.

YE KUCH ISTARHA LAGEGA




Configuration: Data sources
localhost:30080/datasources
Configuration
Organization: Main Org.
Data sources
Users
Teams
Plugins
Preferences
API keys
No data sources defined
Add data source
ProTip: You can also define data sources through configuration files. Learn more
Documentation | Support | Community | Open Source | v8.3.0 (914fcedb72) | New version available!
31°C
Sunny
Search
ENG
IN
13:06
05-04-2025


Add data source: Add data sou
localhost:30080/datasources/new
Add data source
Choose a data source type
Filter by name or type
Cancel
Time series databases
Prometheus
Open source time series database & alerting
Core
Learn more
Select
Graphite
Open source time series database
Core
OpenTSDB
Open source time series database
Core
InfluxDB
Open source time series database
Core
Logging & document databases
Loki
31°C
Sunny
Search
ENG
IN
13:06
05-04-2025

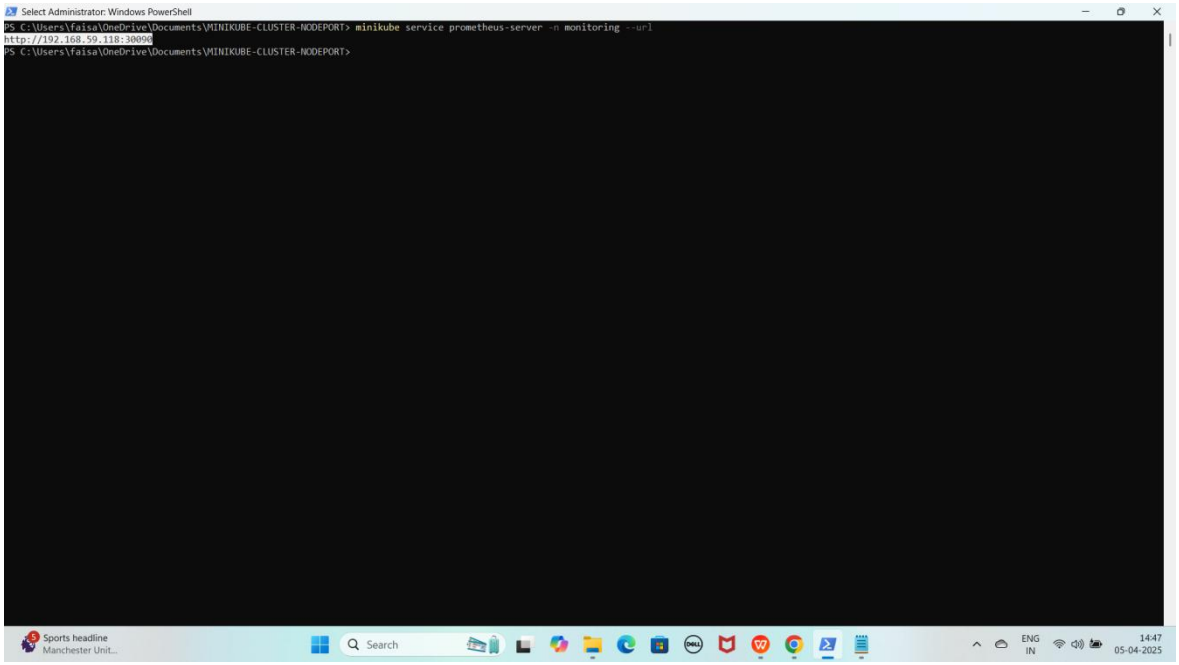


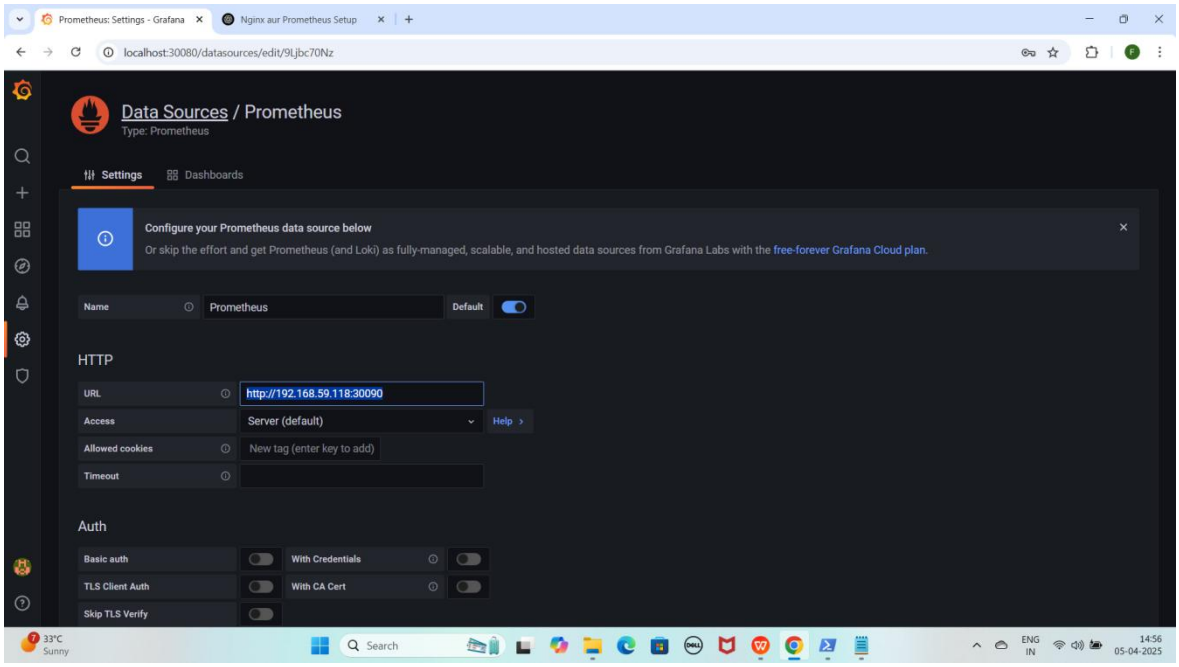
NOTE: Minikube VirtualBox me run ho raha ho, to Grafana me localhost kaam nahi karega. Uski jagah minikube ip use karenge kyunki localhost Grafana ke container ka hota hai, host machine ka nahi.

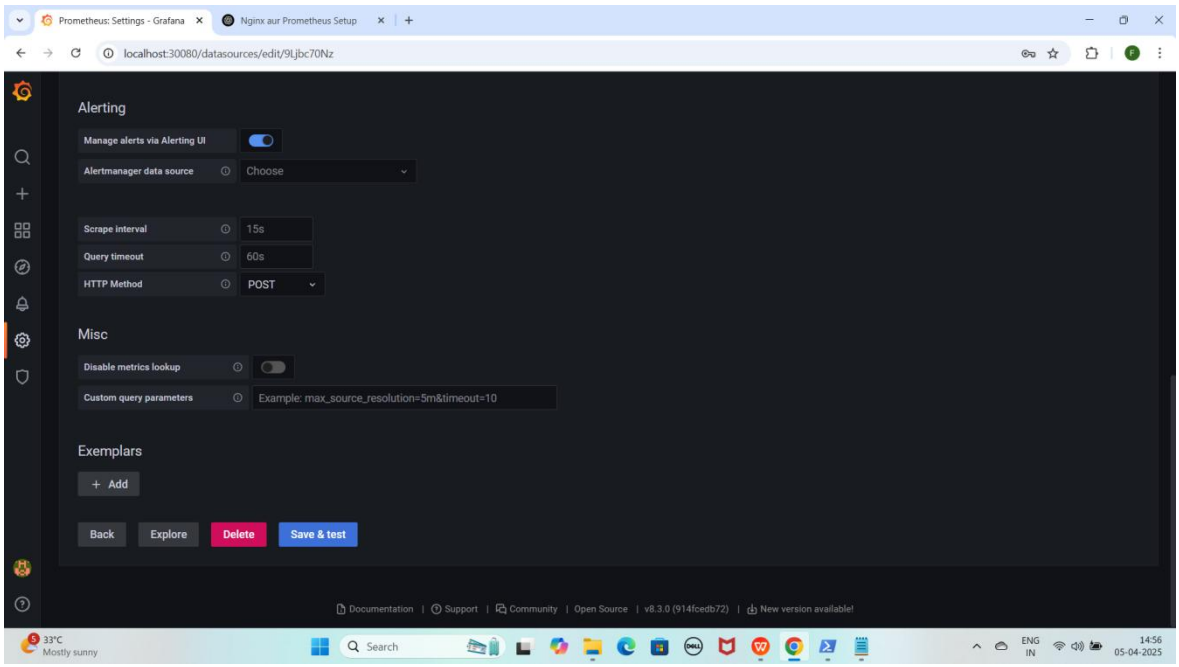
1. **Proper URLs ke liye, Prometheus datasource add karne ke liye yeh command run karein**

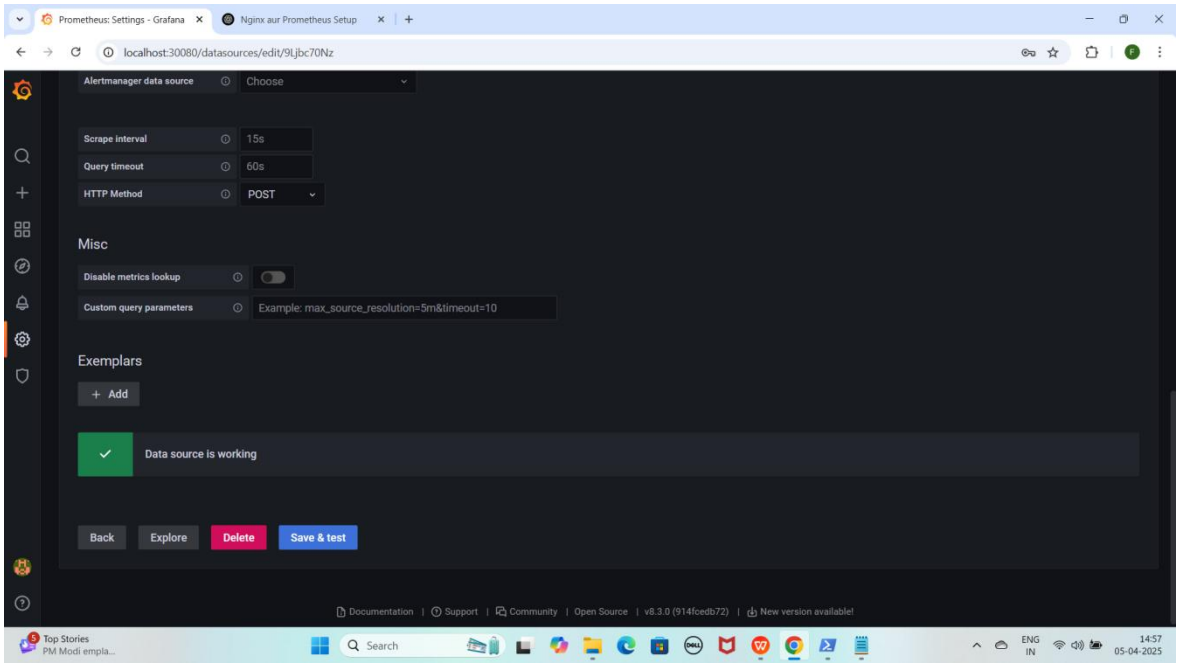
minikube service prometheus-server -n monitoring --url

YE KUCH ISTARHA LAGEGA





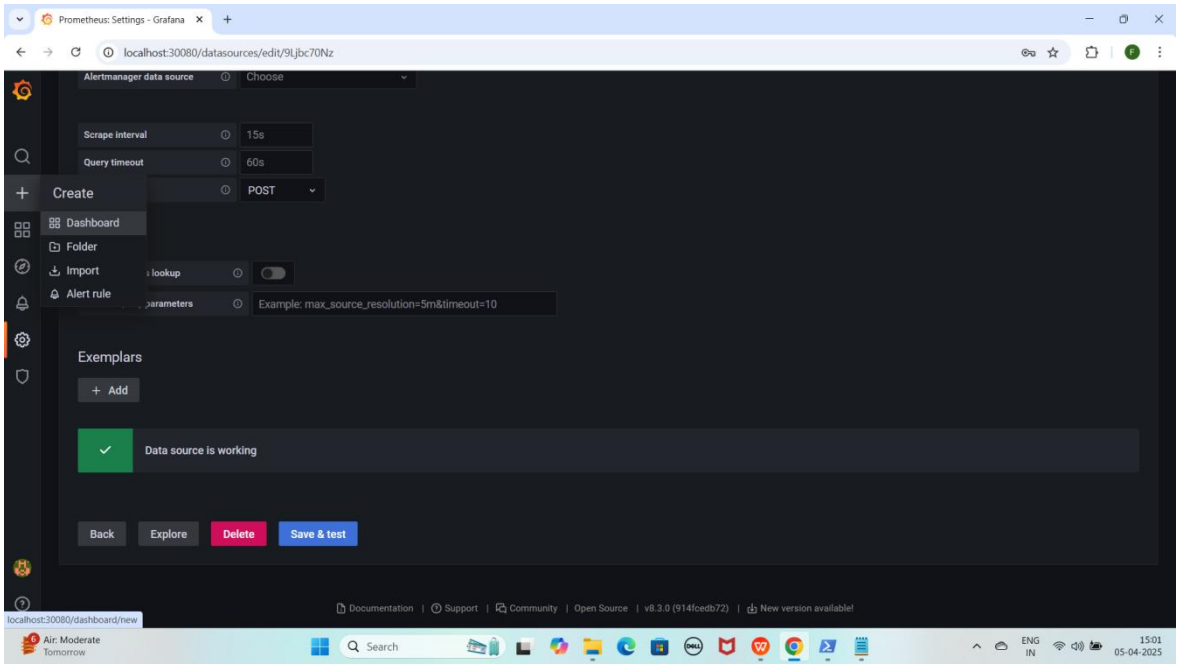


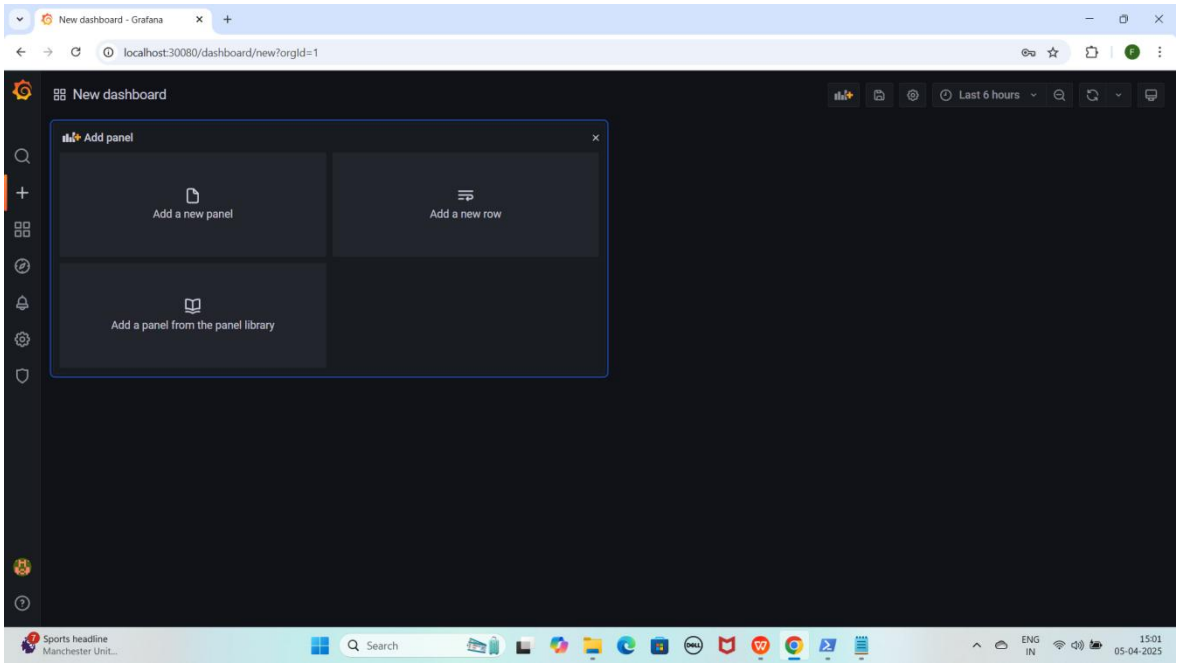


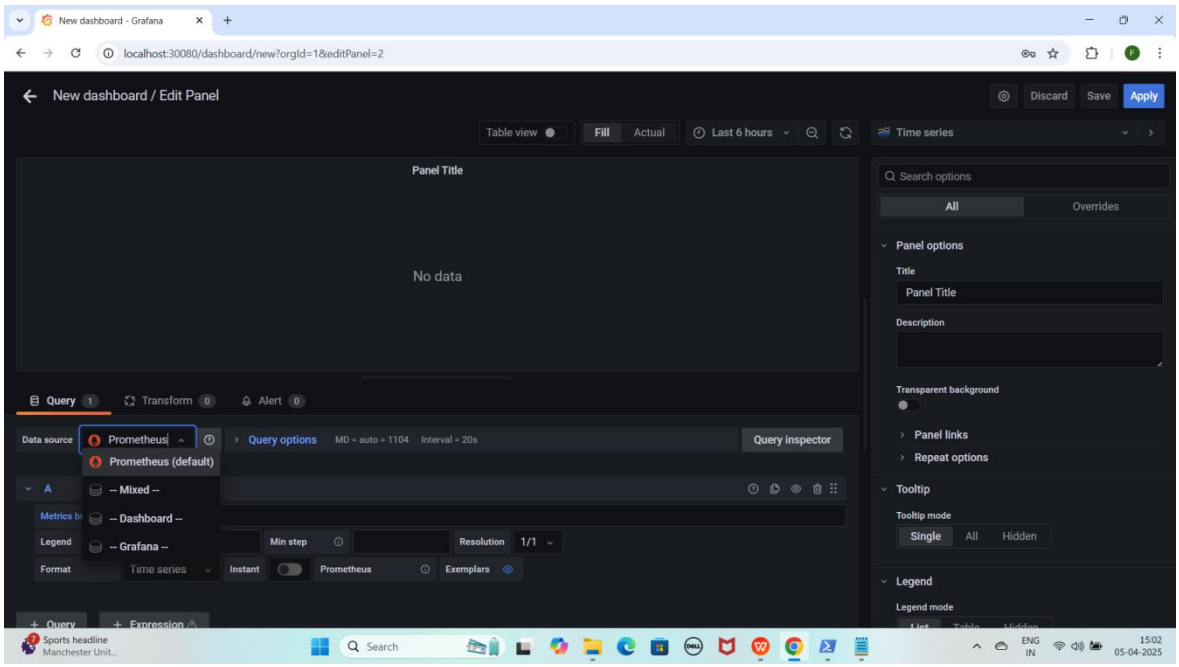
NOTE: Save & test pe click karne ke baad aapko Data source is working karke pop up aayega

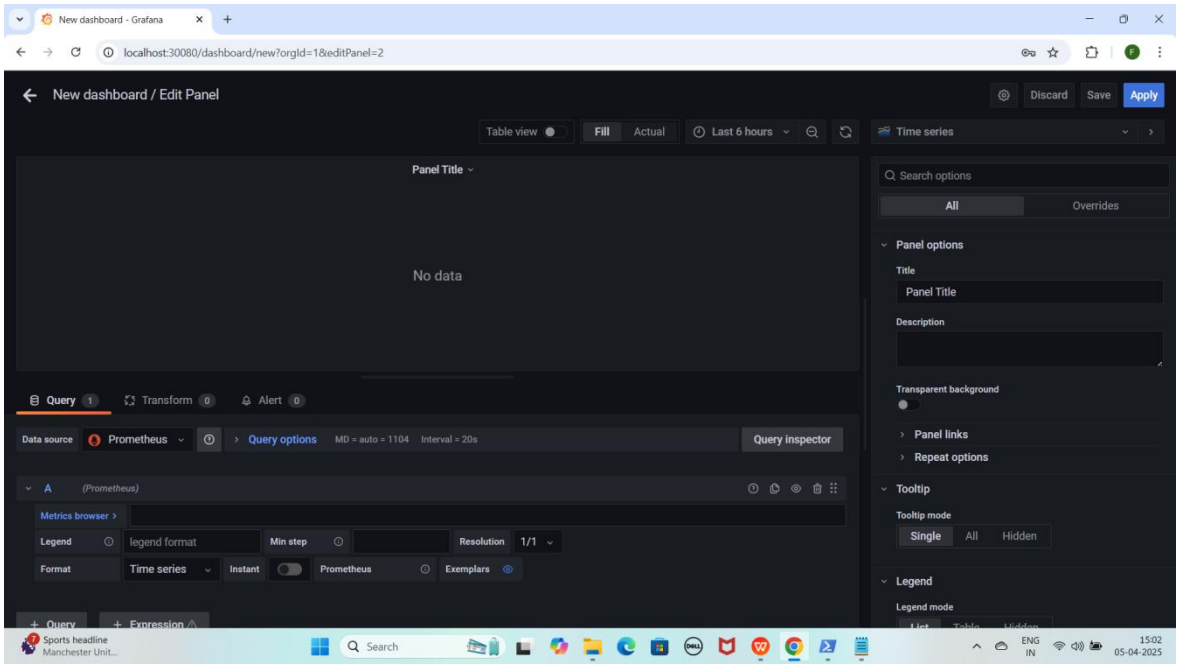
- **Prometheus ke Metrics visualize** karne ke liye **"+" (plus) icon** pe click karo.
- **Dashboard** select karo aur **"Add a new panel"** pe click karo.
- **Query section** me **Data Source ko "Prometheus"** select karo.

YE KUCH ISTARHA LAGEGA






New dashboard - Grafana
localhost:30080/dashboard/new?orgId=1&editPanel=2
New dashboard / Edit Panel
Discard
Save
Apply
Table view
Fill
Actual
Last 6 hours
Time series
Panel Title
No data
Search options
All
Overrides
Panel options
Title
Panel Title
Description
Transparent background
Panel links
Repeat options
Tooltip
Tooltip mode
Single
All
Hidden
Legend
Legend mode
Query 1
Transform 0
Alert 0
Data source
Prometheus
Query options
MD = auto = 1104
Interval = 20s
Query inspector
Prometheus (default)
-- Mixed --
-- Dashboard --
-- Grafana --
A
Metrics b
Legend
Min step
Resolution
1/1
Format
Time series
Instant
Prometheus
Exemplars
Query
Expression
Sports headline
Manchester Unit...
Search
ENG
IN
15:02
05-04-2025

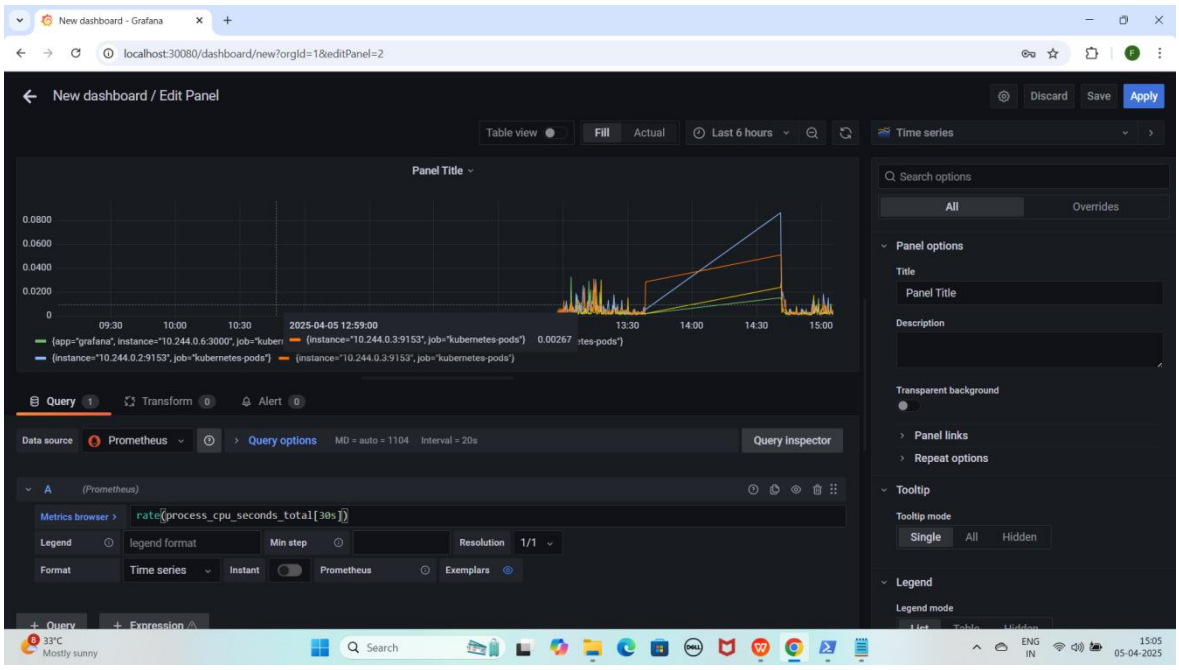

New dashboard - Grafana
localhost:30080/dashboard/new?orgId=1&editPanel=2
New dashboard / Edit Panel
Discard
Save
Apply
Table view
Fill
Actual
Last 6 hours
Time series
Panel Title
No data
Search options
All
Overrides
Panel options
Title
Panel Title
Description
Transparent background
Panel links
Repeat options
Tooltip
Tooltip mode
Single
All
Hidden
Legend
Legend mode
Query 1
Transform 0
Alert 0
Data source
Prometheus
Query options
MD = auto = 1104
Interval = 20s
Query inspector
A
(Prometheus)
Metrics browser
Legend
legend format
Min step
Resolution
1/1
Format
Time series
Instant
Prometheus
Exemplars
Query
Expression
Sports headline
Manchester Unit...
Search
ENG
IN
15:02
05-04-2025

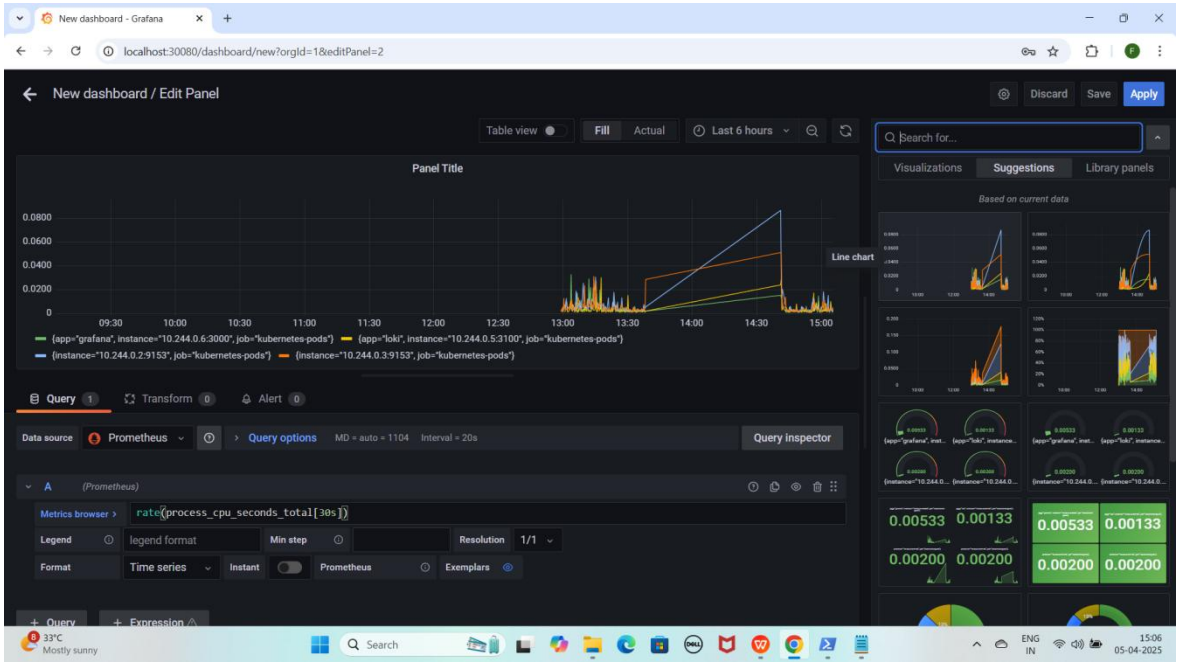
2. Prometheus ko data source select karne ke baad, CPU Usage dekhne ke liye Metric Browser me yeh query paste karein

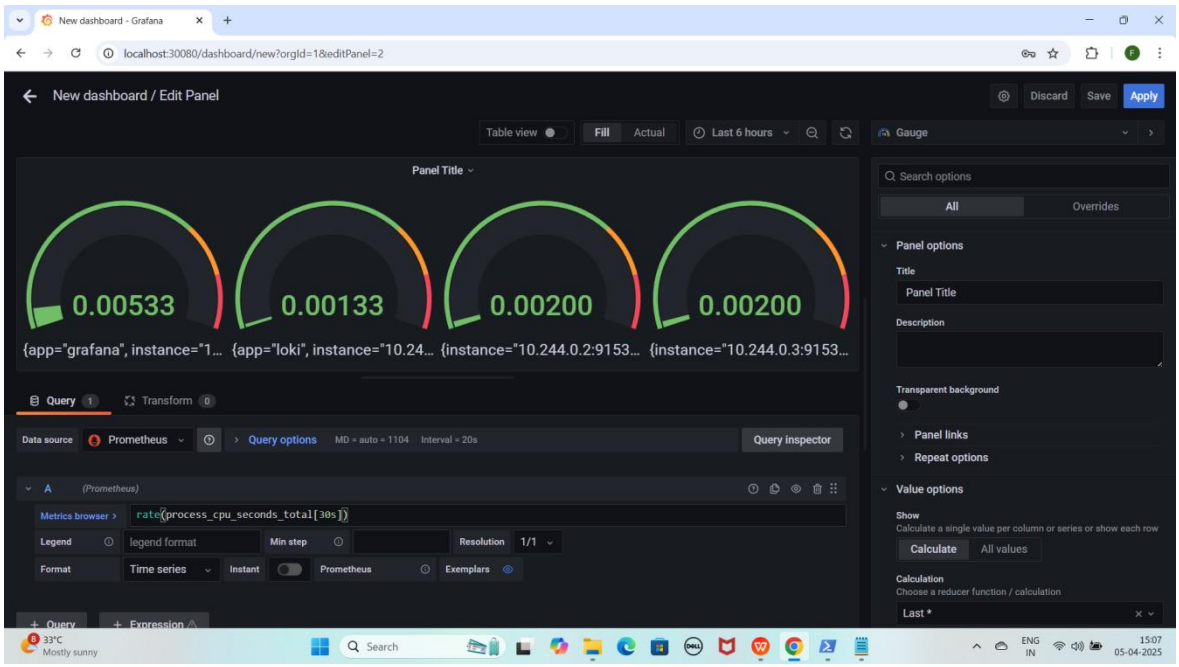
rate(process_cpu_seconds_total[30s])

- **"Time Series"** pe click karein.
- **Suggestions** me se **"Dashboard"** select karein jaise maine select kiya hai.

YE KUCH ISTARHA LAGEGA



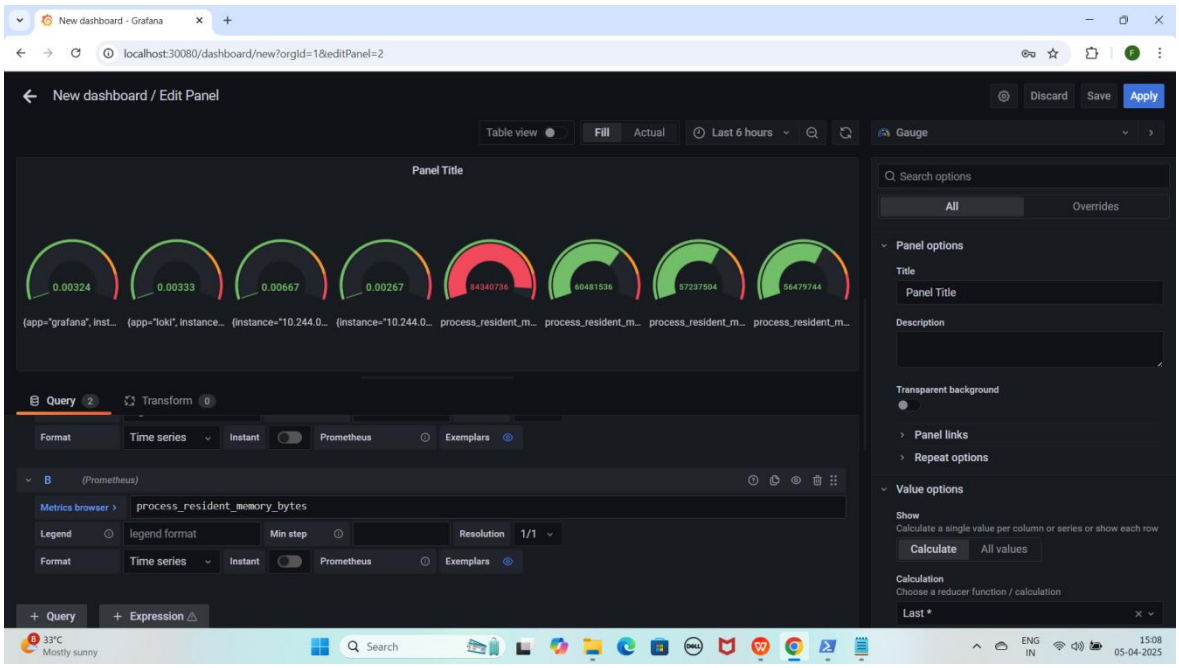



New dashboard - Grafana
localhost:30080/dashboard/new?orgId=1&editPanel=2
New dashboard / Edit Panel
Discard
Save
Apply
Table view
Fill
Actual
Last 6 hours
Gauge
Panel Title
0.00533
0.00133
0.00200
0.00200
{app="grafana", instance="1...
{app="loki", instance="10.24...
{instance="10.244.0.2:9153...
{instance="10.244.0.3:9153...
Query 1
Transform 0
Data source
Prometheus
Query options
MD = auto = 1104
Interval = 20s
Query inspector
A
(Prometheus)
Metrics browser
rate(process_cpu_seconds_total[30s])
Legend
legend format
Min step
Resolution
1/1
Format
Time series
Instant
Prometheus
Exemplars
+ Query
+ Expression
Search options
All
Overrides
Panel options
Title
Panel Title
Description
Transparent background
Panel links
Repeat options
Value options
Show
Calculate a single value per column or series or show each row
Calculate
All values
Calculation
Choose a reducer function / calculation
Last *
33°C
Mostly sunny
Search
ENG
IN
15:07
05-04-2025

3. Memory Usage dekhne ke liye "+ Query" par click karein.
Yeh query paste karein taake memory usage dekh sakein

process_resident_memory_bytes

YE KUCH ISTARHA LAGEGA

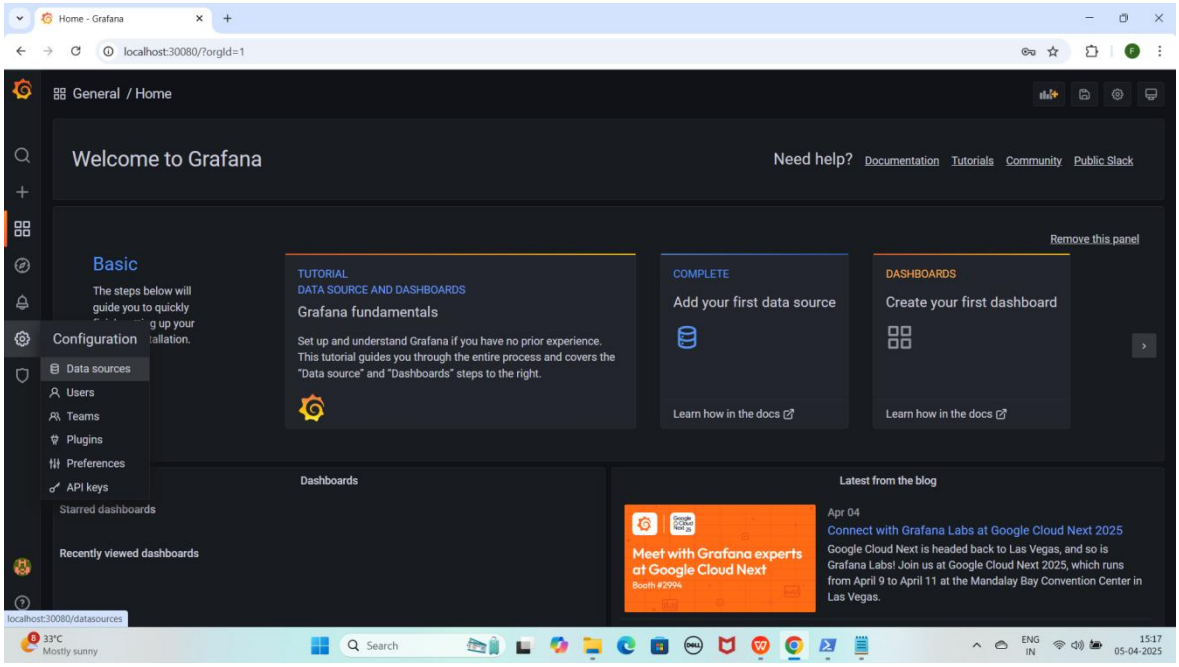


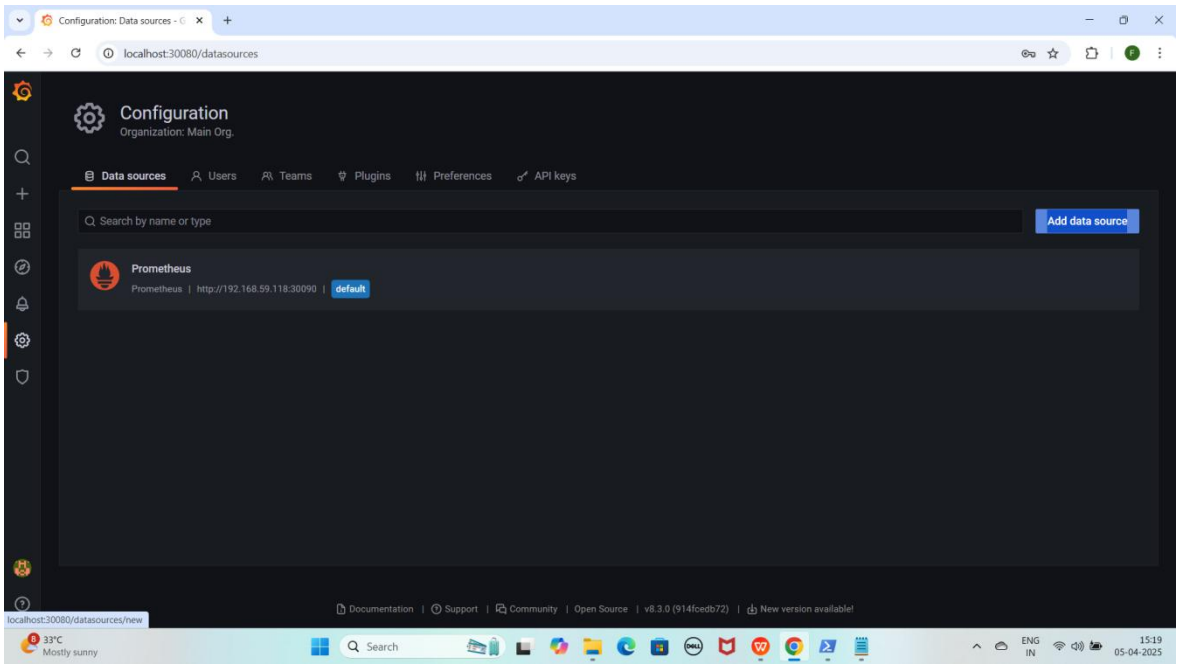
NOTE : Itna karne ke baad aap 30 sec ke interval par CPU usage, current Memory Usage ko Monitor kar sakte hain.

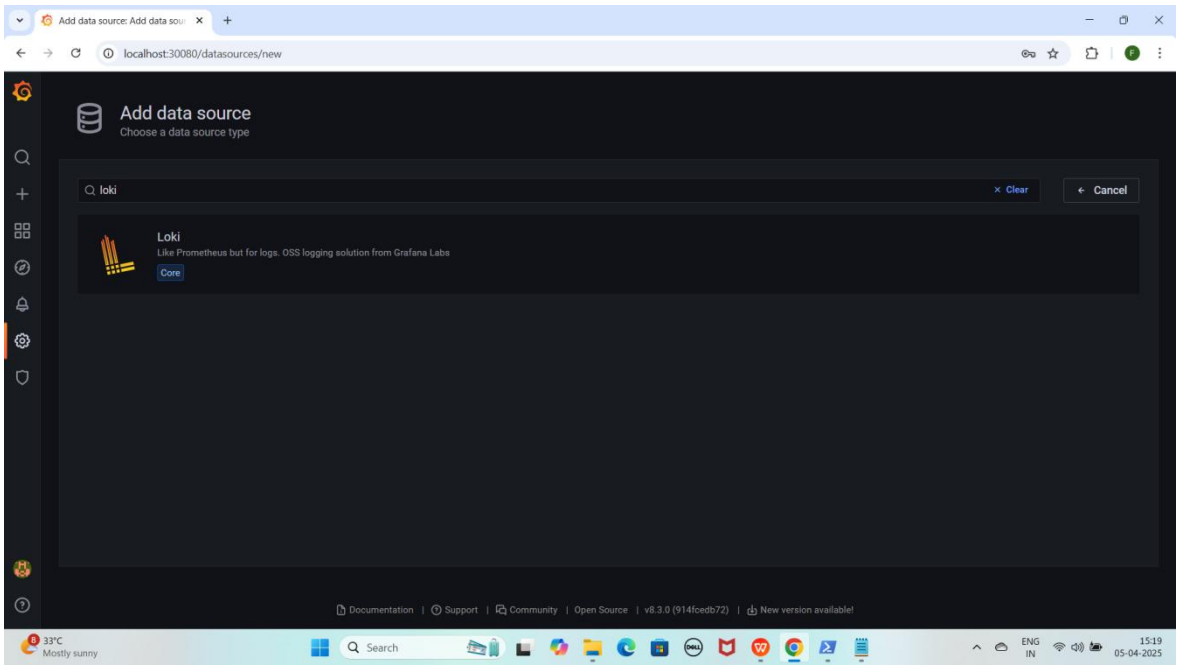
Step 9: Grafana Mein Loki Data Source Add Karna Aur Dashboard Create Karna

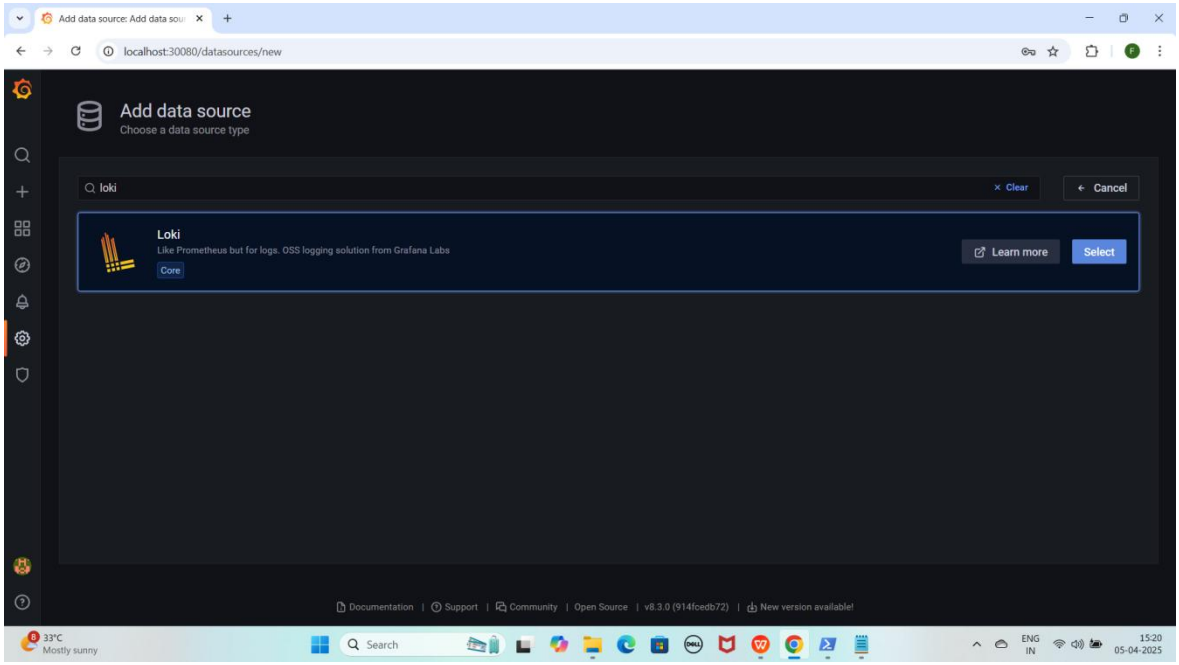
- **Grafana** open karo aur **Settings** icon pe click karo.
- **Data Sources** select karo.
- **Add data source** pe click karo.
- Search bar me **"Loki"** likho aur **Loki** select karo.
- minikube service loki -n monitoring --url command Minikube VM ki IP deta hai, Is IP ko Grafana me datasource URL me use karo:
    - **Mere case me yeh kuch is tarah hogi:** http://192.168.59.118:30091
    - **Aapke case me IP different ho sakti hai.**
- **HTTPS section** me URL box me paste karo.
- Neeche scroll karo aur **"Save & Test"** pe click karo.

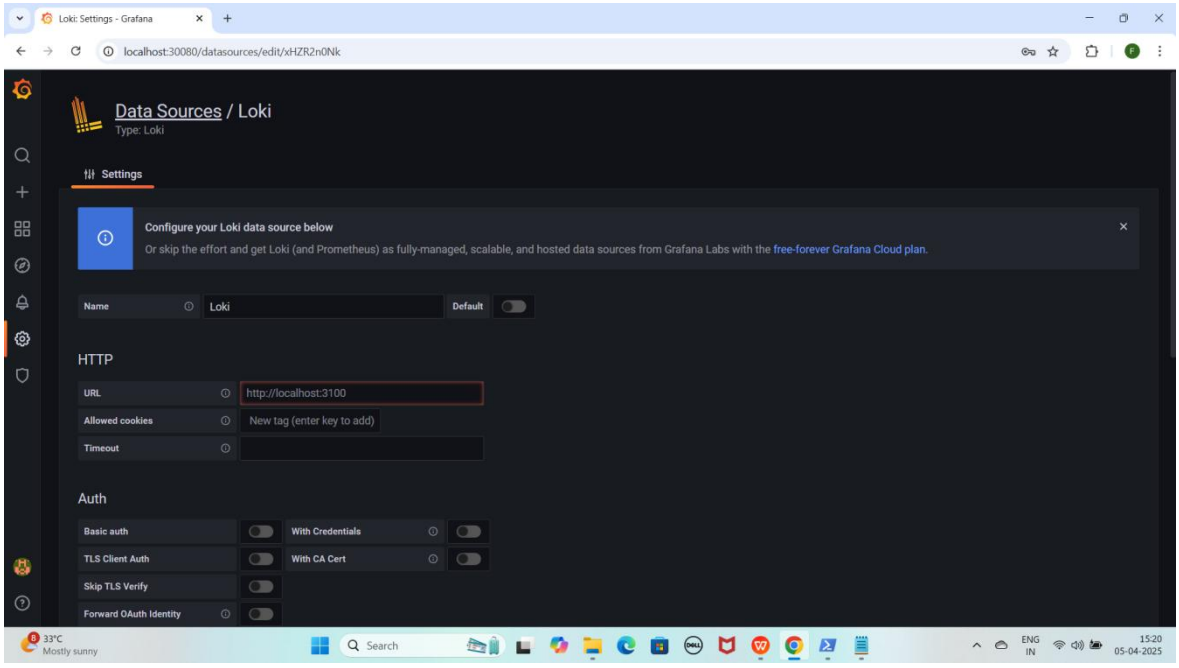
YE KUCH ISTARHA LAGEGA




Configuration: Data sources -
localhost:30080/datasources
Configuration
Organization: Main Org.
Data sources
Users
Teams
Plugins
Preferences
API keys
Search by name or type
Add data source
Prometheus
Prometheus | http://192.168.59.118:30090 | default
Documentation | Support | Community | Open Source | v8.3.0 (914fcedb72) | New version available!
localhost:30080/datasources/new
33°C
Mostly sunny
Search
ENG
IN
15:19
05-04-2025


Add data source: Add data sou
localhost:30080/datasources/new
Add data source
Choose a data source type
loki
Clear
Cancel
Loki
Like Prometheus but for logs. OSS logging solution from Grafana Labs
Core
Documentation | Support | Community | Open Source | v8.3.0 (914fcedb72) | New version available!
33°C
Mostly sunny
Search
ENG
IN
15:19
05-04-2025



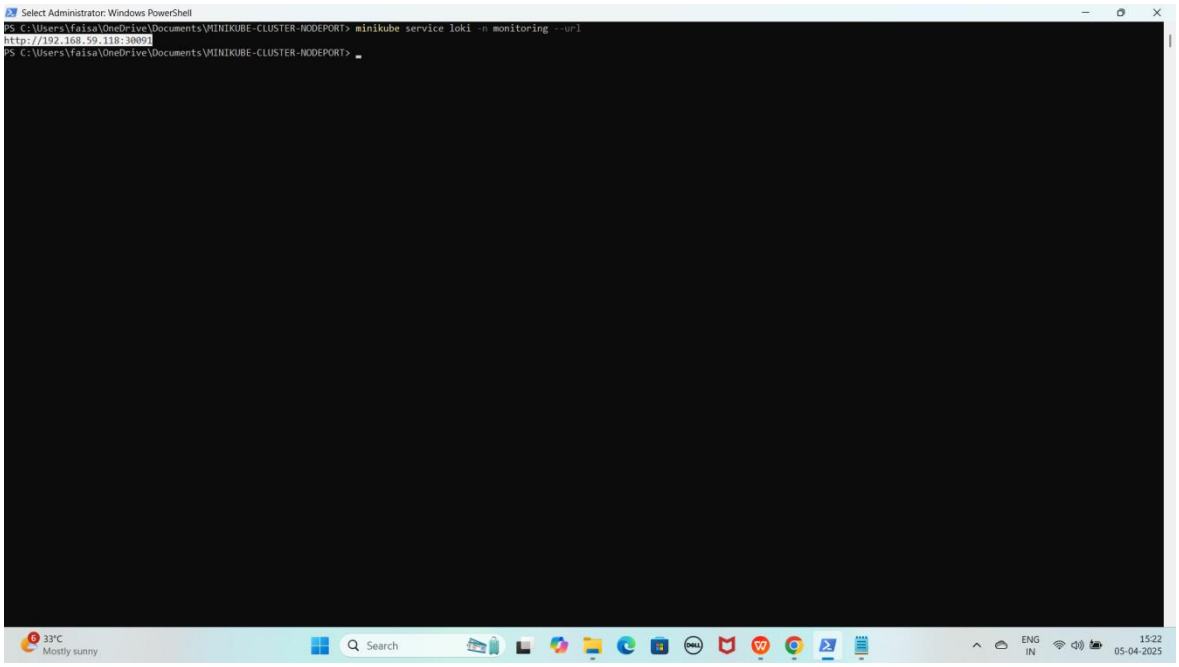


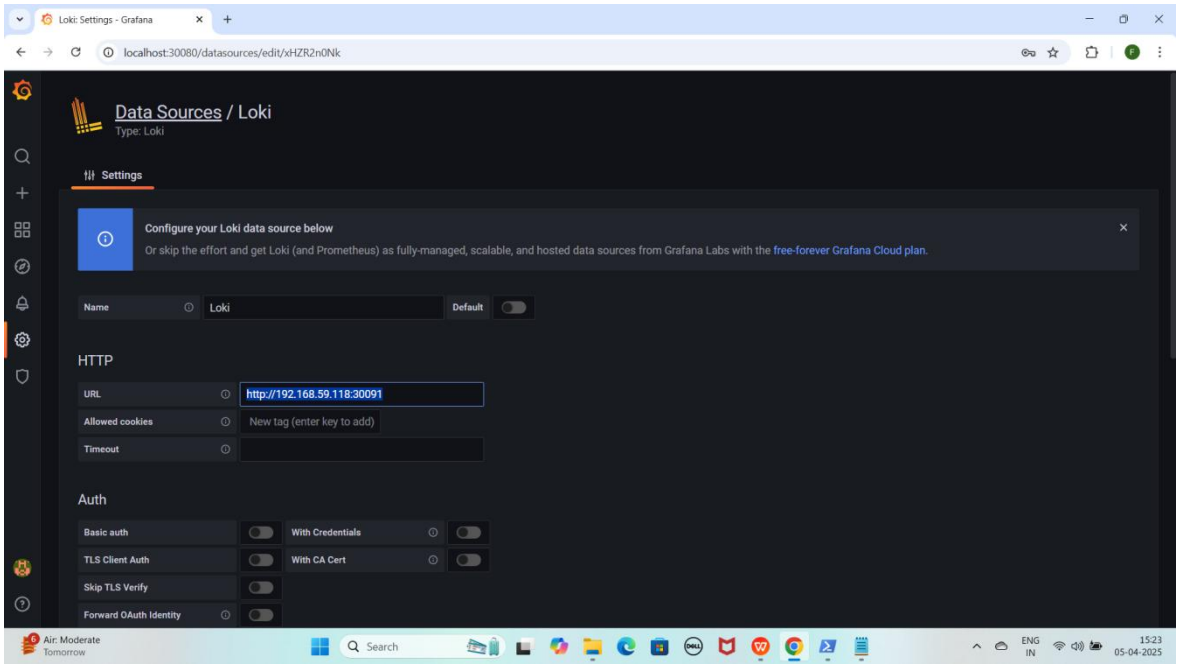
NOTE: Minikube VirtualBox me run ho raha ho, to Grafana me localhost kaam nahi karega. Uski jagah minikube ip use karenge kyunki localhost Grafana ke container ka hota hai, host machine ka nahi.

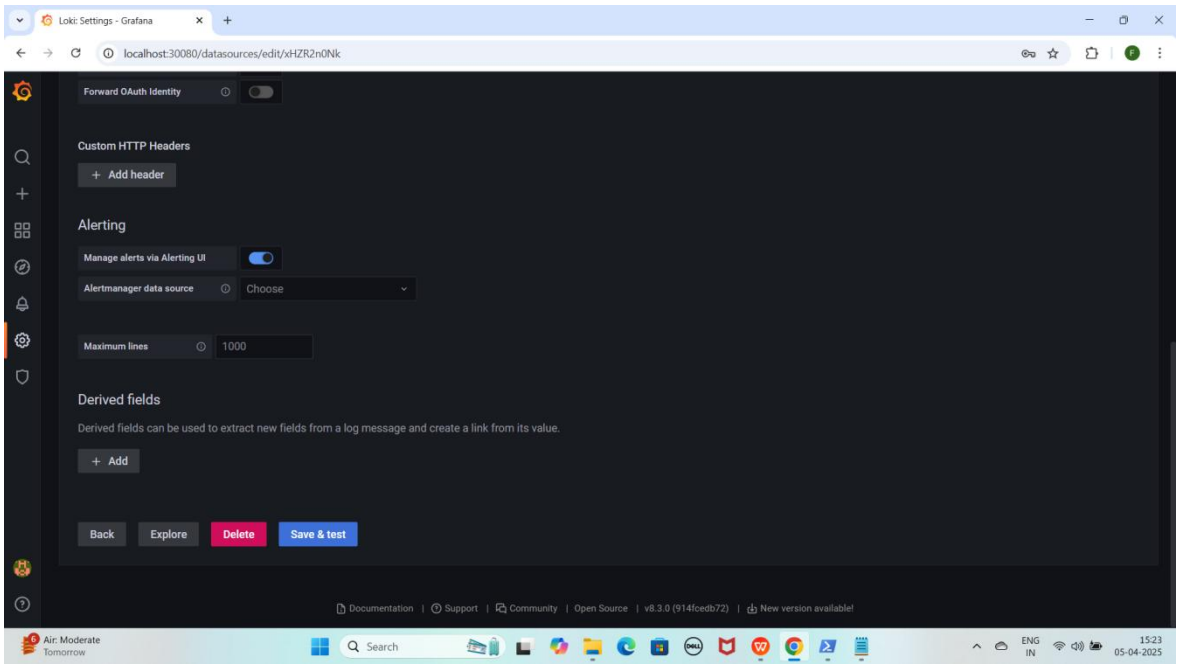
1. Proper URLs ke liye, Loki datasource add karne ke liye yeh command run karein

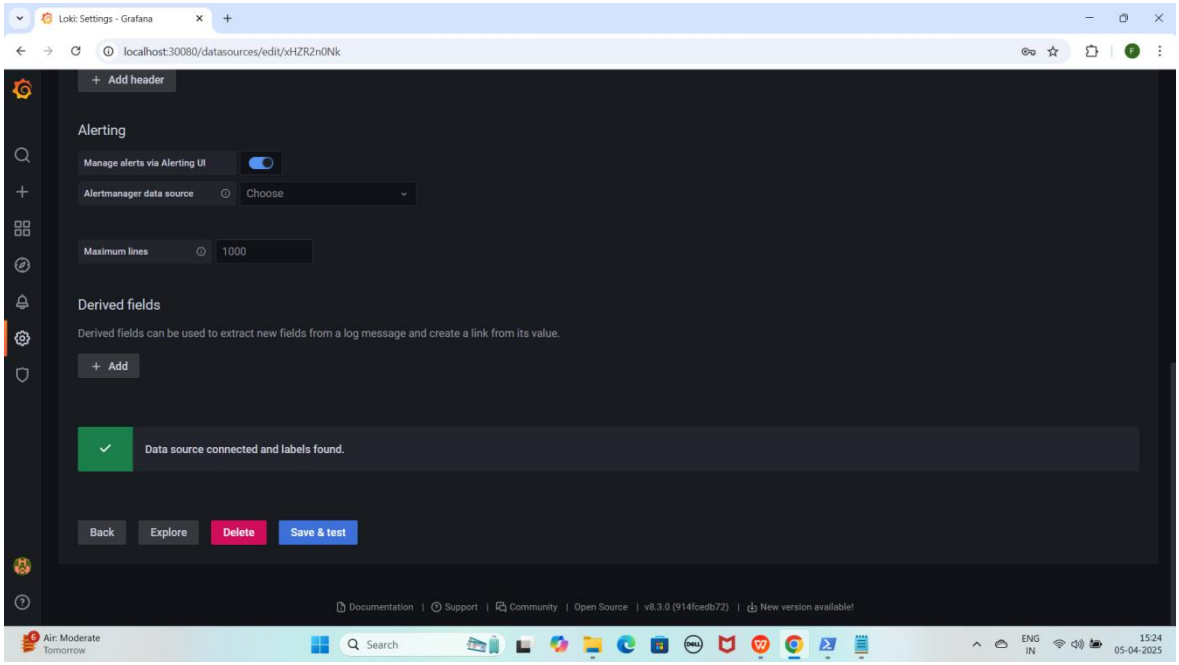
minikube service loki -n monitoring --url

YE KUCH ISTARHA LAGEGA





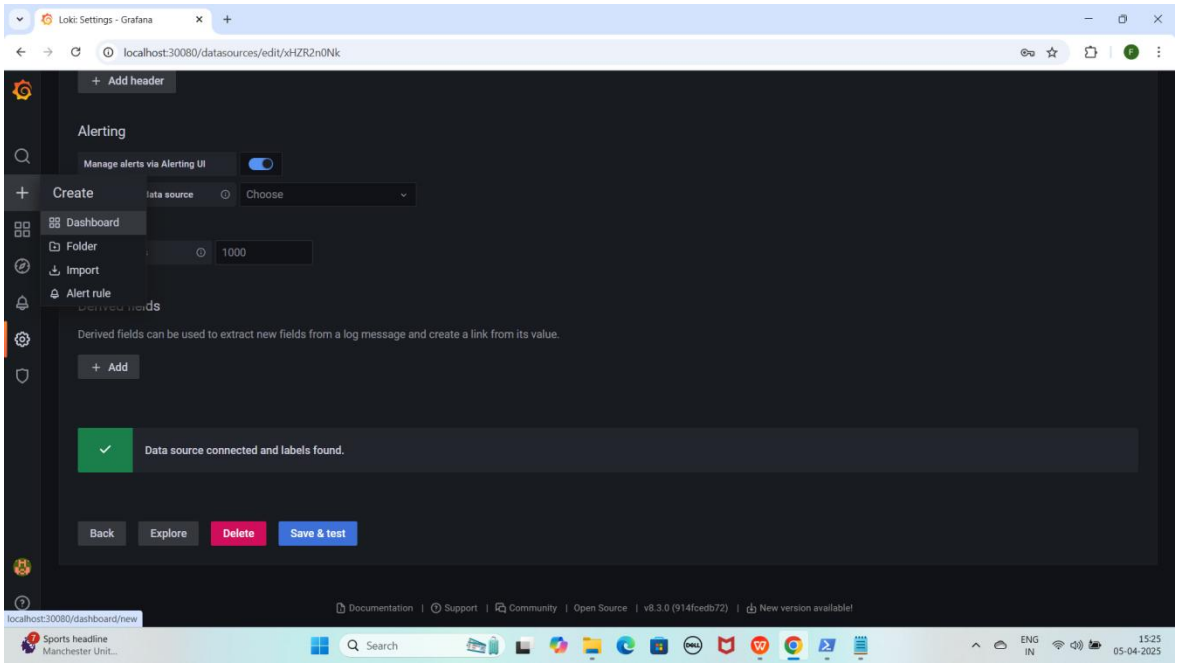


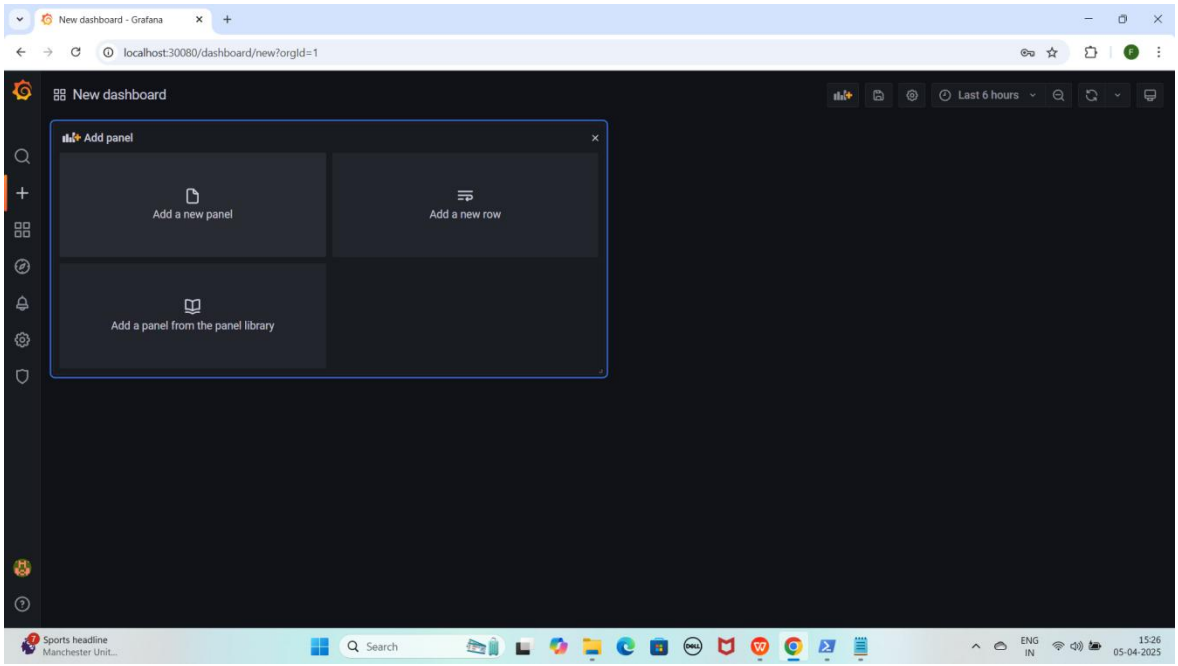


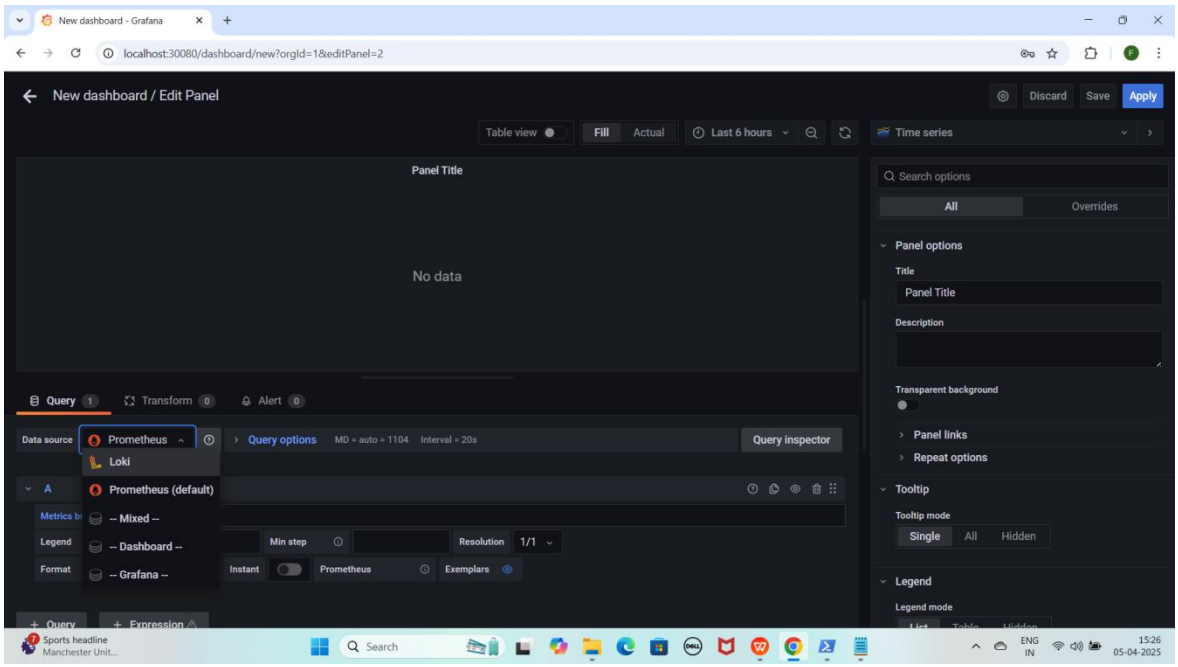
NOTE : Save & test pe click karne ke baad aapko Data source connected and label found karke pop up aayega

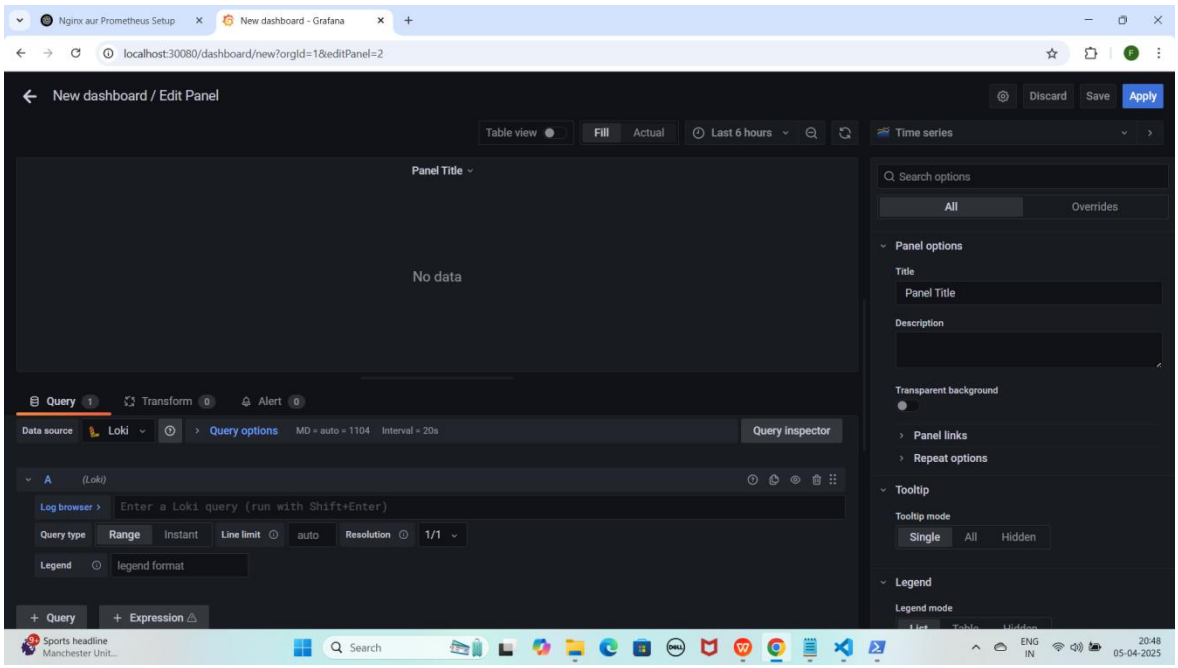
- **Loki ke Loggs visualize** karne ke liye **"+" (plus) icon** pe click karo.
- **Dashboard** select karo aur **"Add a new panel"** pe click karo.
- **Query section** me **Data Source ko "Loki"** select karo.

YEKUCH ISTARHA LAGEGA



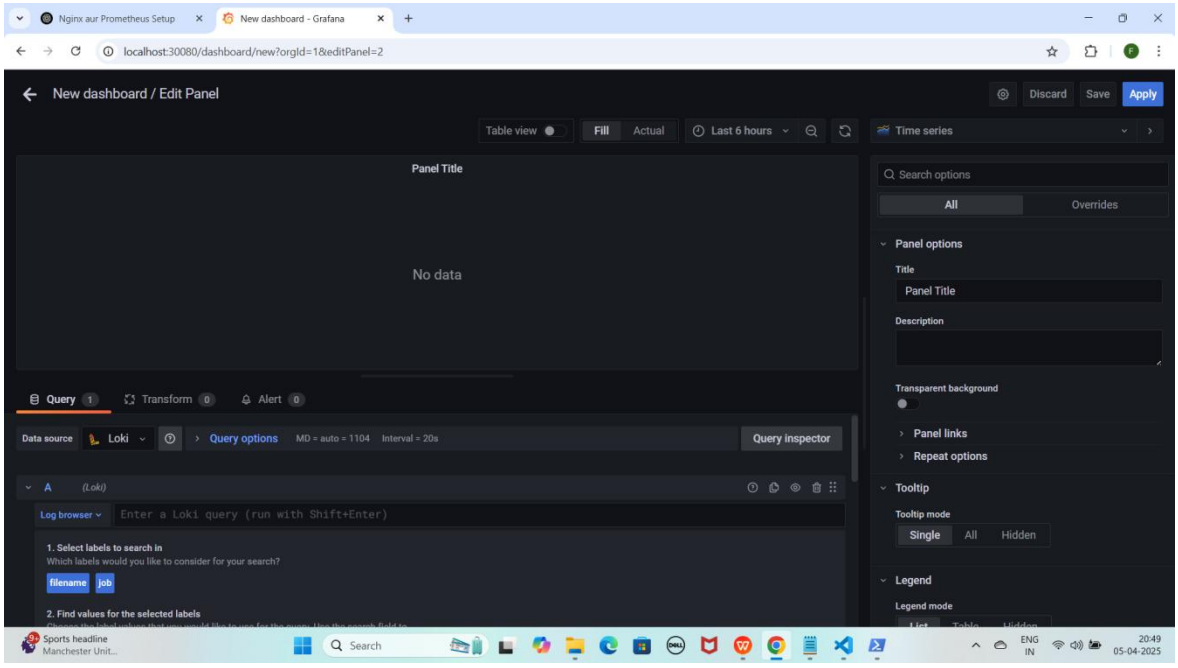


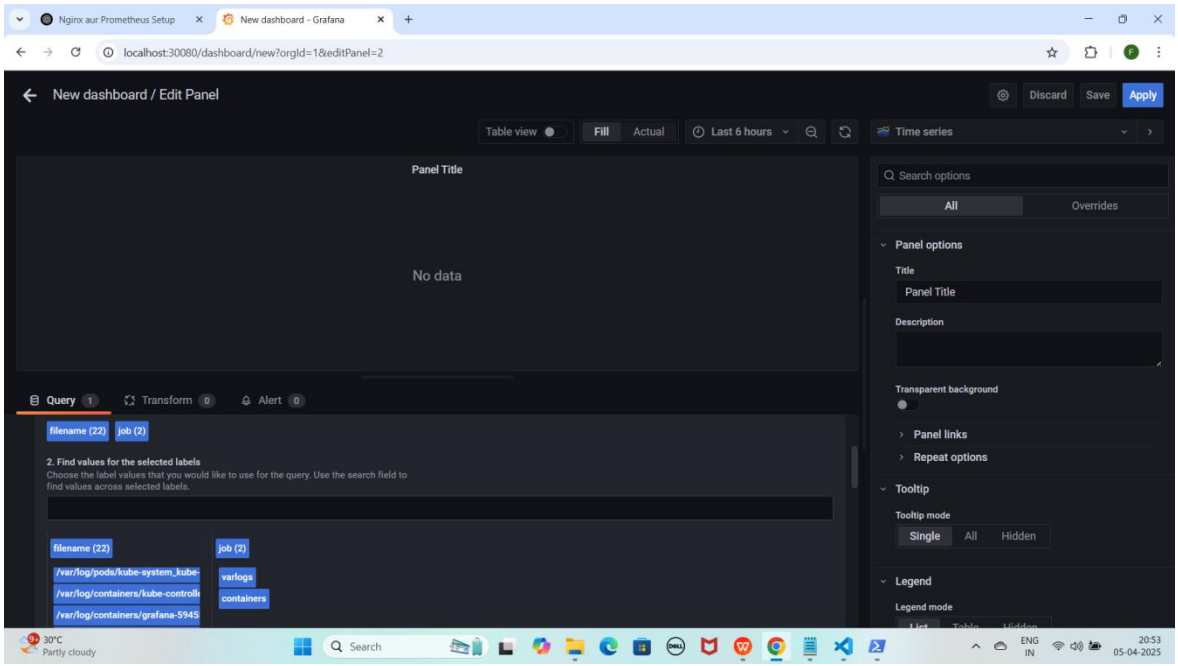

New dashboard - Grafana
localhost:30080/dashboard/new?orgId=1&editPanel=2
New dashboard / Edit Panel
Discard
Save
Apply
Table view
Fill
Actual
Last 6 hours
Time series
Panel Title
No data
Search options
All
Overrides
Panel options
Title
Panel Title
Description
Transparent background
Panel links
Repeat options
Tooltip
Tooltip mode
Single
All
Hidden
Legend
Legend mode
Query 1
Transform 0
Alert 0
Data source
Prometheus
Query options
MD = auto = 1104
Interval = 20s
Query inspector
Loki
Prometheus (default)
-- Mixed --
-- Dashboard --
-- Grafana --
A
Metrics br
Legend
Format
Min step
Resolution
1/1
Instant
Prometheus
Exemplars
+ Query
+ Expression
Sports headline
Manchester Unit...
Search
ENG
IN
15:26
05-04-2025

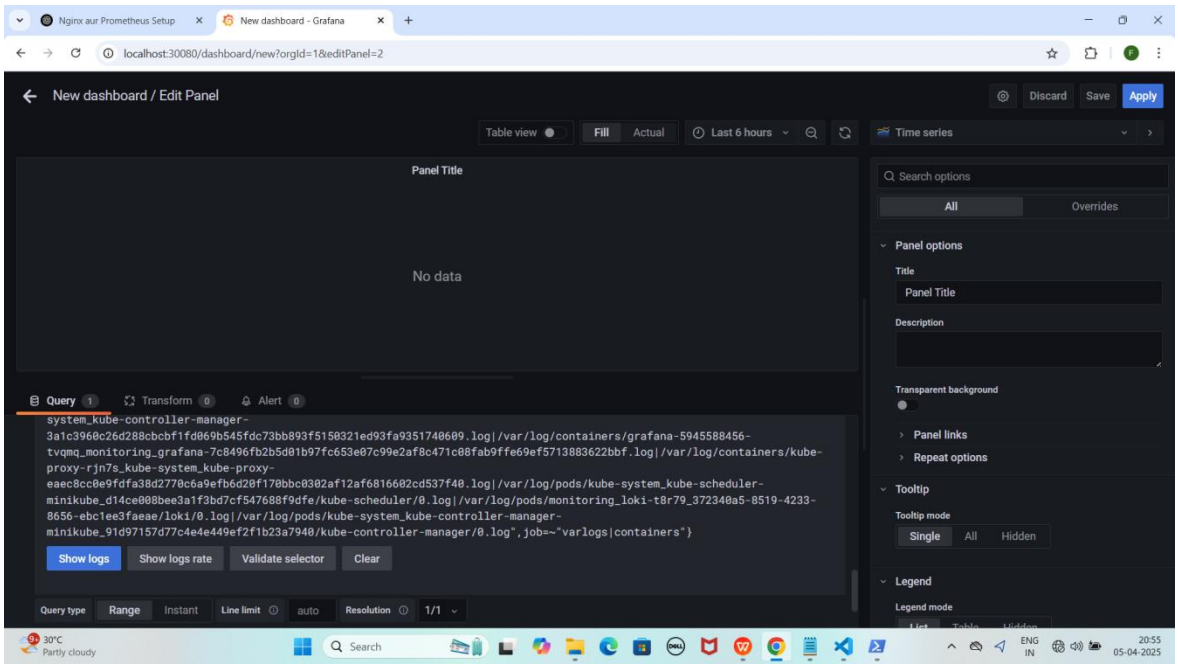

Nginx aur Prometheus Setup
New dashboard - Grafana
localhost:30080/dashboard/new?orgId=1&editPanel=2
New dashboard / Edit Panel
Discard
Save
Apply
Table view
Fill
Actual
Last 6 hours
Time series
Panel Title
No data
Search options
All
Overrides
Panel options
Title
Panel Title
Description
Transparent background
Panel links
Repeat options
Tooltip
Tooltip mode
Single
All
Hidden
Legend
Legend mode
Query 1
Transform 0
Alert 0
Data source
Loki
Query options
MD = auto = 1104
Interval = 20s
Query inspector
A
(Loki)
Log browser
Enter a Loki query (run with Shift+Enter)
Query type
Range
Instant
Line limit
auto
Resolution
1/1
Legend
legend format
+ Query
+ Expression
Sports headline
Manchester Unit...
Search
ENG
IN
20:48
05-04-2025

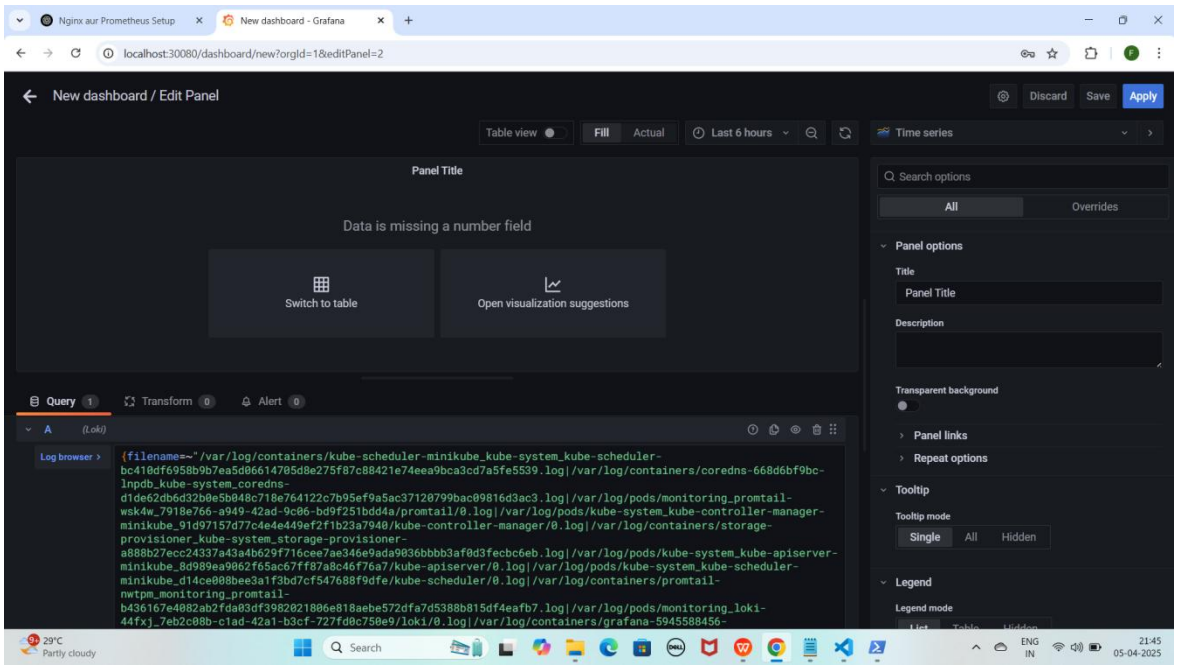
2. **"Log Browser"** pe click karo.
3. Pehle **"filename"** select karo or uske logs bhi, phir **"job"** (jaise ki **varlogs and containers**) select karo or uske logs bhi select karo.
4. Neeche **scroll** karo aur **"Show logs"** pe click karo.

YEKUCH ISTARHA LAGEGA



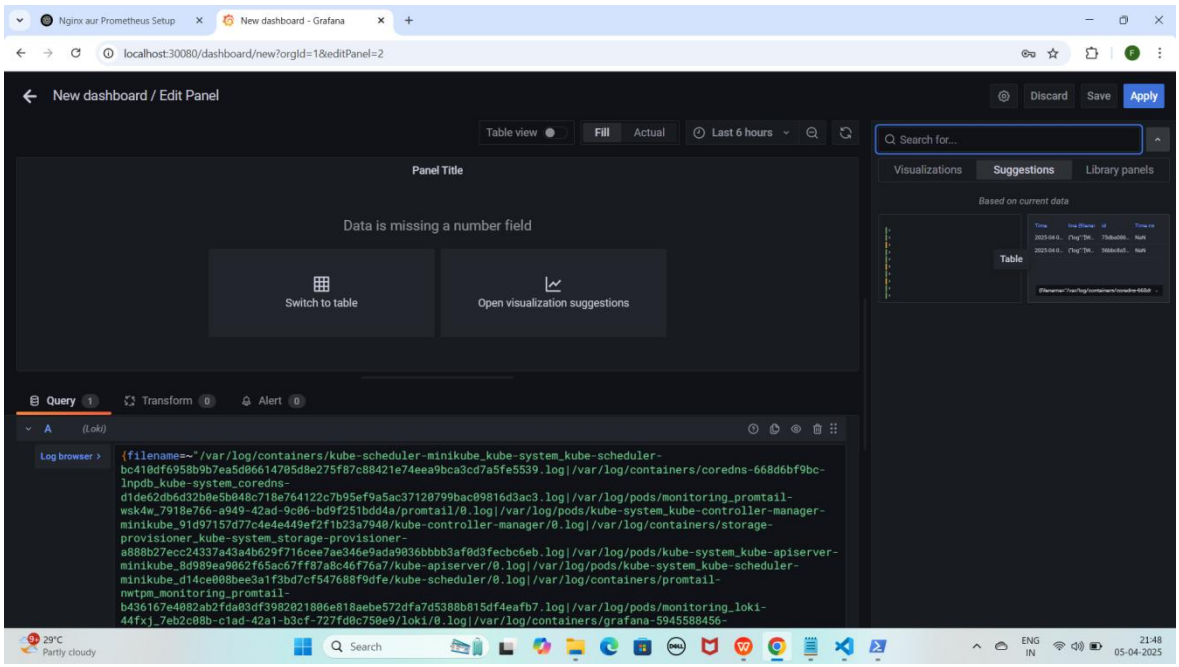


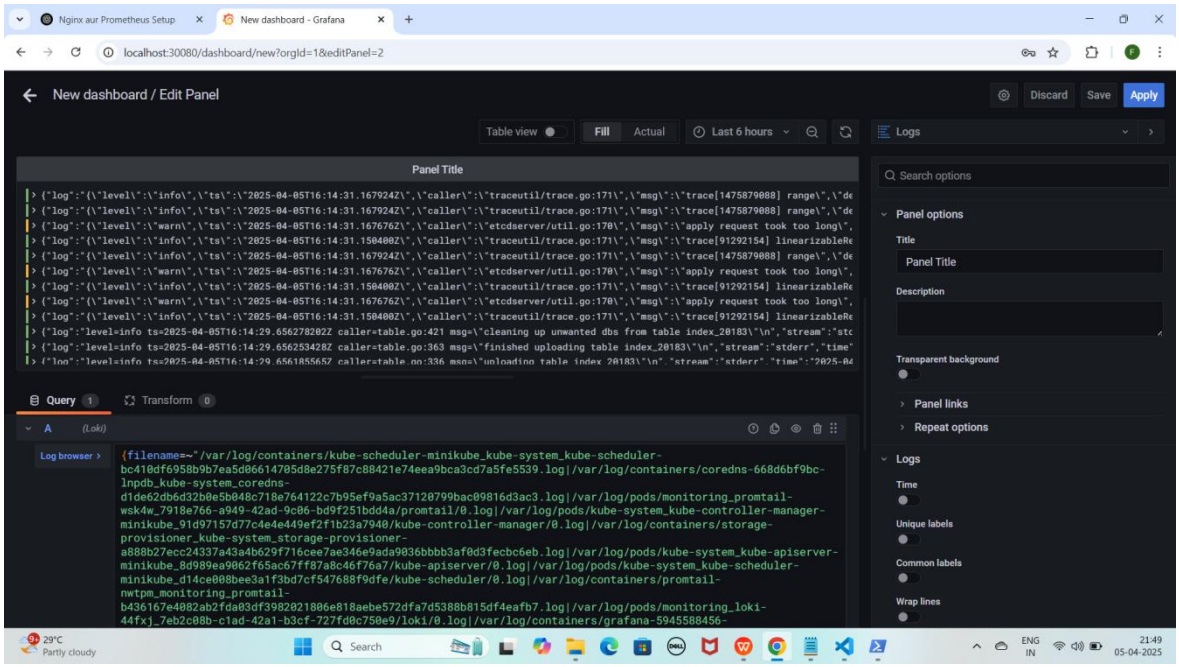




5. Time Series pe click karo
6. Suggestions me jao aur "Dashboard" select karo Jaise ki maine kiya hai

YEKUCH ISTARHA LAGEGA





NOTE : Is setup se hum cluster kel saare Logs Monitor kar sakte hain.

Recommend : Har Step aur Command ko meri Snapshots se Match karein taake Confirm ho sake ke sab kuch sahi tarah se Execute hua hai.

Project Video Demo : https://youtu.be/KTkrwvuFGGU

*****Commands Used in This Project*****

PART 1: Minikube Cluster Creation and Setup

1. Start Minikube Cluster using VirtualBox driver with 4GB RAM and 2 CPUs

minikube start --driver=virtualbox --memory=4000 --cpus=2 --force

2. Check Minikube Status

minikube status

3. Verify Node is Ready

kubectl get nodes

Part 2: Nginx pods and Service Deployment

1. Deploy NGINX with Replicas

kubectl apply -f nginx-deployment.yaml

2. Expose NGINX using NodePort Service

kubectl apply -f nginx-nodeport-service.yaml

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/nginx-service 30007:80" -WindowStyle Hidden

3. Verify Deployments & Services

kubectl get pods

kubectl get services

Part 3: MySQL Secrets and ConfigMap Configuration

1. Generate Base64 Encodings For Secrets

```
echo -n Faisal Khan | base64

echo -n Faisalkhan35@ | base64

echo -n 'RmFpc2FsIEtoYW4=' | base64 --decode

echo -n 'RmFpc2Fsa2hhbjM1QA==' | base64 --decode
```

2. Apply Secrets and ConfigMaps

```
kubectl apply -f mysql-secrets.yaml

kubectl apply -f mysql-configmap.yaml
```

3. Apply RBAC (Role-Based Access Control)

```
kubectl apply -f service-account.yaml

kubectl apply -f role.yaml

kubectl apply -f rolebinding.yaml
```

4. Verify Pods

```
kubectl get pods
```

Part 4: MySQL Database Pods and Services Deployment

1. Deploy MySQL Services & Persistent Volumes

kubectl apply -f mysql-headless-service.yaml

kubectl apply -f mysql-pv.yaml

kubectl apply -f mysql-pv-2.yaml

kubectl apply -f mysql-pv-3.yaml

2. Deploy MySQL StatefulSet

kubectl apply -f mysql-statefulset.yaml

3. Verify Deployments & Services

kubectl get pods

kubectl get services

Part 5: Accessing MySQL Database in Minikube Cluster

1. Access MySQL Pod

kubectl exec -it mysql-0 -- /bin/bash

2. Login to MySQL

mysql -u root -p

3. Create & Verify Database

CREATE DATABASE faisal_db;

SHOW DATABASES;

Part 6: Monitoring Using Prometheus and Loki With Grafana

1. Create Monitoring Namespace

kubectl create namespace monitoring

2. Deploy Prometheus Components

kubectl apply -f prometheus-daemonset.yaml

kubectl apply -f prometheus-rbac.yaml

kubectl apply -f prometheus-nodeport-service.yaml

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/prometheus-server 30090:80 -n monitoring" -WindowStyle Hidden

1. Verify Prometheus Pods & Services

kubectl get pods -n monitoring

kubectl get services -n monitoring

4. Important Prometheus Metrics

rate(process_cpu_seconds_total[30s])

process_resident_memory_bytes

5. Deploy Loki & Promtail

kubectl apply -f promtail-daemonset.yaml

kubectl apply -f loki-daemonset.yaml

kubectl apply -f loki-nodeport-service.yaml

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/loki 30091:3100 -n monitoring" -WindowStyle Hidden

6. Verify Loki & Promtail Pods & Services

kubectl get pods -n monitoring

kubectl get services -n monitoring

7. Deploy Grafana

kubectl apply -f grafana-deployment.yaml

Start-Process -FilePath "kubectl" -ArgumentList "port-forward service/grafana 30080:80 -n monitoring" -WindowStyle Hidden

8. Verify Grafana Pods & Services

kubectl get pods -n monitoring

kubectl get services -n monitoring