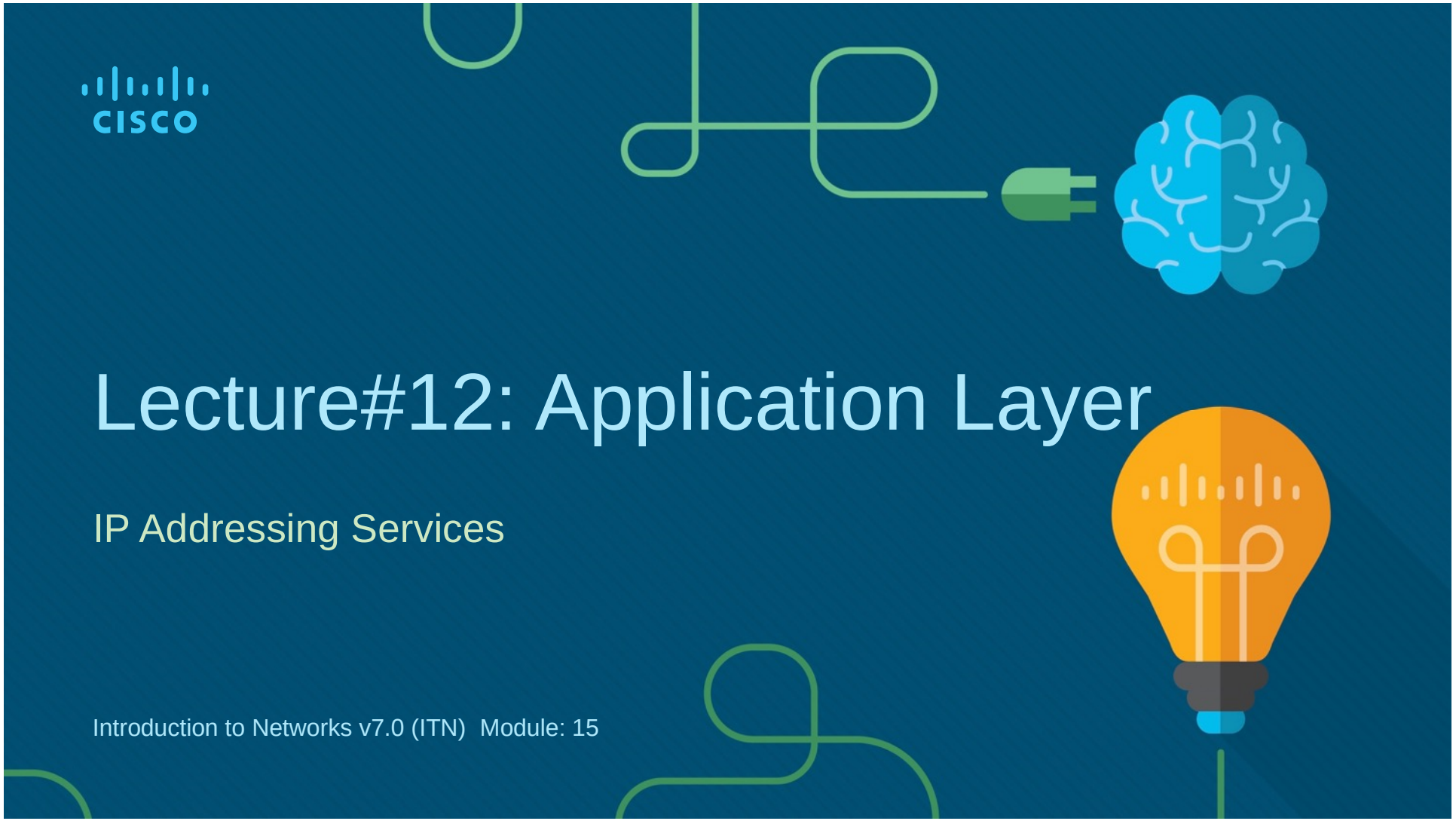


Lecture#12: Application Layer

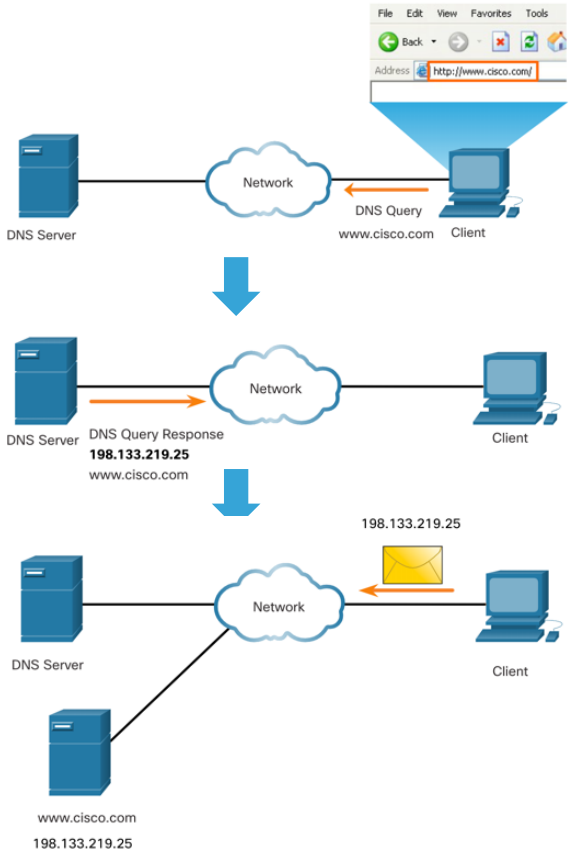
IP Addressing Services

Introduction to Networks v7.0 (ITN) Module: 15

12.1.1 DNS

Domain Name Service

- Domain names were created to convert the numeric IP addresses into a simple, recognizable name.
- Fully-qualified domain names (FQDNs), such as http://www.cisco.com, are much easier for people to remember than 198.133.219.25.
- The DNS protocol defines an automated service that matches resource names with the required numeric network address. It includes the format for queries, responses, and data.



DNS Message Format

The DNS server stores different types of resource records that are used to resolve names. These records contain the name, address, and type of record.

Some of these record types are as follows:

- **A** - An end device IPv4 address
- **NS** - An authoritative name server
- **AAAA** - An end device IPv6 address (pronounced quad-A)
- **MX** - A mail exchange record

When a client makes a query, the server DNS process first looks at its own records to resolve the name. If it is unable to resolve the name by using its stored records, it contacts other servers to resolve the name.

After a match is found and returned to the original requesting server, the server temporarily stores the numbered address in the event that the same name is requested again.

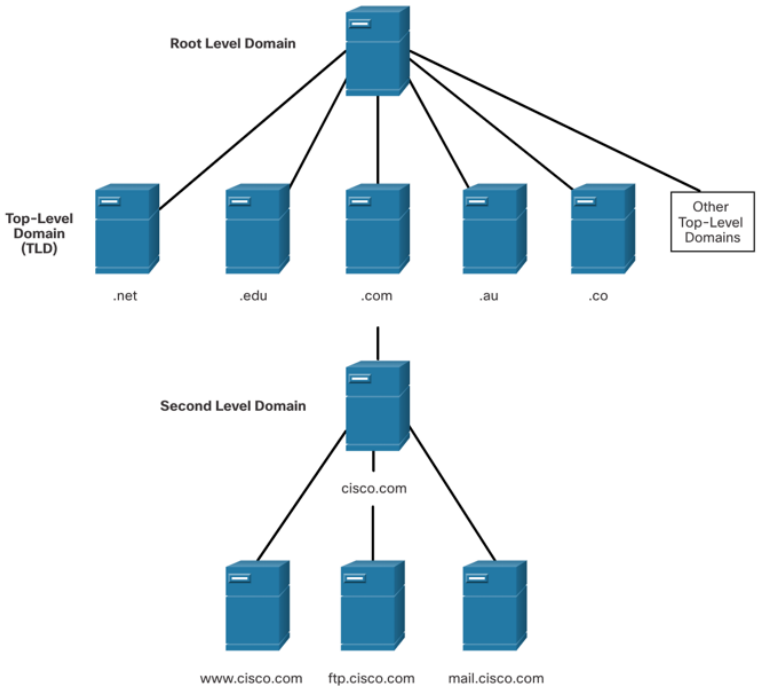
DNS Message Format (Cont.)

DNS uses the same message format between servers, consisting of a question, answer, authority, and additional information for all types of client queries and server responses, error messages, and transfer of resource record information.

DNS message section	Description
Question	The question for the name server
Answer	Resource Records answering the question
Authority	Resource Records pointing toward an authority
Additional	Resource Records holding additional information

DNS Hierarchy

- DNS uses a hierarchical system to create a database to provide name resolution.
- Each DNS server maintains a specific database file and is only responsible for managing name-to-IP mappings for that small portion of the entire DNS structure.
- When a DNS server receives a request for a name translation that is not within its DNS zone, the DNS server forwards the request to another DNS server within the proper zone for translation.
- Examples of top-level domains:
  - **.com** - a business or industry
  - **.org** - a non-profit organization
  - **.au** - Australia



The nslookup Command

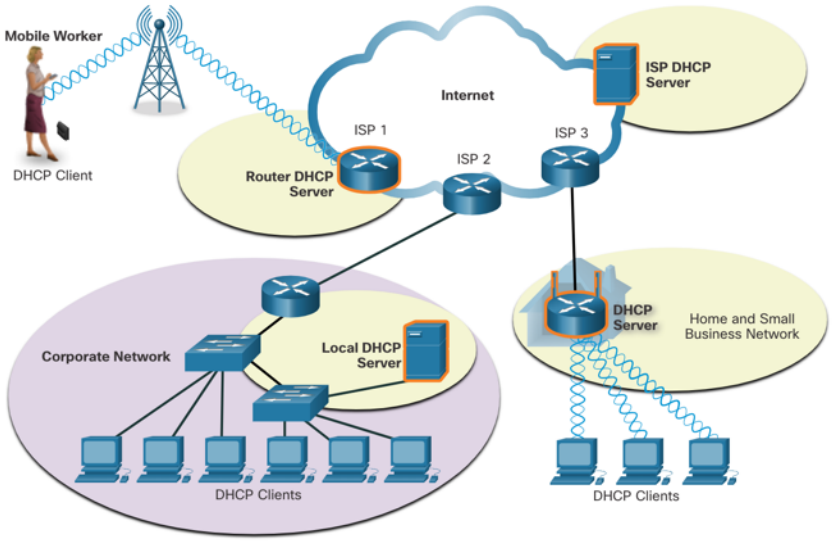
- Nslookup is a computer operating system utility that allows a user to manually query the DNS servers configured on the device to resolve a given host name.
- This utility can also be used to troubleshoot name resolution issues and to verify the current status of the name servers.
- When the **nslookup** command is issued, the default DNS server configured for your host is displayed.
- The name of a host or domain can be entered at the **nslookup** prompt.

```
C:\Users> nslookup
Default Server:  dns-sj.cisco.com
Address:  171.70.168.183
> www.cisco.com
Server:  dns-sj.cisco.com
Address:  171.70.168.183
Name:    origin-www.cisco.com
Addresses:  2001:420:1101:1::a
          173.37.145.84
Aliases:  www.cisco.com
> cisco.netacad.net
Server:  dns-sj.cisco.com
Address:  171.70.168.183
Name:    cisco.netacad.net
Address:  72.163.6.223
>
```

12.1.2 DHCP

Dynamic Host Configuration Protocol

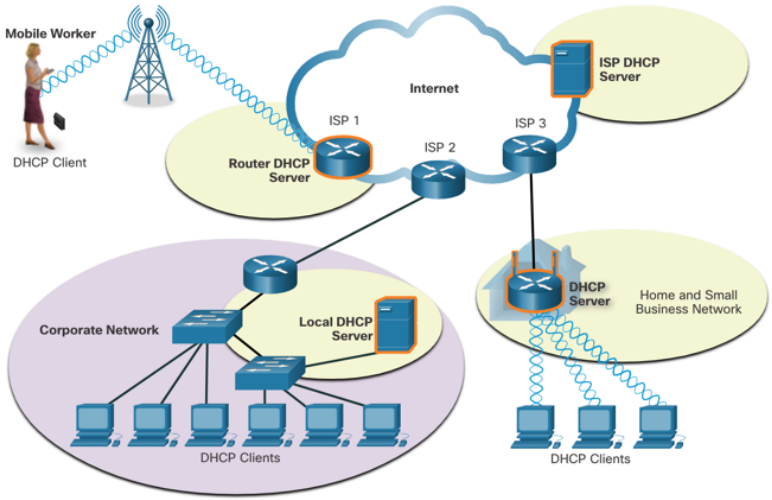
- The Dynamic Host Configuration Protocol (DHCP) for IPv4 service automates the assignment of IPv4 addresses, subnet masks, gateways, and other IPv4 networking parameters.
- DHCP is considered dynamic addressing compared to static addressing. Static addressing is manually entering IP address information.
- When a host connects to the network, the DHCP server is contacted, and an address is requested. The DHCP server chooses an address from a configured range of addresses called a pool and assigns (leases) it to the host.



Dynamic Host Configuration Protocol (Cont.)

- Many networks use both DHCP and static addressing. DHCP is used for general purpose hosts, such as end user devices. Static addressing is used for network devices, such as gateway routers, switches, servers, and printers.

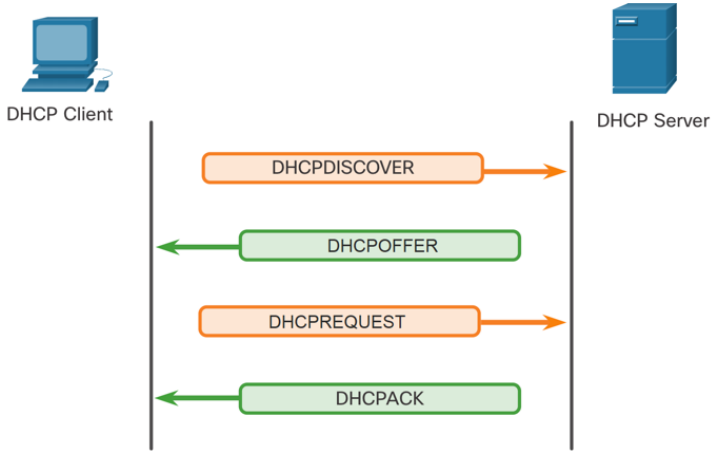
Note: *DHCP for IPv6 (DHCPv6) provides similar services for IPv6 clients. However, DHCPv6 does not provide a default gateway address. This can only be obtained dynamically from the Router Advertisement message of the router.*



DHCP Operation

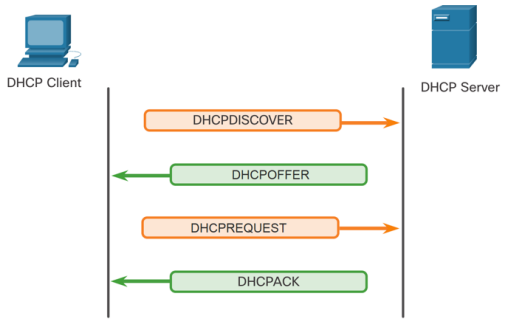
The DHCP Process:

- When an IPv4, DHCP-configured device boots up or connects to the network, the client broadcasts a DHCP discover (DHCPDISCOVER) message to identify any available DHCP servers on the network.
- A DHCP server replies with a DHCP offer (DHCPOFFER) message, which offers a lease to the client. (If a client receives more than one offer due to multiple DHCP servers on the network, it must choose one.)



DHCP Operation (Cont.)

- The client sends a DHCP request (DHCPREQUEST) message that identifies the explicit server and lease offer that the client is accepting.
- The server then returns a DHCP acknowledgment (DHCPACK) message that acknowledges to the client that the lease has been finalized.
- If the offer is no longer valid, then the selected server responds with a DHCP negative acknowledgment (DHCPNAK) message and the process must begin with a new DHCPDISCOVER message.



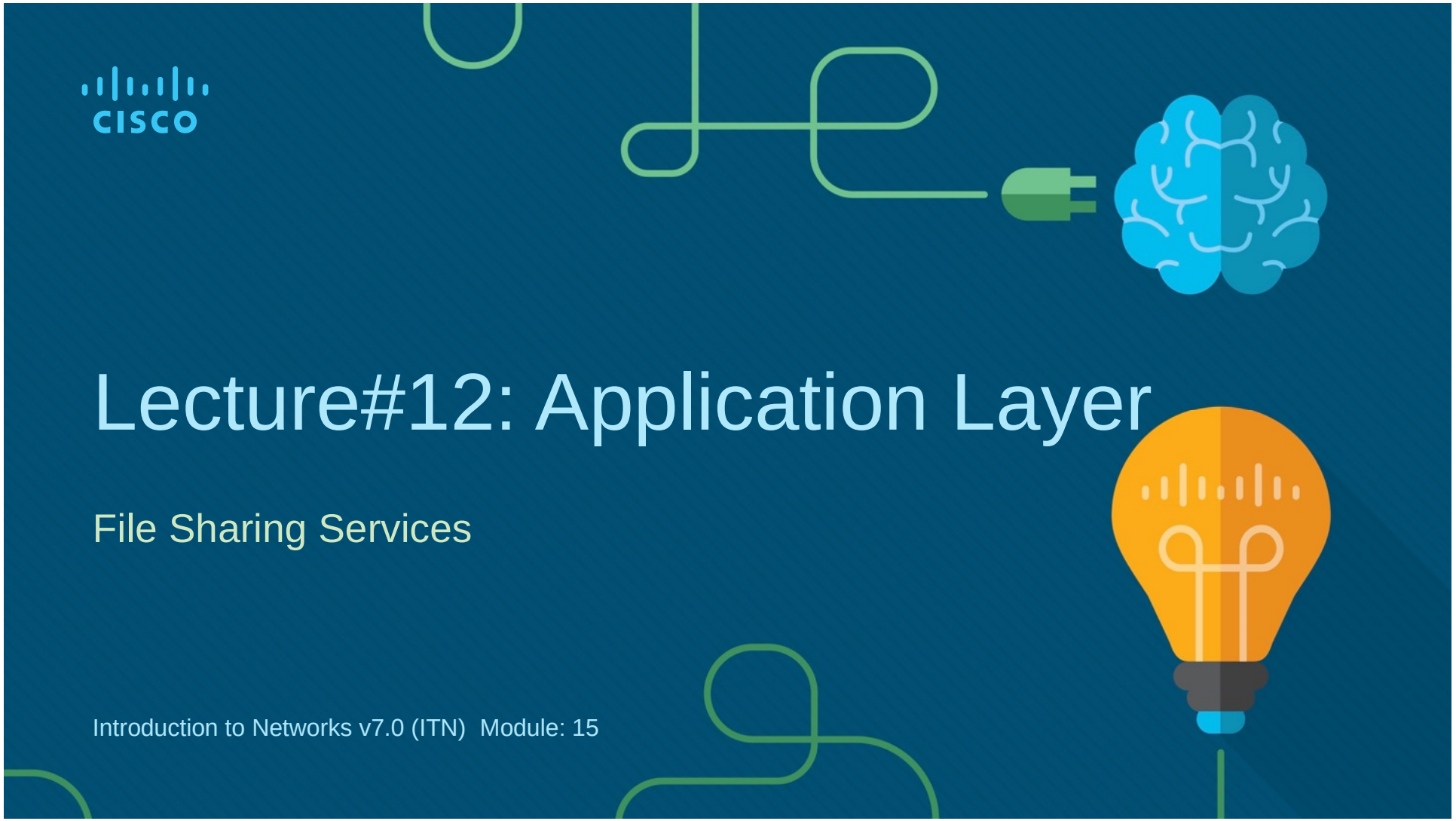
- ***Note**: DHCPv6 has a set of messages that is similar to those for DHCPv4. The DHCPv6 messages are SOLICIT, ADVERTISE, INFORMATION REQUEST, and REPLY.*

IP Addressing Services

Lab – Observe DNS Resolution

In this lab, you complete the following objectives:

- Observe the DNS Conversion of a URL to an IP Address
- Observe DNS Lookup Using the **nslookup** Command on a Web Site
- Observe DNS Lookup Using the **nslookup** Command on Mail Servers



Lecture#12: Application Layer

File Sharing Services

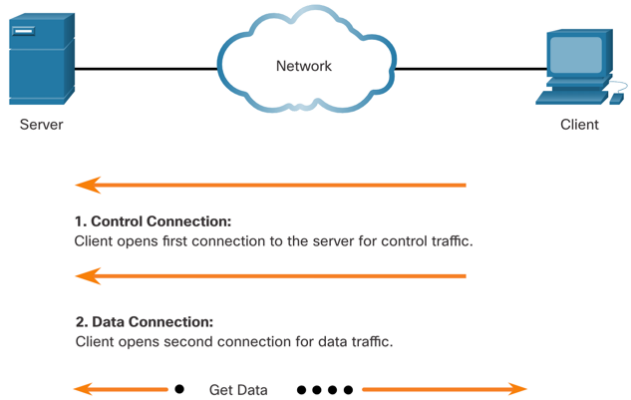
Introduction to Networks v7.0 (ITN) Module: 15

12.2.1 FTP

File Sharing Services

File Transfer Protocol

FTP was developed to allow for data transfers between a client and a server. An FTP client is an application which runs on a computer that is being used to push and pull data from an FTP server.



Step 1 - The client establishes the first connection to the server for control traffic using TCP port 21. The traffic consists of client commands and server replies.

Step 2 - The client establishes the second connection to the server for the actual data transfer using TCP port 20. This connection is created every time there is data to be transferred.

Step 3 - The data transfer can happen in either direction. The client can download (pull) data from the server, or the client can upload (push) data to the server.

12.2.1 SMB

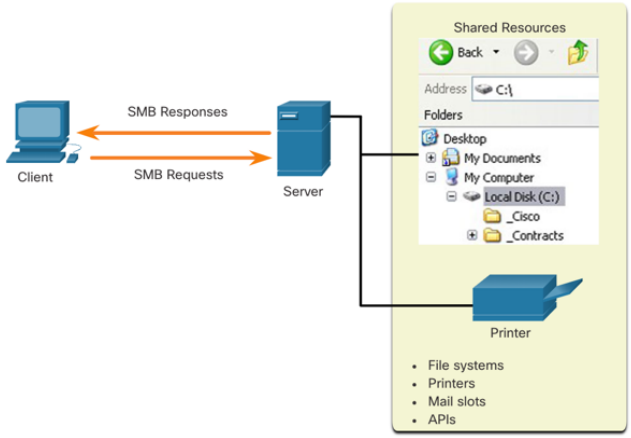
File Sharing Services

Server Message Block

The **Server Message Block** (SMB) is a client/server, request-response file sharing protocol. Servers can make their own resources available to clients on the network.

Three functions of SMB messages:

- Start, authenticate, and terminate sessions
- Control file and printer access
- Allow an application to send or receive messages to or from another device



Unlike the file sharing supported by FTP, clients establish a long-term connection to servers. After the connection is established, the user of the client can access the resources on the server as though the resource is local to the client host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