DEDICATED INFRASTRUCTURE IN A MULTITENANT WORLD

Adobe

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Adobe Experience Manager Cloud Service

Author of Jenkins Kubernetes plugin

Long time OSS contributor at Jenkins, Apache Maven, Puppet,…

ADOBE EXPERIENCE MANAGER

Content Management System

Digital Asset Management

Digital Enrollment and Forms

Used by many Fortune 100 companies

An existing distributed Java OSGi application

Using OSS components from Apache Software Foundation

A huge market of extension developers

Writing modules that run in-process on AEM

AEM ON KUBERNETES

Running on Azure

14+ clusters and growing

Multiple regions: US, Europe, Australia, Japan, more coming

Adobe has a dedicated team managing clusters for multiple products

Customers can run their own code

Cluster permissions are limited for security

Traffic leaving the clusters must be encrypted for compliance

Using namespaces to provide a scope

- network isolation
- quotas
- permissions

More details on our Kubernetes setup in my KubeCon 2020 talk

https://tinyurl.com/csanchez-kcna20

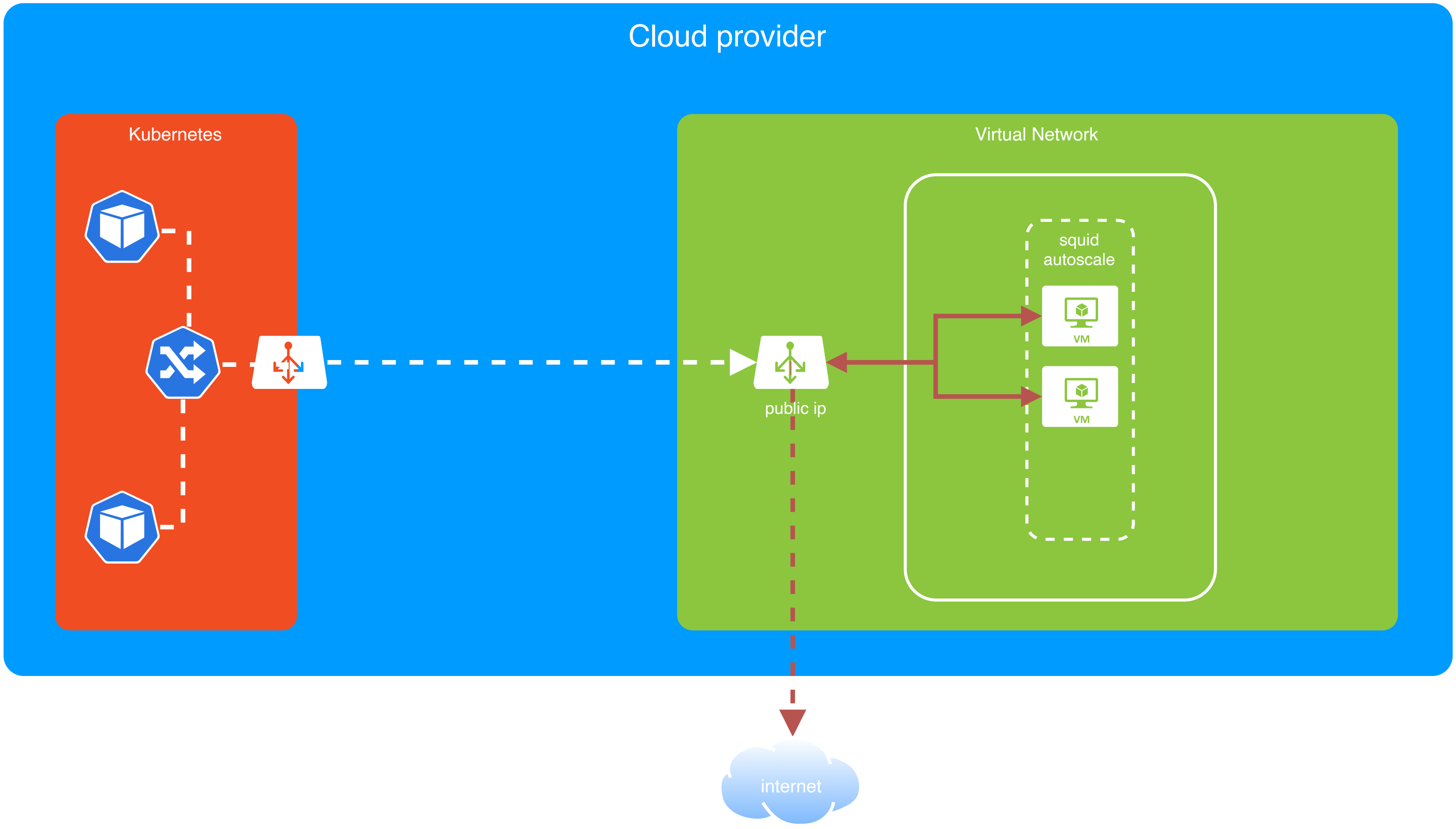
DEDICATED INFRASTRUCTURE

Customers want to have dedicated infrastructure

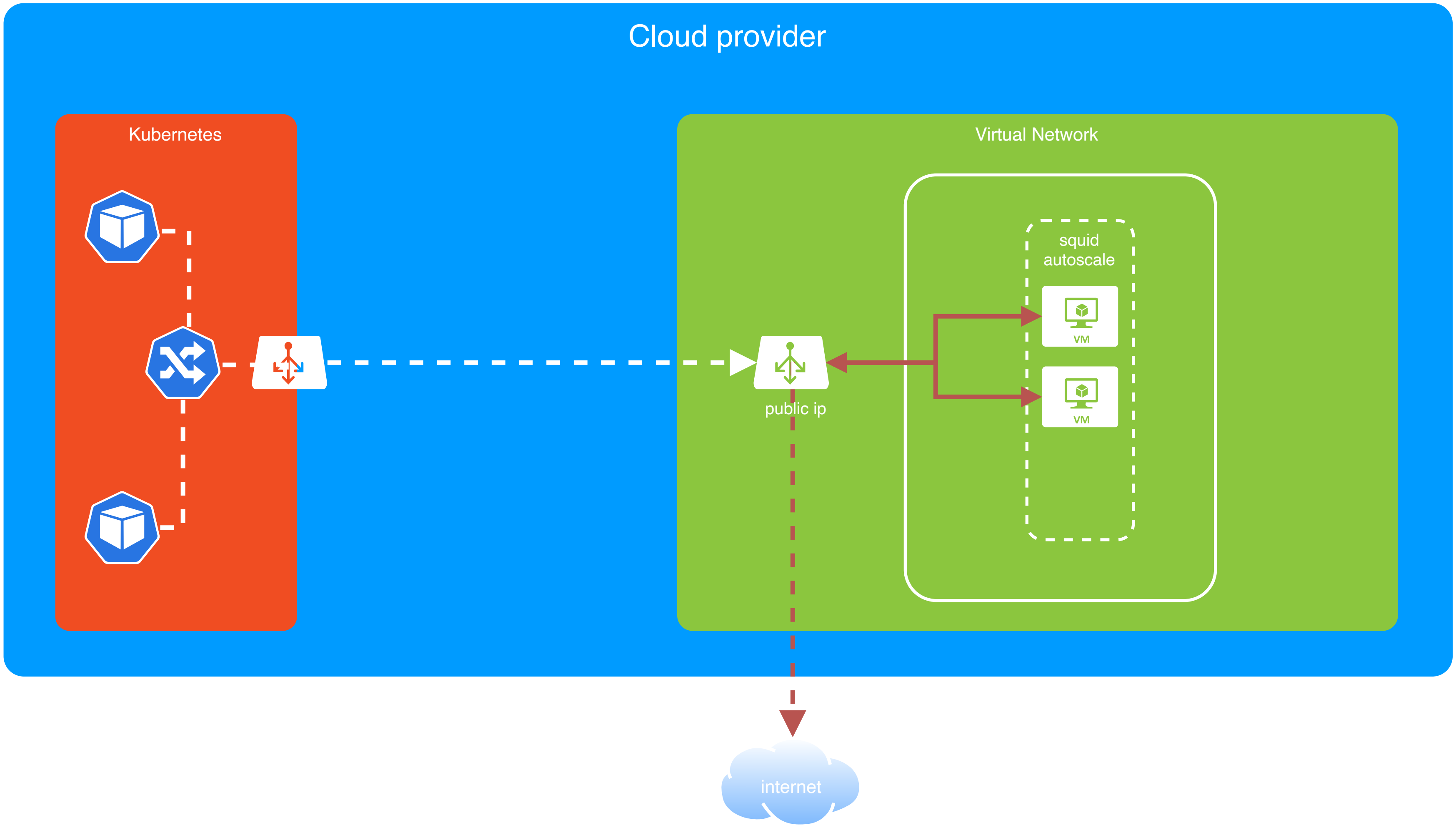
- Egress IPs
- Private connections (VNET peering, Private Link, ExpressRoute, Direct Connect,...)
- VPN

FIRST VERSION: SQUID

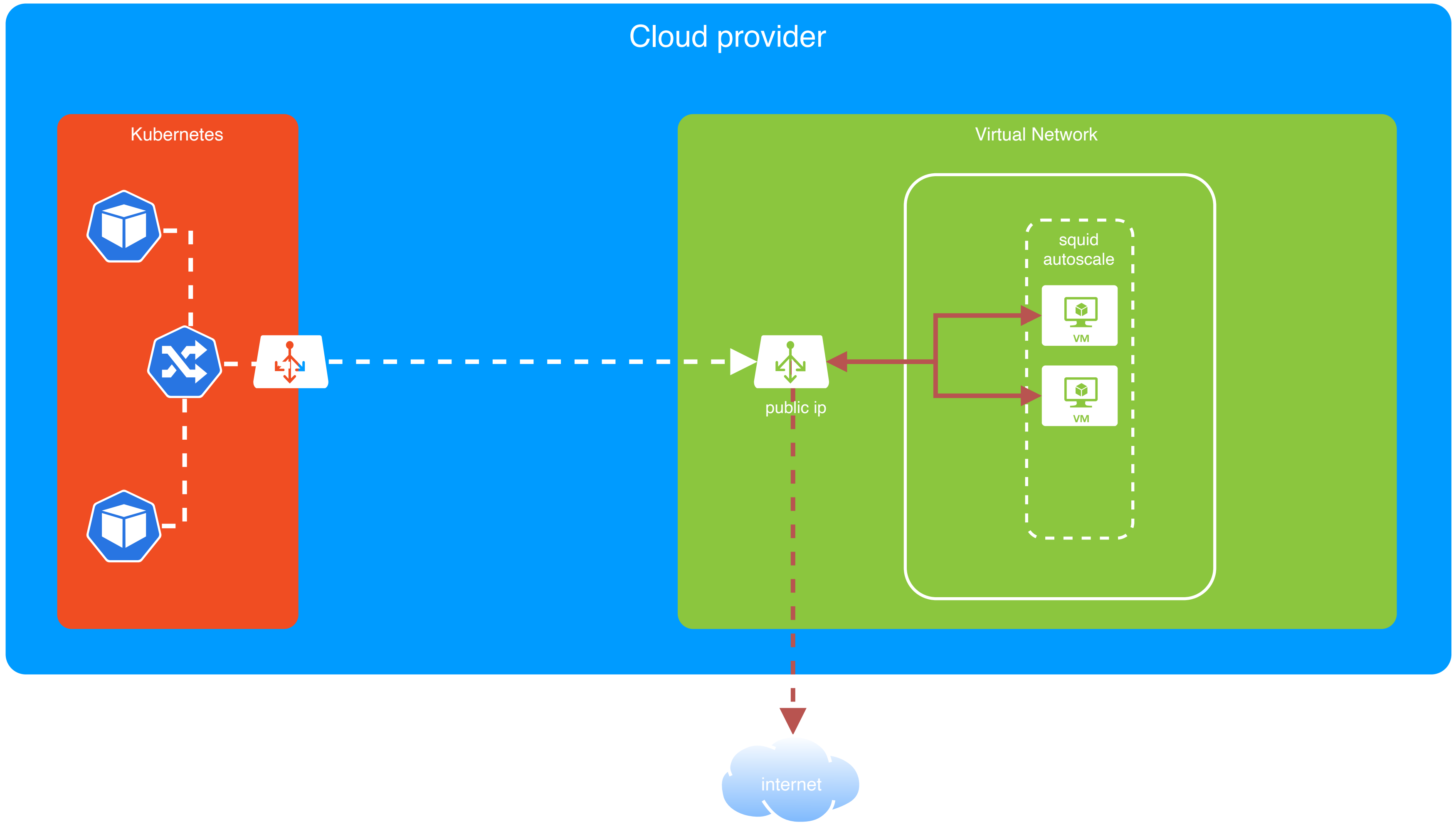
Running Squid Proxy in VMs



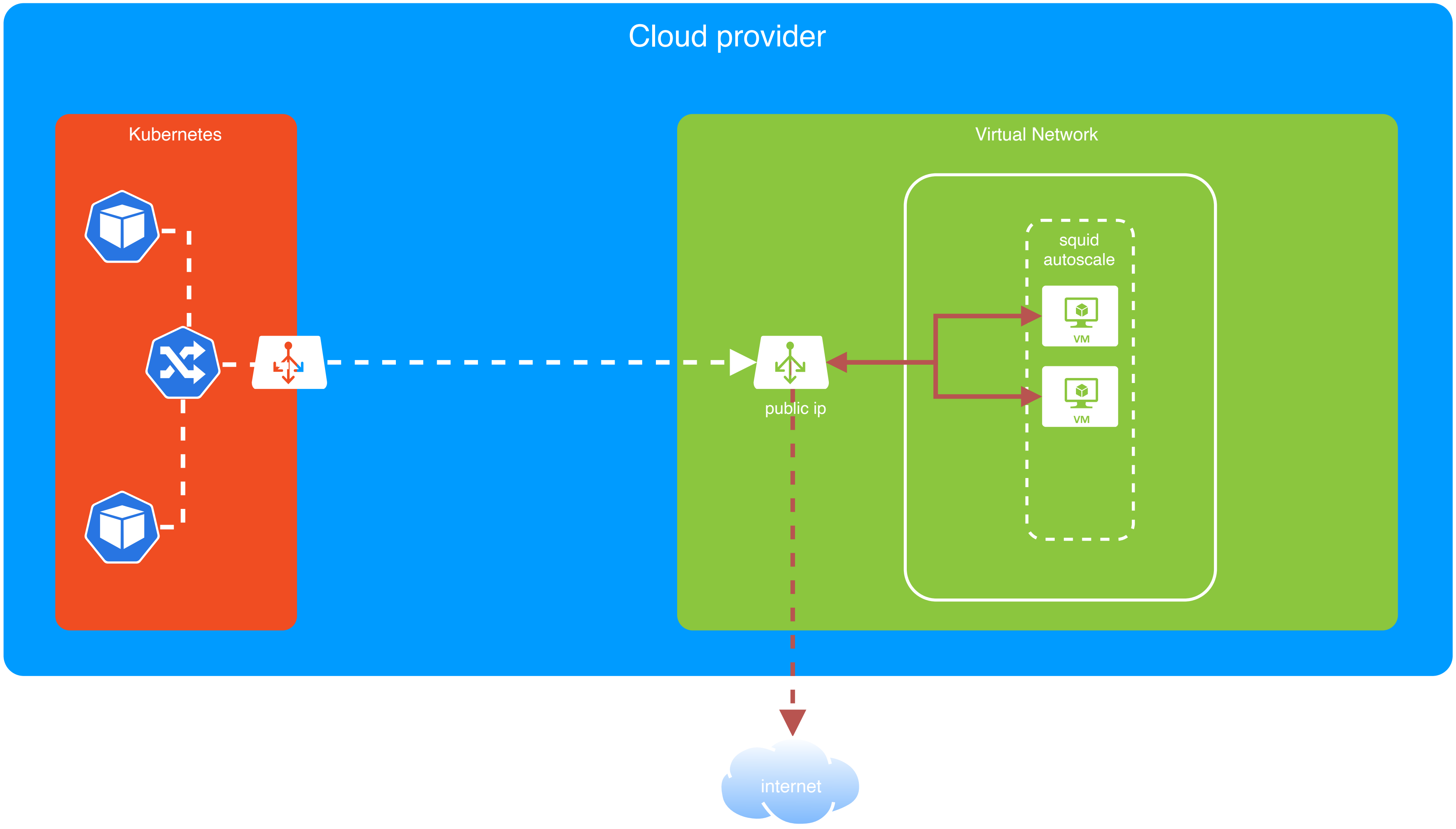
Load Balancer in front of VMs gives a dedicated egress ip



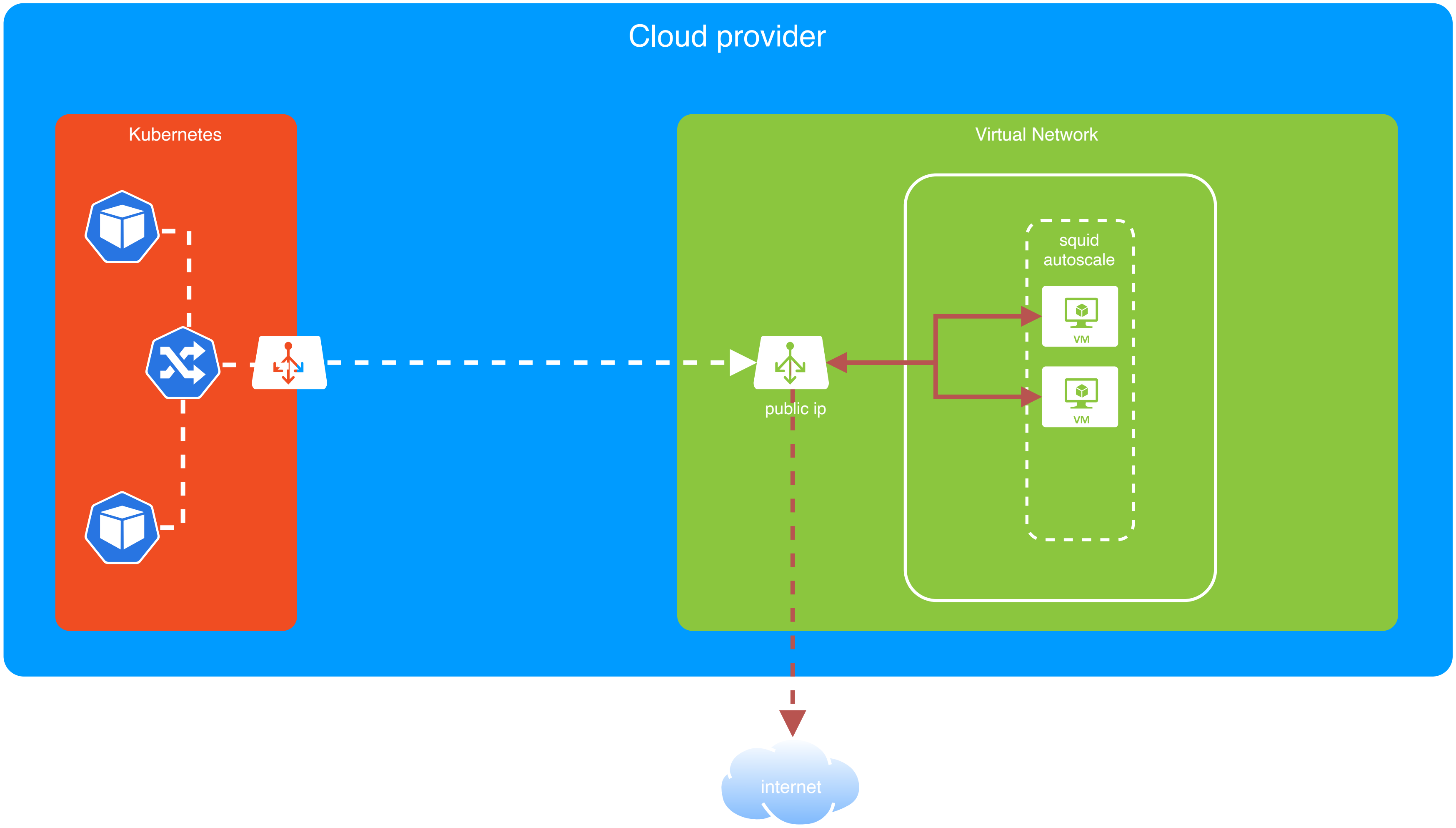
JVM is configured with Squid as HTTP proxy for transparent forwarding



k8s network policies prevent one tenant to access a different tenant proxy



Each tenant gets a VM auto scale set and a Load Balancer



All VMs run in a VNET peered to the k8s cluster VNET

SQUID VERSION: PROS

Simple and transparent config in JVM using http proxy system properties

VNET peering makes traffic private

SQUID VERSION: CONS

Proxy authn/authz is not well supported, needs network policies

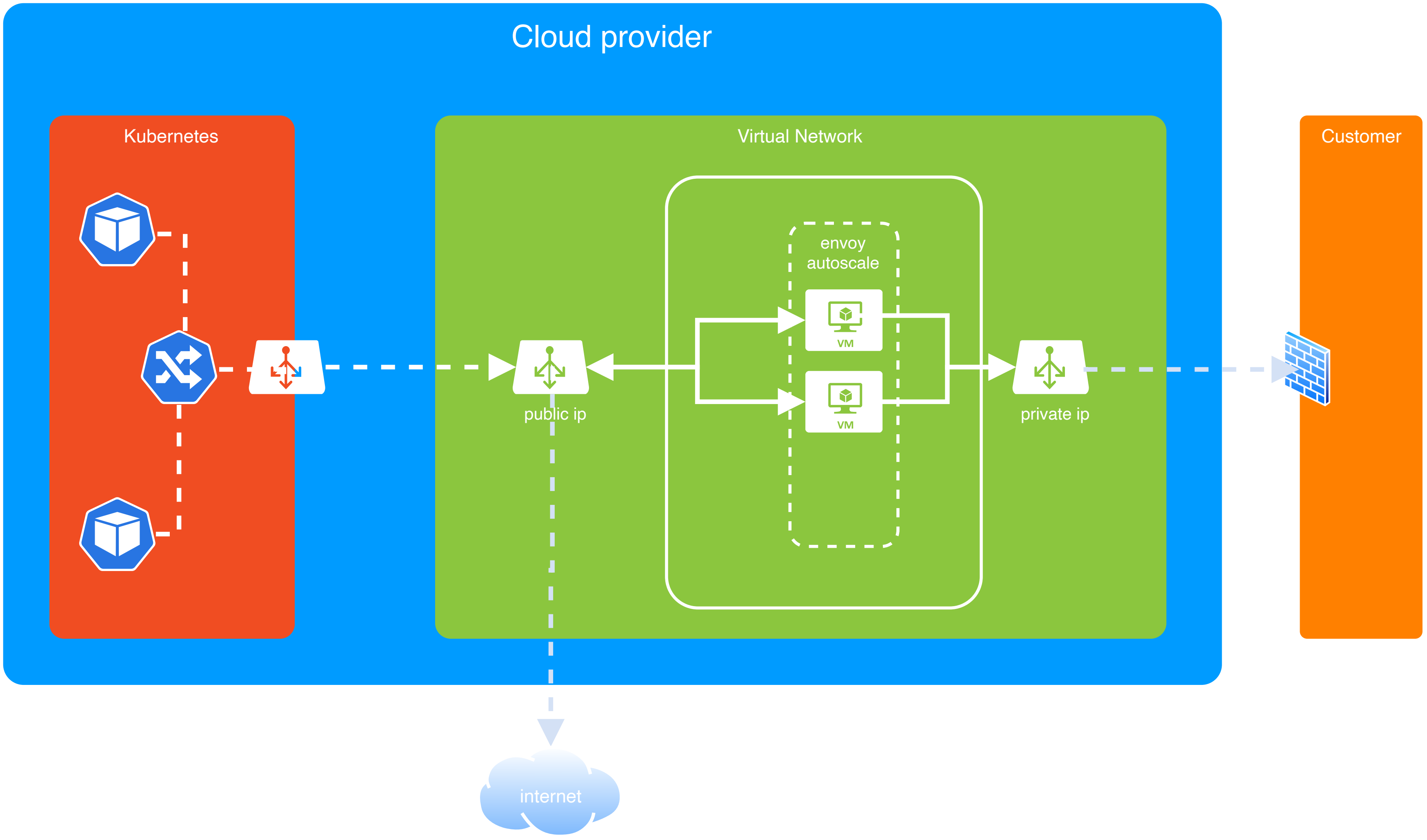
Only works for http/s protocol

Http traffic is not encrypted

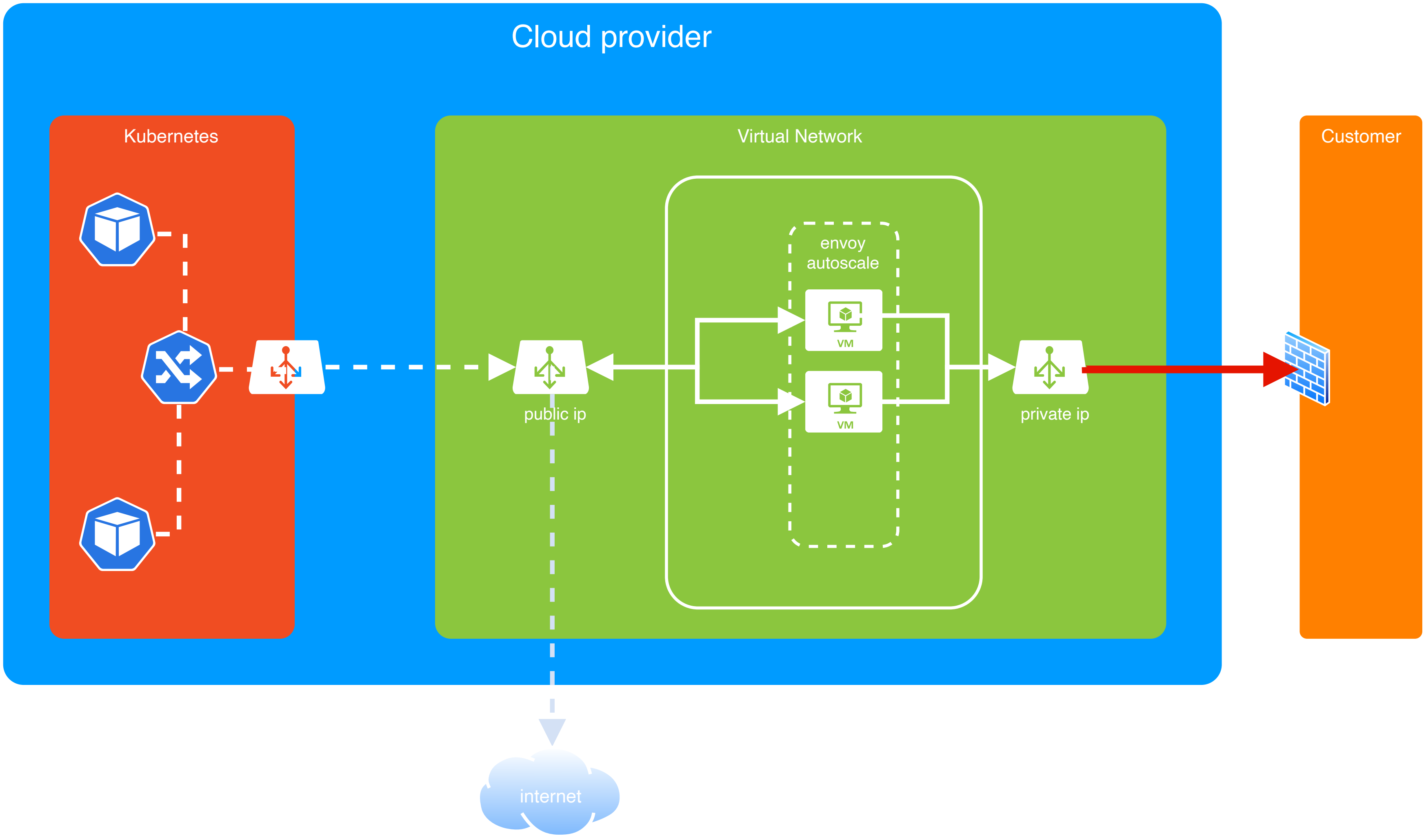
Does not support other use cases (VPN, private connections,...)

SECOND VERSION: ENVOY

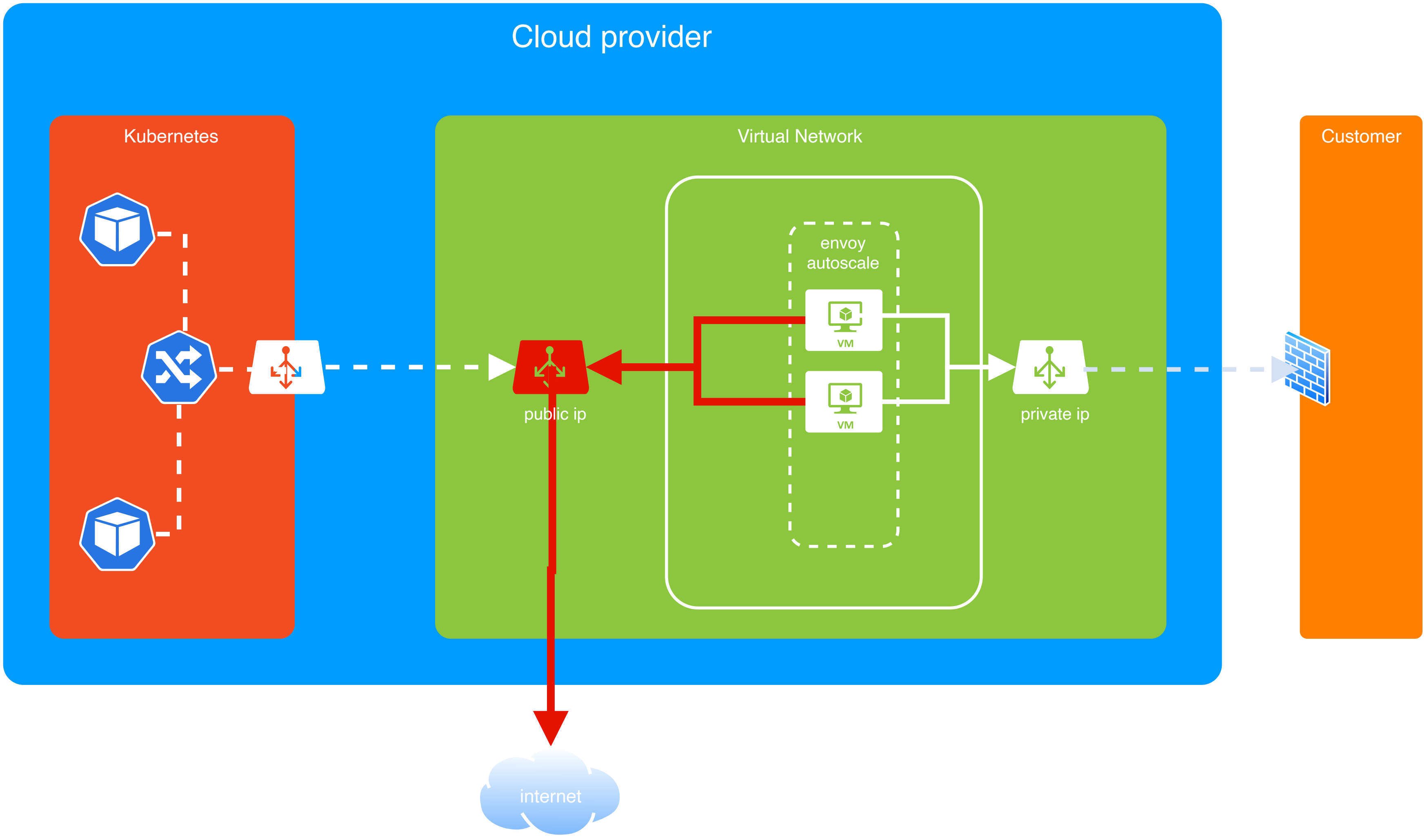
Running Envoy on VMs and pod sidecars in Kubernetes



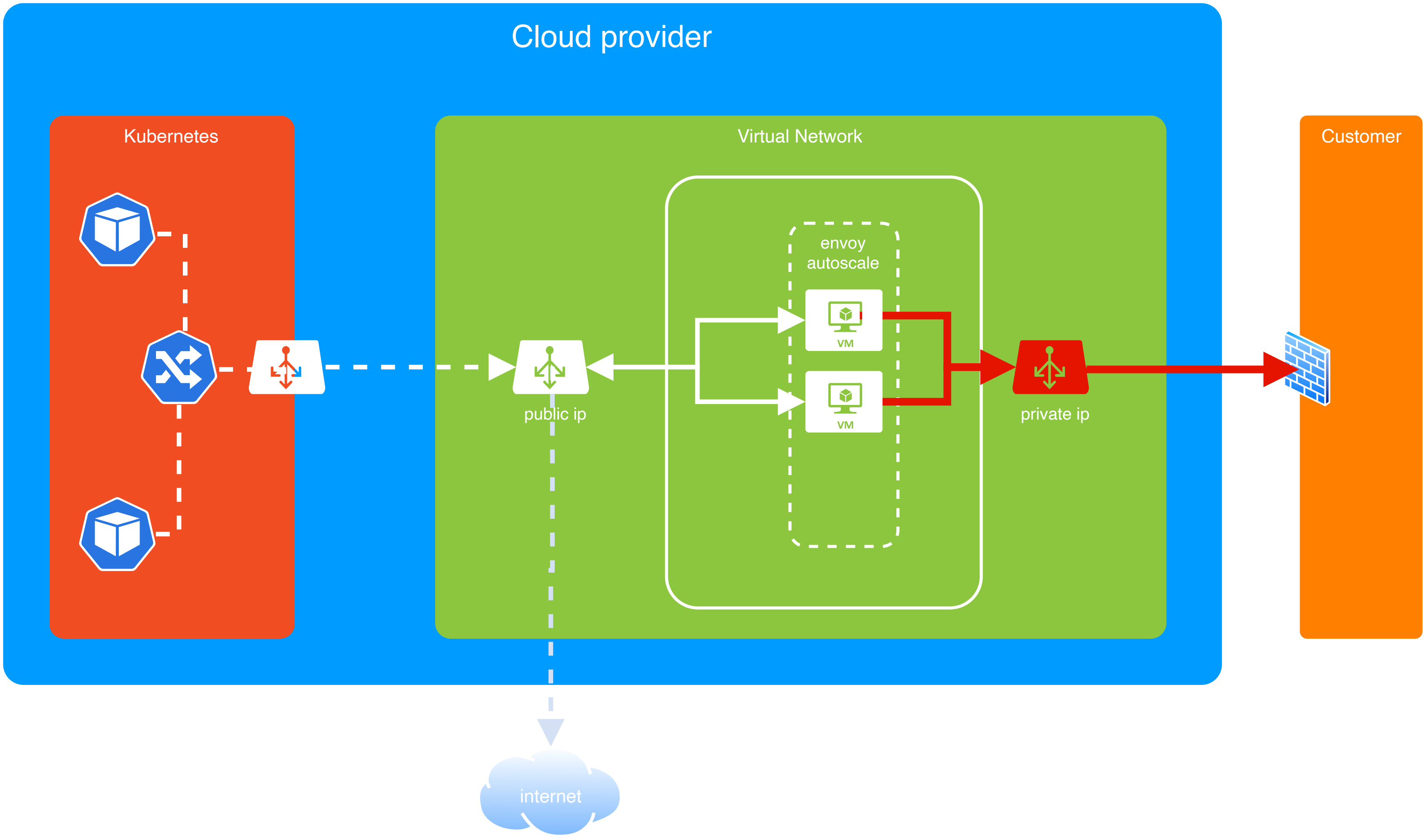
Each tenant gets a VNET, a VM auto scale set and a Load Balancer



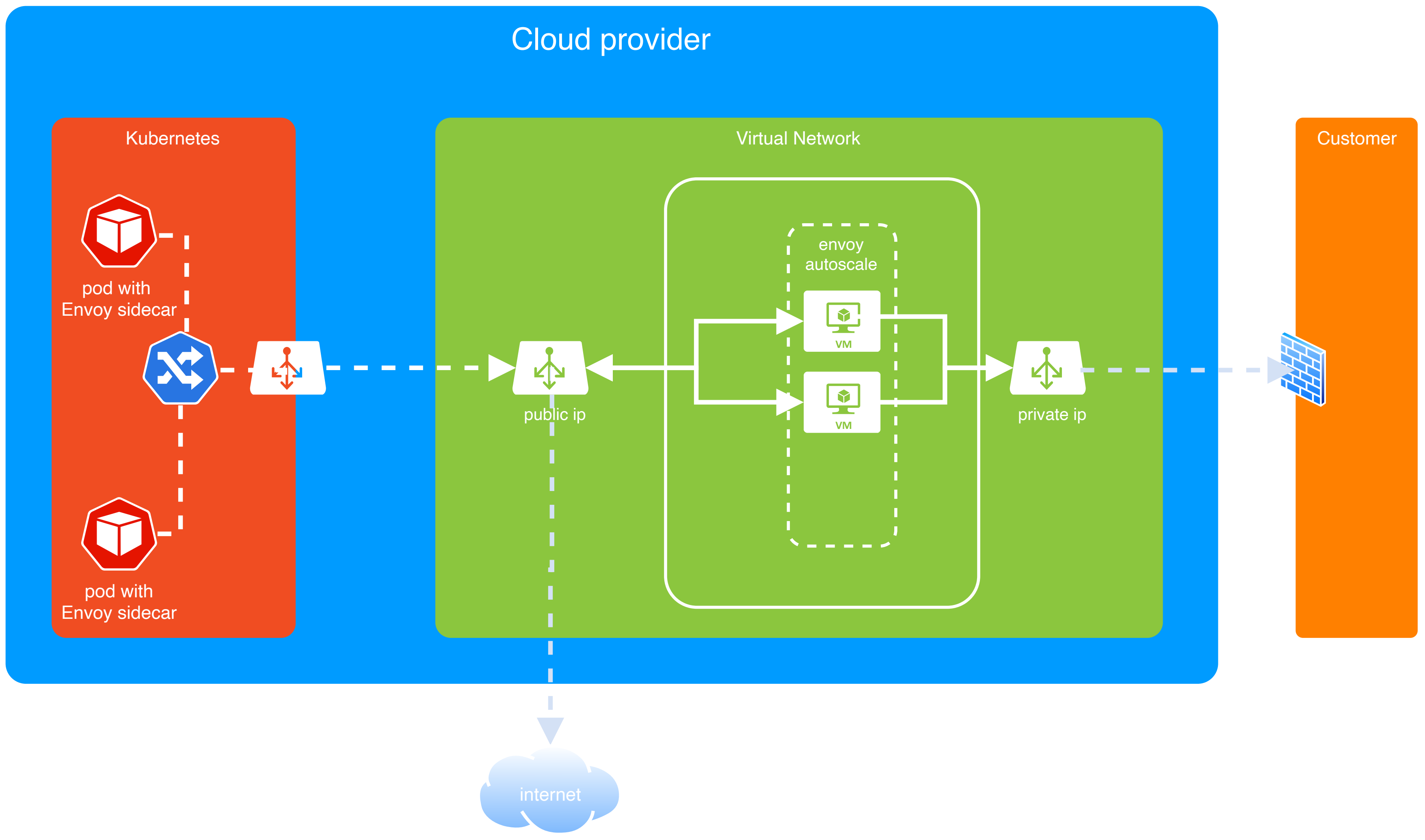
VNET can be privately connected to customer network



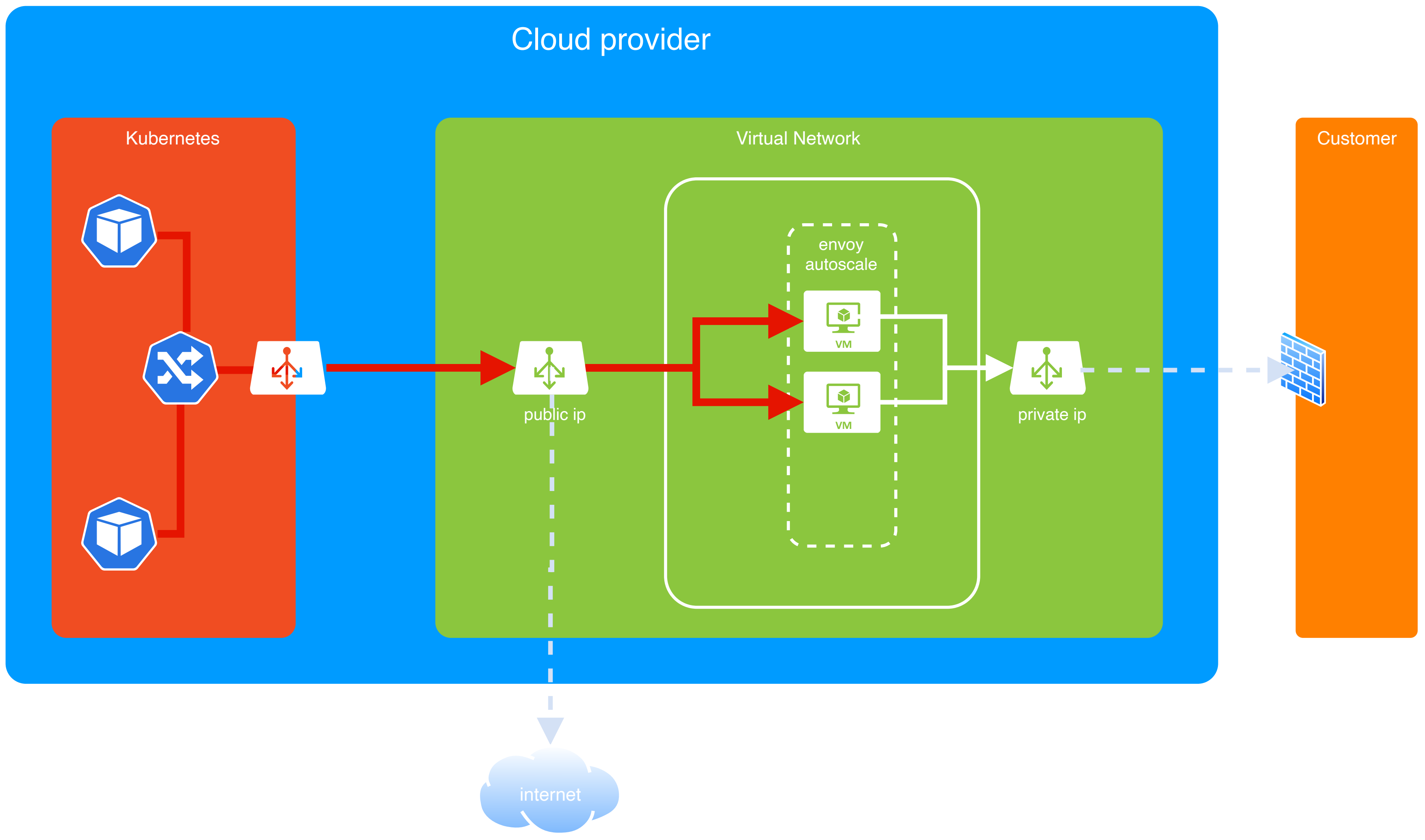
Load Balancer in front of VMs gives a dedicated public egress ip



Private Load Balancer in front of VMs gives a dedicated private egress ip



JVM is configured with Envoy sidecar as HTTP proxy for transparent forwarding



HTTP2 tunnel between sidecar Envoy and VM Envoy with mTLS

ENVOY: PROS

Simple and transparent config in JVM using http proxy system properties

Any protocol supported using different listeners in sidecar

All traffic is encrypted

ENVOY: PROS

VNET allows configuration of VPN, private connections at cloud level as a service

mTLS prevents unauthorized connections and one tenant to connect to another tenant Envoy

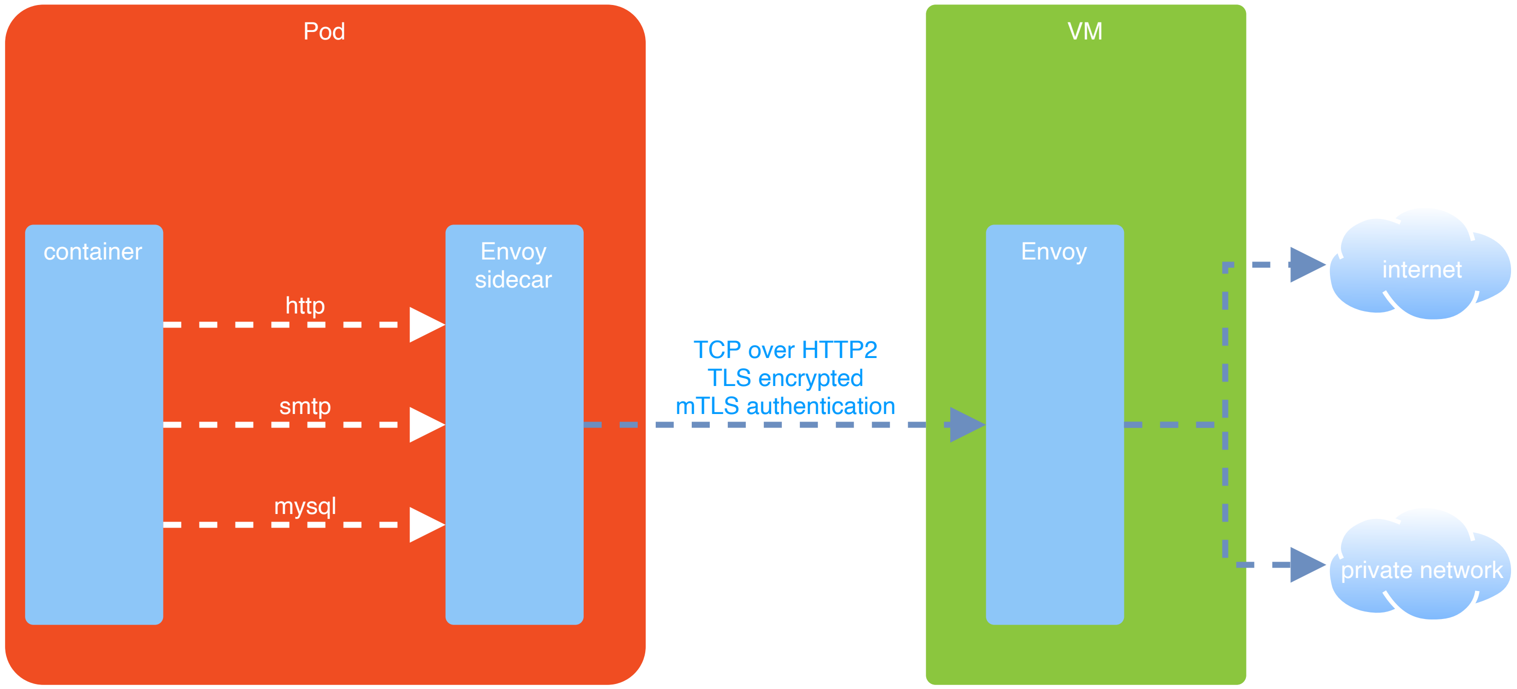
ENVOY: CONS

VPN and private connections require a non overlapping ip range with private network

Needs one set of certificates for each tenant for sidecars and VMs: rotation, expiration,...

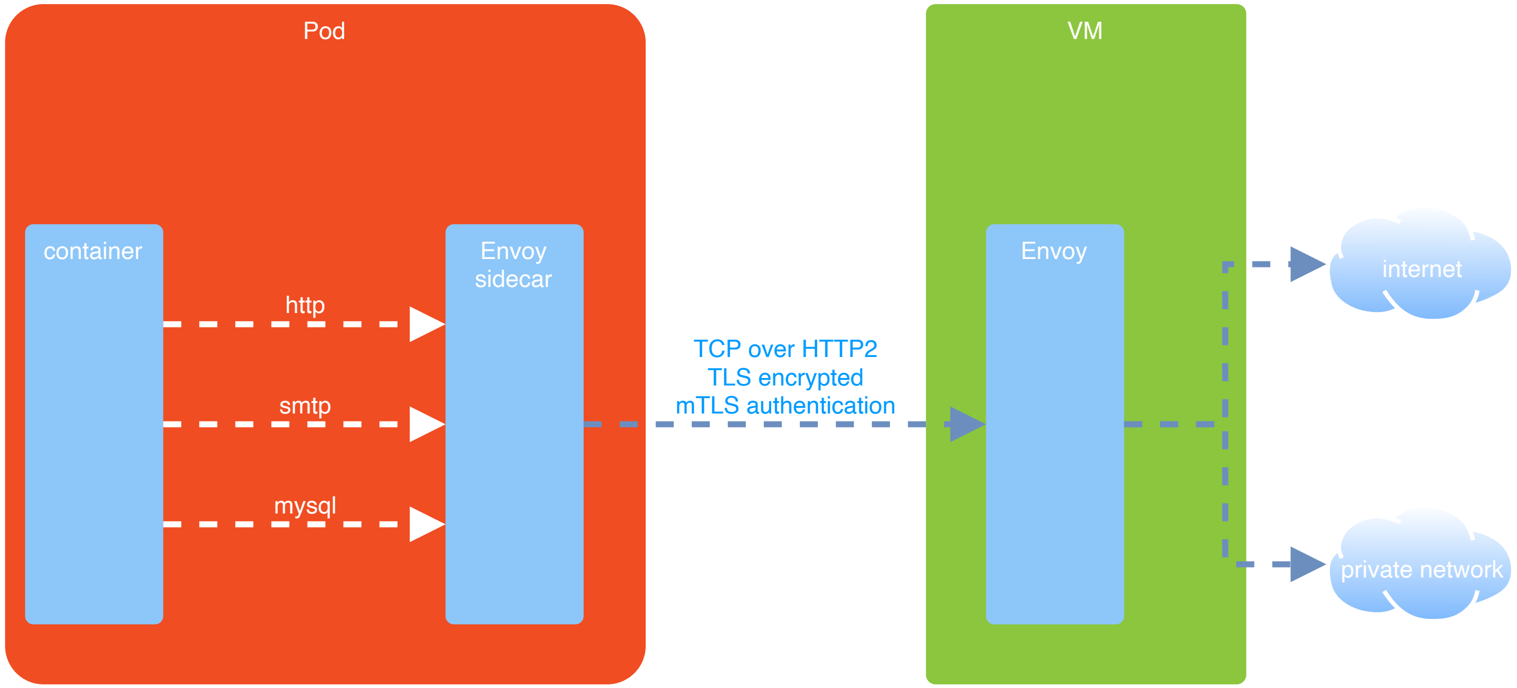
ENVOY CONFIGURATION

ENVOY SIDECAR



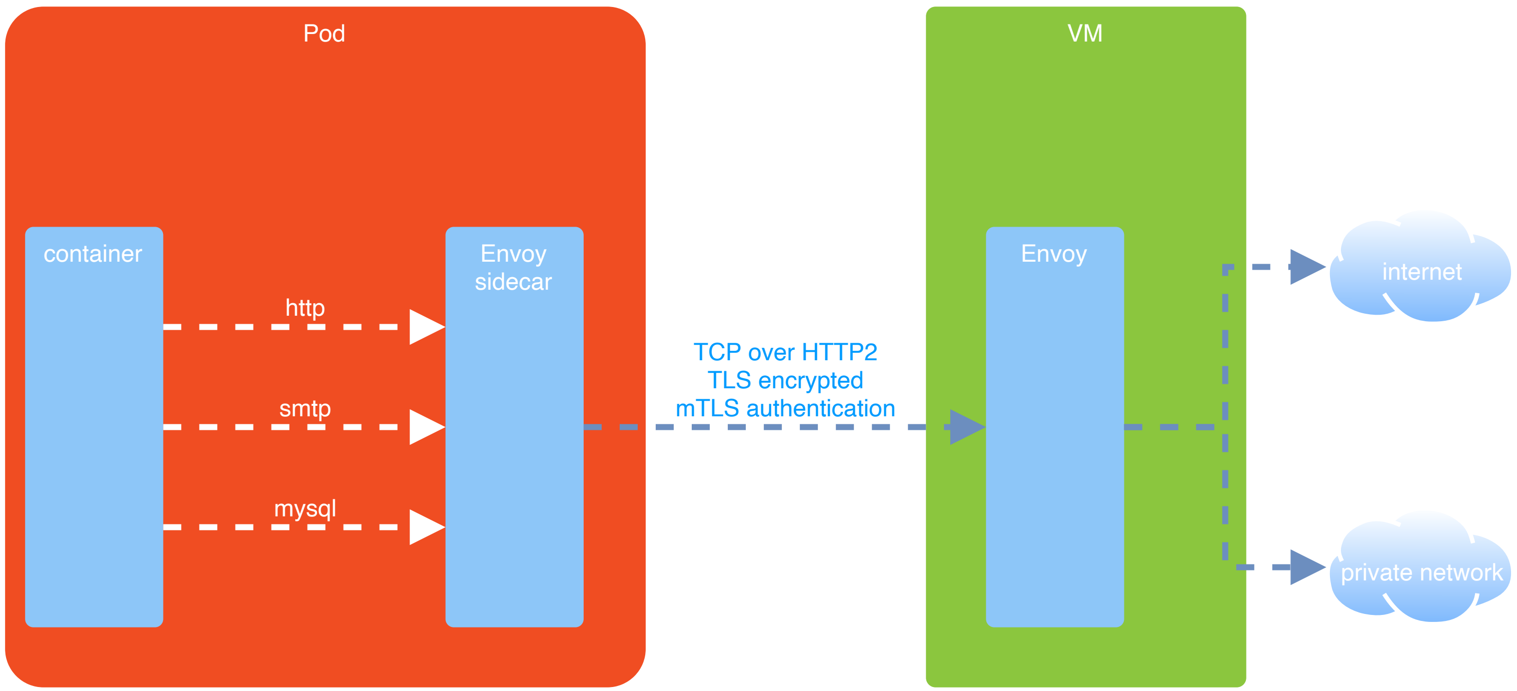
One listener with TcpProxy filter for http/s. `HTTP CONNECT` gives Envoy the destination

ENVOY SIDECAR



One listener for each non http port. Destination hardcoded in `tunneling_config`

ENVOY SIDECAR



One cluster with the VM Envoy LB as endpoint and TLS `transport_socket` config

ENVOY SIDECAR: HTTP LISTENER

```yaml
- name: listener_0
  "@type": type.googleapis.com/envoy.config.listener.
  v3.Listener
  address:
    socket_address:
      protocol: TCP
      address: 0.0.0.0
      port_value: 3128
  filter_chains:
  - filters:
    - name: tcp
      typed_config:
        "@type": type.googleapis.com/envoy.extensions
        .filters.network.tcp_proxy.v3.TcpProxy
        stat_prefix: tcp_stats
        cluster: cluster_0
```

ENVOY SIDECAR: NON HTTP LISTENER

```yaml
- filters:
  - name: tcp
    typed_config:
      "@type": type.googleapis.com/envoy.extensions.
      filters.network.tcp_proxy.v3.TcpProxy
      stat_prefix: tcp_stats
      cluster: cluster_0
      tunneling_config:
        hostname: mysql:3306
```

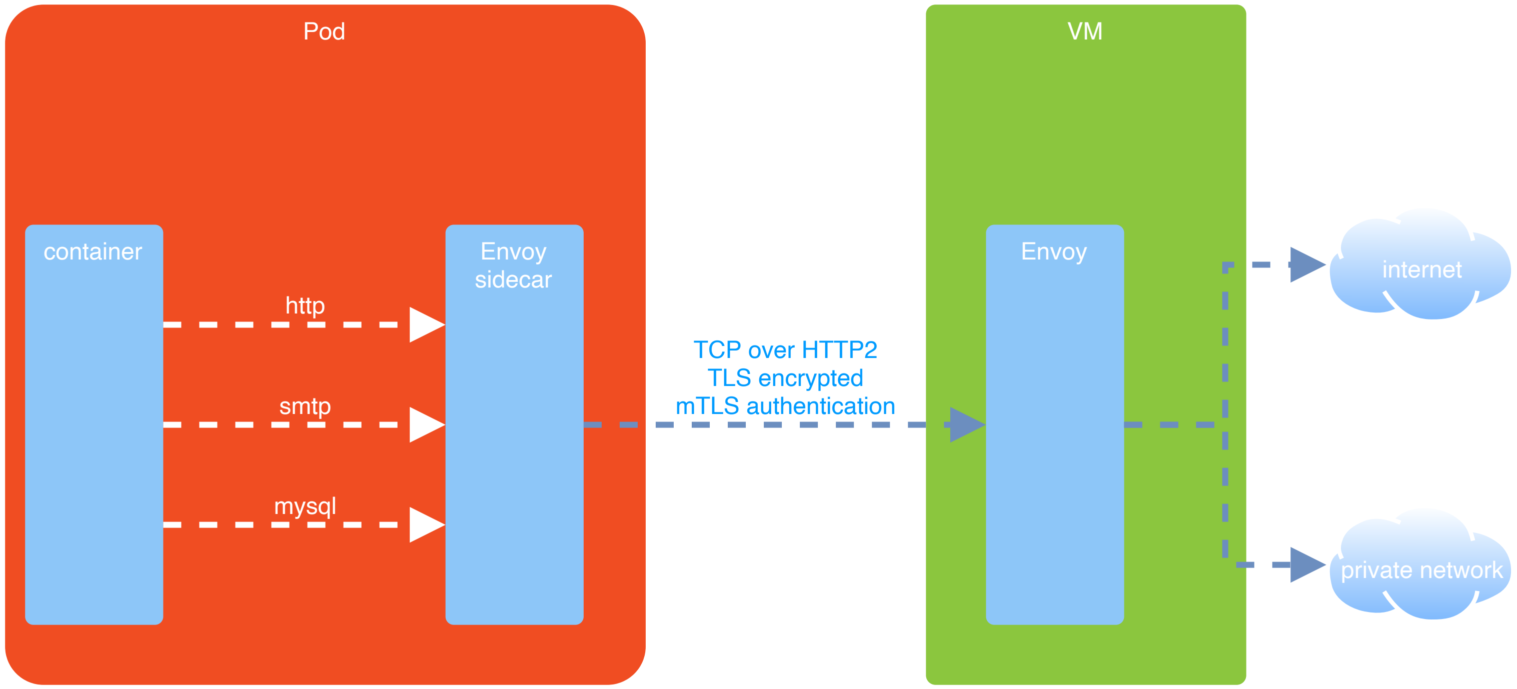
ENVOY SIDECAR: CLUSTER

```
- name: cluster_0
  "@type": type.googleapis.com/envoy.config.cluster.v3.C
  connect_timeout: 5s
  type: logical_dns
  respect_dns_ttl: true
  http2_protocol_options:
    {}
  load_assignment:
    cluster_name: cluster_0
    endpoints:
      - lb_endpoints:
          - endpoint:
              address:
                socket_address:
                  address: envoy_vm
                  port_value: 443
```

ENVOY SIDECAR: CLUSTER

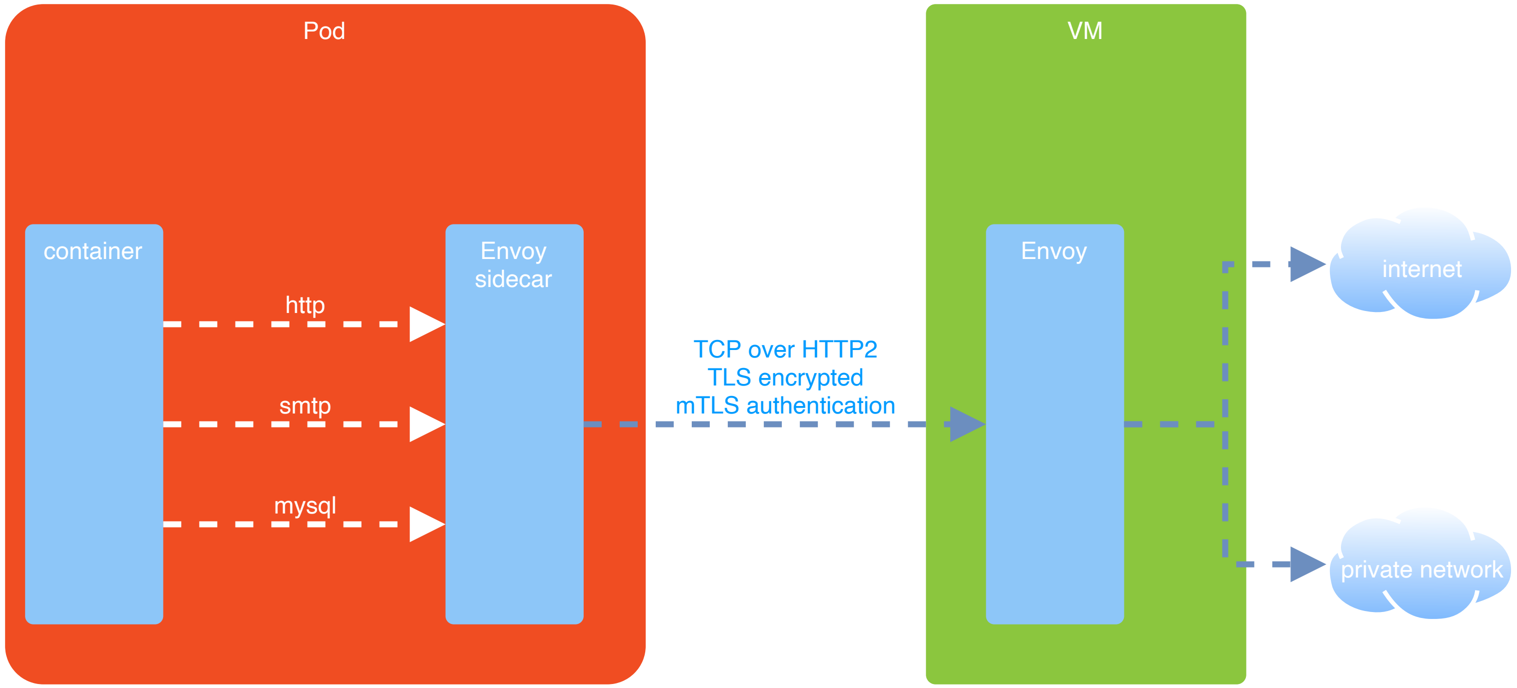
```
transport_socket:
  name: envoy.transport_sockets.tls
  typed_config:
    "@type": type.googleapis.com/envoy.extensions.tran
    common_tls_context:
      tls_certificates:
        - certificate_chain: {
            filename: "/etc/envoy/certs/tls.crt" }
          private_key: {
            filename: "/etc/envoy/certs/tls.key" }
      tls_params:
        tls_minimum_protocol_version: TLSv1_2
      validation_context:
        trusted_ca: {
          filename: /etc/envoy/cacert.pem}
```

ENVOY IN VM



One `HttpConnectionManager` listener with `CONNECT` upgrade

ENVOY IN VM



One `dynamic_forward_proxy` cluster for all destinations

ENVOY IN VM: LISTENER

```yaml
- name: listener_0
  "@type": type.googleapis.com/envoy.config.listener.v3.
  address:
    socket_address:
      protocol: TCP
      address: 0.0.0.0
      port_value: 443
  filter_chains:
  - filters:
    - name: envoy.filters.network.http_connection_manage
      typed_config:
        "@type": type.googleapis.com/envoy.extensions
        .filters.network.http_connection_manager.v3.
        HttpConnectionManager
        stat_prefix: ingress_http
```

ENVOY IN VM: LISTENER

```yaml
route_config:
  name: local_route
  virtual_hosts:
  - name: local_service
    domains:
      - "*"
    routes:
      - match:
          connect_matcher:
            {}
        route:
          cluster: dynamic_forward_proxy_cluster
          upgrade_configs:
            - upgrade_type: CONNECT
              connect_config:
                {}
      # needed to be used as a proxy with http (not s)
      - match:
          prefix: "/"
        route:
          cluster: dynamic_forward_proxy_cluster
```

ENVOY IN VM: LISTENER

```
http_filters:
- name: envoy.filters.http.dynamic_forward_proxy
  typed_config:
    "@type": type.googleapis.com/envoy.extensions.
    filters.http.dynamic_forward_proxy.v3.FilterConfig
    dns_cache_config:
      name: dynamic_forward_proxy_cache_config
      dns_lookup_family: V4_ONLY
- name: envoy.filters.http.router
  typed_config:
    "@type": type.googleapis.com/envoy.extensions.
    filters.http.router.v3.Router
http2_protocol_options:
  allow_connect: true
upgrade_configs:
  - upgrade_type: CONNECT
```

ENVOY IN VM: LISTENER

```yaml
transport_socket:
  name: envoy.transport_sockets.tls
  typed_config:
    "@type": type.googleapis.com/envoy.extensions.
    transport_sockets.tls.v3.DownstreamTlsContext
    common_tls_context:
      tls_certificates:
        - certificate_chain: {
            filename: "/etc/envoy/certs/envoy.pem" }
          private_key: {
            filename: "/etc/envoy/certs/envoy.key" }
      tls_params:
        tls_minimum_protocol_version: TLSv1_2
      validation_context:
        trusted_ca:
          filename: /etc/envoy/certs/cacert.pem
        # only allow connections with this SAN
        match_subject_alt_names:
          exact: "envoy_sidecar"
    require_client_certificate: true
```

ENVOY IN VM: CLUSTER

```
- name: dynamic_forward_proxy_cluster
  "@type": type.googleapis.com/envoy.config.cluster.
  v3.Cluster
  connect_timeout: 1s
  lb_policy: CLUSTER_PROVIDED
  cluster_type:
    name: envoy.clusters.dynamic_forward_proxy
    typed_config:
      "@type": type.googleapis.com/envoy.extensions.
      clusters.dynamic_forward_proxy.v3.ClusterConfig
      dns_cache_config:
        name: dynamic_forward_proxy_cache_config
        dns_lookup_family: V4_ONLY
```

ENVOY CONFIG: RESOURCES

envoyproxy.io

arch_overview/http/upgrades

sandboxes/tls

sandboxes/double-proxy

ENVOY DEBUGGING

TLS connection errors only show up in `connection` component debug logs

Client only sees socket closing messages

Example: certificate SAN does not match `match_subject_alt_names`

VM side

```
envoy_vm_1     [debug][connection]
[source/extensions/transport_sockets/tls/ssl_socket.cc:2
[C0] TLS error: 268435581:SSL routines:
OPENSSL_internal:CERTIFICATE_VERIFY_FAILED
```

Sidecar side

```
envoy_sidecar_1 [debug][connection]
[source/extensions/transport_sockets/tls/ssl_socket.cc:2
[C1] TLS error: 268436502:SSL routines:
OPENSSL_internal:SSLV3_ALERT_CERTIFICATE_UNKNOWN
envoy_sidecar_1 [debug][connection]
[source/common/network/connection_impl.cc:241]
[C1] closing socket: 0
```

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