Práctica 4: Kubernetes (K8s)

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Ejercicio 1

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl get nodes -o wide
NAME                      STATUS   ROLES           AGE    VERSION   INTERNAL-IP     EXTERNAL-IP   OS-IMAGE             KERNEL-VERSION      CONTAINER-RUNTIME
idc-aisi2223-k8s-master   Ready    control-plane   10m    v1.26.3   192.168.56.10   <none>        Ubuntu 20.04.5 LTS   5.4.0-139-generic   containerd://1.6.20
idc-aisi2223-k8s-worker-1 Ready    <none>          5m3s   v1.26.3   192.168.56.11   <none>        Ubuntu 20.04.5 LTS   5.4.0-139-generic   containerd://1.6.20
idc-aisi2223-k8s-worker-2 Ready    <none>          8m8s   v1.26.3   192.168.56.12   <none>        Ubuntu 20.04.5 LTS   5.4.0-139-generic   containerd://1.6.20
vagrant@idc-aisi2223-k8s-master:~$ kubectl cluster-info
Kubernetes control plane is running at https://192.168.56.10:6443
CoreDNS is running at https://192.168.56.10:6443/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 1: VMs aprovisionadas con los playbooks de Ansible

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej1/nginx-pod.yml
pod/nginx-pod created
vagrant@idc-aisi2223-k8s-master:~$ kubectl get pods -o wide
NAME        READY   STATUS    RESTARTS   AGE   IP          NODE                        NOMINATED NODE   READINESS GATES
nginx-pod   1/1     Running   0          42s   10.10.1.65   idc-aisi2223-k8s-worker-1   <none>           <none>
vagrant@idc-aisi2223-k8s-master:~$ kubectl describe pod nginx-pod
Name:             nginx-pod
Namespace:        default
Priority:         0
Service Account:  default
Node:             idc-aisi2223-k8s-worker-1/192.168.56.11
Start Time:       Mon, 10 Apr 2023 23:31:10 +0000
Labels:           <none>
Annotations:      cni.projectcalico.org/containerID: bcaae1262e7d8e47978e4aa80fe587a32dd004ffcd71b805e63b32e26bd8f5fe
                  cni.projectcalico.org/podIP: 10.10.1.65/32
                  cni.projectcalico.org/podIPs: 10.10.1.65/32
Status:           Running
IP:               10.10.1.65
IPs:
  IP:  10.10.1.65
Containers:
  nginx-container:
    Container ID:   containerd://deaa4254daf56c2abacc798f9adbd9e06d9bb774e05b7a82cd81f6034662bfdd
    Image:          nginx
    Image ID:       docker.io/library/nginx@sha256:2ab30d6ac53580a6db8b657abf0f68d75360ff5cc1670a85acb5bd85ba1b19c0
    Port:           80/TCP
    Host Port:      0/TCP
    State:          Running
      Started:      Mon, 10 Apr 2023 23:31:37 +0000
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-z9gwv (ro)
```

Figure 2: Información detallada del pod

Ejercicio 2

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej2/nginx-replicaset.yml
replicaset.apps/nginx-replicaset created
vagrant@idc-aisi2223-k8s-master:~$ kubectl describe replicaset nginx-replicaset
Name:         nginx-replicaset
Namespace:    default
Selector:     app=nginx
Labels:       <none>
Annotations:  <none>
Replicas:     2 current / 2 desired
Pods Status:  2 Running / 0 Waiting / 0 Succeeded / 0 Failed
Pod Template:
  Labels:  app=nginx
  Containers:
   nginx-container:
    Image:        nginx
    Port:         80/TCP
    Host Port:    0/TCP
    Environment:  <none>
    Mounts:       <none>
  Volumes:        <none>
Events:
  Type    Reason            Age   From                   Message
  ----    ------            ----  ----                   -------
  Normal  SuccessfulCreate  112s  replicaset-controller  Created pod: nginx-replicaset-5n46x
  Normal  SuccessfulCreate  112s  replicaset-controller  Created pod: nginx-replicaset-tzcq6
vagrant@idc-aisi2223-k8s-master:~$ kubectl get pods -o wide
NAME                     READY   STATUS    RESTARTS   AGE    IP           NODE                      NOMINATED NODE   READINESS GATES
nginx-replicaset-5n46x   1/1     Running   0          116s   10.10.1.1    idc-aisi2223-k8s-worker-2   <none>           <none>
nginx-replicaset-tzcq6   1/1     Running   0          115s   10.10.1.66   idc-aisi2223-k8s-worker-1   <none>           <none>
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 3: Información detallada del ReplicaSet y de los pods

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl describe deployment nginx-deployment
Name:                   nginx-deployment
Namespace:              default
CreationTimestamp:      Wed, 12 Apr 2023 15:35:51 +0000
Labels:                 <none>
Annotations:            deployment.kubernetes.io/revision: 1
Selector:               app=nginx
Replicas:               2 desired | 2 updated | 2 total | 2 available | 0 unavailable
StrategyType:           RollingUpdate
MinReadySeconds:        0
RollingUpdateStrategy:  25% max unavailable, 25% max surge
Pod Template:
  Labels:  app=nginx
  Containers:
   nginx-container:
    Image:        nginx:1.20.2
    Port:         80/TCP
    Host Port:    0/TCP
    Environment:  <none>
    Mounts:       <none>
  Volumes:        <none>
Conditions:
  Type           Status  Reason
  ----           ------  ------
  Progressing    True    NewReplicaSetAvailable
  Available      True    MinimumReplicasAvailable
OldReplicaSets:  <none>
NewReplicaSet:   nginx-deployment-75fdc59b57 (2/2 replicas created)
Events:
  Type    Reason             Age   From                   Message
  ----    ------             ----  ----                   -------
  Normal  ScalingReplicaSet  72m   deployment-controller  Scaled up replica set nginx-deployment-75fdc59b57 to 2
vagrant@idc-aisi2223-k8s-master:~$ kubectl get pods -o wide
NAME                                READY   STATUS    RESTARTS       AGE   IP          NODE                      NOMINATED NODE   READINESS GATES
nginx-deployment-75fdc59b57-6d78c   1/1     Running   1 (6m32s ago)   72m   10.10.1.3   idc-aisi2223-k8s-worker-1   <none>           <none>
nginx-deployment-75fdc59b57-fjw8    1/1     Running   1 (6m32s ago)   72m   10.10.1.4   idc-aisi2223-k8s-worker-1   <none>           <none>
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 4: Información detallada del Deployment y de los pods

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej2/nginx-deployment.yml
deployment.apps/nginx-deployment configured
vagrant@idc-aisi2223-k8s-master:~$ kubectl get deployments -o wide
NAME               READY   UP-TO-DATE   AVAILABLE   AGE   CONTAINERS        IMAGES         SELECTOR
nginx-deployment   2/4     2            2           76m   nginx-container   nginx:1.21.6   app=nginx
vagrant@idc-aisi2223-k8s-master:~$ kubectl get deployments -o wide
NAME               READY   UP-TO-DATE   AVAILABLE   AGE   CONTAINERS        IMAGES         SELECTOR
nginx-deployment   4/4     4            4           78m   nginx-container   nginx:1.21.6   app=nginx
vagrant@idc-aisi2223-k8s-master:~$ kubectl get replicasets -o wide
NAME                          DESIRED   CURRENT   READY   AGE    CONTAINERS        IMAGES         SELECTOR
nginx-deployment-75fdc59b57   0         0         0       78m    nginx-container   nginx:1.20.2   app=nginx,pod-template-hash=75fdc59b57
nginx-deployment-765c9d7f68   4         4         4       115s   nginx-container   nginx:1.21.6   app=nginx,pod-template-hash=765c9d7f68
vagrant@idc-aisi2223-k8s-master:~$ kubectl get pods -o wide
NAME                                READY   STATUS    RESTARTS   AGE    IP           NODE                        NOMINATED NODE   READINESS GATES
nginx-deployment-765c9d7f68-7cg8v   1/1     Running   0          2m6s   10.10.1.66   idc-aisi2223-k8s-worker-2   <none>           <none>
nginx-deployment-765c9d7f68-n9jhj   1/1     Running   0          2m6s   10.10.1.5    idc-aisi2223-k8s-worker-1   <none>           <none>
nginx-deployment-765c9d7f68-nc1b9   1/1     Running   0          93s    10.10.1.68   idc-aisi2223-k8s-worker-2   <none>           <none>
nginx-deployment-765c9d7f68-z5586   1/1     Running   0          99s    10.10.1.6    idc-aisi2223-k8s-worker-1   <none>           <none>
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 5: Información actualizada sobre los Deployment, los ReplicaSet y de los pods

Ejercicio 3

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej2/nginx-deployment.yml
deployment.apps/nginx-deployment created
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej3/
html/               nginx-service.yml
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej3/nginx-service.yml
service/nginx-service created
vagrant@idc-aisi2223-k8s-master:~$ kubectl describe service nginx-service
Name:              nginx-service
Namespace:         default
Labels:            <none>
Annotations:       <none>
Selector:          app=nginx
Type:              ClusterIP
IP Family Policy:  SingleStack
IP Families:       IPv4
IP:                10.109.255.228
IPs:               10.109.255.228
Port:              http  8080/TCP
TargetPort:        80/TCP
Endpoints:         10.10.1.3:80,10.10.1.67:80
Session Affinity:  None
Events:            <none>
vagrant@idc-aisi2223-k8s-master:~$ kubectl get pods -o wide
NAME                                READY   STATUS    RESTARTS   AGE   IP           NODE                        NOMINATED NODE   READINESS GATES
nginx-deployment-75fdc59b57-hx55m   1/1     Running   0          52s   10.10.1.3    idc-aisi2223-k8s-worker-2   <none>           <none>
nginx-deployment-75fdc59b57-wv5vm   1/1     Running   0          52s   10.10.1.67   idc-aisi2223-k8s-worker-1   <none>           <none>
vagrant@idc-aisi2223-k8s-master:~$ kubectl get services -o wide
NAME            TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)    AGE   SELECTOR
kubernetes      ClusterIP   10.96.0.1        <none>        443/TCP    9h    <none>
nginx-service   ClusterIP   10.109.255.228   <none>        8080/TCP   71s   app=nginx
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 6: Información detallada del Service y de los pods

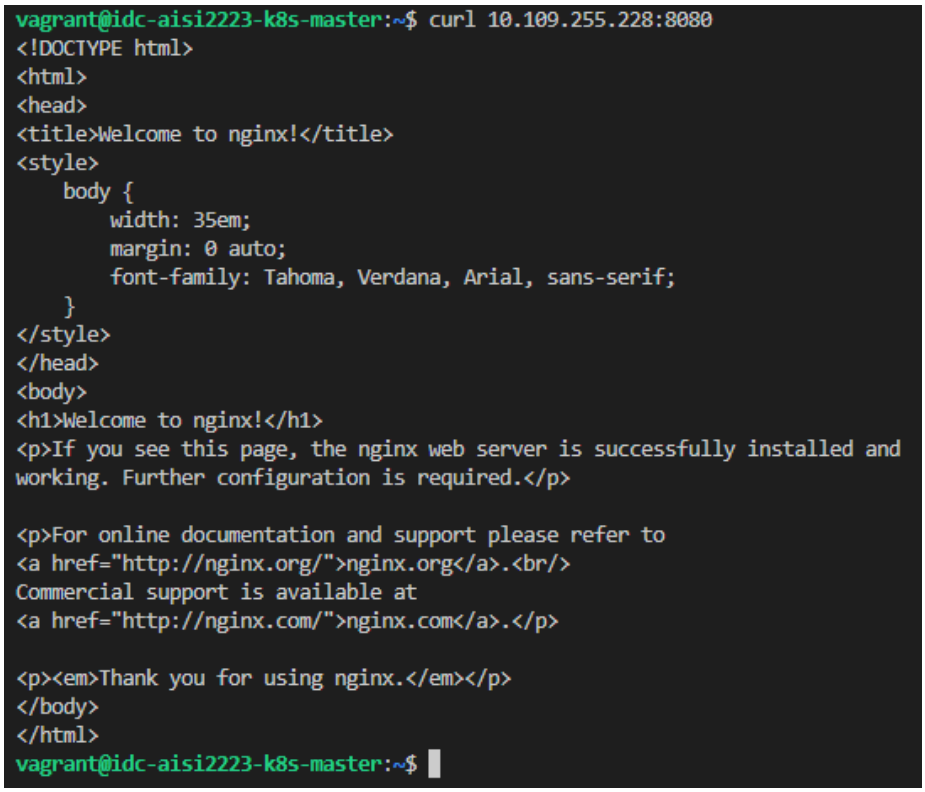

Figure 7: Acceso al servidor Nginx mediante curl usando la ClusterIP del Service

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl create configmap index-configmap --from-file=/vagrant/ej3/html/index.html
configmap/index-configmap created
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej2/nginx-deployment.yml
deployment.apps/nginx-deployment created
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej3/
html/              nginx-service.yml
vagrant@idc-aisi2223-k8s-master:~$ kubectl apply -f /vagrant/ej3/nginx-service.yml
service/nginx-service created
vagrant@idc-aisi2223-k8s-master:~$ kubectl describe service nginx-service
Name:                     nginx-service
Namespace:                default
Labels:                   <none>
Annotations:              <none>
Selector:                 app=nginx
Type:                     NodePort
IP Family Policy:         SingleStack
IP Families:              IPv4
IP:                       10.100.152.129
IPs:                      10.100.152.129
Port:                     http  8080/TCP
TargetPort:               80/TCP
NodePort:                 http  30001/TCP
Endpoints:                10.10.1.4:80,10.10.1.68:80
Session Affinity:         None
External Traffic Policy:  Cluster
Events:                   <none>
vagrant@idc-aisi2223-k8s-master:~$ kubectl get services -o wide
NAME            TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)          AGE   SELECTOR
kubernetes      ClusterIP   10.96.0.1        <none>        443/TCP          10h   <none>
nginx-service   NodePort    10.100.152.129   <none>        8080:30001/TCP   35s   app=nginx
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 8: Información detallada del Service y de todos los servicios en ejecución

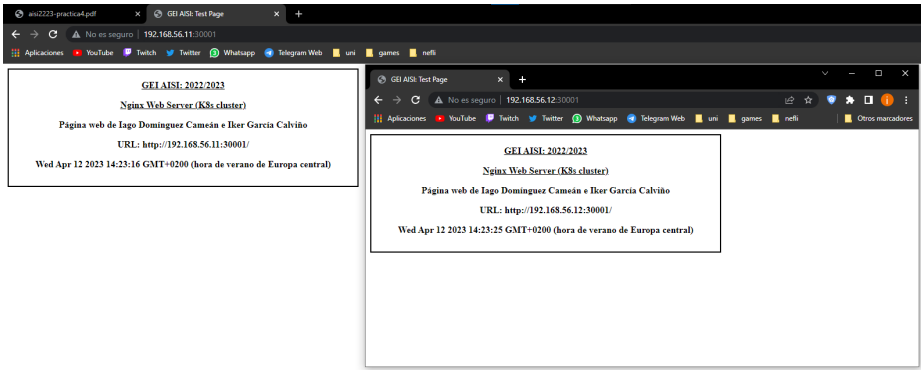

Figure 9: Navegador del host

Ejercicio 4

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl get namespaces
NAME              STATUS   AGE
aisi2223          Active   20m
default           Active   13h
kube-node-lease   Active   13h
kube-public       Active   13h
kube-system       Active   13h
vagrant@idc-aisi2223-k8s-master:~$ kubectl get services -o wide -n aisi2223
NAME              TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)          AGE     SELECTOR
mongodb-service   ClusterIP   10.96.85.40    <none>        27017/TCP        4m56s   app=mongodb
webapp-service    NodePort    10.110.142.4   <none>        3000:30100/TCP   2m21s   app=webapp
vagrant@idc-aisi2223-k8s-master:~$ kubectl get deplyments -o wide -n aisi2223
error: the server doesn't have a resource type "deplyments"
vagrant@idc-aisi2223-k8s-master:~$ kubectl get deployments -o wide -n aisi2223
NAME                READY   UP-TO-DATE   AVAILABLE   AGE     CONTAINERS   IMAGES                          SELECTOR
mongodb-deployment   1/1     1            1           5m10s   mongodb      mongo:4.4                       app=mongodb
webapp-deployment    3/3     3            3           2m35s   webapp       nanajanashia/k8s-demo-app:v1.0   app=webapp
vagrant@idc-aisi2223-k8s-master:~$ kubectl get pods -o wide -n aisi2223
NAME                                 READY   STATUS    RESTARTS   AGE     IP           NODE                       NOMINATED NODE   READINESS GATES
mongodb-deployment-554cd8dcc7-bvblw   1/1     Running   0          5m23s   10.10.1.73   idc-aisi2223-k8s-worker-1   <none>           <none>
webapp-deployment-7c89d58d86-48rqq    1/1     Running   0          2m48s   10.10.1.74   idc-aisi2223-k8s-worker-1   <none>           <none>
webapp-deployment-7c89d58d86-kdvxh    1/1     Running   0          2m48s   10.10.1.75   idc-aisi2223-k8s-worker-1   <none>           <none>
webapp-deployment-7c89d58d86-sccc9    1/1     Running   0          2m48s   10.10.1.6    idc-aisi2223-k8s-worker-2   <none>           <none>
vagrant@idc-aisi2223-k8s-master:~$ kubectl get configmaps -n aisi2223
NAME               DATA   AGE
kube-root-ca.crt   1      20m
mongodb-config     1      20m
vagrant@idc-aisi2223-k8s-master:~$ kubectl get secrets -n aisi2223
NAME             TYPE     DATA   AGE
mongodb-secret   Opaque   2      20m
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 10: Información detallada

User profile

Name: **idc-aisi2223**

Email: **iago.dominguez.camean@udc.es**

Interests: **coding, games, science**

Edit Profile

Figure 11: Perfil de usuario

Ejercicio 5

```
vagrant@idc-aisi2223-k8s-master:~$ kubectl get all
NAME                                    READY   STATUS    RESTARTS   AGE
pod/apache-deployment-7457495c6d-dqhf5  1/1     Running   0          5m7s
pod/apache-deployment-7457495c6d-vzxf7  1/1     Running   0          5m7s
pod/apache-deployment-7457495c6d-zrxrm  1/1     Running   0          5m7s
pod/nginx-deployment-7d57c95866-c5vk6   1/1     Running   0          4m32s
pod/nginx-deployment-7d57c95866-rdnfs   1/1     Running   0          4m32s

NAME                    TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)    AGE
service/apache-service  ClusterIP   10.106.230.147   <none>        9090/TCP   5m7s
service/kubernetes      ClusterIP   10.96.0.1        <none>        443/TCP    129m
service/nginx-service   ClusterIP   10.102.185.204   <none>        8080/TCP   4m32s

NAME                                READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/apache-deployment   1/3     3            1           5m7s
deployment.apps/nginx-deployment    1/2     2            1           4m32s

NAME                                           DESIRED   CURRENT   READY   AGE
replicaset.apps/apache-deployment-7457495c6d   3         3         1       5m7s
replicaset.apps/nginx-deployment-7d57c95866    2         2         1       4m32s
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 12: Información de todos los recursos que hemos creado

```
vagrant@idc-aisi2223-k8s-master:~$ curl 10.106.230.147:9090
<html>
<head>
    <meta charset= "utf-8">
    <title>GEI AISI: Test Page</title>
    <script type="text/javascript">
        function getURL() {
                document.write("URL: " + window.location.href);
        }
        function getTIME() {
                document.getElementById("current_date").innerHTML = Date();
        }
    </script>
</head>
    <body>
        <div style="width:600px;height:200px;border:2px solid #000;text-align: center;">
        <strong><br>
        <u>GEI AISI: 2022/2023</u>
                <p><u>Apache Web Server (K8s cluster)</u></p>
                <p>Página web de Iago Domínguez Cameán e Iker García Calviño</p>

                <p><script>getURL();</script></p>
                <p><div id="current_date"><script>getTIME();</script></p>
        </strong>
        </div>
    </body>
</html>
vagrant@idc-aisi2223-k8s-master:~$
```

```
vagrant@idc-aisi2223-k8s-master:~$ curl 10.102.185.204:8080
<html>
<head>
    <meta charset= "utf-8">
    <title>GEI AISI: Test Page</title>
    <script type="text/javascript">
        function getURL() {
                document.write("URL: " + window.location.href);
        }
        function getTIME() {
                document.getElementById("current_date").innerHTML = Date();
        }
    </script>
</head>
    <body>
        <div style="width:600px;height:200px;border:2px solid #000;text-align: center;">
        <strong><br>
        <u>GEI AISI: 2022/2023</u>
                <p><u>Nginx Web Server (K8s cluster)</u></p>
                <p>Página web de Iago Domínguez Cameán e Iker García Calviño</p>

                <p><script>getURL();</script></p>
                <p><div id="current_date"><script>getTIME();</script></p>
        </strong>
        </div>
    </body>
</html>
vagrant@idc-aisi2223-k8s-master:~$
```

Figure 13: Acceso a ambas aplicaciones mediante curl

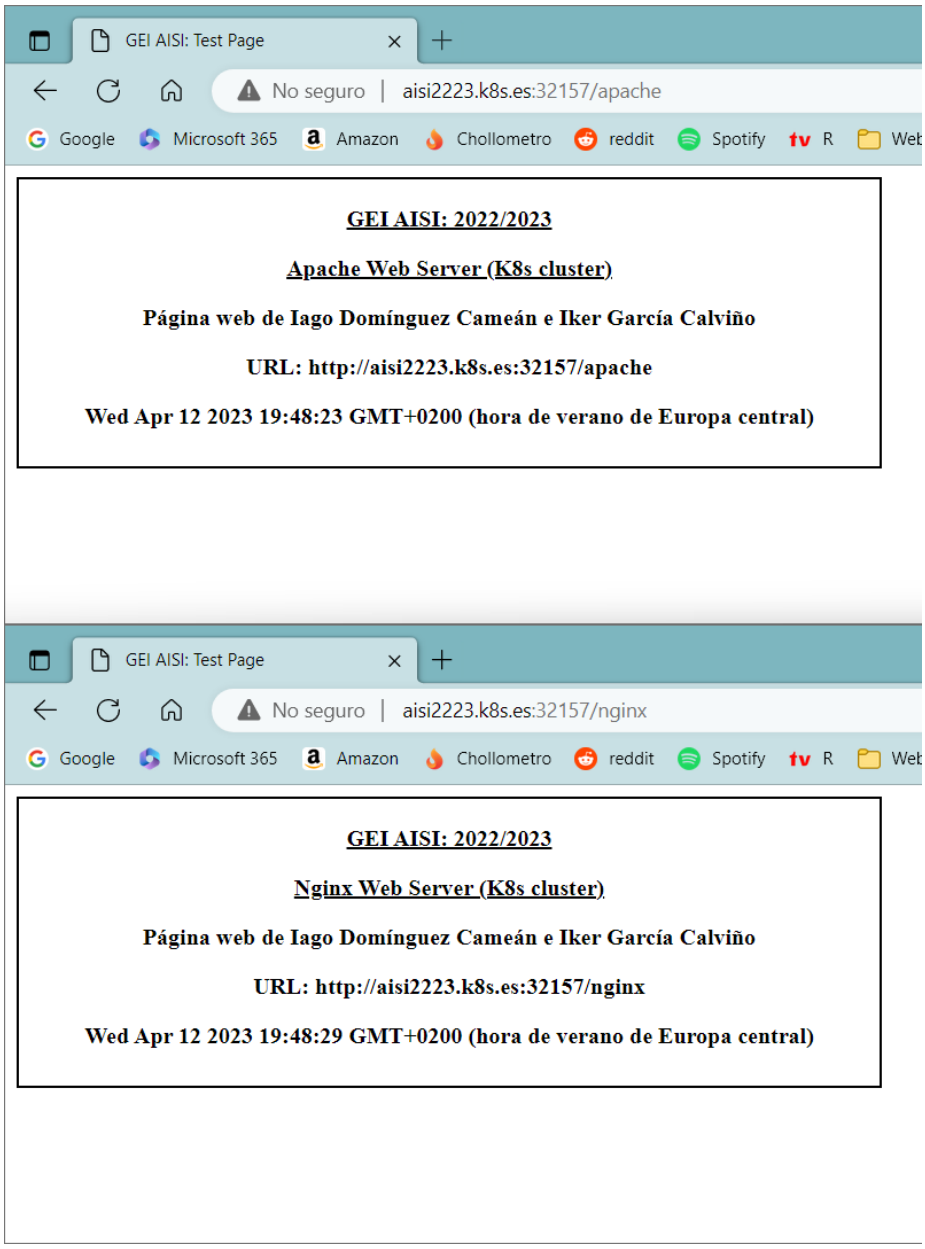

Figure 14: Navegador del host