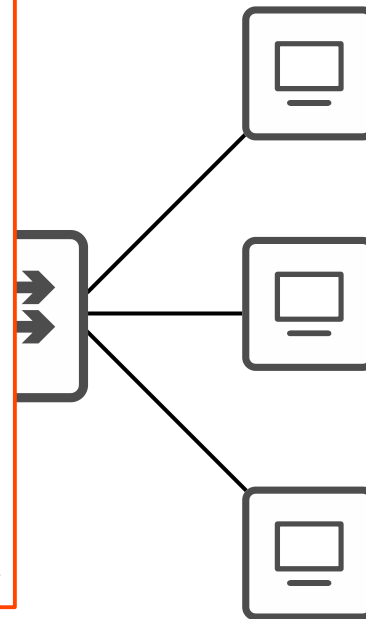


CCNA Day 36

Layer 2 Discovery Protocols (CDP & LLDP)



- 20% 2.0 **Network Access**
- 2.1 Configure and verify VLANs (normal range) spanning multiple switches
 - 2.1.a Access ports (data and voice)
 - 2.1.b Default VLAN
 - 2.1.c Connectivity
 - 2.2 Configure and verify interswitch connectivity
 - 2.2.a Trunk ports
 - 2.2.b 802.1Q
 - 2.2.c Native VLAN
 - 2.3 Configure and verify Layer 2 discovery protocols (Cisco Discovery Protocol and LLDP)
 - 2.4 Configure and verify (Layer 2/Layer 3) EtherChannel (LACP)
 - 2.5 Describe the need for and basic operations of Rapid PVST+ Spanning Tree Protocol and identify basic operations
 - 2.5.a Root port, root bridge (primary/secondary), and other port names
 - 2.5.b Port states (forwarding/blocking)

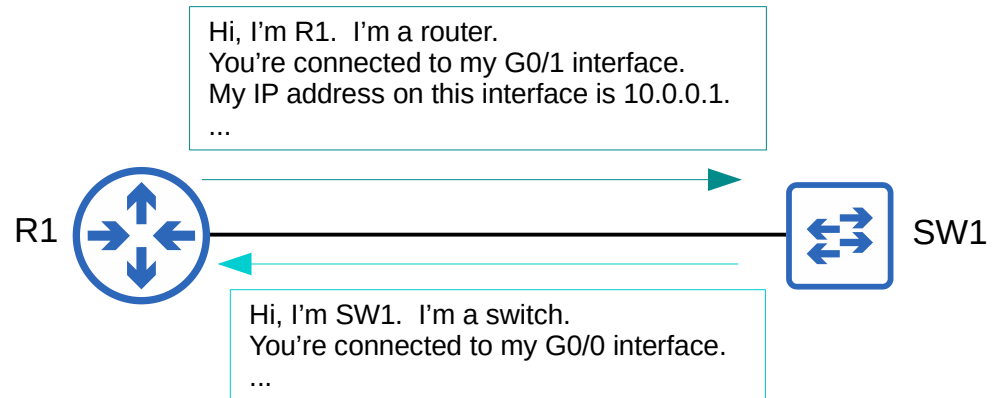


Things we'll cover

- Intro to Layer 2 discovery protocols
- Cisco Discovery Protocol (CDP)
- Link Layer Discovery Protocol (LLDP)

Layer 2 Discovery Protocols

- Layer 2 discovery protocols such as CDP and LLDP share information with and discover information about neighboring (connected) devices.
- The shared information includes host name, IP address, device type, etc.
- CDP is a Cisco proprietary protocol.
- LLDP is an industry standard protocol (IEEE 802.1AB).
- Because they share information about the devices in the network, they can be considered a security risk and are often not used. It is up to the network engineer/admin to decide if they want to use them in the network or not.



Cisco Discovery Protocol

- CDP is a Cisco proprietary protocol.
- It is enabled on Cisco devices (routers, switches, firewalls, IP phones, etc) by default.
- CDP messages are periodically sent to multicast MAC address 0100.0CCC.CCCC.
- When a device receives a CDP message, it processes and discards the message. It does NOT forward it to other devices.
- By default, CDP messages are sent once every **60 seconds**.
- By default, the CDP holdtime is **180 seconds**. If a message isn't received from a neighbor for 180 seconds, the neighbor is removed from the CDP neighbor table.
- CDPv2 messages are sent by default.

Cisco Discovery Protocol

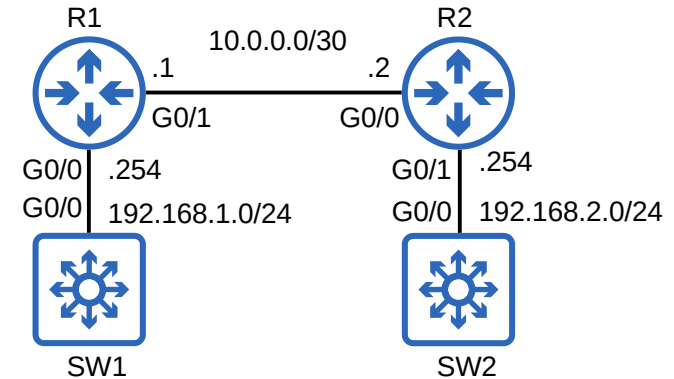
```
R1#show cdp
Global CDP information:
  Sending CDP packets every 60 seconds
  Sending a holdtime value of 180 seconds
  Sending CDPv2 advertisements is enabled
```

```
R1#
R1#show cdp traffic
CDP counters :
  Total packets output: 105, Input: 112
  Hdr syntax: 0, Chksum error: 0, Encaps failed: 0
  No memory: 0, Invalid packet: 0,
  CDP version 1 advertisements output: 0, Input: 0
  CDP version 2 advertisements output: 105, Input: 112
```

```
R1#
R1#show cdp interface
GigabitEthernet0/0 is up, line protocol is up
  Encapsulation ARPA
  Sending CDP packets every 60 seconds
  Holdtime is 180 seconds
GigabitEthernet0/1 is up, line protocol is up
  Encapsulation ARPA
  Sending CDP packets every 60 seconds
  Holdtime is 180 seconds
GigabitEthernet0/2 is administratively down, line protocol is down
  Encapsulation ARPA
  Sending CDP packets every 60 seconds
  Holdtime is 180 seconds
GigabitEthernet0/3 is administratively down, line protocol is down
  Encapsulation ARPA
  Sending CDP packets every 60 seconds
  Holdtime is 180 seconds

cdp enabled interfaces : 4
interfaces up          : 2
interfaces down        : 2
```

```
R1#show cdp
% CDP is not enabled
R1#
```



Cisco Discovery Protocol

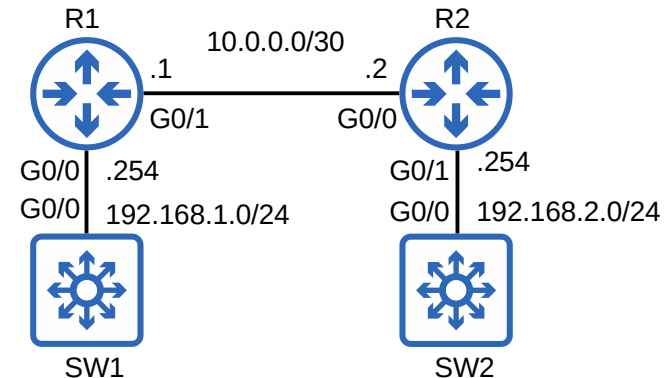
```
R1#show cdp neighbors
```

Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
 S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone,
 D - Remote, C - CVTA, M - Two-port Mac Relay

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
SW1	Gig 0/0	153	R S I		Gig 0/0
R2	Gig 0/1	146	R B		Gig 0/0

Total cdp entries displayed : 2

R1#



Cisco Discovery Protocol

```
R1#show cdp neighbors
```

Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
 S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone,
 D - Remote, C - CVTA, M - Two-port Mac Relay

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
SW1	Gig 0/0	153	R S I		Gig 0/0
R2	Gig 0/1	146	R B		Gig 0/0

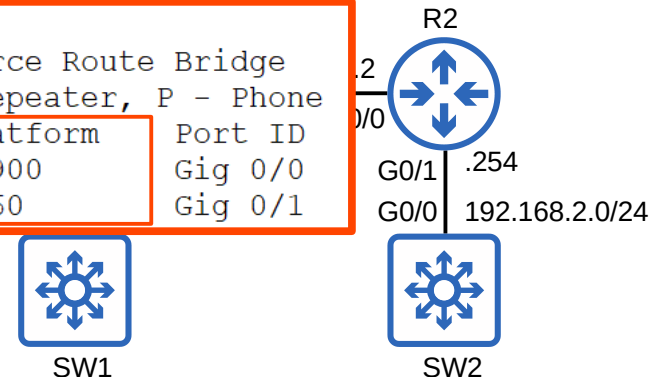
Total cdp entries displayed : 2

```
R1#
```

```
R1#show cdp neighbors
```

Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
 S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
R2	Gig 0/1	124	R	C2900	Gig 0/0
SW1	Gig 0/0	126	S	2960	Gig 0/1



Cisco Discovery Protocol

```
R1#show cdp neighbors detail
```

```
-----  
Device ID: SW1  
Entry address(es):  
Platform: Cisco , Capabilities: Router Switch IGMP  
Interface: GigabitEthernet0/0, Port ID (outgoing port): GigabitEthernet0/0  
Holdtime : 174 sec
```

```
Version :  
Cisco IOS Software, vios_12 Software (vios_12-ADVENTERPRISEK9-M), Version 15.2(4.0.55)E, TEST ENGINEERING ESTG_WEEKLY BUILD, synced to END_OF_FLO_ISP  
Technical Support: http://www.cisco.com/techsupport  
Copyright (c) 1986-2015 by Cisco Systems, Inc.  
Compiled Tue 28-Jul-15 18:52 by sasyamal
```

```
advertisement version: 2  
VTP Management Domain: ''  
Native VLAN: 1  
Duplex: full
```

```
-----  
Device ID: R2  
Entry address(es):  
  IP address: 10.0.0.2  
Platform: Cisco , Capabilities: Router Source-Route-Bridge  
Interface: GigabitEthernet0/1, Port ID (outgoing port): GigabitEthernet0/0  
Holdtime : 163 sec  
  
Version :  
Cisco IOS Software, IOSv Software (VIOS-ADVENTERPRISEK9-M), Version 15.6(2)T, RELEASE SOFTWARE (fc2)  
Technical Support: http://www.cisco.com/techsupport  
Copyright (c) 1986-2016 by Cisco Systems, Inc.  
Compiled Tue 22-Mar-16 16:19 by prod_rel_team
```

```
advertisement version: 2  
Duplex: full  
Management address(es):  
  IP address: 10.0.0.2
```

```
Total cdp entries displayed : 2
```

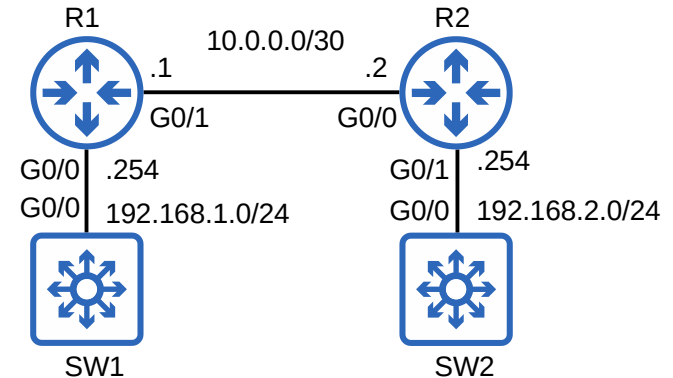
Cisco Discovery Protocol

```
R1#show cdp entry R2
```

```
-----
Device ID: R2
Entry address(es):
  IP address: 10.0.0.2
Platform: Cisco , Capabilities: Router Source-Route-Bridge
Interface: GigabitEthernet0/1, Port ID (outgoing port): GigabitEthernet0/0
Holdtime : 178 sec

Version :
Cisco IOS Software, IOSv Software (VIOS-ADVENTERPRISEK9-M), Version 15.6(2)T, RELEASE SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2016 by Cisco Systems, Inc.
Compiled Tue 22-Mar-16 16:19 by prod_rel_team

advertisement version: 2
Duplex: full
Management address(es):
  IP address: 10.0.0.2
```



CDP show commands summary

- **R1# show cdp**
→ shows basic information about CDP (timers, version)
- **R1# show cdp traffic**
→ displays how many CDP messages have been sent and received
- **R1# show cdp interface**
→ displays which interfaces CDP is enabled on
- **R1# show cdp neighbors**
→ lists CDP neighbors and some basic information about each neighbor
- **R1# show cdp neighbors detail**
→ lists each CDP neighbor with more detailed information
- **R1# show cdp entry *name***
→ displays the same info as above, but for the specified neighbor only

CDP Configuration Commands

- CDP is globally enabled by default.
- CDP is also enabled on each interface by default.
- To enable/disable CDP globally: `R1(config)# [no] cdp run`
- To enable/disable CDP on specific interfaces: `R1(config-if)# [no] cdp enable`
- Configure the CDP timer: `R1(config)# cdp timer seconds`
- Configure the CDP holdtime: `R1(config)# cdp holdtime seconds`
- Enable/disable CDPv2: `R1(config)# [no] cdp advertise-v2`

Link Layer Discovery Protocol

- LLDP is an industry standard protocol (IEEE 802.1AB).
- It is usually disabled on Cisco devices by default, so it must be manually enabled.
- A device can run CDP and LLDP at the same time.
- LLDP messages are periodically sent to multicast MAC address 0180.C200.000E.
- When a device receives an LLDP message, it processes and discards the message. It does NOT forward it to other devices.
- By default, LLDP messages are sent once every **30 seconds**.
- By default, the LLDP holdtime is **120 seconds**.
- LLDP has an additional timer called the 'reinitialization delay'. If LLDP is enabled (globally or on an interface), this timer will delay the actual initialization of LLDP. **2 seconds** by default.

LLDP Configuration Commands

- LLDP is usually globally disabled by default.
- LLDP is also disabled on each interface by default.

- To enable LLDP globally: `R1(config)# lldp run`

- To enable LLDP on specific interfaces (tx):

```
R1(config-if)# lldp transmit
```

- To enable LLDP on specific a interface (rx):

```
R1(config-if)# lldp receive
```

- Configure the LLDP timer: `R1(config)# lldp timer seconds`

- Configure the LLDP holdtime: `R1(config)# lldp holdtime seconds`

- Configure the LLDP reinit timer: `R1(config)# lldp reinit seconds`

Link Layer Discovery Protocol

```
R1#show lldp traffic
```

```
LLDP traffic statistics:
```

```
  Total frames out: 4
  Total entries aged: 0
  Total frames in: 3
  Total frames received in error: 0
  Total frames discarded: 0
  Total TLVs discarded: 0
  Total TLVs unrecognized: 0
```

```
R1#
```

```
R1#show lldp interface
```

```
GigabitEthernet0/0:
```

```
  Tx: enabled
  Rx: enabled
  Tx state: IDLE
  Rx state: WAIT FOR FRAME
```

```
GigabitEthernet0/1:
```

```
  Tx: enabled
  Rx: enabled
  Tx state: IDLE
  Rx state: WAIT FOR FRAME
```

```
GigabitEthernet0/2:
```

```
  Tx: enabled
  Rx: enabled
  Tx state: INIT
  Rx state: WAIT PORT OPER
```

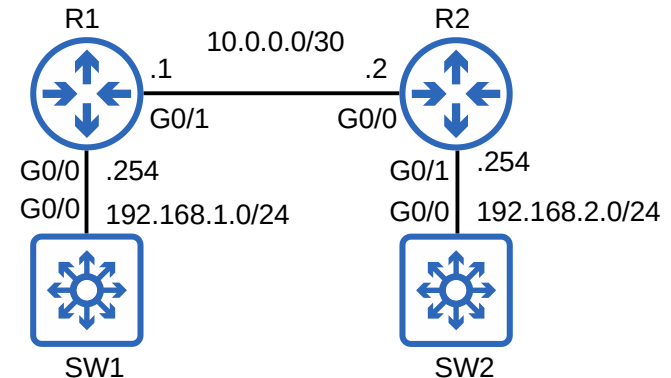
```
GigabitEthernet0/3:
```

```
  Tx: enabled
  Rx: enabled
  Tx state: INIT
  Rx state: WAIT PORT OPER
```

```
R1#show lldp
```

```
Global LLDP Information:
```

```
  Status: ACTIVE
  LLDP advertisements are sent every 30 seconds
  LLDP hold time advertised is 120 seconds
  LLDP interface reinitialisation delay is 2 seconds
```



Link Layer Discovery Protocol

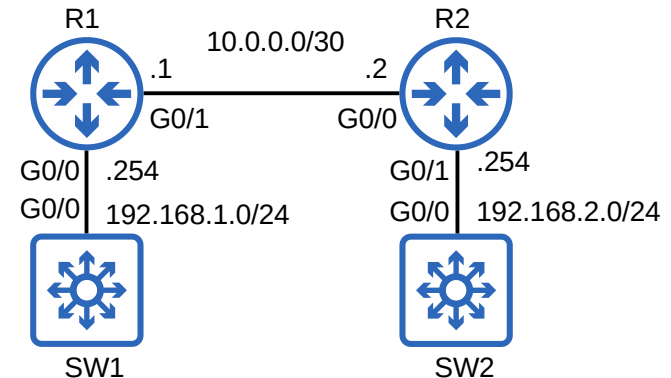
```
R1#show lldp neighbors
```

Capability codes:

(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID	Local Intf	Hold-time	Capability	Port ID
SW1	Gi0/0	120		Gi0/0
R2	Gi0/1	120	R	Gi0/0

Total entries displayed: 2



Link Layer Discovery Protocol

```
R1#show lldp neighbors detail
```

```
Local Intf: Gi0/0  
Chassis id: 0c04.41d2.1a00  
Port id: Gi0/0  
Port Description: GigabitEthernet0/0  
System Name: SW1
```

```
System Description:
```

```
Cisco IOS Software, vios_l2 Software (vios_l2-ADVENTERPRISEK9-M), Version 15.2(4.0.55)E, TEST ENGINEERING ESTG_WEEKLY BUILD, synced to END_OF_FLO_ISP  
Technical Support: http://www.cisco.com/techsupport  
Copyright (c) 1986-2015 by Cisco Systems, Inc.  
Compi
```

```
Time remaining: 99 seconds
```

```
System Capabilities: B,R  
Enabled Capabilities - not advertised
```

```
Management Addresses - not advertised
```

```
Auto Negotiation - not supported
```

```
Physical media capabilities - not advertised
```

```
Media Attachment Unit type - not advertised
```

```
Vlan ID: - not advertised
```

```
-----  
Local Intf: Gi0/1  
Chassis id: 0c04.418d.a400  
Port id: Gi0/0  
Port Description: GigabitEthernet0/0  
System Name: R2
```

```
System Description:
```

```
Cisco IOS Software, IOSv Software (VIOS-ADVENTERPRISEK9-M), Version 15.6(2)T, RELEASE SOFTWARE (fc2)  
Technical Support: http://www.cisco.com/techsupport  
Copyright (c) 1986-2016 by Cisco Systems, Inc.  
Compiled Tue 22-Mar-16 16:19 by prod_rel_team
```

```
Time remaining: 92 seconds
```

```
System Capabilities: B,R
```

```
Enabled Capabilities: R
```

```
Management Addresses:
```

```
IP: 10.0.0.2
```

Link Layer Discovery Protocol

```
R1#show lldp entry SW1
```

Capability codes:

(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Local Intf: Gi0/0

Chassis id: 0c04.41d2.1a00

Port id: Gi0/0

Port Description: GigabitEthernet0/0

System Name: SW1

System Description:

Cisco IOS Software, vios_12 Software (vios_12-ADVENTERPRISEK9-M), Version 15.2(4.0.55)E, TEST ENGINEERING ESTG_WEEKLY BUILD, synced to END_OF_FLO_ISP

Technical Support: <http://www.cisco.com/techsupport>

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Compi

Time remaining: 119 seconds

System Capabilities: B,R

Enabled Capabilities: R

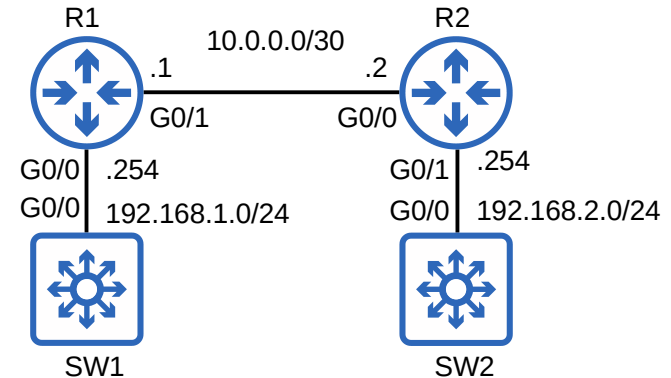
Management Addresses - not advertised

Auto Negotiation - not supported

Physical media capabilities - not advertised

Media Attachment Unit type - not advertised

Vlan ID: - not advertised



LLDP show commands summary

- **R1# show lldp**
→ shows basic information about LLDP (timers, version)
- **R1# show lldp traffic**
→ displays how many LLDP messages have been sent and received
- **R1# show lldp interface**
→ displays which interfaces LLDP tx/rx is enabled on
- **R1# show lldp neighbors**
→ lists LLDP neighbors and some basic information about each neighbor
- **R1# show lldp neighbors detail**
→ lists each LLDP neighbor with more detailed information
- **R1# show lldp entry *name***
→ displays the same info as above, but for the specified neighbor only

Wireshark Captures

```
> Frame 12: 369 bytes on wire (2952 bits), 369 bytes captured (2952 bits) on interface -, id 0
  ✓ IEEE 802.3 Ethernet
    > Destination: CDP/VTP/DTP/PAgP/UDLD (01:00:0c:cc:cc:cc)
    > Source: 0c:04:41:47:57:00 (0c:04:41:47:57:00)
    Length: 355
  > Logical-Link Control
    ✓ Cisco Discovery Protocol
      Version: 2
      TTL: 180 seconds
      Checksum: 0xee0f [correct]
      [Checksum Status: Good]
      > Device ID: R1
      > Software Version
      > Platform: Cisco
      > Addresses
      > Port ID: GigabitEthernet0/0
    ✓ Capabilities
      Type: Capabilities (0x0004)
      Length: 8
      ✓ Capabilities: 0x00000005
        ....1 = Router: Yes
        ...0. = Transparent Bridge: No
        ...1. = Source Route Bridge: Yes
        ...0.. = Switch: No
        ...0... = Host: No
        ...0.... = IGMP capable: No
        ...0..... = Repeater: No
        ...0..... = VoIP Phone: No
        ...0..... = Remotely Managed Device: No
        ...0..... = CVTA/STP Dispute Resolution/Cisco VT Camera: No
        ...0..... = Two Port Mac Relay: No
      > IP Prefixes: 1
      > Duplex: Full
      > Management Addresses
```

Wireshark Captures

```

> Frame 466: 325 bytes on wire (2600 bits), 325 bytes captured (2600 bits) on interface -, id 0
> Ethernet II, Src: 0c:04:41:d2:1a:00 (0c:04:41:d2:1a:00), Dst: LLDP Multicast (01:80:c2:00:00:0e)
  > Link Layer Discovery Protocol
    > Chassis Subtype = MAC address, Id: 0c:04:41:d2:1a:00
    > Port Subtype = Interface name, Id: Gi0/0
    > Time To Live = 120 sec
    > System Name = SW1
    > [truncated]System Description = Cisco IOS Software, vios_12 Software (vios_12-ADVENTERPRISEK9-M), Versio
    > Port Description = GigabitEthernet0/0
    > Capabilities
      0000 111. .... = TLV Type: System Capabilities (7)
      .... 0000 0100 = TLV Length: 4
      > Capabilities: 0x0014
        .... 0 = Other: Not capable
        .... 0 = Repeater: Not capable
        .... 1 = Bridge: Capable
        .... 0 = WLAN access point: Not capable
        .... 1 = Router: Capable
        .... 0 = Telephone: Not capable
        .... 0 = DOCSIS cable device: Not capable
        .... 0 = Station only: Not capable
      > Enabled Capabilities: 0x0010
        .... 0 = Other: Not capable
        .... 0 = Repeater: Not capable
        .... 0 = Bridge: Not capable
        .... 0 = WLAN access point: Not capable
        .... 1 = Router: Capable
        .... 0 = Telephone: Not capable
        .... 0 = DOCSIS cable device: Not capable
        .... 0 = Station only: Not capable
    > End of LLDPDU
  
```

Things we'll cover

- Intro to Layer 2 discovery protocols
- Cisco Discovery Protocol (CDP)
- Link Layer Discovery Protocol (LLDP)

Which of the following commands show the configured CDP timers? (select two)

- a) R1#show cdp
- b) R1#show cdp traffic
- c) R1#show cdp interface
- d) R1#show cdp neighbors

Which of the following commands represent the default CDP state? (select two)

- a) R1(config)#no cdp run
- b) R1(config)#cdp holdtime 120
- c) R1(config-if)#cdp enable
- d) R1(config)#cdp timer 60

Quiz 3

You issue the **show lldp entry SW1** command on R1. R1's neighbor SW1 is a multilayer switch. What do you expect to see in the 'system capabilities' field of the output?

- a) System Capabilities: B
- b) System Capabilities: B,R
- c) System Capabilities: S
- d) System Capabilities: S,R

Which of the following statements about LLDP are true? (select two)

- a) LLDP only operates on Cisco devices.
- b) Interface Tx and Rx operations are enabled separately.
- c) LLDP messages are sent every 60 seconds by default.
- d) LLDP can be used to learn the OSPF settings of a neighboring device.
- e) LLDP can be used to learn the VTP settings of a neighboring device.
- f) LLDP can be used to learn the OS version of a neighboring device.

Quiz 5

Which interface on R2 is SW2 connected to?

```
R2#show cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone,
                  D - Remote, C - CVTA, M - Two-port Mac Relay

Device ID         Local Intrfce   Holdtme    Capability   Platform   Port ID
SW4                Gig 0/2        131        R S I               Gig 0/3
SW2                Gig 0/1        173        R S I               Gig 0/0
SW3                Gig 0/3        179        R S I               Gig 0/2
R1                 Gig 0/0        163        R B                  Gig 0/1

Total cdp entries displayed : 4
R2#
```

- a) G0/0
- b) G0/1
- c) G0/2
- d) G0/3