Multiple Virtual IP Address

Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	PCF
Applicable Platform(s)	SMI
Feature Default Setting	Disabled – Configuration required to enable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

Revision Details	Release
Enhancement introduced. PCF supports N5 Interface.	2022.02.0
Enhancement introduced. PCF supports dual stack (IPv4 and IPv6) connectivity on N7, N28 and NNRF external interfaces/endpoints.	2022.01.0

Revision Details	Release
Enhancement introduced. PCF supports IPv6 connectivity on N7, N28 and NNRF external interfaces/endpoints.	2021.04.0
Enhancement introduced. Support added for HTTP IDLE Connection Timeout on Server	2021.02.0
First introduced.	2020.01.0

Feature Description

You can now enable the IPv4 communication between PCF and the other network functions such as AF, SMF, NRF, CHF, and UDR through multiple virtual IP addresses (VIP). With a provision to configure discrete VIP addresses or external IP addresses for each rest-ep service and link them to an endpoint, you can prevent sharing of IP addresses between the NFs. Multiple VIPs take the role of a load balancer to offer a high availability environment.

In a scenario where multiple calls are simultaneously made to a distinct network function, the policy service spawns different REST ep services to complete each interaction. PCF spawns a service using the IP address available in the IP pool.

PCF supports both IPv4 and IPv6 connectivity on N5, N7, N28 and NNRF external interfaces/endpoints (inbound and outbound).

Architecture

This section describes how the network function components interact when the multiple VIP model is implemented.

The multiple VIP architecture focuses on high availability and load-balancing aspect of IP addresses in 5G. With relevance to the multiple VIP graphic, the Policy Engine invokes a new rest-ep service for a NF when you assign an IP address as an external endpoint. All the incoming requests from the network functions, such as NRF and SMF are routed to the rest-ep-service and the traffic is redirected to the pcf-rest-ep pod. The pod has a bilateral communication with the PCF Engine. The rest-ep-service operates as a load balancer.

Figure 1: Multiple VIPs
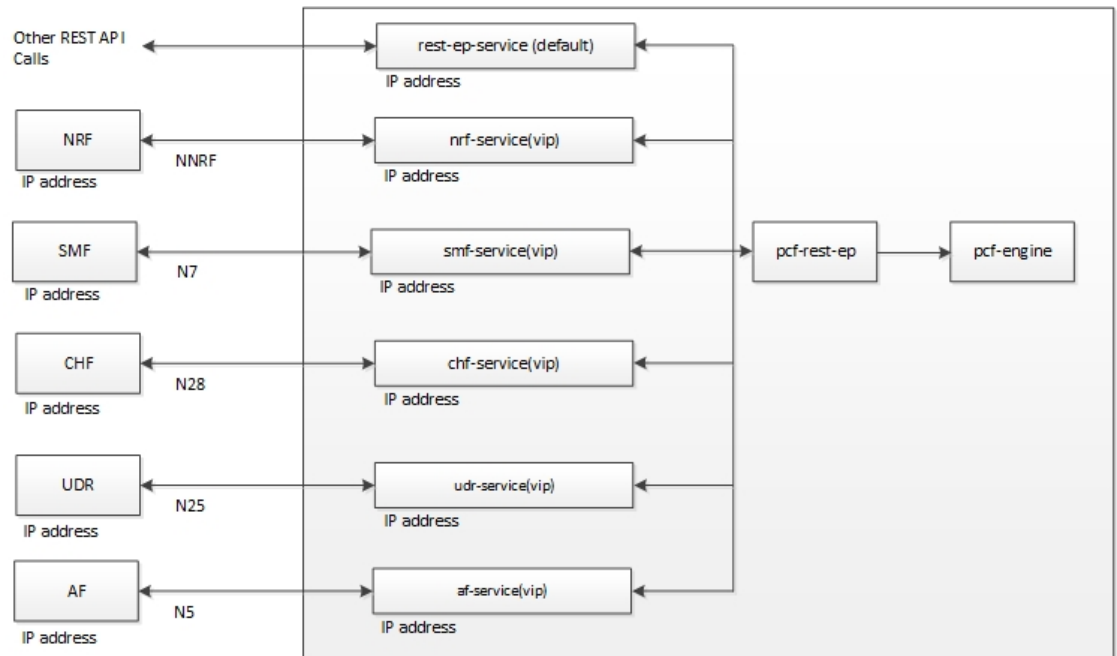
How it Works

This section describes how this feature works.

After the admin associates an IP address to a network function such as PCF, a new endpoint is linked to the network function through the rest-ep service. This service enables you to connect to the pcf-rest-ep pod.

You can configure multiple IP address for the N5, N7, N36, N28, and Nnrf interfaces. During this process, an individual K8 service resource of type Load Balancer is created for each interface that communicates with the rest-endpoint pod. These IP addresses get listed in the ExternalIP property of the K8 service.

PCF supports multiple IP service communications with one replica of the rest-endpoint pod.

Configuration Support for Multiple Virtual IP Address

The configuration of the multiple virtual IP address involves the following:

• Configuring the REST Endpoints

• Verifying the REST Endpoints Configuration

Configuring the REST Endpoints

This section describes how to configure the IP address, port numbers, and other attributes for a REST endpoint.

Note   Configuration changes to the REST endpoint cause the endpoint to restart automatically. Cisco recommends making such changes only within the maintenance window.

Before configuring the external IP addresses for the PCF REST endpoints, make sure that you configure and deploy the IP addresses using the SMI Deployer.

For a single interface both IPv4 or IPv6 address can be used.

To configure REST endpoint, use the following configuration in the Policy Ops Center console:

```
config
   rest-endpoint
      interface [ n5 | n7 | n15 | n25 | n28 | nnrf ]
           ip
           ipv6 interface_ipv6_address
           port interface_port_number
      ips ip_address
      port port_number
      http-connection-limit maximum_inbound_connection_count
      http-idle-connection-timeout-on-server-seconds idle_connection_timeout
      replicas replica_count
      inbound-request-timeout-ms inbound_timeout
      outbound-request-timeout-ms outbound_timeout
      repository repository_address
      tracing-service-name tracing_service
      uri-scheme uri_scheme
      end
```

NOTES:

- For each REST endpoint, use a separate **rest-endpoint** *ip_address* command.

- **interface [n5 | n7 | n15 | n25 | n28 | nnrf]**—Specify the interface name and IP address that is configured for the external IP. *interface_name ip_address* must include the interface name such as N7, N36, N28, and NNRF.

    - **ip** *interface_ip_address*—Specify the IPv4 address that is assigned for the interface.

    - **ipv6** *interface_ipv6_address*—Specify the IPv6 address that is assigned for the interface.

    - **port** *interface_port_number*—Specify the port number for the interface.

      For example, to enable the N15 interface allocate resources such as IP and port number. Once the interface is configured, the PCF-AMF traffic can pass through N15.

- **ips** *ip_address*—Specify the IPv4 or IPv6 address that is assigned as a REST endpoint external IP address.

- **port** *port_number*—Specify the port number for the REST endpoint.

- **http-connection-limit** *maximum_inbound_connection_count*—Specify the maximum number of inbound HTTP connections that the REST endpoint server must accept. Default value is 200.

- **http-idle-connection-timeout-on-server-seconds** *idle_connection_timeout*—Specify the idle connection timeout for REST connection where PCF is acting as server. Default value is 60 seconds.

If the value is less than or equal to 0, the default value of 60 seconds is used.

- **replicas** *replica_count*—Specify the number of instances of the service-based interface.

- **inbound-request-timeout-ms** *inbound_timeout*—Specify the timeout period after which the inbound request expires. You can configure a single *inbound_timeout* value for all the configured interfaces or the single interface.

- **outbound-request-timeout-ms** *outbound_timeout*—Specify the timeout period after which the outbound request expires. You can configure a single *outbound_timeout* value for all the configured interfaces or the single interface.

- **repository** *repository_address*—Specify a repository that the network interface optimizes.

- **tracing-service-name** *tracing_service*—Specify the service that is used for tracing purpose.

- **uri-scheme** *uri_scheme*—Specify the URI scheme as HTTP or HTTPs.

Note If the configured IP address is not accessible, then PCF fails to connect with the other NFs and reports an error message in the service as "Failed to allocate IP for "pcf/udr-rest-ep": no available IPs".

Verifying the REST Endpoints Configuration

This section describes how to verify the REST Endpoints configuration.

After an interface IP address is configured, you can observe a new service with the name as *<interface-name>*-rest-ep. The service type as ClusterIP gets created within the configured IP address. For example, n36-rest-ep.

If an IP address is not associated to an interface, then PCF considers an external IP address and associates it with the interface.