**LABORATORY 6:  DOMAIN NAME SYSTEM (DNS)**

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**Objectives**

By the end of the laboratory, students will be able to
* configure a DNS server.
* verify the function of DNS service.

**Introduction:**

Computers in the networks use IP addresses to uniquely present their location. Unfortunately, IP addresses are hard to be remembered by human beings. When a user wants to visit a web-site, he will enter the URL to the web browser. The URL is usually in the format of a domain name, for example, ***www.yahoo.com***. Domain names are much easier to remember as compared to IP addresses.

The conversion of a domain name to its associated IP address is called _DNS name resolution_, in which the DNS server resolves the domain name to the IP address. Figure 6.1 demonstrates the DNS name resolution process. The DNS client in the laptop sends a DNS Query to the DNS server. The DNS server resolves the domain name ***www.yahoo.com*** to the IP address 106.10.139.246, and returns the IP address to the DNS client. The web browser then directly sends a HTTP Request to the IP address of the web server, 106.10.139.246, for the web-page. The web server receives the HTTP Request and returns the web-page in HTML format.
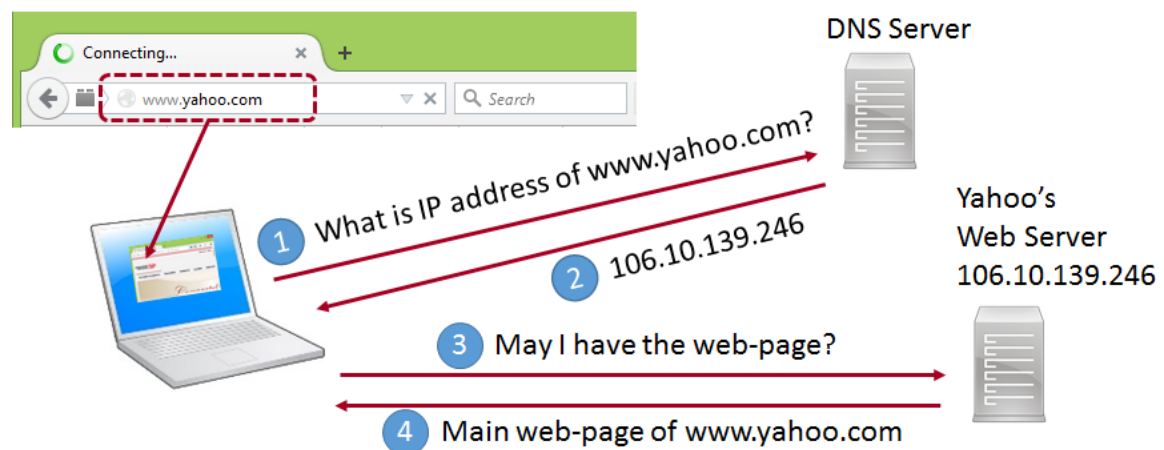


**Figure 6.1 – DNS name resolution process.**

It is actually possible for the web browser to directly send the HTTP Request to the web server if the IP address of the web server is known. It is not mandatory to invoke the DNS name resolution process. However, since it is much harder to remember the IP address of a web server than its domain name, it is a rare practice to enter URL in the form of IP addresses. Furthermore, the IP address of a web server may change (e.g. a backup web server takes over the web hosting). It is then impossible to access the web server via its obsolete IP address. The DNS service however will be able to

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provide the renewed IP address of the web server, as long as the new IP address is linked to the domain name.

To inform a host about the DNS server to be contacted for DNS name resolution, the IP address of the DNS server can be either configured manually, or automatically through the DHCP process. It is also a common practice to have more than one DNS server IP address supplied to a host. This provides a robust DNS service since the secondary DNS server offers an alternative solution if the primary DNS server is out of action.


**Equipment:**

Windows OS laptops with Cisco Packet Tracer installed.


**Procedures:**

1. **Construction and Configuration of a Computer Network for Testing DNS service.**

    1.1 Construct the network shown in Figure 6.2. Use router model 2811 for Router0 and Router1. Add serial interface to the two routers.
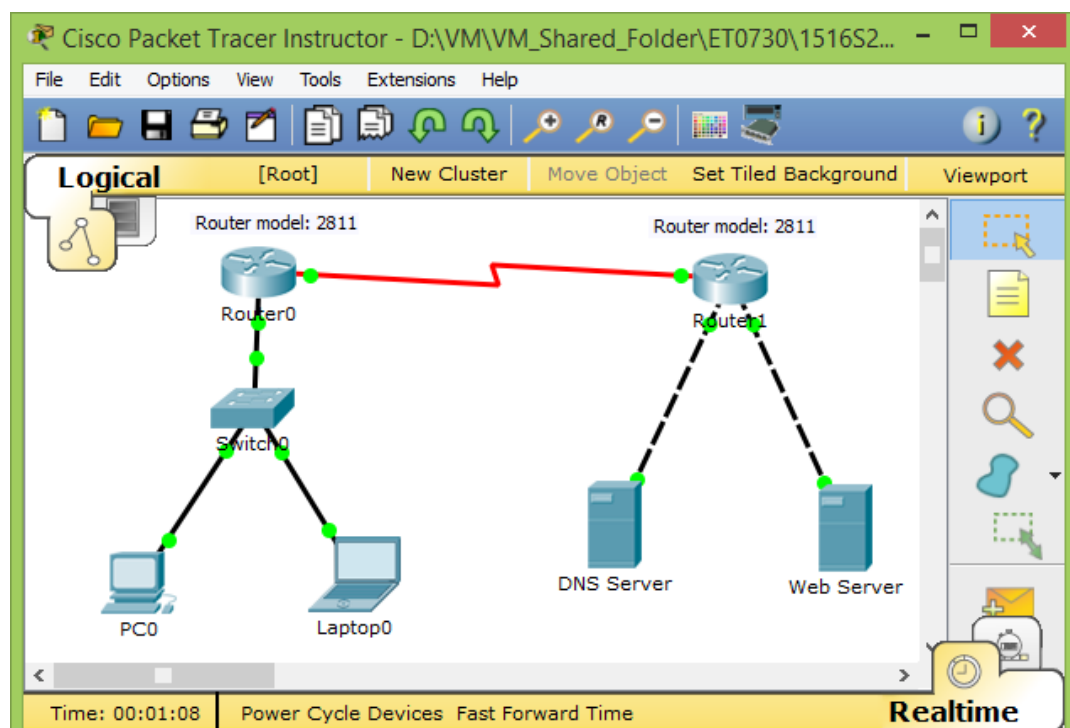


**Figure 6.2 - A network for testing DNS service.**

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1.2 Configure the hosts, servers and the routers interfaces with parameters as shown in Table 6.1 below. Configure Router0's serial interface as DCE, and Router1's serial interface as DTE. The serial link bitrate should be set to 56 kbps.

| Device | IP Address | Subnet Mask | Default gateway |
|--------|-----------|-------------|-----------------|
| PC0 | 192.168.1.101 | 255.255.255.0 | 192.168.1.1 |
| Laptop0 | 192.168.1.102 | 255.255.255.0 | 192.168.1.1 |
| Router0's Fe0/0 | 192.168.1.1 | 255.255.255.0 | Not applicable |
| Router0's s0/0/0 | 10.10.10.1 | 255.255.255.252 | Not applicable |
| Router1's s0/0/0 | 10.10.10.2 | 255.255.255.252 | Not applicable |
| Router1's Fe0/0 | 20.20.20.1 | 255.255.255.0 | Not applicable |
| Router1's Fe0/1 | 30.30.30.1 | 255.255.255.0 | Not applicable |
| DNS Server | 20.20.20.20 | 255.255.255.0 | 20.20.20.1 |
| Web Server | 30.30.30.30 | 255.255.255.0 | 30.30.30.1 |

**Table 6.1 – Network configuration parameters for Figure 3.2.**

1.3 Configure Router0 and Router1 for RIP routing. For Router0, enter networks 192.168.1.0 and 10.10.10.0. For Router1, enter networks 10.10.10.0, 20.20.20.0 and 30.30.30.0.

1.4 Verify the connectivity from PC0 to the DNS server and web server.

1.5 Click on PC0 and select the "Config" tab. In the textbox next to "DNS Server", enter the IP address of the DNS Server (i.e. 20.20.20.20, as shown in Figure 6.3). This informs PC0 about the DNS server to be contacted for DNS name resolution.
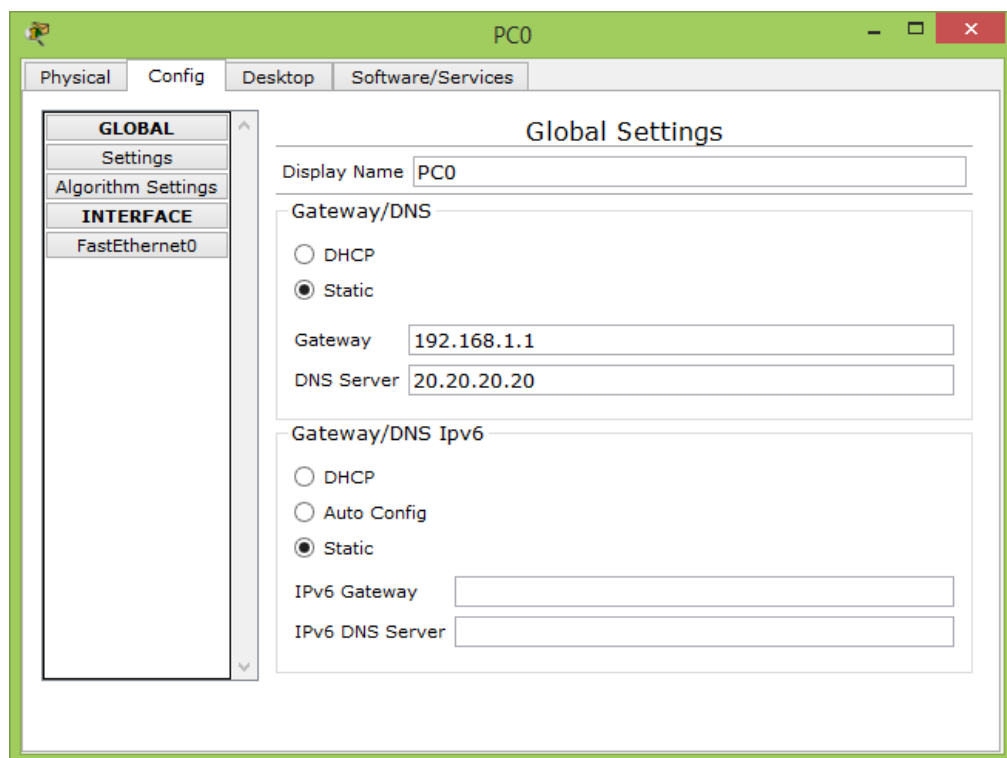


**Figure 6.3 – Enter DNS Server IP address for host PC0.**

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**2. Configuration of DNS Server.**

2.1   Configure the DNS server by carrying out the following steps.

2.1.1   Click on DNS Server.

2.1.2   Click "Services" → "DNS".

2.1.3   Click the "On" radio button next to "DNS Service". This activates the DNS service on the DNS server.

2.1.4   In the textbox of "Name", enter www.CompanyA.com. In the textbox of "Address", enter 30.30.30.30 (i.e. the IP address of the Web Server). Figure 6.4 shows the entries to be made.
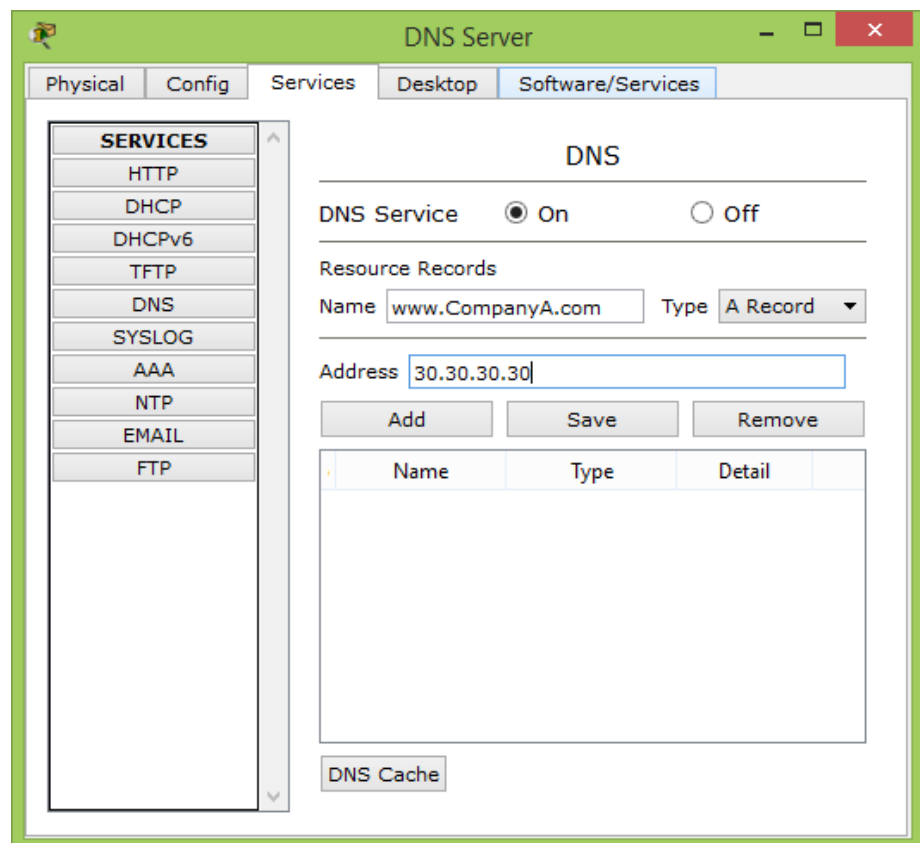


**Figure 6.4 – Adding an entry to the DNS database.**

2.1.5   Click the "Add" button. A new entry will be added to the table below. The domain name will be in lowercase. This is fine since DNS service is not case-sensitive.

**3. Configuration of Web Server.**

3.1   Configure the Web server by carrying out the following steps.

3.1.1   Click on Web Server.

3.1.2   Click "Services" → "HTTP".

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3.1.3  Make sure that the "On" radio button next to "HTTP" is selected. This activates the HTTP service on the Web server. The HTTPs service may be left "On", although it will not be used in this lab experiment. Figure 6.5 shows the HTTP service configuration.
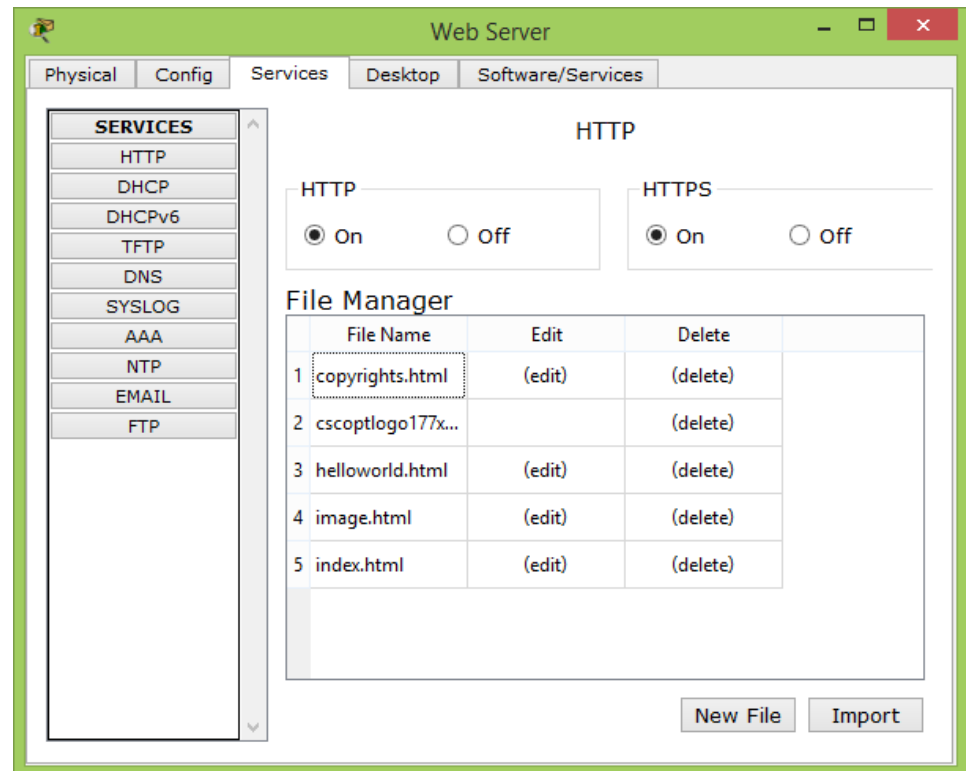


**Figure 6.5 – Configuration of web hosting service on the Web Server.**

## 4.    Verification of the DNS Service.

4.1  Switch the Packet Tracer to "Simulation Mode".

4.2  Click the "Show All/None" button once. This de-selects all protocols.

4.3  Click the "Edit Filters" button, then select "Ipv4" tab. Put a tick in the box next to "DNS". The rest should not be selected.

4.4  Click on the "Misc" tab, then put a tick in the box next to "HTTP". The rest should not be selected.

4.5  Click somewhere else to close the "Edit Filters" window.

4.6  Click on PC0. Select the "Desktop" tab, then select "Web Browser".

4.7  Enter *www.CompanyA.com* in the URL textbox. Click the "Go" button.

4.8  Minimise the PC0 window. You should see a DNS packet appearing at PC0.

4.9  At the Simulation Panel, click the "Info" box of "DNS" type. Figure 6.6 shows the "Info" box of "DNS" type to be clicked. A window showing the PDU information will pop up, as shown in Figure 6.7.
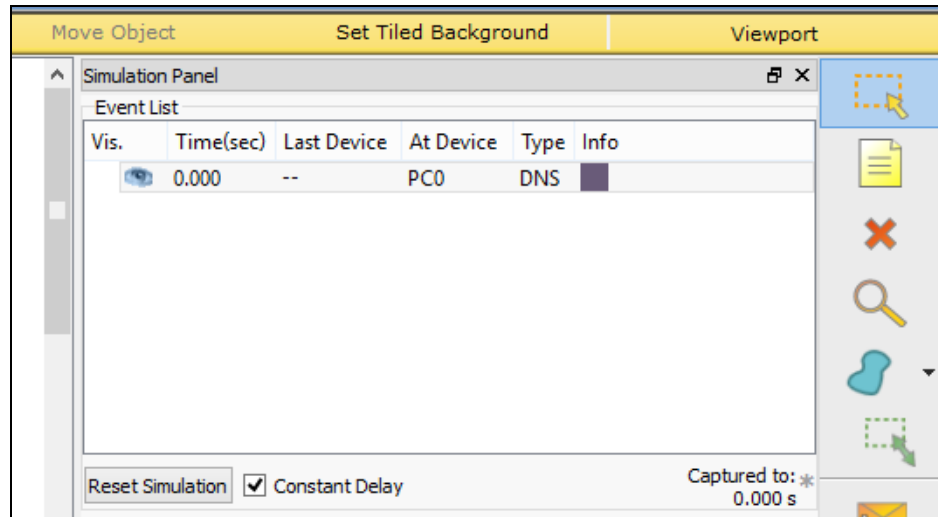
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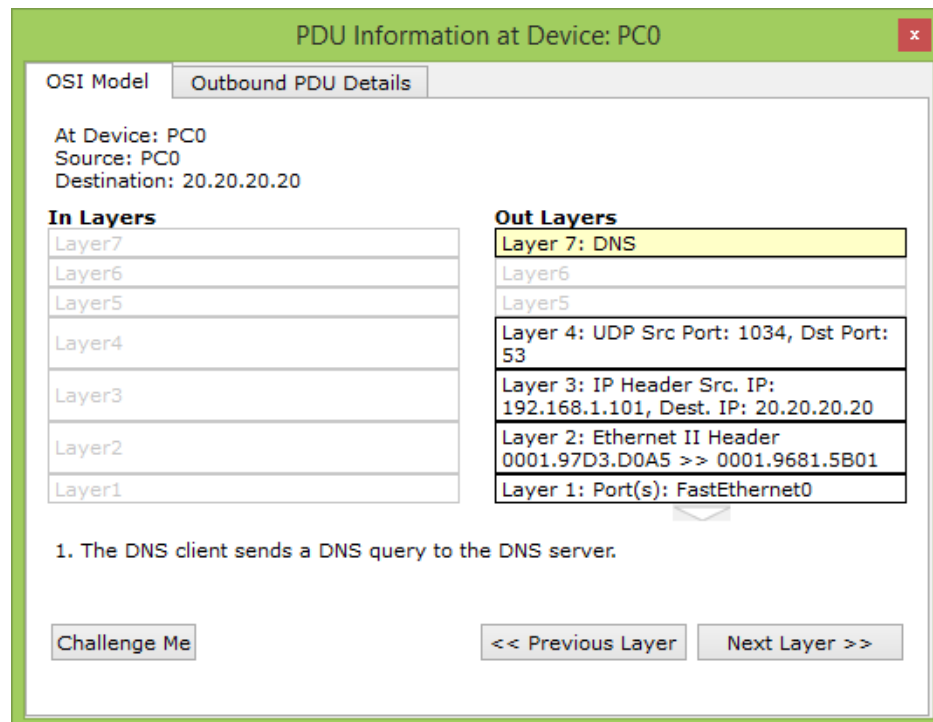**Figure 6.6 – DNS info box representing the DNS Query.**



**Figure 6.7 – PDU information of the DNS Query.**

4.10  Click on "Layer 7: DNS" of the "Out Layers" column (right-hand-side). A message appears at lower part of the window. The message should be showing "**1. The DNS client sends a DNS query to the DNS server.**".

**<u>Question:</u>**

By checking "Layer 3" of the "Out Layers" column, where is the DNS Query sent to? Write down the IP address. Whose IP address is that?

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4.11 Click the "Capture/Forward" button 4 times. The DNS Query packet will arrive at the DNS server. Click on the "DNS" info box.

4.12 Click on "Layer 7: DNS" of the "In Layers" column (left-hand-side). Two messages appear at lower part of the window. Record these two messages.

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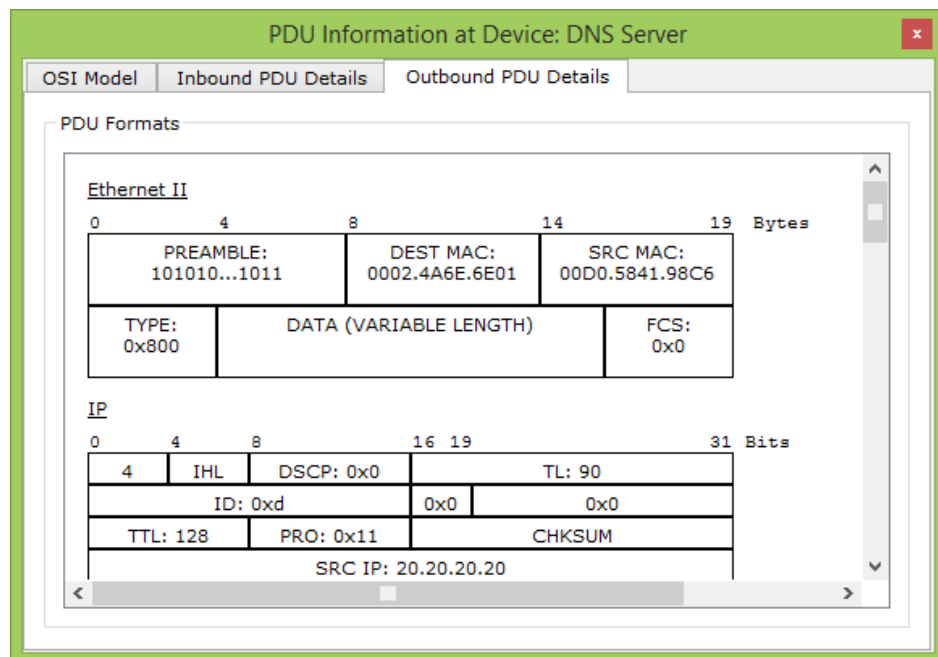
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4.13 Click on "Layer 7: DNS" of the "Out Layers" column (right-hand-side). One message appears at lower part of the window. Record this message.

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4.14 Click on the "Outbound PDU Details" tab. You should see what Figure 6.8 below shows.



**Figure 6.8 – Outbound PDU Details of the DNS Response.**

4.15 Drag the scroll bar to reach the bottom. Look out for "DNS Answer" message. There may be two such messages. Look at the second "DNS Answer" message. Look out for "ADDRESS:" field.

**Question:**

What is the value next to "ADDRESS:"? Whose IP address is that?

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4.16 Click the "Capture/Forward" button several times until a "HTTP" packet appears at PC0. This is the HTTP Request to be sent to the Web Server.

4.17 Click the "Auto Capture/Play" button, so that the simulation proceeds automatically. When the simulation is completed, a window with title "Buffer Full – Packet Tracer" pops up. Click the "View Previous Events" button to close it.

4.18 Click on the last "HTTP" info box.

4.19 Click on "Layer 7: HTTP" of the "In Layers" column (left-hand-side). One message appears at lower part of the window. Record this message.

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4.20 Click on PC0 to bring up PC0's Web Browser window again. You should get a web-page shown in the Browser window, as shown in Figure 6.9.
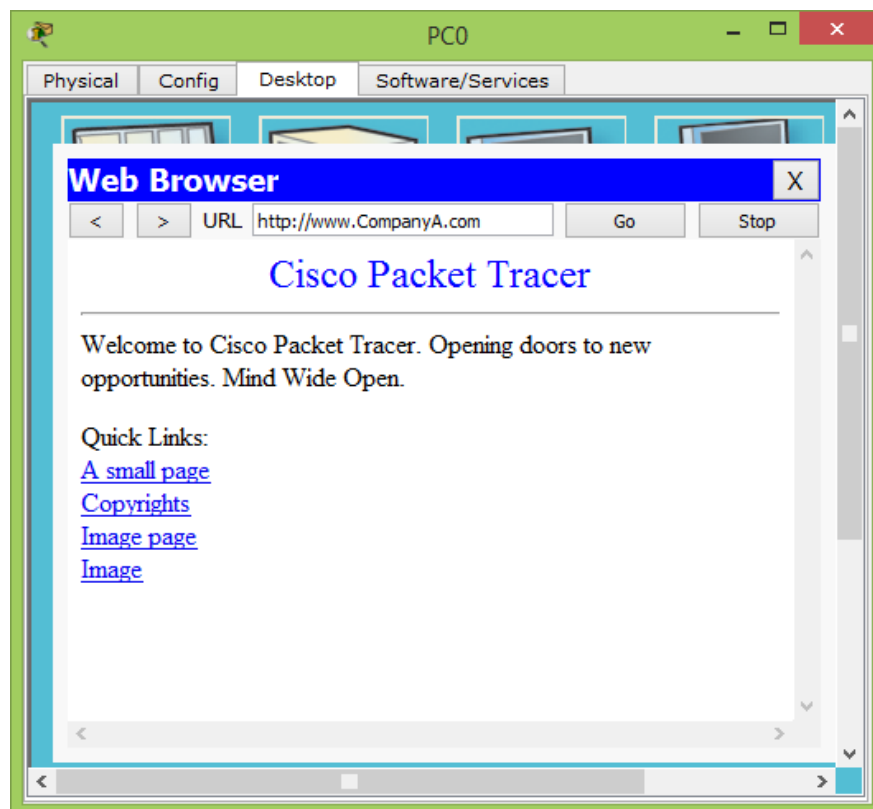


**Figure 6.9 – A web-page is the HTTP reply from the Web Server.**

## 5. Importance of the DNS Service.

5.1 Click the "Reset Simulation" button to clear the simulation panel.

5.2 Switch the Packet Tracer to "Realtime Mode".

5.3 Click on Laptop0. Select the "Desktop" tab, then select "Web Browser".

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5.4 Enter *www.CompanyA.com* in the URL textbox. Click the "Go" button.

**Question:**

What is the message shown in Laptop0's Web Browser window?

Host name unresolved.

**Question:**

What do you think is the root cause of the problem?

Laptop0 did not have the DNS server IP address properly configured.

Hence it does not know which server to contact for DNS name

Resoltuion.

5.5 Enter **http://30.30.30.30** in the URL textbox of the Web Browser. Click the "Go" button.

**Question:**

Does Laptop0's Web Browser window show a web-page now? If the IP address of the web server is known, is DNS service needed? Why is DNS service important then?

The webpage is shown. The DNS service is still needed. Firstly, domain

names are easier to remember than IP addresses. Secondly, it allows for

easy change of IP address without affecting the end user.

5.6 Close the Web Browser window of Laptop0.

5.7 Configure Laptop0 to assign 20.20.20.20 as its DNS server.

5.8 Launch the Web Browser on Laptop0 again. Enter *www.CompanyA.com* as the URL again, and click the "Go" button.

**Question:**

Does Laptop0's Web Browser window show a web-page now?

Yes.