Problem No: 08

Problem Name: Create a Simple DNS Server

Objective

To implement a simple Domain Name System (DNS) server in Python that resolves domain names into IP addresses using a predefined mapping.

Theory

The Domain Name System (DNS) is responsible for translating human-readable domain names (e.g., example.com) into IP addresses.

DNS operates using a client-server model:

- Client sends domain query
- DNS server searches for matching IP
- Server responds with IP address

In this experiment, a simple DNS server is created using UDP sockets. The server listens for domain name queries and responds with corresponding IP addresses stored in a dictionary.

Key Concepts

- DNS resolution
- UDP socket communication
- Client-server architecture
- Domain to IP mapping

Application

DNS servers are essential for:

- Internet browsing
- Email services
- Web hosting
- Network infrastructure

Implementation in Python

Server Code (dns_server.py)

```
import socket

# Predefined DNS records
dns_records = {
    "example.com": "93.184.216.34",
    "google.com": "142.250.190.78",
    "localhost": "127.0.0.1"
}

HOST = "127.0.0.1"
PORT = 5353

server = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
server.bind((HOST, PORT))

print("Simple␣DNS␣Server␣running...")

while True:
    data, addr = server.recvfrom(1024)
    domain = data.decode().strip()

    ip = dns_records.get(domain, "Domain␣not␣found")

    server.sendto(ip.encode(), addr)
```

Client Code (dns_client.py)

```
import socket

HOST = "127.0.0.1"
PORT = 5353

client = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)

domain = input("Enter␣domain␣name:␣")
client.sendto(domain.encode(), (HOST, PORT))

response, _ = client.recvfrom(1024)
print("IP␣Address:", response.decode())
```

Execution Steps

1. Run `dns_server.py`
2. Run `dns_client.py`
3. Enter domain name (e.g., example.com)
4. Server returns corresponding IP address

Result

The DNS server successfully resolves predefined domain names to IP addresses using UDP communication.

Sample Output

Client Console:

```
Enter domain name: example.com
IP Address: 93.184.216.34
```

Discussion

This experiment demonstrates basic DNS functionality using UDP sockets. Although simplified, it reflects the fundamental principle of real-world DNS systems.

Conclusion

A simple DNS server was successfully implemented in Python. The experiment provides foundational understanding of domain name resolution and network-based client-server communication.