BridgeMode Feature support in RPI

1. Scope of the work

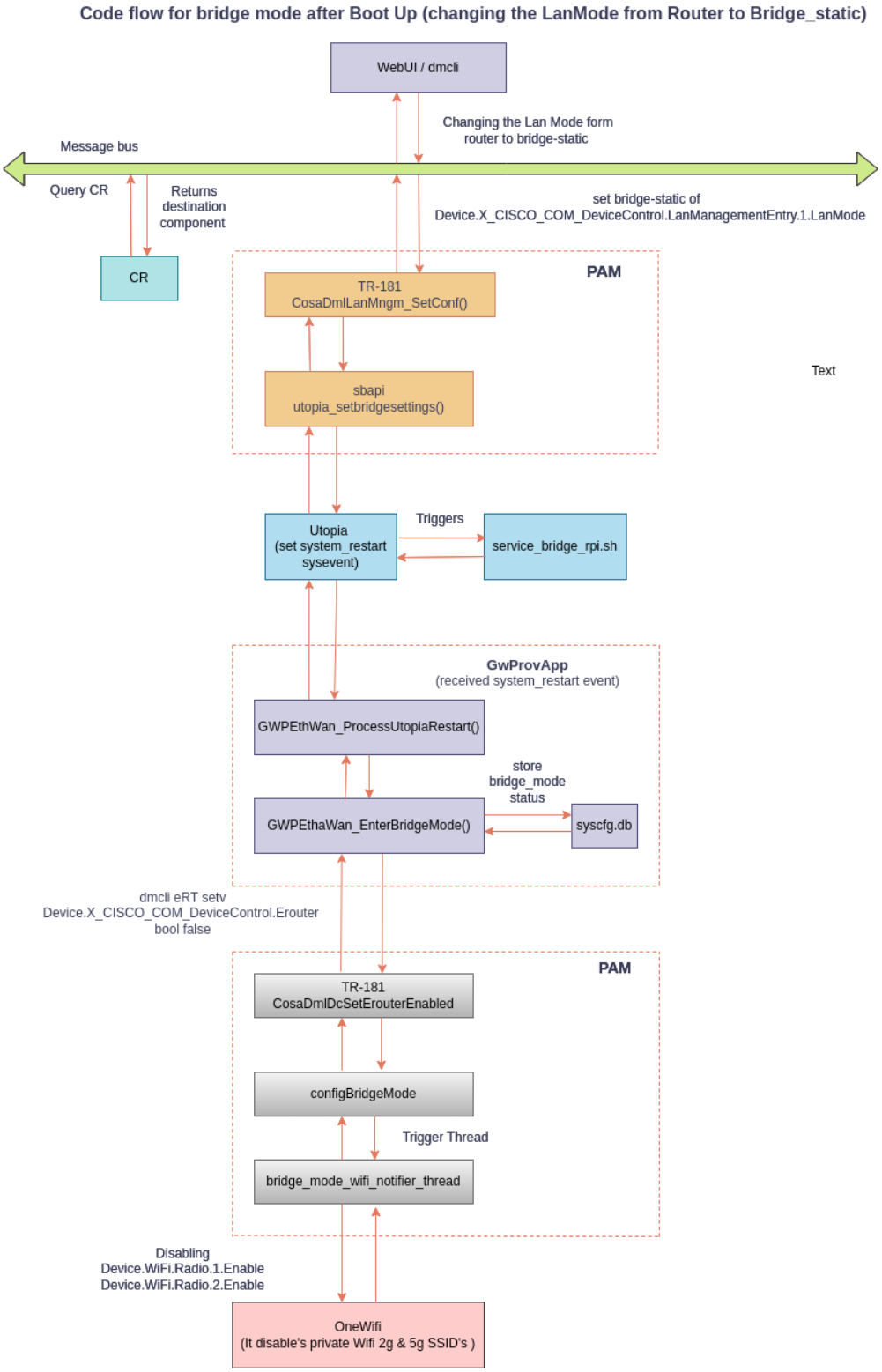
To disable router mode and enable brigdemode in RPI Router . It means, by default device will be in router mode. Once changed to bridge mode , Private WIFI will stop its broadcasting, Ethernet Client should get public IP address (in erouter series) and Wireless client will lose its connection to private WIFI.

2. Target Audience

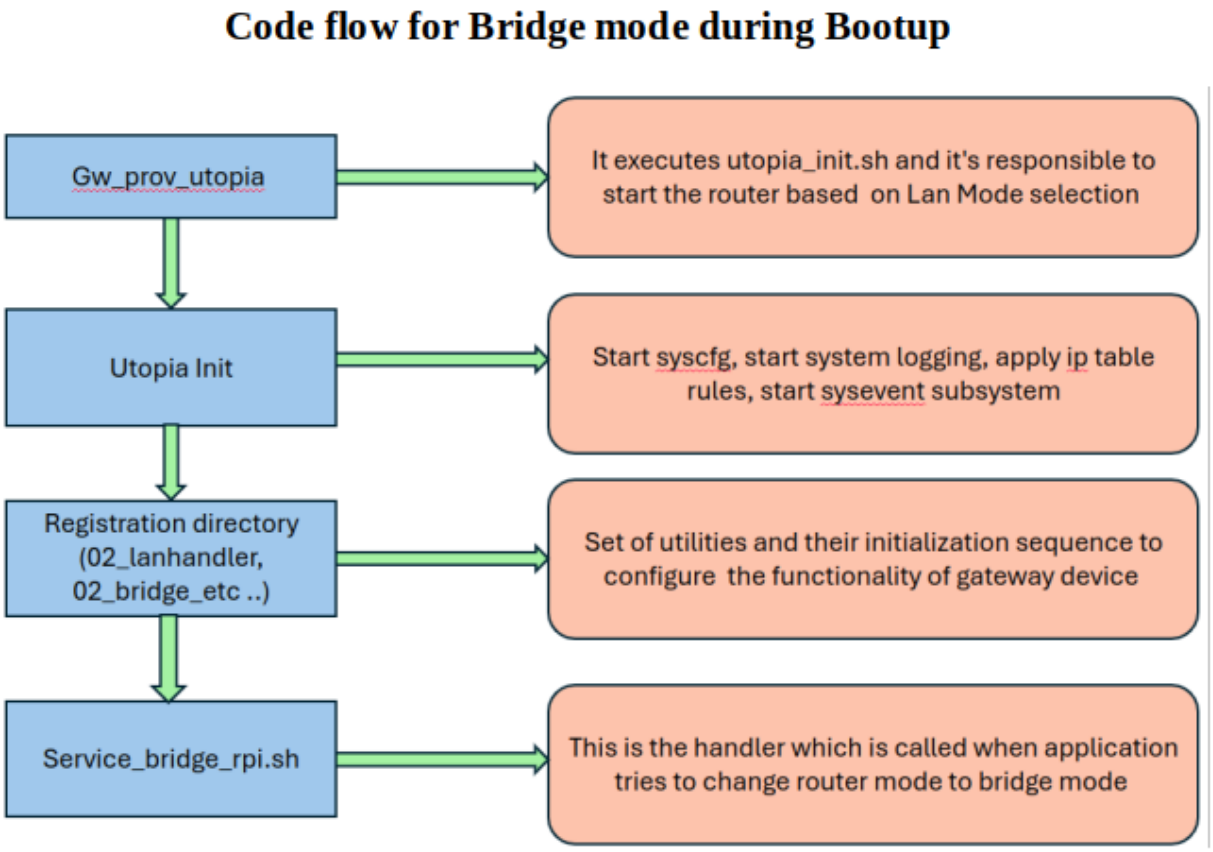
- RDK-B Operators
- RDK-B SoC Vendors
- RDK-B OEM's
- RDK-B Application Vendors
- RDK-B System Integrators

3. High level Code Flow Design

3.1. After boot-up



3.2. During boot-up



4. Supported device

- Raspberry Pi4 32 bit
- Raspberry Pi4 64 bit

5. Build Instructions

Target	Yocto version	Build instruction
RPI4 32bit	Dunfell	RPI 4B Model Reference Platform
RPI4 32bit	Kirkstone	kirkstone RDK-B RPI4 32 bit
RPI4 64bit	Dunfell	RPI 4B Model Reference Platform with 64bit Arch
RPI4 64bit	Kirkstone	Kirkstone RDK-B RPI4 64 bit (Both User Space & Kernel Space)

6. TR-181 Data Model Parameter of Bridge Mode

Module	TR-181 DM Parameter	Input	Output
CcspPandM	Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode	bridge-static	To disable router mode functionalities and enable bridge mode functionalities in RPI Router. It means ,Private WIFI will stop its broadcasting, Ethernet Client should get public IP address (in erouter series) and Wireless client will lose its connection to private WIFI.
CcspPandM	Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode	router	Change from bridge mode to router mode and verify basic functionality is working fine like internet connectivity for wifi and ethernet clients and also verify admin ui page is accessible.

7. Test Procedure

7.1. Enabling BridgeMode via dmcli

To enable bridge mode run the following dmcli commands,

```
dmcli eRT getv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
dmcli eRT setv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode string bridge-static
```

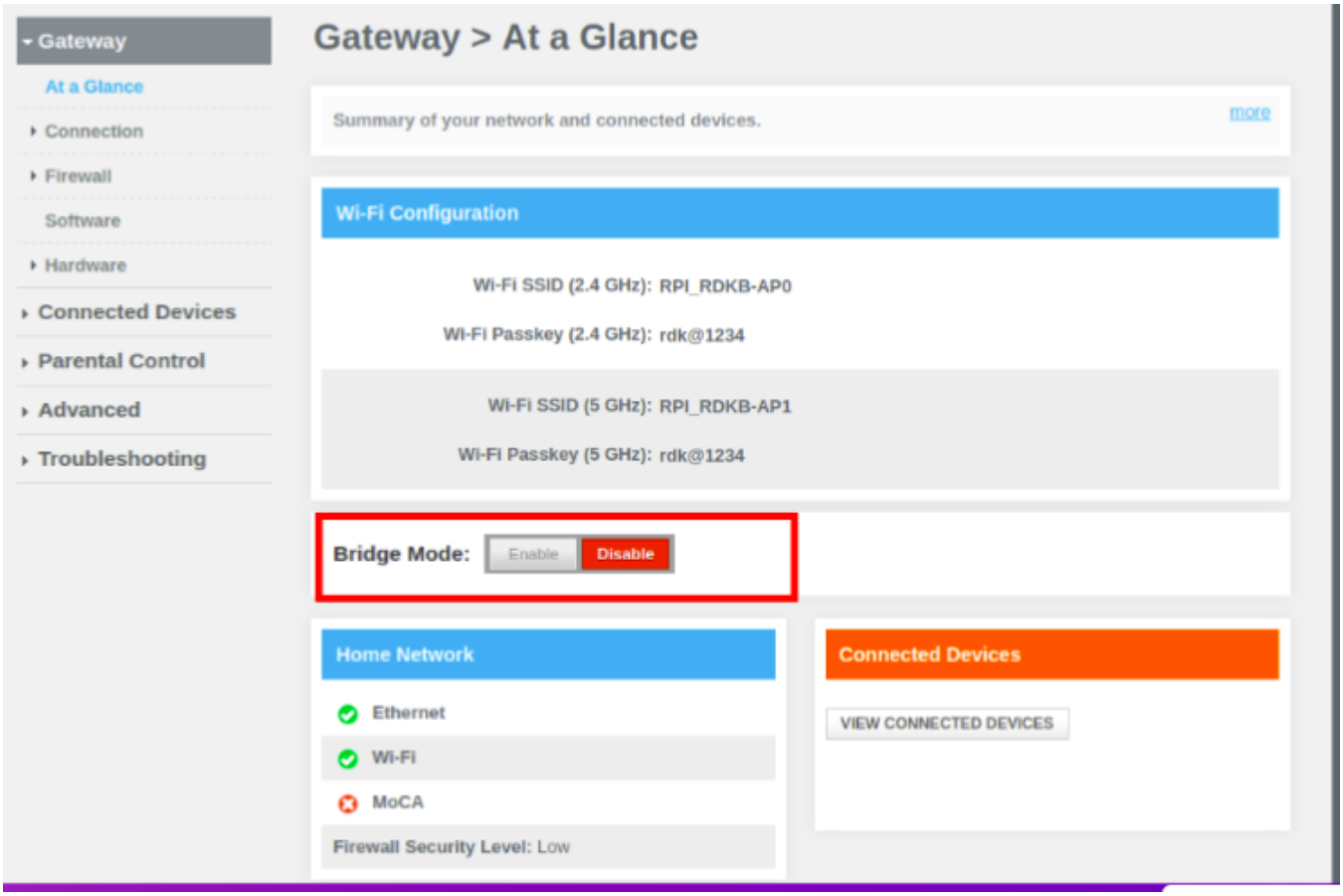
7.2. Enabling BridgeMode via WebUI

Follow the below steps to enable the bridge mode in UI,

1. Open the RPI Router User Interface on web browser

2. From the left-hand column, select "Gateway -> At a Glance"

3. Next to "Enable Bridge Mode", click Enable.



Once the RPI is in bridgemode , below test cases are needs to be passed,

- brlan0 will lose IP address
- A new bridge is created lan0(interface link llan0) which will have 10.0.0.1 ip address
- Private WiFi should stops broadcasting
- Ethernet (lan) clients should get Public IP address(i,e in erouter ip series)
- Verify whether the admin UI page is accessible by using 10.0.0.1 ip in ethernet client device
- Changing from bridgemode to router mode and verify basic functionalities are working fine like Private WiFi should be broadcasted, able to get ip & internet access for wifi and lan clients and admin UI also accessible in connected clients.

8. RPI Test Results

8.1. Router Bridge-Static

1. Changing the LanMode from router to bridge-static mode

```
root@RaspberryPi-Gateway:~# dmcli eRT getv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.pam): Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
Execution succeed.
Parameter    1 name: Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
              type:     string,    value: router

root@RaspberryPi-Gateway:~# dmcli eRT setv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode string bridge-static
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
setv from/to component(eRT.com.cisco.spvtg.ccsp.pam): Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
Execution succeed.

root@RaspberryPi-Gateway:~# dmcli eRT getv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.pam): Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
Execution succeed.
Parameter    1 name: Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
              type:     string,    value: bridge-static

root@RaspberryPi-Gateway:~#
```

2. A new bridge is created lan0(interface link llan0) which will have 10.0.0.1 ip address

```
lan0      Link encap:Ethernet  HWaddr 76:1D:80:6E:70:9C
          inet addr:10.0.0.1  Bcast:10.0.0.255  Mask:255.255.255.0
          inet6 addr: fe80::741d:80ff:fe6e:709c/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1668 errors:0 dropped:208 overruns:0 frame:0
          TX packets:103 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:116743 (114.0 KiB)  TX bytes:4778 (4.6 KiB)

llan0     Link encap:Ethernet  HWaddr 26:52:43:15:18:98
          UP BROADCAST RUNNING PROMISC MULTICAST  MTU:1500  Metric:1
          RX packets:103 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1668 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4778 (4.6 KiB)  TX bytes:116743 (114.0 KiB)
```

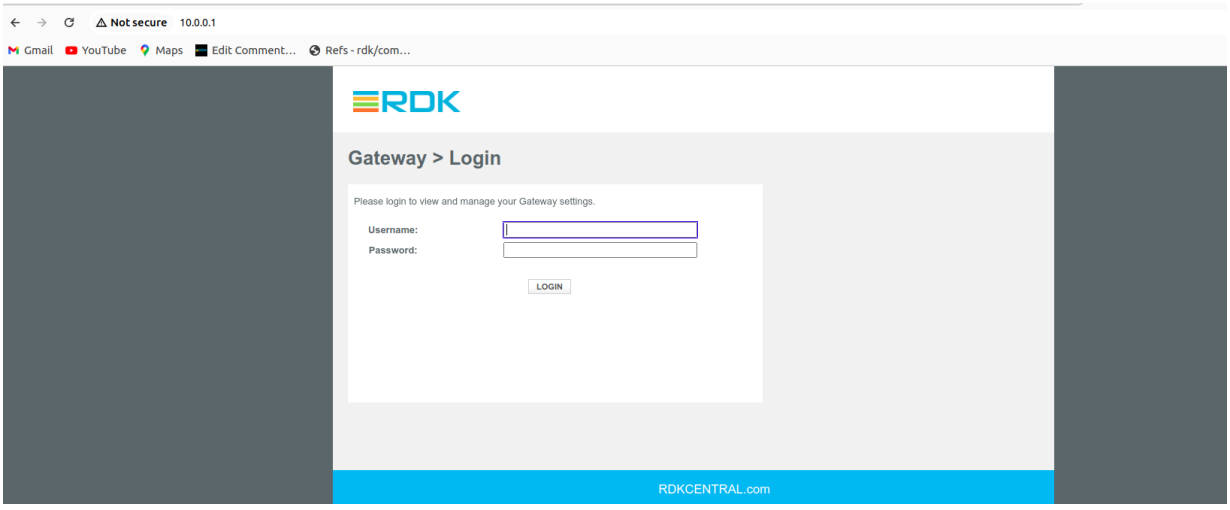
3. Private WiFi should stops broadcasting

```
root@RaspberryPi-Gateway:~# ifconfig wlan0
wlan0     Link encap:Ethernet  HWaddr D8:3A:DD:3C:5C:C5
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:228 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:51059 (49.8 KiB)

root@RaspberryPi-Gateway:~# ifconfig wlan1
wlan1     Link encap:Ethernet  HWaddr D0:37:45:F2:3C:B9
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:49 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

root@RaspberryPi-Gateway:~# dmcli eRT getv Device.WiFi.SSID.1.Enable
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.wifi): Device.WiFi.SSID.1.Enable
Execution succeed.
Parameter    1 name: Device.WiFi.SSID.1.Enable
               type:       bool,    value: false

root@RaspberryPi-Gateway:~# dmcli eRT getv Device.WiFi.SSID.2.Enable
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.wifi): Device.WiFi.SSID.2.Enable
Execution succeed.
Parameter    1 name: Device.WiFi.SSID.2.Enable
               type:       bool,    value: false

root@RaspberryPi-Gateway:~#
```

4.Ethernet (lan) clients should get Public IP address(i,e in erouter ip series)

```
chtsl00388@chtsl00388-IdeaPad-5-14ITL05:~$ ifconfig enx00e04e6b71e0
enx00e04e6b71e0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.2.205  netmask 255.255.255.0  broadcast 192.168.2.255
        inet6 fe80::a218:3b9c:d972:df25  prefixlen 64  scopeid 0x20<link>
        ether 00:e0:4e:6b:71:e0  txqueuelen 1000  (Ethernet)
        RX packets 2018  bytes 178850 (178.8 KB)
        RX errors 0  dropped 237  overruns 0  frame 0
        TX packets 267  bytes 91976 (91.9 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

chtsl00388@chtsl00388-IdeaPad-5-14ITL05:~$ ping google.com
PING google.com (142.250.195.174) 56(84) bytes of data.
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=1 ttl=119 time=1.95 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=2 ttl=119 time=2.34 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=3 ttl=119 time=2.51 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=4 ttl=119 time=1.79 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=5 ttl=119 time=1.83 ms
^C
--- google.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 1.785/2.082/2.511/0.290 ms
chtsl00388@chtsl00388-IdeaPad-5-14ITL05:~$
```

5. Verify whether the admin UI page is accessible by using 10.0.0.1 ip in ethernet client device



6. brlan0 shouldn't have IP address

```
root@RaspberryPi-Gateway:~# ifconfig brlan0
brlan0    Link encap:Ethernet  HWaddr 26:52:43:15:18:98
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:9921 errors:0 dropped:706 overruns:0 frame:0
          TX packets:1081 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:819731 (800.5 KiB)  TX bytes:2206797 (2.1 MiB)

root@RaspberryPi-Gateway:~# brctl show brlan0
bridge name     bridge id               STP enabled     interfaces
brlan0          8000.265243151898       no              erouter0
                                                        eth1
                                                        llan0
root@RaspberryPi-Gateway:~#
```

8.2. Bridge-Static Router

1. Changing the LanMode from bridge-static to Router Mode

```
root@RaspberryPi-Gateway:~# dmcli eRT getv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.pam): Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
Execution succeed.
Parameter    1 name: Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
              type:     string,    value: bridge-static

root@RaspberryPi-Gateway:~# dmcli eRT setv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode string router
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
setv from/to component(eRT.com.cisco.spvtg.ccsp.pam): Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
Execution succeed.

root@RaspberryPi-Gateway:~# dmcli eRT getv Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.pam): Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
Execution succeed.
Parameter    1 name: Device.X_CISCO_COM_DeviceControl.LanManagementEntry.1.LanMode
              type:     string,    value: router

root@RaspberryPi-Gateway:~#
```

2. lan0 and llan0 interfaces should be deleted

```
root@RaspberryPi-Gateway:~# ifconfig lan0
ifconfig: lan0: error fetching interface information: Device not found
root@RaspberryPi-Gateway:~# ifconfig llan0
ifconfig: llan0: error fetching interface information: Device not found
root@RaspberryPi-Gateway:~#
```

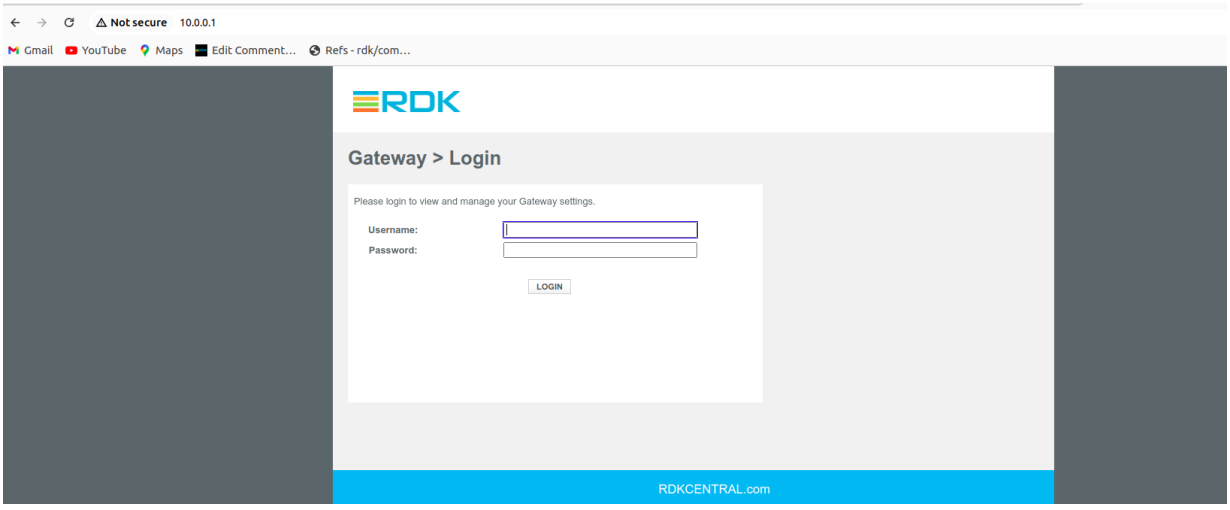
3.Private WiFi Should be broadcasted

```
root@RaspberryPi-Gateway:~# ifconfig wlan0
wlan0     Link encap:Ethernet  HWaddr D8:3A:DD:3C:5C:C5
          inet6 addr: fe80::da3a:ddff:fe3c:5cc5/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:387 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:77256 (75.4 KiB)

root@RaspberryPi-Gateway:~# ifconfig wlan1
wlan1     Link encap:Ethernet  HWaddr D0:37:45:F2:3C:B9
          inet6 addr: fe80::d237:45ff:fef2:3cb9/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:204 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

root@RaspberryPi-Gateway:~# dmcli eRT getv Device.WiFi.SSID.2.Enable
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.wifi): Device.WiFi.SSID.2.Enable
Execution succeed.
Parameter    1 name: Device.WiFi.SSID.2.Enable
               type:       bool,    value: true

root@RaspberryPi-Gateway:~# dmcli eRT getv Device.WiFi.SSID.1.Enable
CR component name is: eRT.com.cisco.spvtg.ccsp.CR
subsystem_prefix eRT.
getv from/to component(eRT.com.cisco.spvtg.ccsp.wifi): Device.WiFi.SSID.1.Enable
Execution succeed.
Parameter    1 name: Device.WiFi.SSID.1.Enable
               type:       bool,    value: true

root@RaspberryPi-Gateway:~#
```

4. WiFi and Lan connected clients should get IP address and internet access

```
chtsl00388@chtsl00388-IdeaPad-5-14ITL05:~$ ifconfig enx00e04e6b71e0
enx00e04e6b71e0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.2.205  netmask 255.255.255.0  broadcast 192.168.2.255
        inet6 fe80::a218:3b9c:d972:df25  prefixlen 64  scopeid 0x20<link>
        ether 00:e0:4e:6b:71:e0  txqueuelen 1000  (Ethernet)
        RX packets 2018  bytes 178850 (178.8 KB)
        RX errors 0  dropped 237  overruns 0  frame 0
        TX packets 267  bytes 91976 (91.9 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

chtsl00388@chtsl00388-IdeaPad-5-14ITL05:~$ ping google.com
PING google.com (142.250.195.174) 56(84) bytes of data.
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=1 ttl=119 time=1.95 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=2 ttl=119 time=2.34 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=3 ttl=119 time=2.51 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=4 ttl=119 time=1.79 ms
64 bytes from maa03s41-in-f14.1e100.net (142.250.195.174): icmp_seq=5 ttl=119 time=1.83 ms
^C
--- google.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 1.785/2.082/2.511/0.290 ms
chtsl00388@chtsl00388-IdeaPad-5-14ITL05:~$
```

5.Admin UI should be accessible via connected clients.



6.brlan0 should have IP address

```
root@RaspberryPi-Gateway:~# ifconfig brlan0
brlan0    Link encap:Ethernet  HWaddr 48:F8:B3:52:26:E1
          inet addr:10.0.0.1  Bcast:10.255.255.255  Mask:255.0.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:22927 errors:0 dropped:1739 overruns:0 frame:0
          TX packets:1117 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1965971 (1.8 MiB)  TX bytes:2209353 (2.1 MiB)

root@RaspberryPi-Gateway:~# brctl show brlan0
bridge name     bridge id               STP enabled     interfaces
brlan0          8000.48f8b35226e1       no              eth1
                                                        wlan0
                                                        wlan1
root@RaspberryPi-Gateway:~#
```

Tested Image details,

```
root@RaspberryPi-Gateway:~# cat /version.txt
imagename:rdkb-generic-broadband-image_rdk-next_20240415045005
BRANCH=rdk-next
YOCTO_VERSION=kirkstone
VERSION=5.04.15.24
SPIN=0
BUILD_TIME="2024-04-15 04:50:05"
Generated on Mon Apr 15  04:50:05 UTC 2024
root@RaspberryPi-Gateway:~#
```

9. References

9.1. Ticket details

REFPLTB-2901 - Getting issue details... STATUS

REFPLTB-2843 - Getting issue details... STATUS

REFPLTB-2943 - Getting issue details... STATUS

9.2. Code review links

https://code.rdkcentral.com/r/q/topic:%22RPI_BRIDGEMODE%22