

CONCEPTS

MetalLB hooks into your Kubernetes cluster, and provides a network load-balancer implementation. In short, it allows you to create Kubernetes services of type `LoadBalancer` in clusters that don't run on a cloud provider, and thus cannot simply hook into paid products to provide load balancers.

It has two features that work together to provide this service: address allocation, and external announcement.

Address allocation

In a Kubernetes cluster on a cloud provider, you request a load balancer, and your cloud platform assigns an IP address to you. In a bare-metal cluster, MetalLB is responsible for that allocation.

MetalLB cannot create IP addresses out of thin air, so you do have to give it *pools* of IP addresses that it can use. MetalLB will take care of assigning and unassigning individual addresses as services come and go, but it will only ever hand out IPs that are part of its configured pools.

How you get IP address pools for MetalLB depends on your environment. If you're running a bare-metal cluster in a colocation facility, your hosting provider probably offers IP addresses for lease. In that case, you would lease, say, a /26 of IP space (64 addresses), and provide that range to MetalLB for cluster services.

Alternatively, your cluster might be purely private, providing services to a nearby LAN but not exposed to the internet. In that case, you could pick a range of IPs from one of the private address spaces (so-called RFC1918 addresses), and assign those to MetalLB. Such addresses are free, and work fine as long as you're only providing cluster services to your LAN.

Or, you could do both! MetalLB lets you define as many address pools as you want, and doesn't care what "kind" of addresses you give it.

When one or more IPs are assigned to a service, MetalLB tries to keep them assigned to that service. In case of removal of those IPs from the pools (deletion or edit of the IPAddressPool those IPs are taken from), MetalLB will assign another set of IPs to the service (when available).

External announcement

After MetalLB has assigned an external IP address to a service, it needs to make the network beyond the cluster aware that the IP "lives" in the cluster. MetalLB uses standard networking or routing protocols to achieve this, depending on which mode is used: ARP, NDP, or BGP.

Layer 2 mode (ARP/NDP)

In layer 2 mode, one machine in the cluster takes ownership of the service, and uses standard address discovery protocols (ARP for IPv4, NDP for IPv6) to make those IPs reachable on the local network. From the LAN's point of view, the announcing machine simply has multiple IP addresses.

The [layer 2 mode](#) sub-page has more details on the behavior and limitations of layer 2 mode.

BGP

In BGP mode, all machines in the cluster establish [BGP](#) peering sessions with nearby routers that you control, and tell those routers how to forward traffic to the service IPs. Using BGP allows for true load balancing across multiple nodes, and fine-grained traffic control thanks to BGP's policy mechanisms.

The [BGP mode](#) sub-page has more details on BGP mode's operation and limitations.
