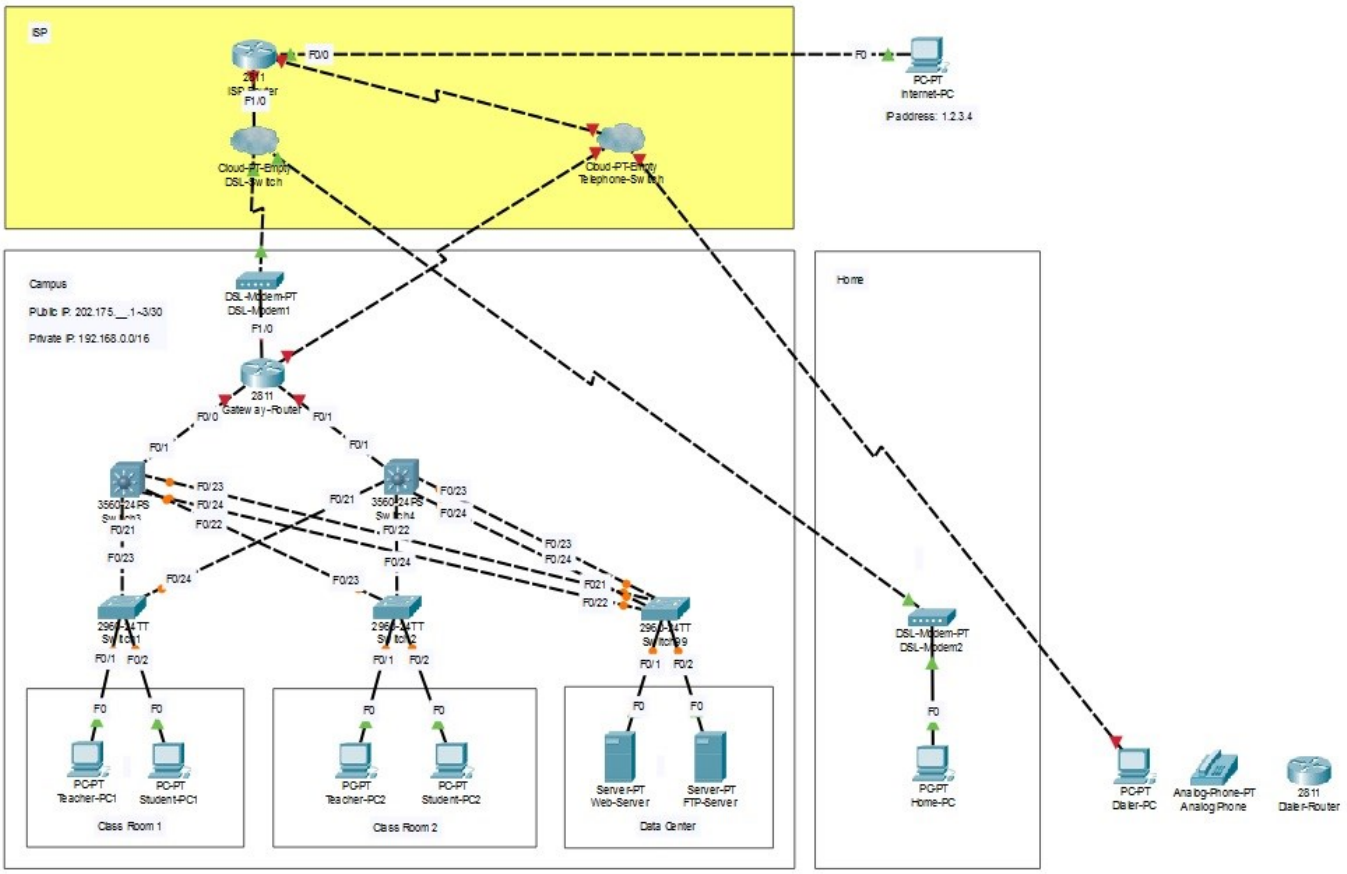
Lab 6.Analog Dialup and ISDN

Objective

- Understand the WAN technologies of Analog Dialup.
- Understand the WAN technologies of ISDN.

Topology



Host name	Interface	IPv4/IPv6 address	Phone number
ISP-Router	Modem 0/0/0	IPv4: 202.175.__1.__1/24	85311111111
Gateway-Router	Modem 0/0/0	IPv4: 192.168.__66.__1/24	85322222222
Dialup-PC/ or Campus-PC	Modem 0/0/0	IPv4: 202.175.__1.101~199/24 or IPv4: 192.168.__66.101~199/24	85333333333

Part 1 - Analog Dialup Connection.

Step 1 - Configure the Analog Dialup in the provider's site.

1. Create a user account for the dialup subscribers to login.
   ISP-Router(config)# ***username*** Dialup-User ***password*** Hello

2. Create a local pool of addresses that will be assigned to the dialup subscribers.
   ISP-Router(config)# ***ip dhcp excluded-address*** 202.175.1.1 202.175.1.100

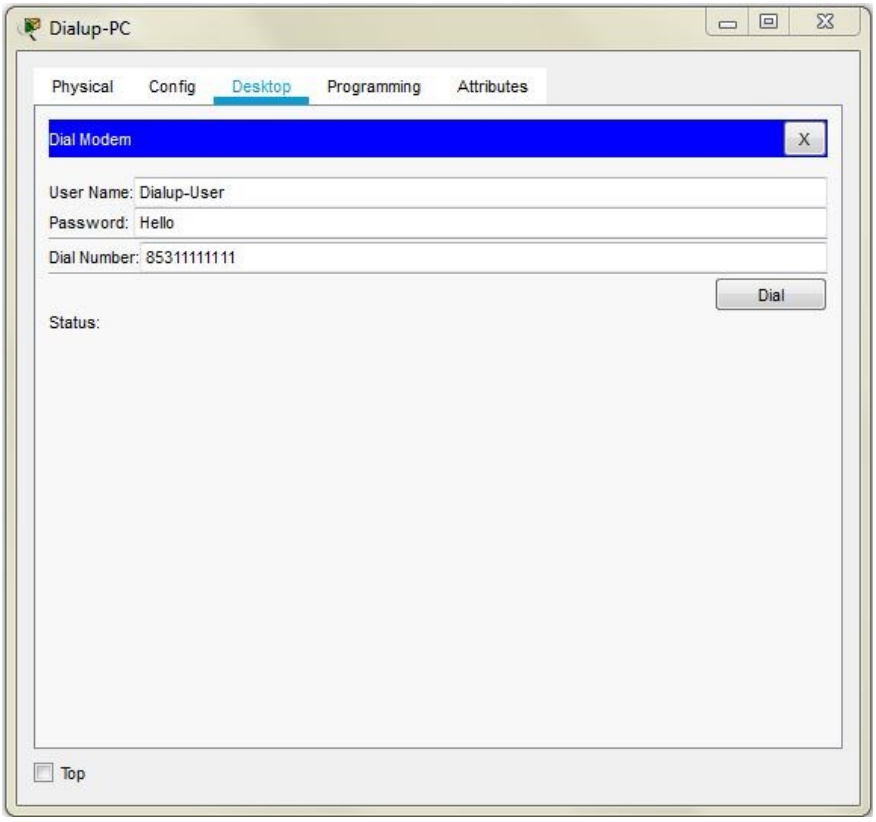
   ISP-Router(config)# ***ip dhcp pool*** Dialup-DHCPPool
   ISP-Router(dhcp-config)# ***network*** 202.175.1.0 255.255.255.0
   ISP-Router(dhcp-config)# ***default-router*** 202.175.1.1

3. Configure the modem interface on the ISP-Router.
   ISP-Router(config)# ***interface Modem0/0/0***
   ISP-Router(config-if)# ***ip address*** 202.175.1.1 255.255.255.0

4. Configure the physical interface (e.g. FastEthernet 0/0) that connected to the Internet.
   ISP-Router(config)# ***interface FastEthernet*** 0/0
   ISP-Router(config-if)# ***ip address*** 1.1.1.1 255.0.0.0
   ISP-Router(config-if)# ***no shutdown***

Step 2 - Configure the Analog Dialup in the subscriber's site.

5. Connect the dialup subscriber to the Analog network from Dialup-PC, using the applications, Dial-up.



6. Verify a notification indicating the Dialup session has successfully formed in ISP-Router:

   Output of ISP-Router:

```
%LINK-5-CHANGED: Interface Modem0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Modem0/0/0, changed state to up
```

7. Display the IP address of the virtual-access interface in ISP-Router.
   ISP-Router# ***show ip interface brief***

   Output of ISP-Router:

```
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        1.1.1.1         YES manual up                    up
FastEthernet0/1        unassigned      YES NVRAM  administratively down down
Modem0/0/0             202.175.1.1     YES unset  up                    up
Modem0/0/1             unassigned      YES unset  down                  down
FastEthernet1/0        unassigned      YES NVRAM  administratively down down
Serial1/0/0            unassigned      YES NVRAM  administratively down down
Serial1/0/1            unassigned      YES NVRAM  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
```

8. Display the IPv4 address of Dialup-PC, using the applications, Command Prompt.
   Dialup-PC:\> ***ipconfig***

   Output of Dialup-PC:

```
C:\>ipconfig

Modem0 Connection:(default port)

   Link-local IPv6 Address.....: ::
   IP Address.....: 202.175.1.101
   Subnet Mask.....: 255.255.255.0
   Default Gateway.....: 202.175.1.1
```

9. Test the IP connectivity from Dialup-PC to Internet-PC using ***ping***.
   Dialup-PC:\> ***ping*** 1.2.3.4

   Output of Dialup-PC:

```
C:\>ping 1.2.3.4

Pinging 1.2.3.4 with 32 bytes of data:

Reply from 1.2.3.4: bytes=32 time=214ms TTL=127
Reply from 1.2.3.4: bytes=32 time=184ms TTL=127
Reply from 1.2.3.4: bytes=32 time=135ms TTL=127
Reply from 1.2.3.4: bytes=32 time=133ms TTL=127

Ping statistics for 1.2.3.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 133ms, Maximum = 214ms, Average = 166ms
```

Step 3 - Configure the Analog Dialup in the Campus network.

10. Create a user account for the campus users to login.
    Gateway-Router(config)# ***username*** Campus-User ***password*** Hello

11. Create a local pool of addresses that will be assigned to the campus users.
    Gateway-Router(config)# ***ip dhcp excluded-address*** 192.168.66.1 192.168.66.100

    Gateway-Router(config)# ***ip dhcp pool*** Dialup-DHCPPool
    Gateway-Router(dhcp-config)# ***network*** 192.168.66.0 255.255.255.0
    Gateway-Router(dhcp-config)# ***default-router*** 192.168.66.1

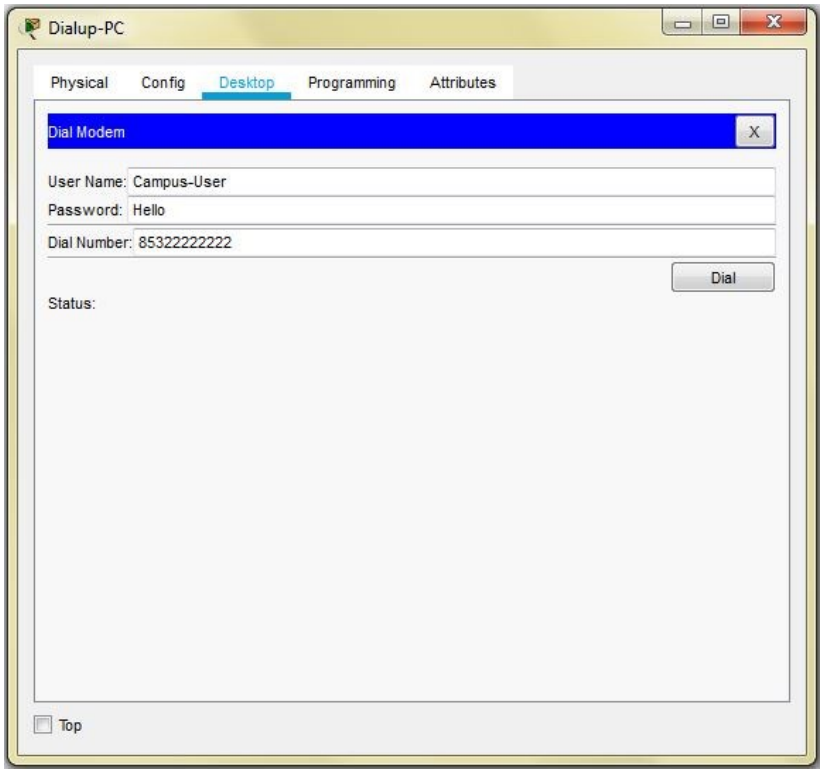
12. Configure the modem interface on the Gateway-Router.
    Gateway-Router(config)# ***interface Modem0/0/0***
    Gateway-Router(config-if)# ***ip address*** 192.168.66.1 255.255.255.0

13. Configure the interfaces (e.g. FastEthernet 0/0 and FastEthernet 0/1) that connected to the Campus network.
    Gateway-Router(config)# ***interface FastEthernet*** 0/0
    Gateway-Router(config-if)# ***ip address*** 192.168.101.1 255.255.255.0
    Gateway-Router(config-if)# ***no shutdown***

    Gateway-Router(config)# ***interface FastEthernet*** 0/1
    Gateway-Router(config-if)# ***ip address*** 192.168.102.1 255.255.255.0
    Gateway-Router(config-if)# ***no shutdown***

Step 4 - Configure the Analog Dialup in the Campus user.

14. Connect the dialup subscriber to the Analog network from Dialup-PC/Campus-PC, using the applications, Dial-up.



15. Verify a notification indicating the Dialup session has successfully formed in Gateway-Router:

Output of Gateway -Router:

```
%LINK-5-CHANGED: Interface Modem0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Modem0/0/0, changed state to up
```

16. Display the IP address of the virtual-access interface in Gateway-Router.
Gateway-Router# ***show ip interface brief***

Output of Gateway-Router:

```
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        192.168.101.1   YES manual up                    up
FastEthernet0/1        192.168.102.1   YES manual up                    up
Modem0/0/0             192.168.66.1    YES NVRAM  up                    up
Modem0/1/0             unassigned      YES NVRAM  down                  down
FastEthernet1/0        unassigned      YES NVRAM  administratively down down
Serial1/0/0            unassigned      YES NVRAM  administratively down down
Serial1/0/1            unassigned      YES NVRAM  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
```

17. Display the IPv4 address of Dialup-PC, using the applications, Command Prompt.
Dialup-PC:\> ***ipconfig***

Output of Dialup-PC:

```
C:\>ipconfig

Modem0 Connection:(default port)

   Link-local IPv6 Address.....: ::
   IP Address.....: 192.168.66.101
   Subnet Mask.....: 255.255.255.0
   Default Gateway.....: 192.168.66.1
```

18. Test the IP connectivity from Dialup-PC to Campus network using ***ping***.
Dialup-PC:\> ***ping*** 192.168.101.1

Output of Dialup-PC:

```
C:\>ping 192.168.101.1

Pinging 192.168.101.1 with 32 bytes of data:

Reply from 192.168.101.1: bytes=32 time=152ms TTL=255
Reply from 192.168.101.1: bytes=32 time=182ms TTL=255
Reply from 192.168.101.1: bytes=32 time=141ms TTL=255
Reply from 192.168.101.1: bytes=32 time=184ms TTL=255

Ping statistics for 192.168.101.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 141ms, Maximum = 184ms, Average = 164ms
```

Part 2 - ISDN BRI in the subscriber's site.

Topology

Host name	Interface	IPv4/IPv6 address	Phone number
Router11	BRI 0/1/0	IPv4: 172. 17. 0. 11/24	853111111
Router22	BRI 0/1/0	IPv4: 172. 17. 0. 22/24	853222222

Step 1 - Configure the ISDN BRI interface.

19. Check the status of ISDN BRI before making any configuration.
    Router# ***show isdn status***

    Output of Router:

```
**** No Global ISDN Switchtype currently defined ****
ISDN BRI0/1/0 interface
        dsl 2, interface ISDN Switchtype = none
    Layer 1 Status:
        SHUTDOWN
    Layer 2 Status:
        Layer 2 NOT Activated
    Layer 3 Status:
        0 Active Layer 3 Call(s)
```

20. What is the layer 1 status of ISDN?
    Shutdown.

---

21. Specify the ISDN BRI switch type.
    (Note: ISDN BRI switch type is the implementation of Q.931, the signaling protocol used in the D channel.)
    Router(config)# ***isdn switch-type*** basic-ni
    (Note: ISDN Switch type is National ISDN, when using the keyword basic-ni.)

    (Note: The providers use a variety of switch types for their ISDN services, and the switch types vary from provider to provider. The switch type used in the subscriber has to be matched with that provided by the provider. The ISDN BRI switch types include:
    - AT&T's 5ESS, 4ESS and Nortel's DMS-100 are the most common types used in the United States and Canada.
    - NTT is the most common type used in Japan.
    - Net3 and Net5 are the most common types used in United Kingdom.
    - VN2, VN3 are the most common types used in France.)

22. Display the ISDN BRI interfaces.
    Router# ***show ip interface brief***

    Output of Router:

```
Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            unassigned      YES unset  administratively down down

FastEthernet0/1            unassigned      YES unset  administratively down down

Serial0/0/0                unassigned      YES unset  administratively down down

Serial0/0/1                unassigned      YES unset  administratively down down

BRI0/1/0                   unassigned      YES unset  administratively down down

BRI0/1/0:1                 unassigned      YES unset  administratively down down

BRI0/1/0:2                 unassigned      YES unset  administratively down down
```

23. What are these ISDN BRI interfaces?
BRI0/1/0, BRI0/1/0:1, BRI0/1/0:2 are the interfaces for the ISDN D, B1 and B2 channels respectively.

24. Activate the ISDN BRI interface (e.g. interface bri 0/1/0).
Router(config)# ***interface bri*** 0/1/0
Router(config-if)# ***no shutdown***

25. Display the status of ISDN BRI.
Router# ***show isdn status***

Output of Router:

```
Global ISDN Switchtype = basic-ni
ISDN BRI0/1/0 interface
        dsl 2, interface ISDN Switchtype = basic-ni
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 64, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
        0 Active Layer 3 Call(s)
```

26. What is the layer 1 status of ISDN?
Active.

27. What is the value of TEI in the layer 2 status?
64.

(Note: Each terminal equipment in ISDN needs a unique identifier, terminal endpoint identifier (TEI). If the TEI is statically assigned during installation, the TEI is a number ranging from 0 to 63. If the TEI is dynamically assigned by the switch during the started up, the TEIs range from 64 to 126. A TEI of 127, or all 1s, indicates a broadcast.)

Step 2 - Configure the ISDN dialer profile.

28. Configure the interesting traffic.
(Note: The traffic that causes an ISDN dialup connection is referred to as interesting traffic.)

Router(config)# ***dialer-list*** 22 ***protocol ip permit***
(Note: Define all IP traffic as the interesting traffic.)

Router(config)# ***interface dialer*** 22
(Note: the dialer interface is a logical interface for making the ISDN dialup connection.)
Router(config-if)# ***dialer-group*** 22
(Note: Associate the interesting traffic with the dialer interface.)

29. Configure the ISDN dialer information.
Router(config)# ***interface dialer*** 22
Router(config-if)# ***dialer remote-name*** Router22
(Note: Specify the hostname of the remote router.)
Router(config-if)# ***dialer string*** 853222222
(Note: Specify the ISDN phone number.)

30. Configure the ISDN dialer timer.
    Router(config)# ***interface dialer*** 22
    Router(config-if)# ***dialer idle-timeout*** 60
    (Note: Specify the dialer idle timer to 60 seconds.)

    (Note: Once an ISDN dialup connection is established, any traffic via this connection will be permitted. However, only the interesting traffic resets the idle timer.)

31. Configure the layer 2 protocol used in B channel.
    Router(config)# ***interface dialer*** 22
    Router(config-if)# ***encapsulation ppp***
    (Note: Specify the Point-to-point protocol.)
    Router(config-if)# ***ppp authentication chap***
    (Note: Specify the PPP authentication using CHAP.)

    Router(config)# ***username*** Router22 ***password*** Hello
    (Note: Create a user account for CHAP authentication.)

32. Configure the layer 3 protocol used in B channel.
    Router(config)# ***interface dialer*** 22
    Router(config-if)# ***ip address*** 172.17.0.11 255.255.255.0
    (Note: Specify the Internet protocol and the IP address.)

33. Activate the dialer interface.
    Router(config)# ***interface dialer*** 22
    Router(config-if)# ***no shutdown***

Step 3 - Associate the dialer profile with the physical interface.

34. Create a dialer pool, and associate the dialer profile with the physical interface (e.g. interface bri 0/1/0).
    Router(config)# ***interface dialer*** 22
    Router(config-if)# ***dialer pool*** 11

    Router(config)# ***interface bri*** 0/1/0
    Router(config-if)# ***dialer pool-member*** 11

Step 4 - Make the ISDN dialup connection.

35. Display the status of the ISDN BRI interface (e.g. interface bri 0/1/0).
    Router# ***show interface bri*** 0/1/0

Output of Router:

```
BRI0/1/0 is up, line protocol is up (spoofing)
  Hardware is GT96K BRI with U interface (3086)
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Last input 00:00:03, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/1/16 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 48 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     26 packets input, 134 bytes, 0 no buffer
     Received 1 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     25 packets output, 117 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier transitions
```

36. What is the status of the ISDN BRI interface?
    BRI0/1/0 is up, line protocol is up (spoofing).

    (Note: The interface is spoofing that provides a mechanism for the interface to simulate an active state for internal processes, such as routing.)

37. Turn on the dialer debugging.
    Router# ***debug dialer***

38. Turn on the ppp negotiation debugging.
    Router# ***debug ppp negotiation***

39. Turn on the ppp authentication debugging.
    Router# ***debug ppp authentication***

40. Trigger the ISDN dialup connection by ***ping*** from the local router to the remote router.
    Router# ***ping*** 172.17.0.22

Output of Router:

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.17.0.22, timeout is 2 seconds:

*Nov 11 09:19:04.072: BR0/1/0 DDR: rotor dialout [best] least recent failure is
also most recent failure
*Nov 11 09:19:04.072: BR0/1/0 DDR: rotor dialout [best] trying untried dialout
*Nov 11 09:19:04.072: BR0/1/0 DDR: rotor dialout [best] also has most recent fai
lure
*Nov 11 09:19:04.072: BR0/1/0 DDR: rotor dialout [best]
*Nov 11 09:19:04.072: BR0/1/0 DDR: Dialing cause ip (s=172.17.0.11, d=172.17.0.2
2)
*Nov 11 09:19:04.072: BR0/1/0 DDR: Attempting to dial 853222222.....
Success rate is 0 percent (0/5)
Router11#
*Nov 11 09:19:20.404: %LINK-3-UPDOWN: Interface BRI0/1/0:1, changed state to up
*Nov 11 09:19:20.408: BR0/1/0:1: interface must be fifo queue, force fifo
*Nov 11 09:19:20.408: %DIALER-6-BIND: Interface BR0/1/0:1 bound to profile Di22
*Nov 11 09:19:20.408: %ISDN-6-CONNECT: Interface BRI0/1/0:1 is now connected to
853141414 N/A
*Nov 11 09:19:20.420: BR0/1/0:1 PPP: Phase is DOWN, Setup
*Nov 11 09:19:20.420: BR0/1/0:1 PPP: Using dialer call direction
*Nov 11 09:19:20.420: BR0/1/0:1 PPP: Treating connection as a callout
*Nov 11 09:19:20.420: BR0/1/0:1 PPP: Session handle[8E000002] Session id[1]
*Nov 11 09:19:20.420: BR0/1/0:1 PPP: Phase is ESTABLISHING, Active Open
*Nov 11 09:19:20.420: BR0/1/0:1 PPP: Authorization required
*Nov 11 09:19:20.420: BR0/1/0:1 LCP: O CONFREQ [Closed] id 1 len 15
*Nov 11 09:19:20.420: BR0/1/0:1 LCP:    AuthProto CHAP (0x0305C22305)
*Nov 11 09:19:20.420: BR0/1/0:1 LCP:    MagicNumber 0x4587D3BC (0x05064587D3BC)
*Nov 11 09:19:20.432: BR0/1/0:1 LCP: I CONFREQ [REQsent] id 1 len 15
*Nov 11 09:19:20.432: BR0/1/0:1 LCP:    AuthProto CHAP (0x0305C22305)
*Nov 11 09:19:20.432: BR0/1/0:1 LCP:    MagicNumber 0x33980210 (0x050633980210)
*Nov 11 09:19:20.432: BR0/1/0:1 LCP: O CONFACK [REQsent] id 1 len 15
*Nov 11 09:19:20.432: BR0/1/0:1 LCP:    AuthProto CHAP (0x0305C22305)
*Nov 11 09:19:20.432: BR0/1/0:1 LCP:    MagicNumber 0x33980210 (0x050633980210)
*Nov 11 09:19:20.436: BR0/1/0:1 LCP: I CONFACK [ACKsent] id 1 len 15
*Nov 11 09:19:20.436: BR0/1/0:1 LCP:    AuthProto CHAP (0x0305C22305)
*Nov 11 09:19:20.436: BR0/1/0:1 LCP:    MagicNumber 0x4587D3BC (0x05064587D3BC)
*Nov 11 09:19:20.436: BR0/1/0:1 LCP: State is Open
*Nov 11 09:19:20.436: BR0/1/0:1 PPP: Phase is AUTHENTICATING, by both
*Nov 11 09:19:20.436: BR0/1/0:1 CHAP: O CHALLENGE id 1 len 29 from "Router11"
*Nov 11 09:19:20.448: BR0/1/0:1 CHAP: I CHALLENGE id 1 len 29 from "Router22"
*Nov 11 09:19:20.452: BR0/1/0:1 CHAP: Using hostname from unknown source
*Nov 11 09:19:20.452: BR0/1/0:1 CHAP: Using password from AAA
*Nov 11 09:19:20.452: BR0/1/0:1 CHAP: O RESPONSE id 1 len 29 from "Router11"
*Nov 11 09:19:20.472: BR0/1/0:1 CHAP: I RESPONSE id 1 len 29 from "Router22"
*Nov 11 09:19:20.472: BR0/1/0:1 PPP: Phase is FORWARDING, Attempting Forward
*Nov 11 09:19:20.472: BR0/1/0:1 PPP: Phase is AUTHENTICATING, Unauthenticated Us
er
*Nov 11 09:19:20.472: BR0/1/0:1 PPP: Sent CHAP LOGIN Request
*Nov 11 09:19:20.472: BR0/1/0:1 CHAP: I SUCCESS id 1 len 4
*Nov 11 09:19:20.476: BR0/1/0:1 PPP: Received LOGIN Response PASS
*Nov 11 09:19:20.476: BR0/1/0:1 PPP: Phase is FORWARDING, Attempting Forward
*Nov 11 09:19:20.476: BR0/1/0:1 PPP: Phase is AUTHENTICATING, Authenticated User
*Nov 11 09:19:20.476: BR0/1/0:1 DDR: Remote name for Router22
*Nov 11 09:19:20.476: BR0/1/0:1 PPP: Sent LCP AUTHOR Request
*Nov 11 09:19:20.476: BR0/1/0:1 PPP: Sent IPCP AUTHOR Request
*Nov 11 09:19:20.480: BR0/1/0:1 LCP: Received AAA AUTHOR Response PASS
*Nov 11 09:19:20.480: BR0/1/0:1 IPCP: Received AAA AUTHOR Response PASS
*Nov 11 09:19:20.480: BR0/1/0:1 CHAP: O SUCCESS id 1 len 4
*Nov 11 09:19:20.480: BR0/1/0:1 PPP: Phase is UP
*Nov 11 09:19:20.480: BR0/1/0:1 IPCP: O CONFREQ [Closed] id 1 len 10
*Nov 11 09:19:20.480: BR0/1/0:1 IPCP:    Address 172.17.0.11 (0x0306AC11000B)
*Nov 11 09:19:20.480: BR0/1/0:1 PPP: Sent CDPCP AUTHOR Request
*Nov 11 09:19:20.480: BR0/1/0:1 PPP: Process pending ncp packets
*Nov 11 09:19:20.484: BR0/1/0:1 CDPCP: Received AAA AUTHOR Response PASS
*Nov 11 09:19:20.484: BR0/1/0:1 CDPCP: O CONFREQ [Closed] id 1 len 4
*Nov 11 09:19:20.488: BR0/1/0:1 IPCP: I CONFREQ [REQsent] id 1 len 10
*Nov 11 09:19:20.488: BR0/1/0:1 IPCP:    Address 172.17.0.22 (0x0306AC110016)
*Nov 11 09:19:20.488: BR0/1/0:1 AAA/AUTHOR/IPCP: Start.  Her address 172.17.0.22
, we want 0.0.0.0
*Nov 11 09:19:20.488: BR0/1/0:1 PPP: Sent IPCP AUTHOR Request
*Nov 11 09:19:20.492: BR0/1/0:1 CDPCP: I CONFREQ [REQsent] id 1 len 4
```

41. Display the status of the dialer.
Router# ***show dialer***

Output of Router:

```
BRI0/1/0 - dialer type = ISDN

Dial String      Successes   Failures    Last DNIS   Last status
0 incoming call(s) have been screened.
0 incoming call(s) rejected for callback.

BRI0/1/0:1 - dialer type = ISDN
Idle timer (60 secs), Fast idle timer (20 secs)
Wait for carrier (30 secs), Re-enable (15 secs)
Dialer state is data link layer up
Dial reason: ip (s=172.17.0.11, d=172.17.0.22)
Interface bound to profile Di22
Time until disconnect 56 secs
Current call connected 00:00:14
Connected to 853222222 (Router22)

BRI0/1/0:2 - dialer type = ISDN
Idle timer (120 secs), Fast idle timer (20 secs)
Wait for carrier (30 secs), Re-enable (15 secs)
Dialer state is idle

Di22 - dialer type = DIALER PROFILE
Idle timer (60 secs), Fast idle timer (20 secs)
Wait for carrier (30 secs), Re-enable (15 secs)
Dialer state is data link layer up
Number of active calls = 1

Dial String      Successes   Failures    Last DNIS   Last status
853222222               1          0    00:00:34       successful   Default
```

42. What channel of the ISDB BRI interface does the dialer interface bound to?
The dialer interface is connected to the interface BRI0/0:1, the B channel of the ISDN BRI interface.