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# Course Objectives

- ✓ Core Concepts
- ✓ Scheduling
- ✓ Logging Monitoring
- ✓ Application Lifecycle Management
- ✓ Cluster Maintenance
- ✓ Security
- ✓ Storage
- ✓ Networking
- ✓ Installation, Configuration & Validation
- Troubleshooting

Application Failure



Control Plane Failure



Worker Node Failure



Networking



# Application Failure

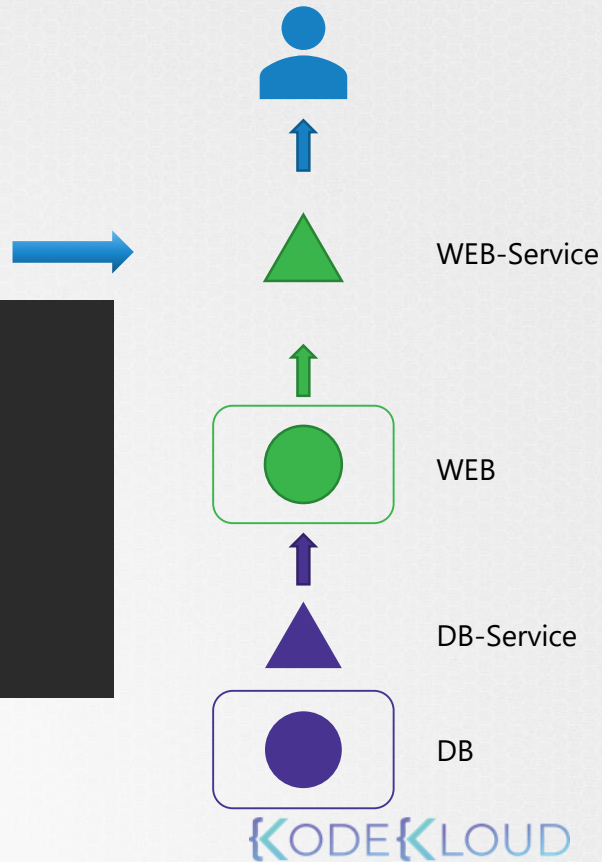
# Check Service Status

```
▶ curl http://web-service-ip:node-port  
curl: (7) Failed to connect to web-service-ip port node-port: Connection timed out
```

```
▶ kubectl describe service web-service
```

```
Name: web-service  
Namespace: default  
Labels: <none>  
Annotations: <none>  
Selector: name=webapp-mysql  
Type: NodePort  
IP: 10.96.0.156  
Port: <unset> 8080/TCP  
TargetPort: 8080/TCP  
NodePort: <unset> 31672/TCP  
Endpoints: 10.32.0.6:8080  
Session Affinity: None  
External Traffic Policy: Cluster  
Events: <none>
```

```
apiVersion: v1  
kind: Pod  
metadata:  
  name: webapp-mysql  
  labels:  
    app: example-app  
    name: webapp-mysql  
spec:  
  containers:  
  - name: webapp-mysql  
    image: simple-webapp-mysql  
    ports:  
    - containerPort: 8080
```



# Check Service

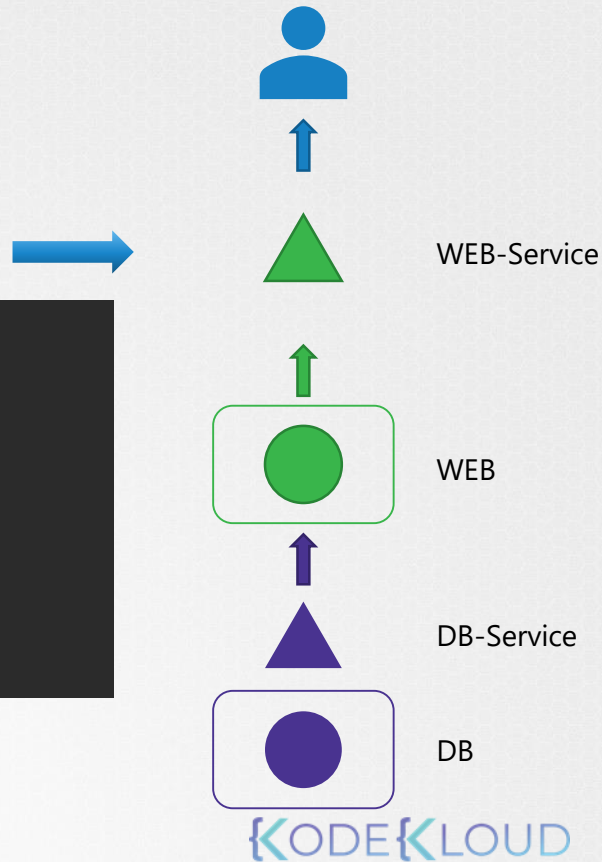
```
▶ curl http://web-service-ip:node-port
```

```
curl: (7) Failed to connect to web-service-ip port node-port: Connection timed out
```

```
▶ kubectl describe service web-service
```

```
Name:                web-service
Namespace:           default
Labels:              <none>
Annotations:         <none>
Selector:            name=webapp-mysql
Type:               NodePort
IP:                 10.96.0.156
Port:               <unset> 8080/TCP
TargetPort:         8080/TCP
NodePort:           <unset> 31672/TCP
Endpoints:          10.32.0.6:8080
Session Affinity:   None
External Traffic Policy: Cluster
Events:             <none>
```

```
apiVersion: v1
kind: Pod
metadata:
  name: webapp-mysql
  labels:
    app: example-app
    name: webapp-mysql
spec:
  containers:
  - name: webapp-mysql
    image: simple-webapp-mysql
    ports:
    - containerPort: 8080
```



# Check POD

```
▶ kubectl get pod
```

NAME	READY	STATUS	RESTARTS	AGE
Web	1/1	Running	5	50m

```
▶ kubectl describe pod web
```

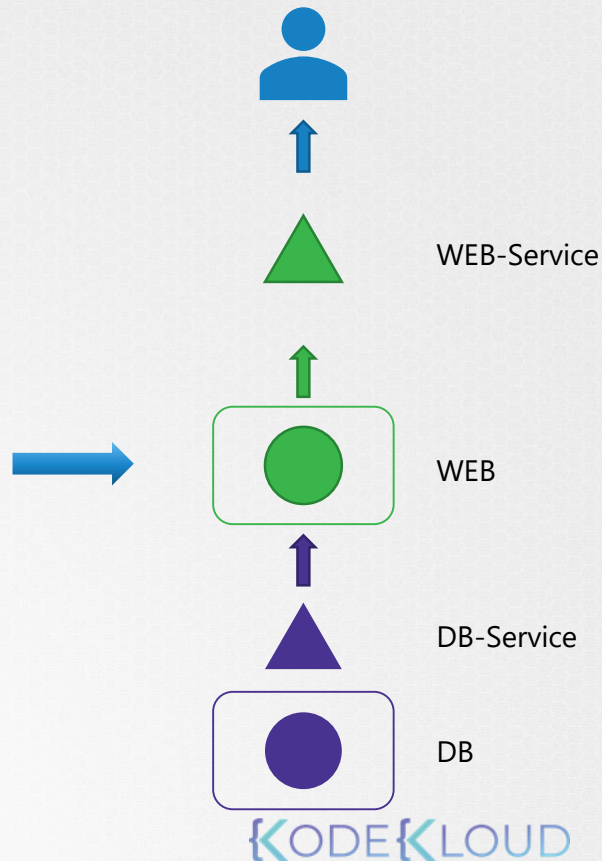
```
...
```

Events:

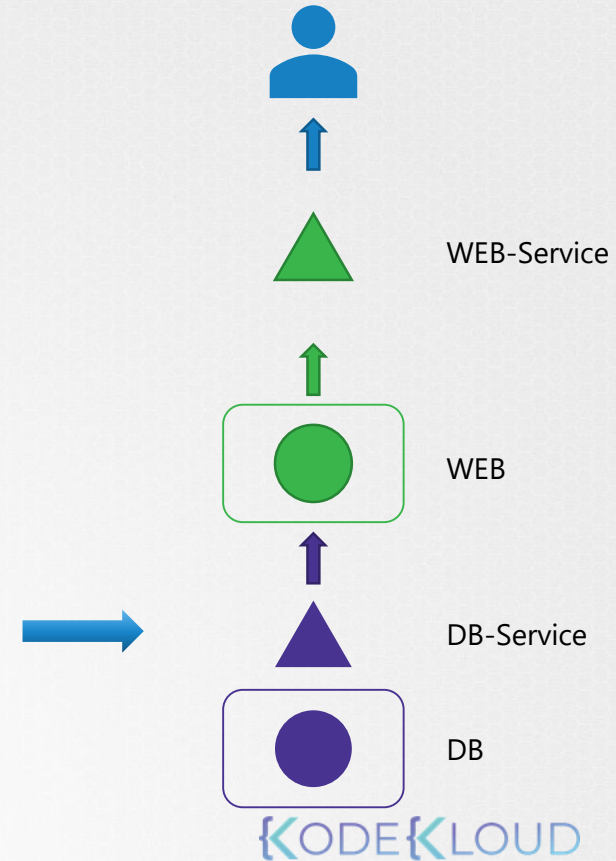
Type	Reason	Age	From	Message
Normal	Scheduled	52m	default-scheduler	Successfully assigned webapp-mysql to worker-1
Normal	Pulling	52m	kubelet, worker-1	pulling image "simple-webapp-mysql"
Normal	Pulled	52m	kubelet, worker-1	Successfully pulled image "simple-webapp-mysql"
Normal	Created	52m	kubelet, worker-1	Created container
Normal	Started	52m	kubelet, worker-1	Started container

```
▶ kubectl logs web -f --previous
```

```
10.32.0.1 - - [01/Apr/2019 12:51:55] "GET / HTTP/1.1" 200 -
10.32.0.1 - - [01/Apr/2019 12:51:55] "GET /static/img/success.jpg HTTP/1.1" 200 -
10.32.0.1 - - [01/Apr/2019 12:51:55] "GET /favicon.ico HTTP/1.1" 404 -
10.32.0.1 - - [01/Apr/2019 12:51:57] "GET / HTTP/1.1" 200 -
10.32.0.1 - - [01/Apr/2019 12:51:57] "GET / HTTP/1.1" 200 -
10.32.0.1 - - [01/Apr/2019 12:51:58] "GET / HTTP/1.1" 200 -
10.32.0.1 - - [01/Apr/2019 12:51:58] "GET / HTTP/1.1" 200 -
10.32.0.1 - - [01/Apr/2019 12:51:58] "GET / HTTP/1.1" 400 - Some Database Error application exiting!
```

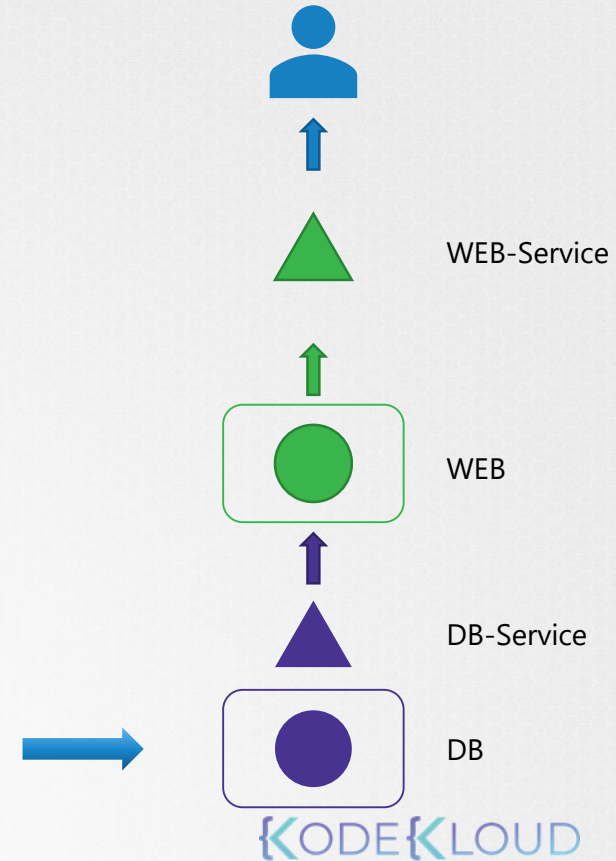


# | Check Dependent Service





# | Check Dependent Applications







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Application Failure



Worker Node Failure



Control Plane Failure



Networking

# Control Plane Failure



# Check Node Status

```
▶ kubectl get nodes
```

NAME	STATUS	ROLES	AGE	VERSION
worker-1	Ready	<none>	8d	v1.13.0
worker-2	Ready	<none>	8d	v1.13.0

```
▶ kubectl get pods
```

NAME	READY	STATUS	RESTARTS	AGE
mysql	1/1	Running	0	113m
webapp-mysql	1/1	Running	0	113m

# Check Controlplane Pods

```
▶ kubectl get pods -n kube-system
```

NAME	READY	STATUS	RESTARTS	AGE
coredns-78fcd66894-5dntv	1/1	Running	0	1h
coredns-78fcd66894-knpz1	1/1	Running	0	1h
etcd-master	1/1	Running	0	1h
kube-apiserver-master	1/1	Running	0	1h
kube-controller-manager-master	1/1	Running	0	1h
kube-proxy-fvbpj	1/1	Running	0	1h
kube-proxy-v5r2t	1/1	Running	0	1h
kube-scheduler-master	1/1	Running	0	1h
weave-net-7kd52	2/2	Running	1	1h
weave-net-jt15m	2/2	Running	1	1h

# Check Controlplane Services

## ▶ service kube-apiserver status

- kube-apiserver.service - Kubernetes API Server  
Loaded: loaded (/etc/systemd/system/kube-apiserver.service; enabled; vendor preset: enabled)  
Active: **active (running)** since Wed 2019-03-20 07:57:25 UTC; 1 weeks 1 days ago  
Docs: <https://github.com/kubernetes/kubernetes>  
Main PID: 15767 (kube-apiserver)  
Tasks: 13 (limit: 2362)

## ▶ service kube-controller-manager status

- kube-controller-manager.service - Kubernetes Controller Manager  
Loaded: loaded (/etc/systemd/system/kube-controller-manager.service; enabled; vendor preset: enabled)  
Active: **active (running)** since Wed 2019-03-20 07:57:25 UTC; 1 weeks 1 days ago  
Docs: <https://github.com/kubernetes/kubernetes>  
Main PID: 15771 (kube-controller)  
Tasks: 10 (limit: 2362)

## ▶ service kube-scheduler status

- kube-scheduler.service - Kubernetes Scheduler  
Loaded: loaded (/etc/systemd/system/kube-scheduler.service; enabled; vendor preset: enabled)  
Active: **active (running)** since Fri 2019-03-29 01:45:32 UTC; 11min ago  
Docs: <https://github.com/kubernetes/kubernetes>  
Main PID: 28390 (kube-scheduler)  
Tasks: 10 (limit: 2362)

# Check Controlplane Services

## ▶ service kubelet status

- kubelet.service - Kubernetes Kubelet  
Loaded: loaded (/etc/systemd/system/kubelet.service; enabled; vendor preset: enabled)  
Active: **active (running)** since Wed 2019-03-20 14:22:06 UTC; 1 weeks 1 days ago  
Docs: <https://github.com/kubernetes/kubernetes>  
Main PID: 1281 (kubelet)  
Tasks: 24 (limit: 1152)

## ▶ service kube-proxy status

- kube-proxy.service - Kubernetes Kube Proxy  
Loaded: loaded (/etc/systemd/system/kube-proxy.service; enabled; vendor preset: enabled)  
Active: **active (running)** since Wed 2019-03-20 14:21:54 UTC; 1 weeks 1 days ago  
Docs: <https://github.com/kubernetes/kubernetes>  
Main PID: 794 (kube-proxy)  
Tasks: 7 (limit: 1152)



# Check Service Logs

► `kubectl logs kube-apiserver-master -n kube-system`

```
I0401 13:45:38.190735      1 server.go:703] external host was not specified, using 172.17.0.117
I0401 13:45:38.194290      1 server.go:145] Version: v1.11.3
I0401 13:45:38.819705      1 plugins.go:158] Loaded 8 mutating admission controller(s) successfully in the following order:
NamespaceLifecycle,LimitRanger,ServiceAccount,NodeRestriction,Priority,DefaultTolerationSeconds,DefaultStorageClass,MutatingAdmissionWebhook.
I0401 13:45:38.819741      1 plugins.go:161] Loaded 6 validating admission controller(s) successfully in the following order:
LimitRanger,ServiceAccount,Priority,PersistentVolumeClaimResize,ValidatingAdmissionWebhook,ResourceQuota.
I0401 13:45:38.821372      1 plugins.go:158] Loaded 8 mutating admission controller(s) successfully in the following order:
NamespaceLifecycle,LimitRanger,ServiceAccount,NodeRestriction,Priority,DefaultTolerationSeconds,DefaultStorageClass,MutatingAdmissionWebhook.
I0401 13:45:38.821410      1 plugins.go:161] Loaded 6 validating admission controller(s) successfully in the following order:
LimitRanger,ServiceAccount,Priority,PersistentVolumeClaimResize,ValidatingAdmissionWebhook,ResourceQuota.
I0401 13:45:38.985453      1 master.go:234] Using reconciler: lease
W0401 13:45:40.900380      1 genericapiserver.go:319] Skipping API batch/v2alpha1 because it has no resources.
W0401 13:45:41.370677      1 genericapiserver.go:319] Skipping API rbac.authorization.k8s.io/v1alpha1 because it has no resources.
W0401 13:45:41.381736      1 genericapiserver.go:319] Skipping API scheduling.k8s.io/v1alpha1 because it has no resources.
```

► `sudo journalctl -u kube-apiserver`

```
Mar 20 07:57:25 master-1 systemd[1]: Started Kubernetes API Server.
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.553377 15767 flags.go:33] FLAG: --address="127.0.0.1"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558273 15767 flags.go:33] FLAG: --admission-control="[]"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558325 15767 flags.go:33] FLAG: --admission-control-config-file=""
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558339 15767 flags.go:33] FLAG: --advertise-address="192.168.5.11"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558353 15767 flags.go:33] FLAG: --allow-privileged="true"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558365 15767 flags.go:33] FLAG: --alsologtostderr="false"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558413 15767 flags.go:33] FLAG: --anonymous-auth="true"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558425 15767 flags.go:33] FLAG: --api-audiences="[]"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558442 15767 flags.go:33] FLAG: --apiserver-count="3"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558454 15767 flags.go:33] FLAG: --audit-dynamic-configuration="false"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558464 15767 flags.go:33] FLAG: --audit-log-batch-buffer-size="10000"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558474 15767 flags.go:33] FLAG: --audit-log-batch-max-size="1"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558484 15767 flags.go:33] FLAG: --audit-log-batch-max-wait="0s"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558495 15767 flags.go:33] FLAG: --audit-log-batch-throttle-burst="0"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558504 15767 flags.go:33] FLAG: --audit-log-batch-throttle-enable="false"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558514 15767 flags.go:33] FLAG: --audit-log-batch-throttle-qps="0"
Mar 20 07:57:25 master-1 kube-apiserver[15767]: I0320 07:57:25.558528 15767 flags.go:33] FLAG: --audit-log-format="json"
```



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○ Application Failure

○ Control Plane Failure

● Worker Node Failure

○ Networking

# Worker Node Failure



# Check Node Status

► `kubectl get nodes`

NAME	STATUS	ROLES	AGE	VERSION
worker-1	Ready	<none>	8d	v1.13.0
worker-2	NotReady	<none>	8d	v1.13.0

► `kubectl describe node worker-1`

```
...
Conditions:
  Type             Status  LastHeartbeatTime             Reason                       Message
  ----             -
  OutOfDisk         False   Mon, 01 Apr 2019 14:30:33 +0000 KubeletHasSufficientDisk    kubelet has sufficient disk space available
  MemoryPressure    False   Mon, 01 Apr 2019 14:30:33 +0000 KubeletHasSufficientMemory  kubelet has sufficient memory available
  DiskPressure      False   Mon, 01 Apr 2019 14:30:33 +0000 KubeletHasNoDiskPressure    kubelet has no disk pressure
  PIDPressure       False   Mon, 01 Apr 2019 14:30:33 +0000 KubeletHasSufficientPID     kubelet has sufficient PID available
  Ready             True    Mon, 01 Apr 2019 14:30:33 +0000 KubeletReady                 kubelet is posting ready status. AppArmor enabled
```

► `kubectl describe node worker-1`

```
...
Conditions:
  Type             Status  LastHeartbeatTime             Reason                       Message
  ----             -
  OutOfDisk         Unknown Mon, 01 Apr 2019 14:20:20 +0000 NodeStatusUnknown          Kubelet stopped posting node status.
  MemoryPressure    Unknown Mon, 01 Apr 2019 14:20:20 +0000 NodeStatusUnknown          Kubelet stopped posting node status.
  DiskPressure      Unknown Mon, 01 Apr 2019 14:20:20 +0000 NodeStatusUnknown          Kubelet stopped posting node status.
  PIDPressure       False   Mon, 01 Apr 2019 14:20:20 +0000 KubeletHasSufficientPID     kubelet has sufficient PID available
  Ready             Unknown Mon, 01 Apr 2019 14:20:20 +0000 NodeStatusUnknown          Kubelet stopped posting node status.
```

# Check Node

▶ top

```
top - 14:43:56 up 3 days, 19:02, 1 user, load average: 0.35, 0.29, 0.21
Tasks: 112 total, 1 running, 72 sleeping, 0 stopped, 0 zombie
%Cpu(s): 3.9 us, 1.7 sy, 0.1 ni, 94.3 id, 0.0 wa, 0.0 hi, 0.1 si, 0.0 st
KiB Mem : 1009112 total, 74144 free, 736608 used, 198360 buff/cache
KiB Swap: 0 total, 0 free, 0 used. 129244 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
34	root	20	0	0	0	0	S	5.9	0.0	0:13.14	kswapd0
28826	999	20	0	1361320	383208	3596	S	5.9	38.0	0:46.95	mysqld
1	root	20	0	78260	5924	3192	S	0.0	0.6	0:21.88	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.02	kthreadd
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0H

▶ df -h

Filesystem	Size	Used	Avail	Use%	Mounted on
udev	481M	0	481M	0%	/dev
tmpfs	99M	1000K	98M	1%	/run
/dev/sda1	9.7G	5.3G	4.5G	55%	/
tmpfs	493M	0	493M	0%	/dev/shm
tmpfs	5.0M	0	5.0M	0%	/run/lock
tmpfs	493M	0	493M	0%	/sys/fs/cgroup
tmpfs	99M	0	99M	0%	/run/user/1000

# Check Kubelet Status

## ▶ service kubelet status

- kubelet.service - Kubernetes Kubelet  
Loaded: loaded (/etc/systemd/system/kubelet.service; enabled; vendor preset: enabled)  
Active: **active (running)** since Wed 2019-03-20 14:22:06 UTC; 1 weeks 1 days ago  
Docs: <https://github.com/kubernetes/kubernetes>  
Main PID: 1281 (kubelet)  
Tasks: 24 (limit: 1152)

## ▶ sudo journalctl -u kubelet

```
-- Logs begin at Wed 2019-03-20 05:30:37 UTC, end at Mon 2019-04-01 14:42:42 UTC. --
Mar 20 08:12:59 worker-1 systemd[1]: Started Kubernetes Kubelet.
Mar 20 08:12:59 worker-1 kubelet[18962]: Flag --tls-cert-file has been deprecated, This parameter should be set via the config file specified by the Kubele
Mar 20 08:12:59 worker-1 kubelet[18962]: Flag --tls-private-key-file has been deprecated, This parameter should be set via the config file specified by the
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.915179 18962 flags.go:33] FLAG: --address="0.0.0.0"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.918149 18962 flags.go:33] FLAG: --allow-privileged="true"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.918339 18962 flags.go:33] FLAG: --allowed-unsafe-sysctls="[]"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.918502 18962 flags.go:33] FLAG: --alsologtostderr="false"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.918648 18962 flags.go:33] FLAG: --anonymous-auth="true"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.918841 18962 flags.go:33] FLAG: --application-metrics-count-limit="100"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.918974 18962 flags.go:33] FLAG: --authentication-token-webhook="false"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.919096 18962 flags.go:33] FLAG: --authentication-token-webhook-cache-ttl="2m0s"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.919299 18962 flags.go:33] FLAG: --authorization-mode="AlwaysAllow"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.919466 18962 flags.go:33] FLAG: --authorization-webhook-cache-authorized-ttl="5m0s"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.919598 18962 flags.go:33] FLAG: --authorization-webhook-cache-unauthorized-ttl="30s"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.919791 18962 flags.go:33] FLAG: --azure-container-registry-config=""
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.919971 18962 flags.go:33] FLAG: --boot-id-file="/proc/sys/kernel/random/boot_id"
Mar 20 08:12:59 worker-1 kubelet[18962]: I0320 08:12:59.920102 18962 flags.go:33] FLAG: --bootstrap-checkpoint-path=""
```



# Check Certificates

```
▶ openssl x509 -in /var/lib/kubelet/worker-1.crt -text
```

```
Certificate:
Data:
  Version: 3 (0x2)
  Serial Number:
    ff:e0:23:9d:fc:78:03:35
  Signature Algorithm: sha256WithRSAEncryption
  Issuer: CN = KUBERNETES-CA
  Validity
    Not Before: Mar 20 08:09:29 2019 GMT
    Not After : Apr 19 08:09:29 2019 GMT
  Subject: CN = system:node:worker-1, O = system:nodes
  Subject Public Key Info:
    Public Key Algorithm: rsaEncryption
    Public-Key: (2048 bit)
    Modulus:
      00:b4:28:0c:60:71:41:06:14:46:d9:97:58:2d:fe:
      a9:c7:6d:51:cd:1c:98:b9:5e:e6:e4:02:d3:e3:71:
      58:a1:60:fe:cb:e7:9b:4b:86:04:67:b5:4f:da:d6:
      6c:08:3f:57:e9:70:59:57:48:6a:ce:e5:d4:f3:6e:
      b2:fa:8a:18:7e:21:60:35:8f:44:f7:a9:39:57:16:
      4f:4e:1e:b1:a3:77:32:c2:ef:d1:38:b4:82:20:8f:
      11:0e:79:c4:d1:9b:f6:82:c4:08:84:84:68:d5:c3:
      e2:15:a0:ce:23:3c:8d:9c:b8:dd:fc:3a:cd:42:ae:
      5e:1b:80:2d:1b:e5:5d:1b:c1:fb:be:a3:9e:82:ff:
      a1:27:c8:b6:0f:3c:cb:11:f9:1a:9b:d2:39:92:0e:
      47:45:b8:8f:98:13:c6:4d:6a:18:75:a4:01:6f:73:
      f6:f8:7f:eb:5d:59:94:46:d8:da:37:75:cf:27:0b:
      39:7f:48:20:c5:fd:c7:a7:ce:22:9a:33:4a:30:1d:
      95:ef:00:bd:fe:47:22:42:44:99:77:5a:c4:97:bb:
      37:93:7c:33:64:f4:b8:3a:53:8c:f4:10:db:7f:5f:
      2b:89:18:d6:0e:68:51:34:29:b1:f1:61:6b:4b:c6:
      c0:73:28:76:c5:86:ce:01:68:5b:1a:c1:86:f5:7b:
```



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# Network Failures