Project Report:

Distributed Network and

TCP Port Scanner with Web UI

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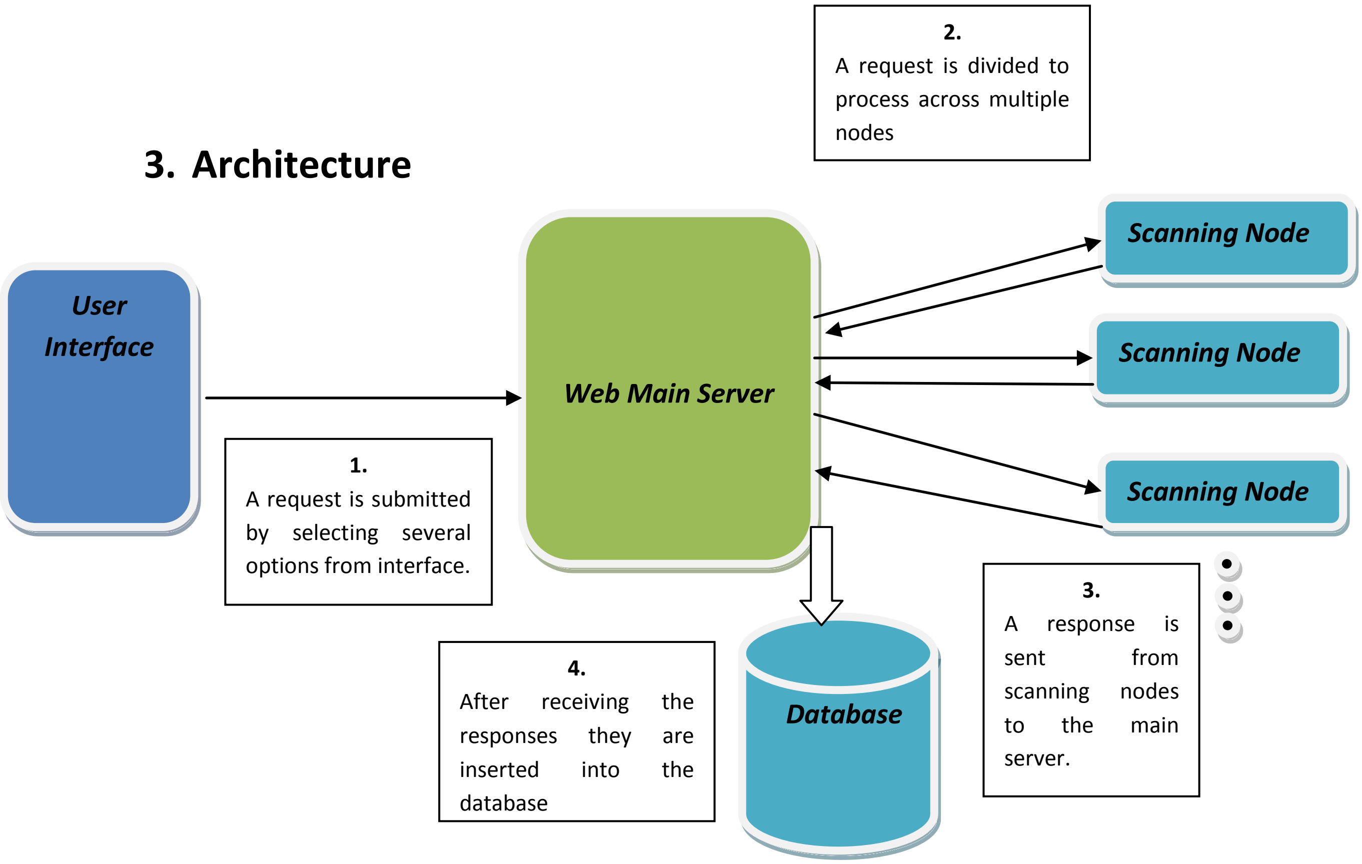
1. Introduction

Network Scanners and Port Scanners are essential tools when trying to understand the layout of a network and the services that a specific host is running. We have implemented a Distributed Network and Port Scanner with a Web UI that can be used to control the scanner. The scanner is distributed across multiple clients so that many hosts (called scanning nodes) can participate in a single scanning effort.

2. Features

- The system supports individual host scan, multiple hosts scan and host scan over a range of ports
- The system supports 3 types of port scanning mode: Normal Port Scanning (full TCP connect to the remote IP address) ,TCP SYN Scanning , TCP FIN Scanning.
- The request can be given with a random flag on so the multiple hosts or port scan does not happen sequentially.
- All the results are stored in the database and can be retrieved and also can be search by giving a specific date.

3. Architecture



2.
A request is divided to process across multiple nodes

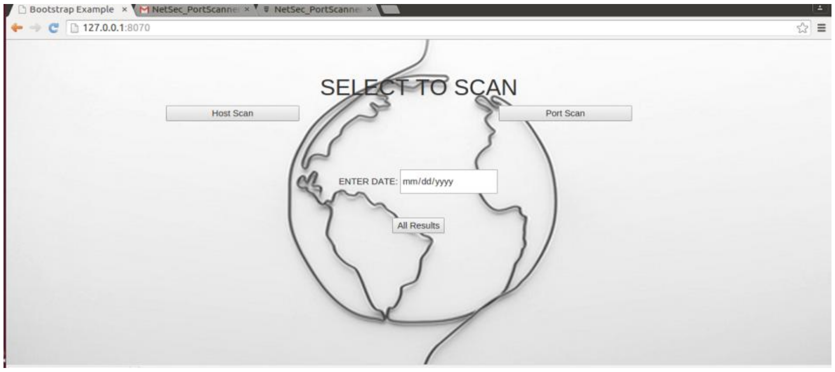
1.
A request is submitted by selecting several options from interface.

3.
A response is sent from scanning nodes to the main server.

4.
After receiving the responses they are inserted into the database

4. General Flow of the implementation

- A request is submitted from the GUI using several options.



- Once the request is submitted the server determines what the type of request is. The system supports 3 types of request. First is individual host scan, second is multiple host scan and third is multiple ports for a single host scan.
- According to the request the number of scans perform are divided equally amongst the scanning nodes which are clients and the individual clients request is sent.
- Both server and scanning nodes support the mechanism of producer consumer queue to handle requests asynchronously.
- The requests are processed and the response packet containing the results is sent back to the main server.
- The server after receiving the responses inserts them into the database.
- The user can then view the results obtained.

5. Implementation Notes

- GUI is implemented using HTML/Javascript and jQuery
- The web server is implemented in Python
- The distributed architecture is implemented using TCP network programming in Python
- The scanning nodes use the scapy library in python.
- Database is implemented using SQLLite3.

6. Database Tables

Following are the tables created in the database to store the requests and the responses:

1. IPINFO is the main table in which all submitted requests are kept into the database.

```
CREATE TABLE IPINFO
(
        IP TEXT,
        TYPE INTEGER,
        ALIVE BOOLEAN,
        TIME DATETIME,
            DATE1 DATE,
            LENGTH INTEGER,
            PRIMARY KEY(IP,TIME)
)
```

IPINFO

IP	TYPE	ALIVE	TIME	DATE1	LENGTH

- IP – Ip address
- Type – Type of Request – 1 – Host Scan 2- Multiple Host Scan 3 – Multiple Port Scan
- ALIVE – Flag set if the IP is alive
- TIME – time stamp of the request
- DATE1- date of the request
- LENGTH – No of ports or no of hosts for type 2 or 3 respectively.

2. PORTDATA is the table which holds data of the responses of the port scan requests.

```
CREATE TABLE PORTDATA
(
            PORT INTEGER,
            IP TEXT,
            TIME DATETIME,
            ALIVE BOOLEAN,
            DATE1 DATE,
            FOREIGN KEY(IP,TIME) REFERENCES IPINFO(IP,TIME)
)
```

PORTDATA

PORT	IP	TIME	ALIVE	DATE1

- PORT – Port number
- IP – Ip address
- TIME – Time stamp of the request
- Alive – Set to tru if the port is alive
- DATE1 – Date of the request

3. IPDATA is the table which holds data of the responses of multiple hosts scan.

```
CREATE TABLE IPDATA
(
            IP TEXT,
            ALIVE BOOLEAN,
            TIME DATETIME,
            DATE1 DATE,
            FOREIGN KEY(IP,TIME) REFERENCES IPINFO(IP,TIME)
```

)

IPDATA

IP	ALIVE	TIME	DATE1

IP – Ip address
ALIVE – Set if the IP address is alive
TIME – time stamp of the request
DATE – date of the request

7. Important functions description

Server.py

- **def add_client(): -**
  This function is to add new scanning nodes and to store the client address in the list handled by the server

- **def client_listen():**
  This function is listening on a specific port for new scanning node to be added

- **def send_client(client_address, request,start, end, ip_list):**
  This function is used to send the request to scanning nodes

- **class ConsumerResponseThread(Thread):**
  def ProducerResponse(response):
  This is producer consumer queue for the responses obtained from the clients.

- **class ConsumerThread(Thread):**
  def Producer (request):
  This is producer consumer queue for the request sent to the client.

client_code.py

- **def scan_ip(ip_list):**
  This functions scans a list of ip's given to it.

- **def scan_port_ack(port_list,ip_addr,logger):**
  This function takes in a list of ports and scans using SYN scanning.

- **def scan_port_connect(port_list,ip_addr,logger):**
  This function takes in a list of ports and scans using full connect scanning.

- **def scan_port_fin(port_list,ip_addr,logger):**
  This function takes in a list of ports and scans using FIN scanning.

8. Testing

Following scenarios have been tested

- Checked if the single host is alive and check if the result is displayed correctly in UI.
- Checked if multiple host scan is working with and without random flag set and all the host results are correctly displayed
- Checked if the multiple port scan is working with and wothout random flag set and all the port results are correctly displayed.
- Checked if the requests are getting properly divided among all the scanning nodes
- Checked if the results can be obtained by searching date.
- Checked if all the three scanning modes are working.

9. Instructions :

NOTE: Please change your internet connection to Wolfie-Guest. (Wolfie-Secure/Open blocks the ICMP packet which is required for pinging the server).

STEPS TO RUN THIS PROJECT:

- STEP 1: Install Scapy and NetAddr packages for python (Scapy : http://www.secdev.org/projects/scapy/ || NetAddr : https://pypi.python.org/pypi/netaddr)
- STEP 2: On machine which you will like to be a server run portscanner_db.py
  (Eg: python portscanner_db.py)
- STEP 3: Initialize server by running in Server.py
  (Eg: python Server.py)
- STEP 4: On Client machines start client by running client_code.py using sudo command or being a root with a command line argument of a port number. For eg "sudo python client_code.py 10005"
- STEP 5: You are set to go you can access service on port 8070 (eg: 127.0.0.1:8070)

10.Resources for reference

- https://docs.python.org/2/howto/sockets.html - Socket Programming
- http://pymotw.com/2/socket/tcp.html - To develop the Client Server communication
- http://www.pythonforpentesting.com/2013/10/port-scanning-with-python.html - Banner Grabbing
- https://securitylair.wordpress.com/2014/02/21/simple-port-scanner-in-python-with-scapy-2/ - Scapy Implementation
- http://agiliq.com/blog/2013/10/producer-consumer-problem-in-python/ - Producer Consumer Problem