ETCD

| Issue | Symptoms | Solution |
| --- | --- | --- |
| Etcd Pod CrashLoop or Fails | Pod restarts repeatedly | Check logs for cause; check data-dir, certs |
| Data Directory Corruption | Errors about WAL or corruption | Restore from snapshot |
| Loss of Quorum (multi-node) | Cluster unhealthy, can't commit | Remove failed member; add new member |
| Certificate Expiry | TLS errors in logs | Renew certificates & update etcd configs |
| Disk Full | Write errors, pod crash | Increase disk size or clean logs/data |
| Network Partition | Member unreachable | Fix network/firewall; restart affected pods |

API SERVER

| Issue | Symptoms | Cause | Solution |
| --- | --- | --- | --- |
| API Server CrashLoop | API server pod repeatedly restarts | Misconfiguration, resource limits, bad certs | Check logs (`kubectl -n kube-system logs`), fix config, check certs, increase resources |
| Unable to Connect to API Server | `kubectl` commands time out or fail | Network issues, firewall rules, API server down | Check API server pod status, network connectivity, firewall rules on ports 6443 (default API port) |
| API Server Certificate Expired | TLS errors when connecting to API server | Expired or invalid server/client certs | Renew certificates using kubeadm or manually, update configs |
| Etcd Unreachable | API server logs show etcd errors, failures | Etcd down, network partition, wrong etcd endpoints | Fix etcd cluster health, check endpoints in API server config, restore etcd if needed |
| High CPU/Memory Usage | API server becomes slow or unresponsive | High client requests, heavy controllers, memory leak | Check resource usage, scale API server (if HA), optimize controllers |
| Authentication/Authorization Failure | API requests denied or forbidden | Invalid tokens, expired service accounts, RBAC misconfig | Verify tokens and RBAC policies, check service account permissions |
| Too Many Open Files Error | API server logs show "too many open files" | File descriptor limits too low | Increase system file descriptor limits for API server process |
| Misconfigured Admission Controllers | API server rejects requests unexpectedly | Admission webhook misconfig or timeout | Check admission webhook configs and logs, fix webhook endpoints or timeouts |
| API Server Hanging on Startup | API server pod stuck in Pending or CrashLoop | Missing dependencies, misconfiguration | Check manifests, logs, and dependent services like etcd |
| Failed to Watch Resources | Controllers fail, event stream disconnects | Network issues, etcd issues, client timeout | Controllers fail, event stream disconnects | Network issues, etcd issues, client timeout | Check API server connectivity to etcd, network health, restart components |

Network Partition

| Issue | Symptoms | Cause | Solution |
| --- | --- | --- | --- |
| Control Plane Nodes Partitioned from Each Other | API servers on different control plane nodes cannot communicate; leader election fails; etcd quorum lost; cluster unstable | Network split between control plane nodes; routing issues; firewall blocking | Check network connectivity between control plane nodes; fix routing/firewall; restore etcd quorum |
| Worker Nodes Partitioned from Control Plane | Nodes NotReady status; pods unable to connect to API server; `kubectl` commands time out | Network broken between worker and control plane; firewall; routing issues | Check network connectivity; fix firewall rules; restart kubelet |
| Pods on Different Nodes Cannot Communicate | Pod-to-pod communication across nodes fails; services fail; app timeouts | Network overlay failure; routing issues; MTU mismatch | Check CNI overlay health; check routes and MTU; restart network components |
| Etcd Cluster Partitioned | Etcd member lost quorum, read/write failures; cluster unstable | Network partition between etcd nodes; firewall blocking | Restore network between etcd nodes; remove unhealthy etcd members; recover cluster |
| Split Brain in Control Plane | Multiple API servers think they are leaders; inconsistent cluster state | Network partition; etcd quorum loss; misconfiguration | Fix network; restore etcd quorum; restart control plane components |
| Service Endpoints Not Updated | Services show endpoints only on subset of nodes | Nodes partitioned; kube-proxy cannot sync endpoints | Restore node connectivity; restart kube-proxy; check endpoints |
| Ingress Controller Partitions | Ingress routes fail; inconsistent access | Network partition between ingress controller and backend services | Fix network; restart ingress controller pods |
| Kubelet Loses API Server Connection | Node reports NotReady; logs show connection timeouts | Network partition; API server unreachable from node | Fix network connectivity; restart kubelet |

CNI ISSUES

| Issue | Symptoms | Cause | Solution |
| --- | --- | --- | --- |
| Pod Network Not Ready / Pod stuck in ContainerCreating | Pods stuck in `ContainerCreating` state, `kubectl get pods` shows no IP assigned | CNI plugin not installed, misconfigured, or crashed | Verify CNI plugin pods (e.g., Calico, Flannel), reinstall or fix configs |
| Pods Cannot Communicate Across Nodes | Pod-to-pod ping fails between nodes, services unreachable | Overlay network broken, wrong CNI config, firewall rules blocking traffic | Check CNI daemonset logs, verify IP forwarding and firewall settings, check network policies |
| Pods Have No IP Address | Pods running but IP is `<none>` | CNI failed to assign IP, IPAM issues | Check CNI logs, IP address management, delete stale IP allocations |
| DNS Resolution Fails Inside Pods | Pods cannot resolve DNS names | CoreDNS pods down, network broken, firewall rules | Check CoreDNS pod health, API server connectivity, restart CoreDNS |
| Network Policy Blocking Traffic Unexpectedly | Pods cannot communicate even though network is up | Misconfigured network policies | Review network policies, adjust or remove restrictive rules |
| CNI Plugin CrashLoopBackOff or Crash | CNI plugin pods repeatedly crash | Version incompatibility, bad config, resource limits | Check plugin pod logs, upgrade or reinstall CNI plugin, increase resources |
| Node Network Interface Missing | CNI plugin fails to create virtual network interfaces | Kernel modules missing, network drivers incompatible | Verify kernel modules, install required drivers, reboot node if needed |
| Packet Drops / High Latency | Slow network performance, TCP timeouts | Overloaded network, MTU mismatches, wrong configs | Tune MTU, scale network resources, monitor network bandwidth |
| CNI Plugin Configuration Outdated | CNI configs don't match cluster setup | Cluster upgraded but CNI configs not updated | Update CNI configs to match Kubernetes version and cluster setup |
| IP Address Exhaustion | New pods cannot get IP, IP allocation errors CNI plugin not installed, misconfigured, or crashed | IP pool exhausted, CIDR too small | Expand pod network CIDR, clean up unused IP allocations |

HELM

| Issue | Symptoms | Solution |
| --- | --- | --- |
| Error: INSTALLATION FAILED: failed to create resource: resource already exists | Resource already present error | Delete resource |
| Helm Release Stuck in Pending State | Kubernetes pod or resource is failing to initialize  Misconfigured values or resource limits | helm status <release>  kubectl get pods -n <namespace> kubectl describe pod <pod-name> -n <namespace> |
| Helm Upgrade Results in Orphaned Resources | After an upgrade, some Kubernetes resources are not updated or are left orphaned. | helm upgrade <release> <chart> --force --recreate-pods |
| Error: found in requirements.yaml, but missing in charts/ directory | Missing or outdated dependencies in the charts/ directory. | helm dependency update |
| Error: UPGRADE FAILED: error validating "": error validating data: unknown field | Syntax or template issues in the Helm chart.  Invalid YAML configurations in values.yaml. | helm template <release> <chart> --values values.yaml |
| Error: release "my-release" failed: secrets is forbidden: User "system:serviceaccount:default:default" cannot create resource "secrets" in API group "" | The Kubernetes service account used by Helm lacks necessary permissions | kubectl create clusterrolebinding helm-admin-binding \ --clusterrole=cluster-admin \ --serviceaccount=<namespace>:<service-account> |

ETCD - DEPENDENCY

| Component | Dependency | Causes |
| --- | --- | --- |
| Kube-apiserver  kubectl hangs or errors like Unable to connect to the server | Yes | API server fails or returns 500 errors  API server can't talk to etcd |
| Kube-controller-manager  Cluster looks empty | Yes | Controllers cannot read/write cluster state |
| Kube-scheduler  Pods won't schedule | Yes | Fails to schedule new pods |
| kubectl | Yes | Commands like get, apply, describe fail |
| helm / tiller  Helm releases not installing | Yes | Can’t read/write releases stored in secrets/configmaps |

kubectl get pods -n kube-system -l component=etcd

kubectl get pods -n kube-system | grep etcd

kubectl logs -n kube-system <etcd-pod-name>

journalctl -u kubelet | grep etcd

API SERVER - DEPENDECY

| Component | Dependency | Causes |
| --- | --- | --- |
| Kubectl  timeout / 500 errors | yes | All commands fail or hang |
| Kubelet  fails to post node status | yes | Can’t register nodes or get new pod specs |
| kube-scheduler | yes | Can’t schedule new pods |
| Kube-controller-manager (crashloopbackoff) | yes | Can’t maintain desired state |
| helm (and tiller)  Times out | yes | Releases can’t be created or modified |
| calico | yes | Network policy updates fail |
| metrics-server | yes | HPA and autoscaling stop functioning |

cat /var/log/pods/kube-system\_kube-apiserver\*/kube-apiserver/\*.log

CALICO DEPENDENCY

| Component | Dependency |  |
| --- | --- | --- |
| kubelet | Networking pod setup on node join | Uses CNI plugin (/opt/cni/bin/calico) |
| kube-apiserver | Watching for Pod/Policy/Node events | Required for Calico controllers & policy sync |
| etcd (or Kubernetes API) | Storing Calico config/state |  |
| calico-node DaemonSet | Setting up routes, BGP, IPAM | Must run on every node |
| calico-kube-controllers | Syncing IPAM, enforcing policies | Talks to API server |
| | kubelet | | --- |  | CNI plugin not triggered | | --- |  | Pods can't get IPs or networking | | --- | | | kube-apiserver | | --- |  | No state updates | | --- |  | No network policy updates or sync | | --- | | | calico-node | | --- |  | Pod networking breaks | | --- |  | No IP allocation, no routing, no policie | | --- | |
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