Email Server exploration with raspberry pi and docker (March 2020)

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***Abstract*— The assigned project was to create a network application layer, an email server, and its exploration with a raspberry pi. A citadel email server and client were built and run on docker files on raspberry pi. A connection was established by sending the mail between the server and client, and a pcap file was generated.**

***Index Terms*— email server, docker, raspberry pi 4**

I. INTRODUCTION

A. Overview

One of the major advantages is to setup an email server on the Raspberry Pi 4 as it costs comparatively low. Other advantages include that one has entire control over personal communication by creating customized domains. We build an email server, citadel, as well as a client, a web-based application to send in emails with our customized domain. The communication of the server clients was successfully captured on the Wireshark tool, and a pcap file was generated.

B. Project Goals

The project goal was to build an email server container that ran on the RPI and a client on Kali on x86_64 VMware guest. We used the citadel email server as specified to us. An email server environment needed to be built first through source code compilations and dockerized and run on the RPI. After that, we need a client application, in our case, the web browser graphical user interface to connect to the server so that users can send and receive emails using the server. Finally, the communication needed to be established between a server and client and the same communication needed to be observed in any packet analyzing tool, Wireshark, and a pcap file needed to be generated.

II. PROJECT EXECUTION

A. Building Email Server and Client

Based on the requirements provided in the Citadel suite website we started compiling a install.sh script file. We used the help of the documentation and easy install guide to obtain the “install.sh” shell script. Running the script file should do core function like downloading source code and dependencies, configure, make, make install, and start the setup of citadel suite. The source of the server can be obtained from the command “apt-get source citadel-server”. The necessary dependencies include Berkeley DB v4.1 or newer, libical v0.26 or newer, libSieve v2.2.3 or newer. Then the install.sh script executes the commands: ./configure, make and make install.

Once the build script “install.sh” was obtained. We created a Dockerfile based on the “systemdubuntuserverenv” Dockerfile provided. This Dockerfile was executed on the Raspberry PI 4 as a “buildserver” container. Since there were many manual inputs required for the installation, we went into the bash of the container running and ran the script “install.sh” that was copied into the container during building of the image. We noticed that specific inputs are required for the proper installation and working of the server which are provided in the deliverables.

Figure 1: Running the install.sh script inside the container

After running the installation, we will commit this container to an image “runtimeserver” to obtain our runtime server environment

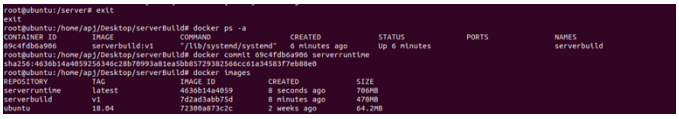

Figure 2: Commit to “runtimeserver” image

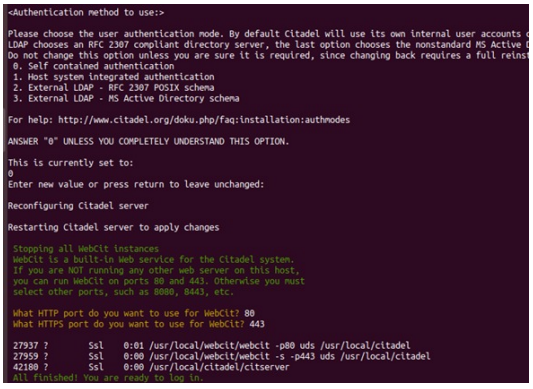

Figure 3: WebCit interface ports 80 and 443

As Figure 3 shows, the Server is correctly installed and we are ready to login to our website browser, also note that the interface ports that is required to communicate with the server is provided as 80 and 443 or HTTP/HTTPS ports, this is so that we can communicate using our web browser which is required.

Since our application was an email server, the client used for communicating with the server is a web browser, which can be obtained in the VM freely and does not require any configurations or installations.

B. Running Citadel Email Server and Client

For running the email server, we initially note down the IP address of the RPI, for us this was "192.168.1.20". After which we run the docker image that was created after committing "runtimeserver".

We now go the client, that is Kali VM and open the Firefox browser, from which we type the IP "192.168.1.20" in the URL. We can see that this redirects to the login page of the citadel server.

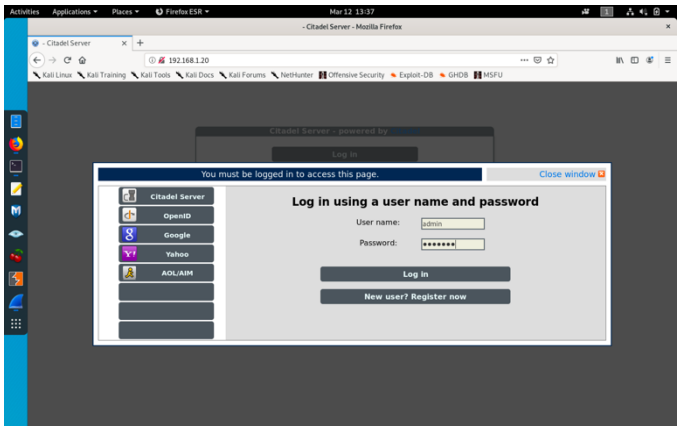

Figure 4: Client connecting to the server

The admin can access and change any required settings in the server.

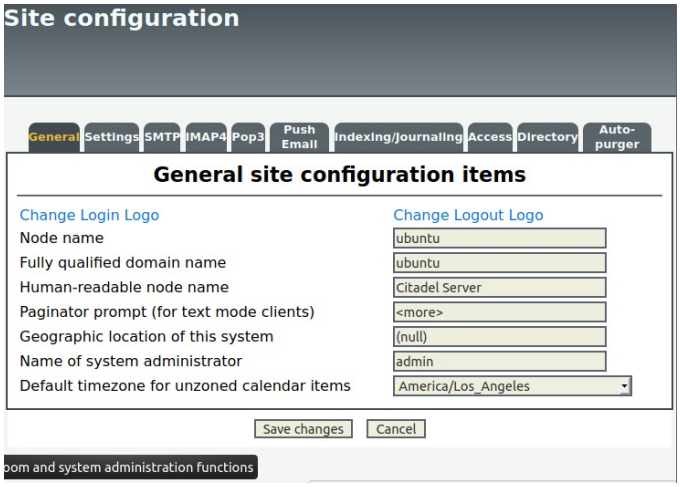

Figure 5: Domains can be customizable

C. Collecting Network Packets with Wireshark

Now that the any user can access the server container running on the RPI from the VM's Firefox browser, they can start sending mails with each other. For this purpose, we have created another user "test", whose email address is "test@ubuntu".

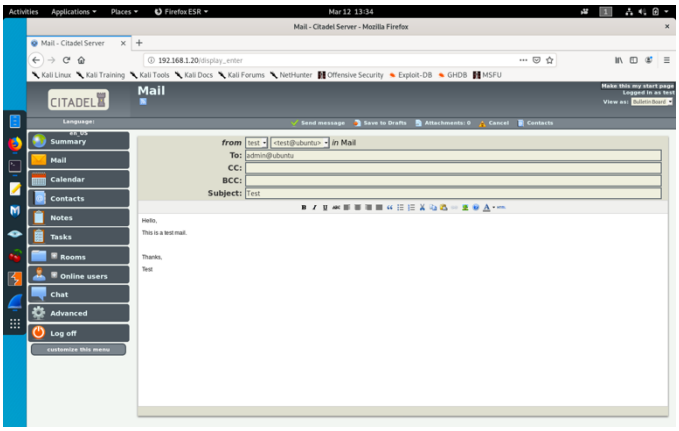

Figure 6: Sending a mail from test@ubuntu to admin@ubuntu

Figure 6 shows user "test" sending a mail to user "admin". Now we login as admin and the read the email, this can be seen in Figure 7.

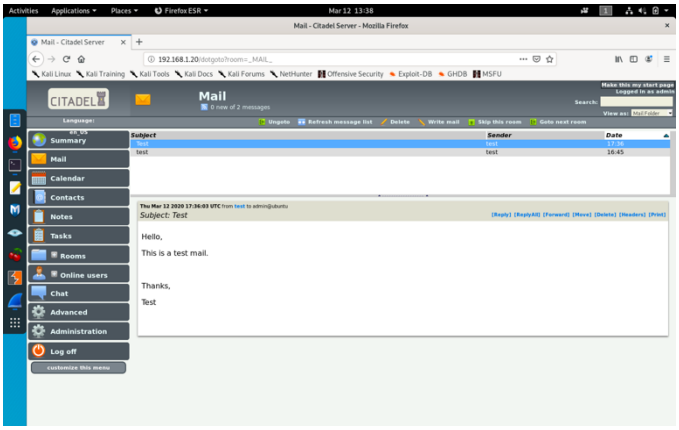

Figure 7: Email received by the admin@ubuntu

We can see that the user admin was able to receive the mail. While doing this procedure, we simultaneously track the packets from the client to server through a packet analyzing tool, Wireshark. The pcap file is obtained for the connection. The following is a screenshot for the pcap file.

Figure 9: PCAP file for the server-client connection

III. Conclusions

Our project goal to build an email server(citadel) and client on: Kali x86 _64 VMware guest with docker was successful. We build and executed a citadel server for email server and the client, the Firefox web browser, was able to send and receive emails. We were able to dockerize the server built in a container on the RPI and the client browser was able to communicate with the server. The communication established between the server and the client was observed in any packet analyzing tool, Wireshark. A pcap file was generated with the correct result.

References

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