Report

Jarpula Bhanu Prasad - AI21BTECH11015

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1 CNI (container Network Interface)

1. CNI is a framework for dynamically configured network resources.
2. Group of libraries and specifications written in GO
3. The plugin specifications defines an interface for the configuring the netwok, provisioning IP addresses and maintaining connectivity with multiple hosts.
4. CNI integrates smoothly with kubelet to enable the use of an overlay or underlay network to automatically configure the network pod between them.
5. Overlay network encapsulate network traffic using a virtual interface such as **virtual extensible LAN (VXLAN)**.
6. Underlay networks work at the physical level and compriese switches and routers.
7. Once we have specified the type of newtork configaration type, the container joins the runtime adds the interface to the container namespace via a call to the CNI plugin and allocates the connected subnewtork routes via calls to the IP address management (IPAM) plugin.
8. CNI uses a software defined networking (SDN) approach to unify container communication throughout clusters.
9. CNI is an initiative of the cloud native computing foundation (CNFF), which specifies the configaration of linux container network interfaces.
10. Instead of making the network solution pluggable it defines a common interface standard for both the newtorking and container execution layers.
11. CNI focuces on the connectivity of container networks and the removal of allocated resources upon termination of containers.
12. (a) Interface plugin: ptp, bridge, macvalan.
    (b) 'chained' plugin: portmap, bandwidth, tuning.

2 MetalLB

1. Bare-metal cluster operators are left with two lesser tools to bring user trafic into their clusters, 'Nodeport' and 'external ip' services.

2. Both of these options have significant downsides for production use, which makes bare-metal cluster second-class citizen in kubernetes cluster.

3. MetalLB aims to readdress this imbalance by offering a network load balancer implementation that integrates with standard network equipement so that external service on bare-metal cluster also 'just-work' as much as possible.

4. MetalLB implements a FRR mode that uses an FRR container as the backend for handling BGP sessions.

5. It provides features that are not availaible with the native BGP implementation, such as pairing BGP sessions with BFD sessions and advertising ipv6 addresses.

6. MetalLB is a load-balancer implementation for bare metal kubernetes clusters using standard routing protocols.

3 Load Balancer

1. A load balancer is a device that acts as a reverse proxy and distributes network or applicaton traffic across a number of servers.

2. Load balancers are used to increase capacity (concurrent users) and reliablility of applicaton.

3. They improve the overall performance of application by decreasing the burden on servers associated with managing and maintaining applications and network sessions as well as by performing application specific tasks.

4 Kubernetes Load Balancer

1. A kubernetes load balancer is a component that distributes network traffic across multiple instances of an application running in a k8s cluster. It acts as traffic managers, ensuring that incomig requests are evenly distributed among the availaible instance to optimize performance and prevent overloading on any single instance providing high availability and scalability.

2. Load balancer in k8s can be implemented by using a cloud provider specific load balancer that operates at the network layer 4 of the OSI model.

3. Cloud specific ingress controllers that can operate at application layer 7, include application gateway to use ingress an ingress controller must be installed on the cluster as they are not included out of box with k8s.

4. Round robin, least connection, session affinity source IP hash are some of loadbalancing techniques.

5. Popular ingress controllers include NGINX, HAProxy, Istio ingress and Traefik.

6. There are two types of load balancers.

   (a) Internal load balancer - Routes traffic only within the cluster and does not allow any external traffic

   (b) External load balancer - Exposes the application to external use or service outside the cluster.