Internet & Networking  
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# DNS

## DNS Query Tracing

My Objective was to trace the DNS query path for the domain google.com using various tools available in Windows

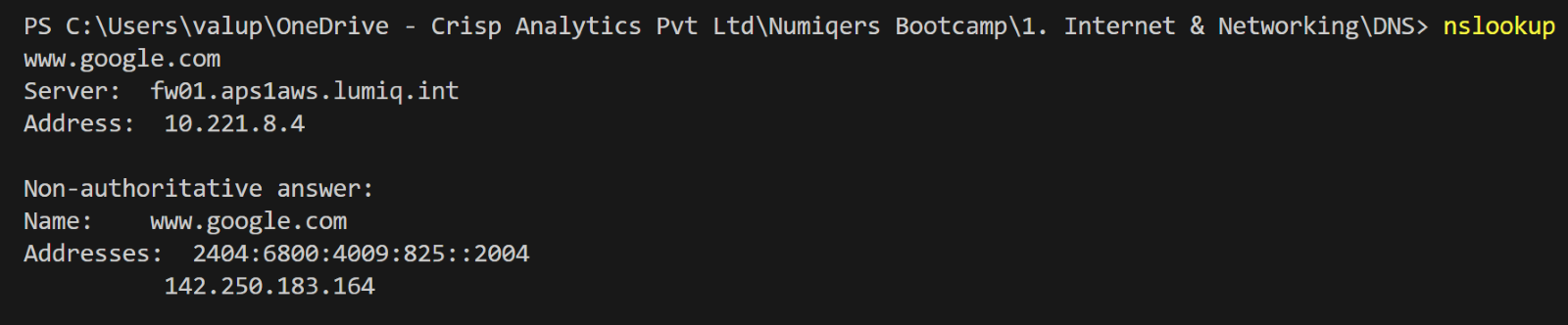
### Tools and Commands Used

**1. nslookup**

**Purpose:** To query the DNS servers and retrieve the IP address associated with the domain.

**Command:** nslookup www.google.com

**Output:**

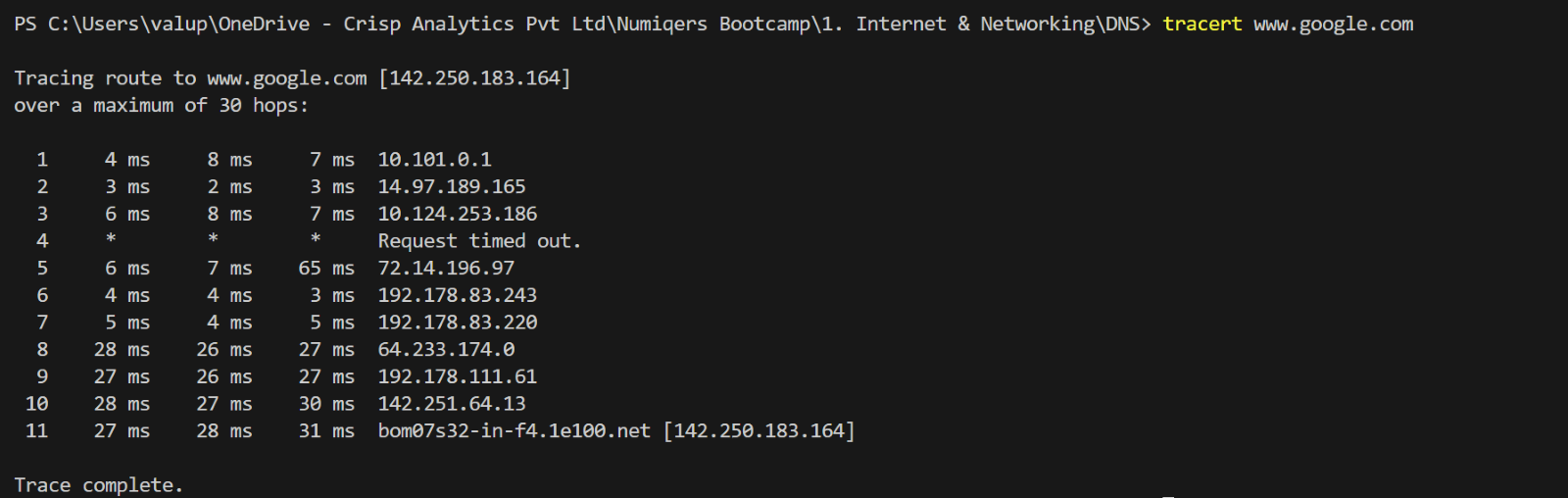


**2. tracert**

**Purpose:** To trace the route packets take to reach the network host google.com.

**Command:** tracert www.google.com

**Output:**

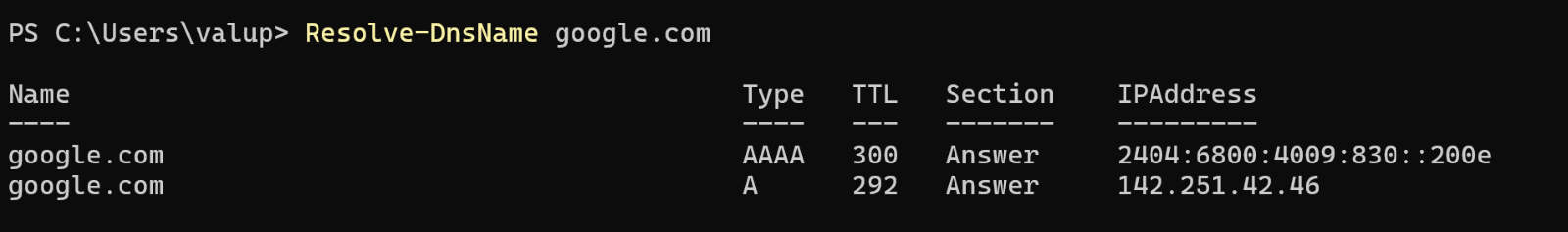


**3. PowerShell (Resolve-DnsName)**

**Purpose:** To resolve DNS names and provide detailed information using PowerShell.

**Command:** Resolve-DnsName google.com

**Output:**

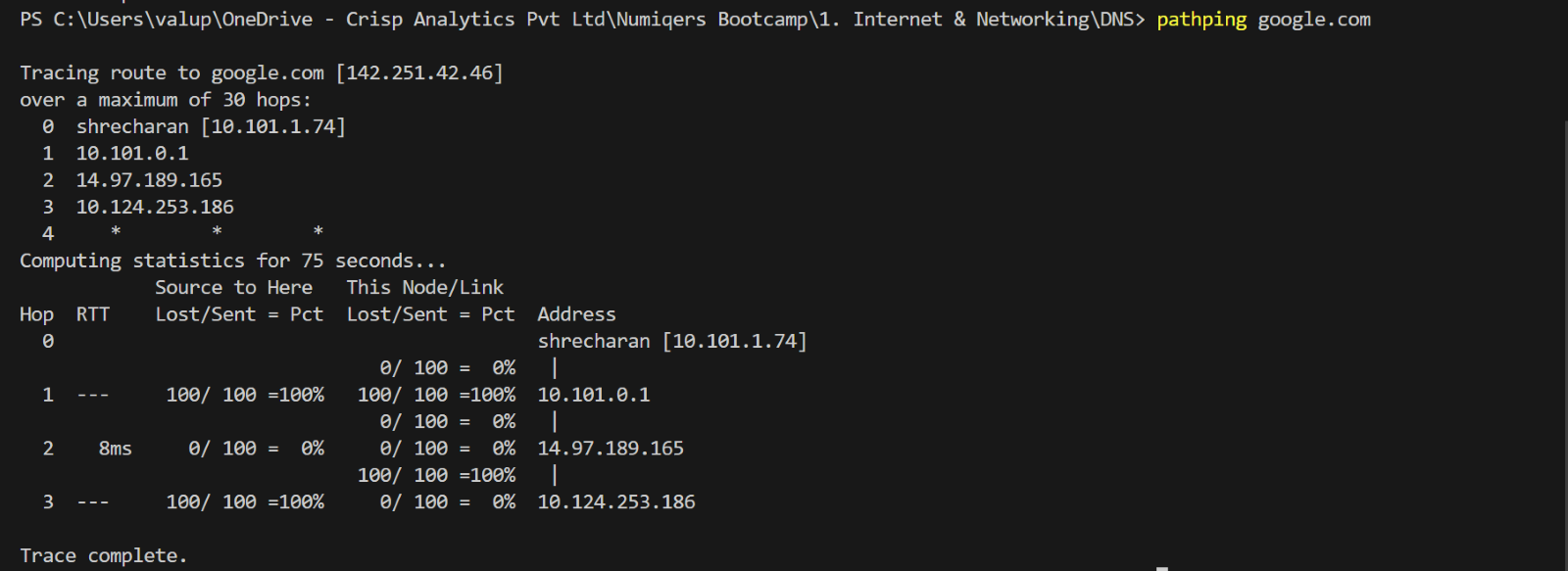


**4. pathping**

**Purpose**: To provide detailed information about network latency and packet loss.

**Command**: pathping google.com

**Output**:



## DNS Server Hosting

Hosting a DNS server on a local machine or virtual server can be done using various DNS software packages. One of the most used DNS server software is BIND (Berkeley Internet Name Domain).

### Steps to Install and Configure BIND DNS Server:

**1. Update the System:**

sudo apt-get update  
sudo apt-get upgrade  
**2. Install BIND9:**

sudo apt-get install bind9 bind9utils bind9-doc

**3. Configure the BIND DNS Server:**

* The main configuration file for BIND is /etc/bind/named.conf.
* There are other configuration files such as /etc/bind/named.conf.options, /etc/bind/named.conf.local, and /etc/bind/named.conf.default-zones.

**4. Edit the BIND Options File:**

Edit the /etc/bind/named.conf.options file to configure the DNS server options.

Add the following basic configuration:

sudo nano /etc/bind/named.conf.options

Add the following lines:

options {  
 directory "/var/cache/bind";  
 forwarders {  
 8.8.8.8; // Google DNS  
 8.8.4.4; // Google DNS  
 };  
  
 allow-query { any; };  
  
 allow-query-cache { localnets; };  
  
 recursion yes;  
};

**5. Define Zones:**

Edit the /etc/bind/named.conf.local file to define our DNS zones.

sudo nano /etc/bind/named.conf.local

Add the following lines to define a zone:

zone "google.com" {  
 type master;  
 file "/etc/bind/zones/db.google.com";  
};  
  
zone "0.168.192.in-addr.arpa" {  
 type master;  
 file "/etc/bind/zones/db.192.168.0"; // Reverse zone file path  
};

**6. Create Zone Files:**

Create the zone files referenced in named.conf.local.

First, create the directory for the zone files:

sudo mkdir /etc/bind/zones

Create the forward zone file for google.com:

sudo nano /etc/bind/zones/db.google.com

Add the following content to the file:

$TTL 604800  
@ IN SOA ns1.google.com. admin.google.com. (  
 2023061001 ; Serial  
 604800 ; Refresh  
 86400 ; Retry  
 2419200 ; Expire  
 604800 ) ; Negative Cache TTL  
  
; Name servers  
@ IN NS ns1.google.com.  
  
; A records for name servers  
ns1 IN A 192.168.0.1  
  
; A records for hosts  
www IN A 192.168.0.2

Create the reverse zone file for 192.168.0.x:

sudo nano /etc/bind/zones/db.192.168.0

Add the following content to the file:

$TTL 604800  
@ IN SOA ns1.google.com. admin.google.com. (  
 2023061001 ; Serial  
 604800 ; Refresh  
 86400 ; Retry  
 2419200 ; Expire  
 604800 ) ; Negative Cache TTL  
  
; Name servers  
@ IN NS ns1.google.com.  
  
; PTR records for reverse DNS  
1 IN PTR ns1.google.com.  
2 IN PTR www.google.com.

**7. Check BIND Configuration:**

Check the configuration files for syntax errors:

sudo named-checkconf  
sudo named-checkzone google.com /etc/bind/zones/db.google.com  
sudo named-checkzone 0.168.192.in-addr.arpa /etc/bind/zones/db.192.168.0

**8. Restart BIND Service:**

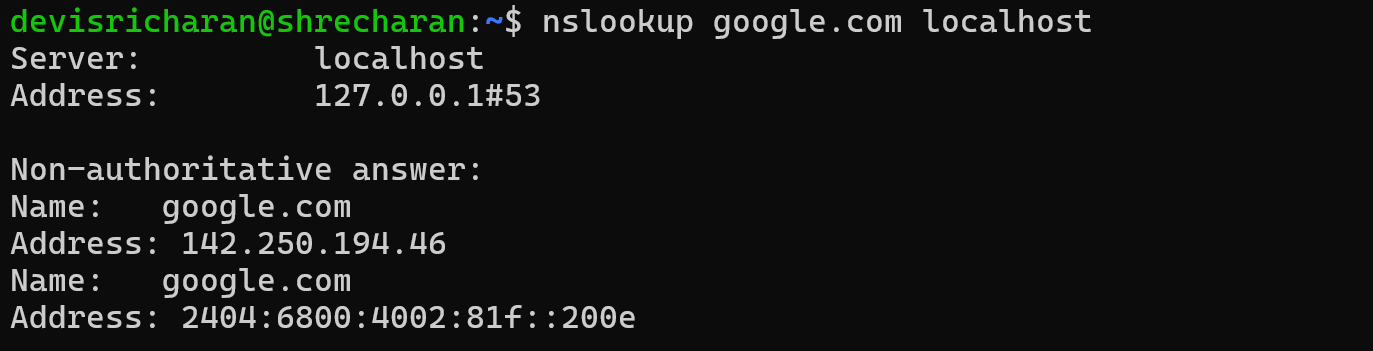
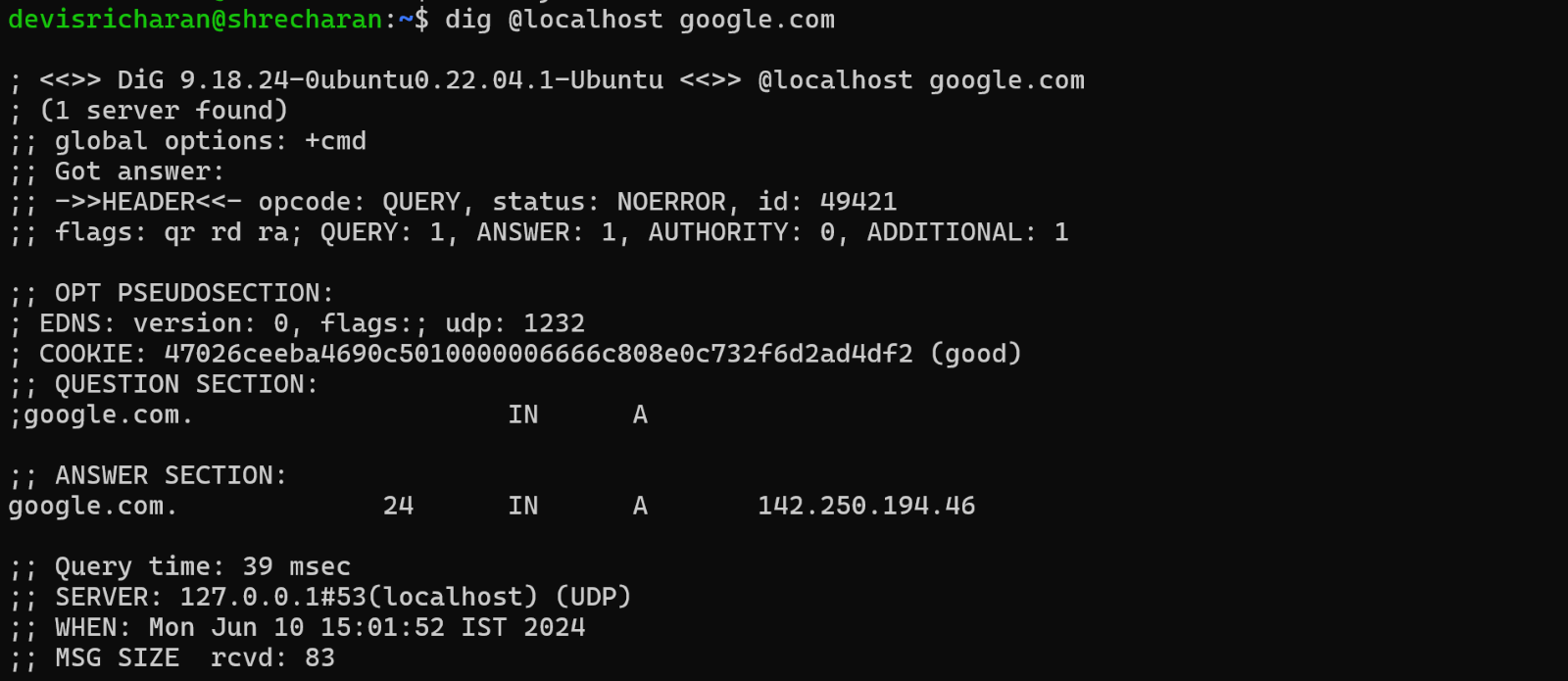
Restart the BIND service to apply the changes:

sudo systemctl restart bind9

**9. Test the DNS Server:**

Use the dig or nslookup command to test the DNS server.

dig @localhost google.com  
nslookup google.com localhost



## DNS Server Configuration

To configure your hosted DNS server to resolve specified domain names to predetermined IP addresses, we need to edit the zone files to include the necessary resource records (RRs) for each domain name.

### Steps to Configure Domain Name Resolution

**1. Edit Zone Files:**

You need to create or edit zone files to include the resource records for your domain names.

**Forward Zone File:**

I wanted to resolve www.google.com to 192.168.0.2 and mail.google.com to 192.168.0.3.

Edit the zone file for google.com:

sudo nano /etc/bind/zones/db.google.com

Modify the following content in the file:

$TTL 604800  
@ IN SOA ns1.google.com. admin.google.com. (  
 2023061001 ; Serial  
 604800 ; Refresh  
 86400 ; Retry  
 2419200 ; Expire  
 604800 ) ; Negative Cache TTL  
  
; Name servers  
@ IN NS ns1.google.com.  
  
; A records for name servers  
ns1 IN A 192.168.0.1  
  
; A records for hosts  
www IN A 192.168.0.2  
mail IN A 192.168.0.3  
  
; MX records for mail servers  
@ IN MX 10 mail.google.com.

**Reverse Zone File:**

To provide reverse DNS resolution, edit the reverse zone file.

Edit the reverse zone file for 192.168.0.x:

sudo nano /etc/bind/zones/db.192.168.0

Add or modify the following content in the file:

$TTL 604800  
@ IN SOA ns1.google.com. admin.google.com. (  
 2023061001 ; Serial  
 604800 ; Refresh  
 86400 ; Retry  
 2419200 ; Expire  
 604800 ) ; Negative Cache TTL  
  
; Name servers  
@ IN NS ns1.google.com.  
  
; PTR records for reverse DNS  
1 IN PTR ns1.google.com.  
2 IN PTR www.google.com.  
3 IN PTR mail.google.com.

**2. Update Serial Numbers:**

Every time we edit a zone file, we must update the serial number in the SOA (Start of Authority) record. This ensures that secondary DNS servers know the zone file has been updated.

The format for the serial number is typically YYYYMMDDXX, where YYYYMMDD is the date and XX is the revision number for that day.

**3. Check Configuration:**

After editing the zone files, check the configuration for syntax errors:

sudo named-checkconf  
sudo named-checkzone google.com /etc/bind/zones/db.google.com  
sudo named-checkzone 0.168.192.in-addr.arpa /etc/bind/zones/db.192.168.0

**4. Restart BIND Service:**

Restart the BIND service to apply the changes:

sudo systemctl restart bind9

**5. Test the DNS Server:**

Using the dig or nslookup command, I tested the DNS server and ensured it resolved the domain names correctly.

dig @localhost www.google.com  
nslookup mail.google.com localhost

