Day9 容器进阶之Kubernetes 网络管理原理分析

大 纲

- Pod网络
- CNI
- Service概念
- 部署和配置网络load balancer
- Ingress概念
- 配置和使用集群DNS

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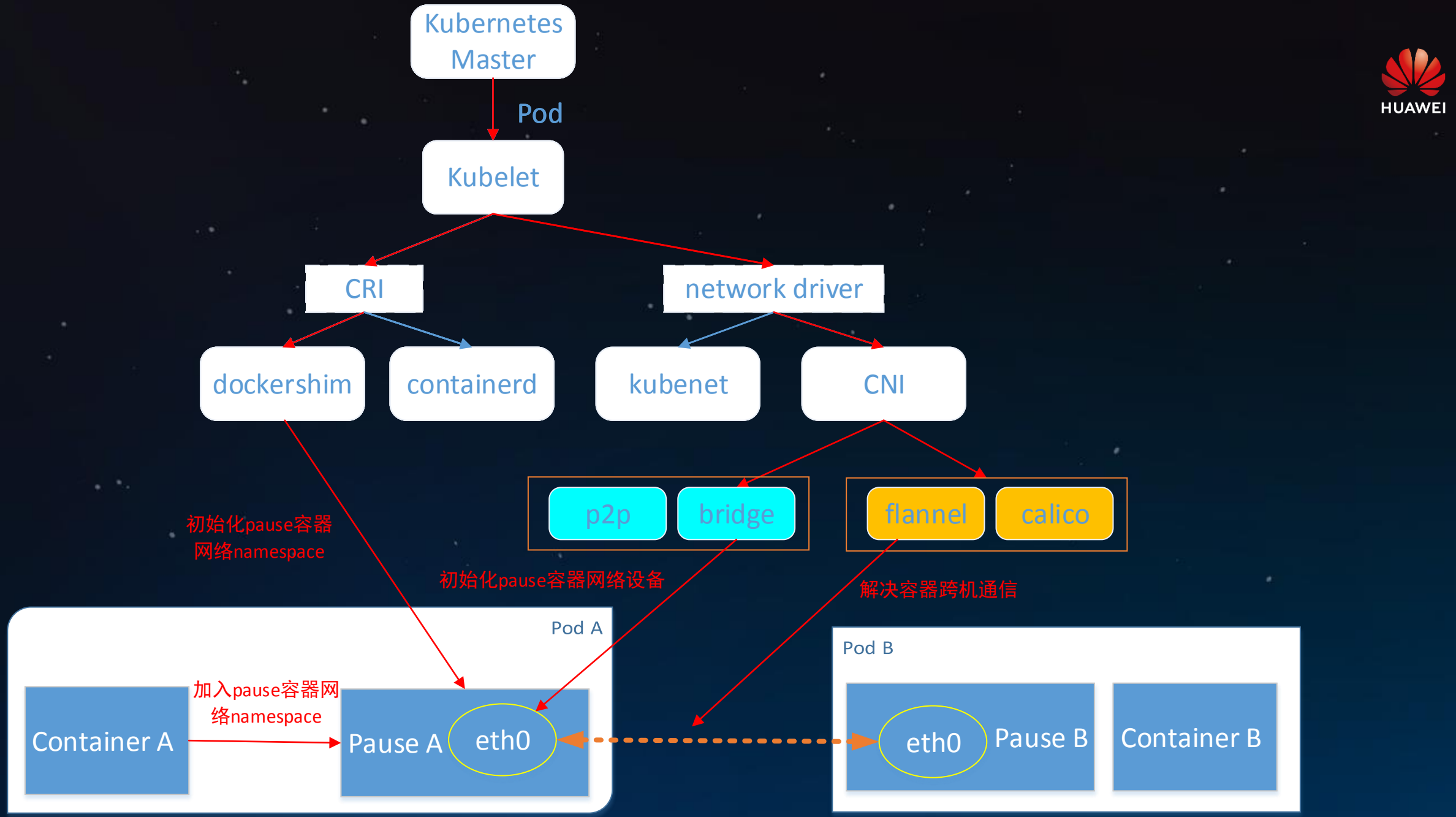
Pod网络

Pod网络

- 一个Pod一个IP
  - 每个Pod独立IP，Pod内所有容器共享网络namespace（同一个IP）
  - 容器之间直接通信，不需要NAT
  - Node和容器直接通信，不需要NAT
  - 其他容器和容器自身看到的IP是一样的
- 集群内访问走Service，集群外访问走Ingress
- CNI（container network interface）用于配置Pod网络
  - 不支持docker网络

扁平网络：性能、可追溯、排错


Kubernetes Master
Pod
Kubelet
CRI
network driver
dockershim
containerd
kubenet
CNI
p2p
bridge
flannel
calico
初始化pause容器网络namespace
初始化pause容器网络设备
解决容器跨机通信
Pod A
Container A
加入pause容器网络namespace
Pause A
eth0
Pod B
eth0
Pause B
Container B

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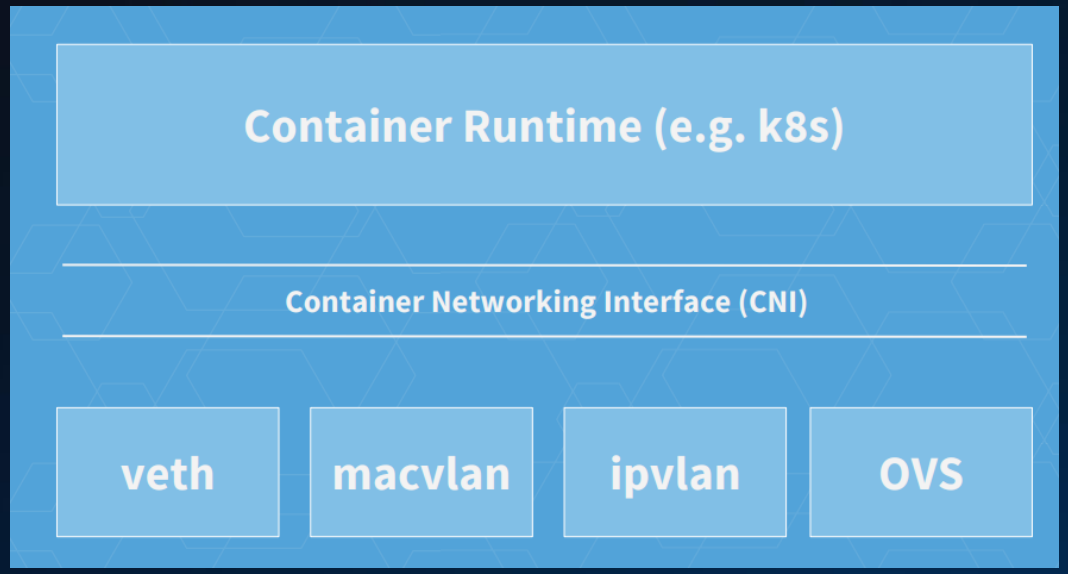
CNI

CNI: Container Network Interface

- 容器网络的标准化
- 使用JSON来描述网络配置
- 两类接口：
  - 配置网络 -- 创建容器时调用

    AddNetwork(net *NetworkConfig, rt* RuntimeConf) (types.Result, error)
  - 清理网络 -- 删除容器时调用

    DelNetwork(net *NetworkConfig, rt* RuntimeConf) error



- Bridge
- PTP
- IPVLAN
- MACVLAN
- VLAN
- PORTMAP

flannel · Project Calico · weaveworks · Google Cloud Platform · nuagenetworks · ROMANA · aws · Contiv · CNI-Genie · OpenContrail · OvS Open vSwitch · cilium · Kube-router

CNI插件：host-local + bridge

```
$ cat /etc/cni/net.d/10-mynet.conf
{
    "name": "mynet",
    "type": "bridge",
    "ipam": {
        "type": "host-local",
        "subnet": "10.10.0.0/16"
    }
}
```

CNI plugin二进制文件： /opt/cni/bin/{host-local, bridge…}

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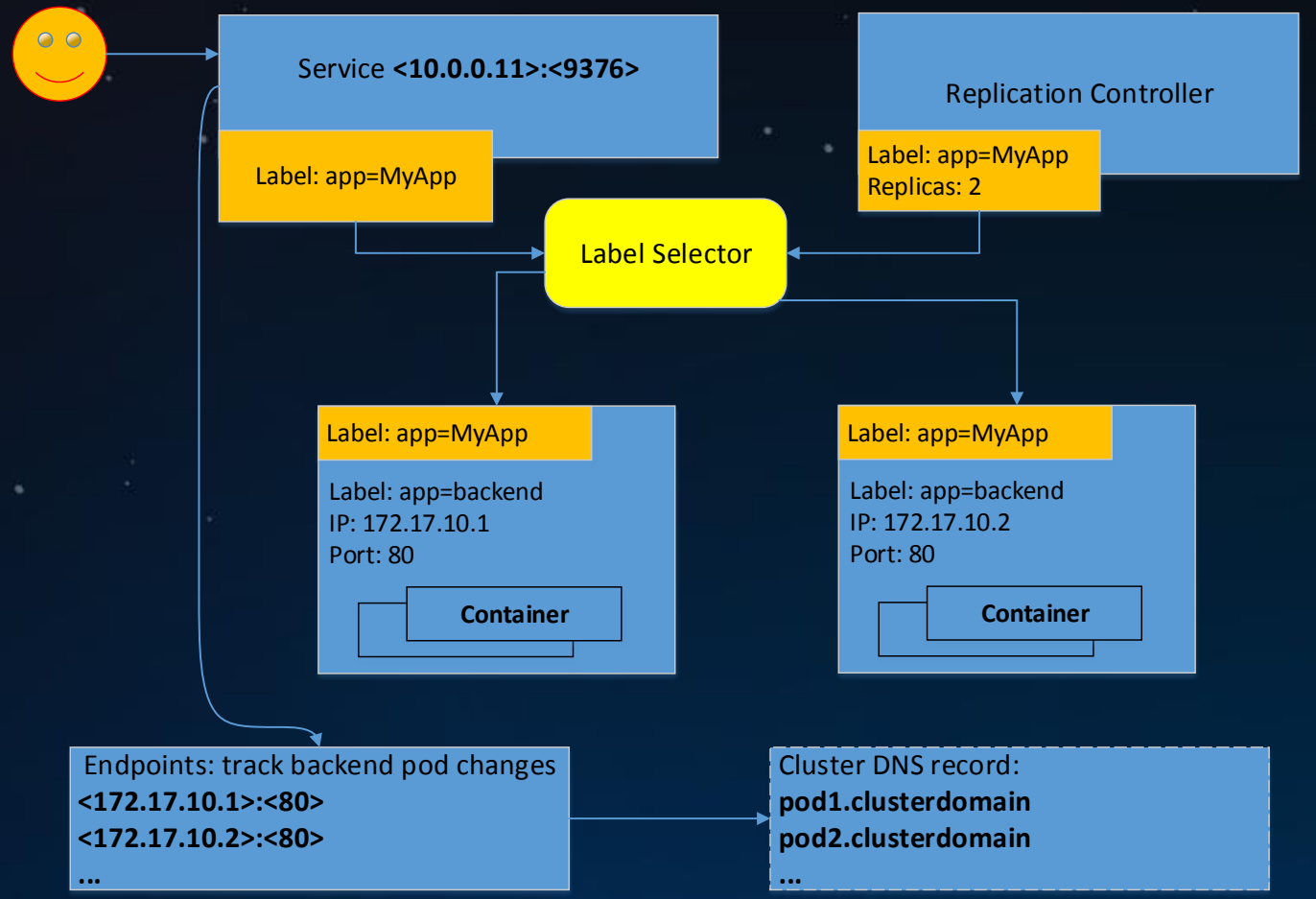
Service

Kubernetes Service



Service和Endpoints定义

```yaml
apiVersion: v1
kind: Service
metadata:
  name: nginx-service
  namespace: default
spec:
  clusterIP: 10.101.28.148
  ports:
  - name: http
    port: 80
    protocol: TCP
    targetPort: 8080
  selector:
    app: nginx
```

```yaml
apiVersion: v1
kind: Endpoints
metadata:
  name: nginx-service
  namespace: default
subsets:
- addresses:
  - ip: 172.17.0.2
    nodeName: 100-106-179-237.node
    targetRef:
      kind: Pod
      name: nginx-rc-c8tw2
      namespace: default
  - ip: 172.17.0.3
    nodeName: 100-106-179-238.node
    targetRef:
      kind: Pod
      name: nginx-rc-x14tv
      namespace: default
  ports:
  - name: http
    port: 8080
    protocol: TCP
```

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部署和配置网络load balancer

LoadBalancer类型Service

- 同时是Cluster IP类型
- 需要跑在特定的cloud provider上
  - Service Controller自动创建一个外部LB并配置安全组
  - 对集群内访问，kube-proxy用iptables或ipvs实现了云服务提供商LB的部分功能：L4转发，安全组规则等。

```
kind: Service
apiVersion: v1
metadata:
  name: my-service
spec:
  selector:
    app: MyApp
  ports:
  - protocol: TCP
    port: 80
    targetPort: 9376
  clusterIP: 10.0.171.239
  loadBalancerIP: 78.11.24.19 #外部LB IP
  type: LoadBalancer
```

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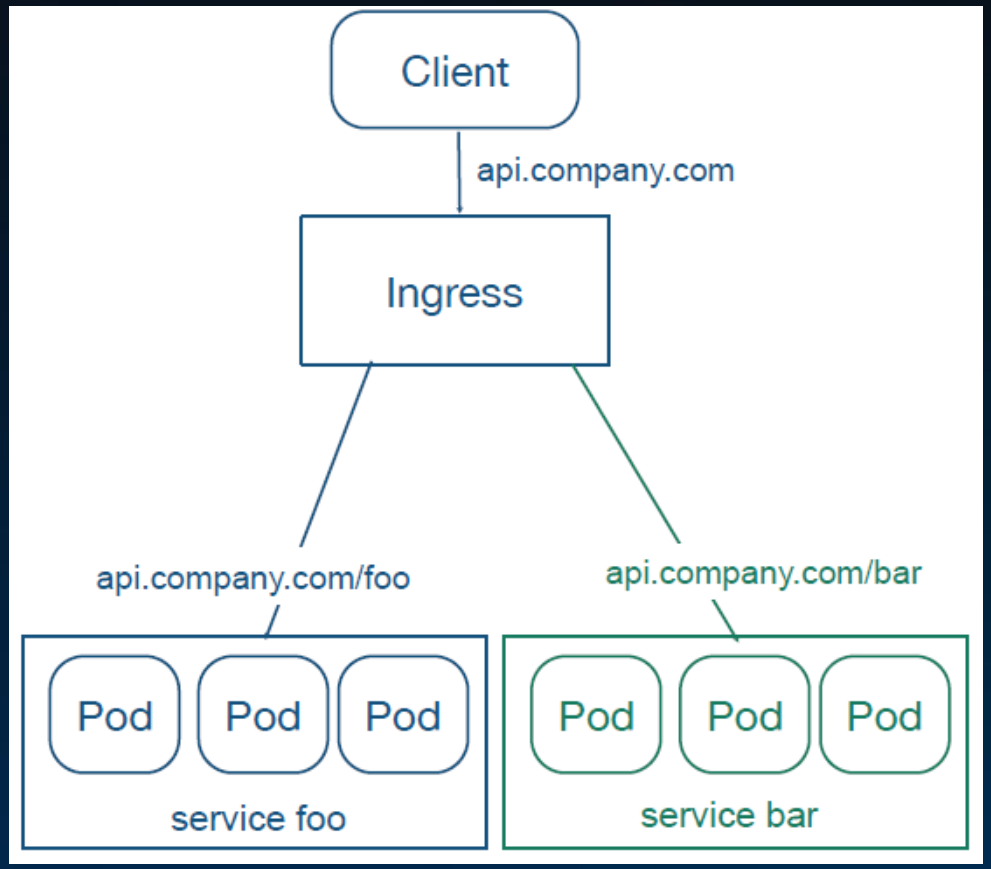
Ingress

Ingress

- Ingress是授权入站连接到达集群服务的规则集合
  - 支持通过URL方式将Service暴露到K8S集群外，Service之上的L7访问入口
  - 支持自定义Service的访问策略
  - 提供按域名访问的虚拟主机功能
  - 支持TLS

```
internet
    |
-----------
[ Services ]
```

```
internet
    |
[ Ingress ]
--|-----|--
[ Services ]
```



```
apiVersion:
extensions/v1beta1
kind: Ingress
metadata:
  name: test-ingress
spec:
  tls:
  - secretName: testsecret
  backend:
    serviceName: testsvc
    servicePort: 80
```

```
$ kubectl get ing
NAME                RULE          BACKEND        ADDRESS
test-ingress        -             testsvc:80     107.178.254.228
```

ADDRESS：Ingress的访问入口地址，由Ingress Controller分配
BACKEND：K8S Service + Port
RULE：自定义的访问策略。
若规则为空，则访问ADDRESS的所有流量都转发给BACKEND

```
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: test
spec:
  rules:
  - host: foo.bar.com
    http:
      paths:
      - path: /foo
        backend:
          serviceName: s1
          servicePort: 80
      - path: /bar
        backend:
          serviceName: s2
          servicePort: 80
```

当LB准备就绪时，Ingress Controller填充ADDRESS字段

```
$ kubectl get ing
NAME      RULE          BACKEND   ADDRESS
test      -
          foo.bar.com
          /foo          s1:80
          /bar          s2:80
```

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DNS

Kubernetes DNS

- 解析Pod和Service的域名的，K8S集群内Pod使用
- Kube-dns和CoreDNS
- 对Service
  - A记录
    - 普通Service：my-svc.my-namespace.**svc.cluster.local → Cluster IP**
    - headless Service： my-svc.my-namespace.**svc.cluster.local → 后端Pod IP列表**
  - SRV记录：
    - _my-port-name._my-port-protocol.my-svc.my-namespace.svc.cluster.local → **Service Port**
- 对Pod
  - A记录
    - **pod-ip**.my-namespace.pod.cluster.local → Pod IP

kubelet配置--cluster-dns把DNS的静态IP传递给每个容器

Kubelet传入--cluster-domain配置伪域名

1-2-3-4