Access the Networking Stack

The Cisco IOS XR Software serves as a networking stack for communication. This section explains how applications on IOS XR can communicate with internal processes, and with servers or outside devices.

Communication Outside Cisco IOS XR

To communicate outside Cisco IOS XR, applications use the `fwdintf` interface address that maps to the `loopback0` interface or a configured Gigabit Ethernet interface address. For information on the various interfaces on IOS XR, see Application Hosting on the Cisco IOS XR Linux Shell.

To have an iPerf or Chef client on IOS XR communicate with its respective server outside IOS XR, you must configure an interface address as the source address on XR. The remote servers must configure this route address to reach the respective clients on IOS XR.

This section provides an example of configuring a Gigabit Ethernet interface address as the source address for external communication.

Using a Gigabit Ethernet Interface for External Communication

To configure a GigE interface on IOS XR for external communication, use these steps:

1 Configure a GigE interface.

```
RP/0/RP0/CPU0:ios(config)# interface GigabitEthernet 0/0/0/1
RP/0/RP0/CPU0:ios(config-if)# ipv4 address 192.57.43.10 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)# no shut
RP/0/RP0/CPU0:ios(config-if)# commit
Fri Oct 30 07:51:14.785 UTC
RP/0/RP0/CPU0:ios(config-if)# exit
RP/0/RP0/CPU0:ios(config)# exit
```

2 Verify whether the configured interface is up and operational on IOS XR.

```
RP/0/RP0/CPU0:ios# show ipv4 interface brief
Fri Oct 30 07:51:48.996 UTC

Interface                  IP-Address      Status                Protocol
Loopback0                  1.1.1.1         Up                    Up
Loopback1                  8.8.8.8         Up                    Up
GigabitEthernet0/0/0/0     192.164.168.10  Up                    Up
```

```
GigabitEthernet0/0/0/1          192.57.43.10    Up                  Up
GigabitEthernet0/0/0/2          unassigned      Shutdown            Down
MgmtEth0/RP0/CPU0/0             192.168.122.197 Up                  Up
RP/0/RP0/CPU0:ios#
```

3 Enter the Linux bash shell and verify if the configured interface is up and running.

```
/* If you are using Cisco IOS XR Version 6.0.0, run the following command */
RP/0/RP0/CPU0:ios# run ip netns exec tpnns bash

/* If you are using Cisco IOS XR Version 6.0.2, run the following command */
RP/0/RP0/CPU0:ios# bash


[xr-vm_node0_RP0_CPU0:~]$ ifconfig
Gi0_0_0_0 Link encap:Ethernet  HWaddr 52:46:04:87:19:3c
          inet addr:192.164.168.10  Mask:255.255.255.0
          inet6 addr: fe80::5046:4ff:fe87:193c/64 Scope:Link
          UP RUNNING NOARP MULTICAST  MTU:1514  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:210 (210.0 B)

Gi0_0_0_1 Link encap:Ethernet  HWaddr 52:46:2e:49:f6:ff
          inet addr:192.57.43.10  Mask:255.255.255.0
          inet6 addr: fe80::5046:2eff:fe49:f6ff/64 Scope:Link
          UP RUNNING NOARP MULTICAST  MTU:1514  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:210 (210.0 B)

Mg0_RP0_CPU0_0 Link encap:Ethernet  HWaddr 52:46:12:7a:88:41
          inet addr:192.168.122.197  Mask:255.255.255.0
          inet6 addr: fe80::5046:12ff:fe7a:8841/64 Scope:Link
          UP RUNNING NOARP MULTICAST  MTU:1514  Metric:1
          RX packets:3 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:294 (294.0 B)  TX bytes:504 (504.0 B)

fwd_ew    Link encap:Ethernet  HWaddr 00:00:00:00:00:0b
          inet6 addr: fe80::200:ff:fe00:b/64 Scope:Link
          UP RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6 errors:0 dropped:1 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:392 (392.0 B)  TX bytes:532 (532.0 B)

fwdintf   Link encap:Ethernet  HWaddr 00:00:00:00:00:0a
          inet6 addr: fe80::200:ff:fe00:a/64 Scope:Link
          UP RUNNING NOARP MULTICAST  MTU:1482  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:1 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:140 (140.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:1500  Metric:1
          RX packets:8 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:672 (672.0 B)  TX bytes:672 (672.0 B)

lo:0      Link encap:Local Loopback
          inet addr:1.1.1.1  Mask:255.255.255.255
          UP LOOPBACK RUNNING  MTU:1500  Metric:1
```

4 Exit the Linux bash shell and configure the GigE interface as the source address for external communication.

```
[xr-vm_node0_RP0_CPU0:~]$ exit

RP/0/RP0/CPU0:ios# config
Fri Oct 30 08:55:17.992 UTC
RP/0/RP0/CPU0:ios(config)# tpa address-family ipv4 update-source gigabitEthernet 0/0/0/1
RP/0/RP0/CPU0:ios(config)# commit
Fri Oct 30 08:55:38.795 UTC
```

Note By default, the `fwdintf` interface maps to the `loopback0` interface for external communication. This is similar to binding a routing process or router ID to the `loopback0` interface. When you use the `tpa address-family ipv4 update-source` command to bind the `fwdintf` interface to a Gigabit Ethernet interface, network connectivity can be affected if the interface goes down.

5 Enter the Linux bash shell and verify whether the GigE interface address is used by the `fwdintf` interface for external communication.

```
/* If you are using Cisco IOS XR Version 6.0.0, run the following command */
RP/0/RP0/CPU0:ios# run ip netns exec tpnns bash

/* If you are using Cisco IOS XR Version 6.0.2, run the following command */
RP/0/RP0/CPU0:ios# bash

[xr-vm_node0_RP0_CPU0:~]$ ip route
default dev fwdintf  scope link  src 192.57.43.10
8.8.8.8 dev fwd_ew  scope link
192.168.122.0/24 dev Mg0_RP0_CPU0_0  proto kernel  scope link  src 192.168.122.197
[xr-vm_node0_RP0_CPU0:~]$
```

External communication is successfully enabled on IOS XR.

East-West Communication for Third-Party Applications

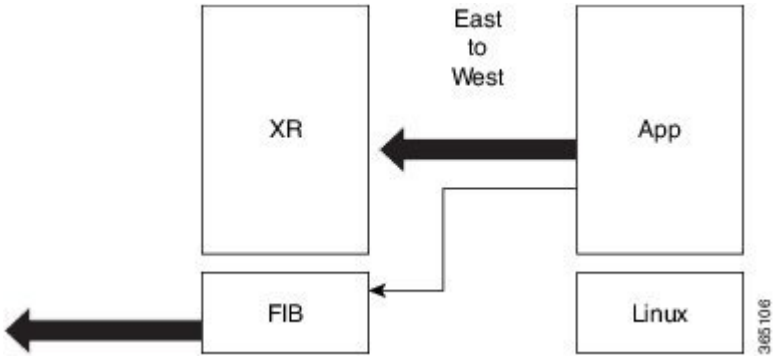
East-West communication on IOS XR is a mechanism by which applications hosted in containers interact with native XR applications (hosted in the XR control plane).

The following figure illustrates how a third-party application hosted on IOS XR interacts with the XR Control Plane.

The application sends data to the Forwarding Information Base (FIB) of IOS XR. The application is hosted in the east portion of IOS XR, while the XR control plane is located in the west region. Therefore, this form of communication between a third-party application and the XR control plane is termed as East-West (E-W) communication.

Third-party applications such as Chef Client and Puppet Agent use this mode of communication to configure and manage containers, packages, and applications on IOS XR. In the future, this support could be extended to IOS XR, configured and managed by such third-party applications.

Figure 1: East-West Communication on IOS XR



For a third-party application to communicate with IOS XR, the Loopback1 interface must be configured. This is explained in the following procedure.

1 Configure the Loopback1 interface on IOS XR.

```
RP/0/RP0/CPU0:ios(config)# interface Loopback1
RP/0/RP0/CPU0:ios(config-if)# ipv4 address 8.8.8.8/32
RP/0/RP0/CPU0:ios(config-if)# no shut
RP/0/RP0/CPU0:ios(config-if)# commit
RP/0/RP0/CPU0:ios(config-if)# exit
RP/0/RP0/CPU0:ios(config)#
```

2 Verify the creation of the Loopback1 interface.

```
RP/0/RP0/CPU0:ios# show ipv4 interface brief
Thu Nov 12 10:01:00.874 UTC

Interface                      IP-Address      Status                Protocol
Loopback0                      1.1.1.1         Up                    Up
Loopback1                      8.8.8.8         Up                    Up
GigabitEthernet0/0/0/0         192.164.168.10  Up                    Up
GigabitEthernet0/0/0/1         192.57.43.10    Up                    Up
GigabitEthernet0/0/0/2         unassigned      Shutdown              Down
MgmtEth0/RP0/CPU0/0            192.168.122.197 Up                    Up
RP/0/RP0/CPU0:ios#
```

3 Enter the third-party network namespace or global VRF depending on the version of IOS XR version you are using for your network.

```
/* If you are using Cisco IOS XR Version 6.0.0, run the following command */
RP/0/RP0/CPU0:ios# run ip netns exec tpnns bash

/* If you are using Cisco IOS XR Version 6.0.2, run the following command */
RP/0/RP0/CPU0:ios# bash
```

4 Verify whether the Loopback1 interface address has been mapped to the E-W interface.

```
[xr-vm_node0_RP0_CPU0:~]$ ip route
default dev fwdintf  scope link  src 192.57.43.10
8.8.8.8 dev fwd_ew  scope link
192.168.122.0/24 dev Mg0_RP0_CPU0_0  proto kernel  scope link  src 192.168.122.197
[xr-vm_node0_RP0_CPU0:~]$
```