Design of a Local Area Network Optimized for Video Streaming

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***Abstract*— The present work consists in the design of a local area network used for video streaming for which the respective investigation and analysis of an app that will transmit video through WIF, in this case the app is called IP Webcam. Based on the information obtained about the functions of the application, a local area network was created and configured using a wireless router to adjust it to the necessities of the app and optimize its performance. Once the router had the correct configuration, the traffic of the network and the range was analysed to define the protocols that are being executed and know the limitations of the video streaming. Once all the test was concluded, the analysis showed that a wireless local area network used exclusively to stream allows the delay of the video received to be minimum and free the network's wideband to allow a higher rate of transmission.**

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I. Introduction

At present, the demand for access to the internet service is increasing and, in turn, the services through the internet have become more quoted. This has allowed the services previously offered in an analogous way, to offer them in a digital way and through Internet networks. One of the services that have become very popular within the internet is the streaming [1].

Streaming consists of that type of technology that allows the visualization of audio or video files, directly from the Internet, through a web page or by a mobile application without having to download the multimedia content in the device prior to its reproduction. This 'distribution of content on the internet', it is possible to visualize it as the file uploads.

In a streaming type of transmission, multimedia data is never stored on the user's computer, so it is safer to use this type of distribution because it prevents plagiarism of content. In addition, streaming allows you to watch or listen to live and live broadcasts through specific players or on a web page. This technology is now implemented as security through IP cameras in addition to other applications such as digital television or live broadcasts [2].

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II. Method of Implementation

There are several applications for smartphones that allow video transmission over the Wi – Fi network, however, in this project we use the IP Webcam application in its free version to reduce implementation costs.

The configuration of the wireless router was also done to establish the IP of the network, to enable the wireless access to the router to allow the transmitter to connect wirelessly and thus to have a portable transmitter and defines the amount of IP available for the network what It results in limiting the amount of viewer of the streaming and thus maintain the quality of the video while the bandwidth of the network is conserved.

A wireless network was designed by means of a wireless router in addition that this allows to visualize the streaming through the Wi – Fi of the network.

This network could assign an IP address to the transmitting device so that the web server could be created through the IP Webcam application and thus could access the web server and streaming from any device connected to the network either Wirelessly or via cables [1] [2].

For the implementation of the WLAN network, a Trendnet TEW-711BR wireless router was used. It is necessary to reset the router to its factory configuration and connect to it by means of a network cable. For this project, it was necessary to configure the router as a DHCP server because it allows clients to automatically connect to the network and dynamically assign them an IP address without having to manually configure the network in each of the devices that to watch the streaming [3].

Within the DHCP server settings, the pool of IP addresses available for allocation to the clients is placed. The control of the amount of IP addresses that the router can assign allows controlling the number of devices that can be connected to the network and therefore to control the number of clients that can accede to the stream to control the traffic of the network and to maintain the quality of the streaming service.

Another necessary configuration in the router for this project is the Wi – Fi configuration of the router. In this case, it is necessary to enable the wireless part of the router, assign an SSID corresponding to the streaming application,

select the channel in which the Wi – Fi will operate, the standard with which it will work and the bandwidth of the channel.

For the transmitter, a mobile application was used to transmit video over a Wi – Fi network. IP Webcam is an application for mobile phones with Android operating system, which allows to use in working together with a PC, the camera of an Android mobile device connected via Wi – Fi to a local network as a webcam. You can give several applications to this tool, but we must remember that the mobile device must be connected to the local network where the PC is located from where the video content is to be monitored. Once the device is connected to a Wi – Fi network, the IP Webcam application will use the IP address assigned to the device as the address for the web server where the streaming recorded by the application will be uploaded. Within the application settings there are several settings for video quality or image resolution.

For this project the following configuration was used within the application:

- Video Resolution: 1920 x 1080
- Image Quality: 50%
- Maximum FPS limit: 30 FPS
- Primary Address: IPv4
- Port: 8080
- Audio and sensors enabled

Some of the configuration parameters of the application were defined to the limit to test the transmission to its maximum capacity and other parameters are defined per the characteristics of the mobile device used and the wireless network [1]. Once the web server is started within the IP Webcam application, the complete IP address, including the port, that the camera is using can be observed and this is the address to which the final devices must access to be able to watch the video that is being transmitted through the network.

III. Analysis of Results

An analysis of the traffic that exists within the network of video streaming was carried out to determine the protocols and the types of communication that are being carried out within the network. For this the Wireshark program was used inside a computer connected to the local network. It is important to note that the local network is used exclusively for video streaming so all data obtained in Wireshark correspond to packages that are carried out within the video streaming application. Figure 1 shows some data packages analyzed in the video streaming network traffic where it can be seen that there are four protocols that are mainly used. These are DNS, TCP, HTTP and DHCP [1].

The DNS protocol is established when initiating a communication between a client and a router as it is sought to assign the DNS server address in the parameters of the client's network to access web pages. The DNS protocol is one of the first to appear when analyzing the network traffic and that in the first DNS packet, the client makes a DNS request to the router, whereas in the second packet, the router reuses to assign a DNS address to the client. This is because this network is a LAN without internet access so it has no connection to any external page and therefore there is no need to assign a DNS address to the network. The only web page that can be accessed within this network is the web interface of video streaming and must be accessed by means of the IP address of the transmitter.

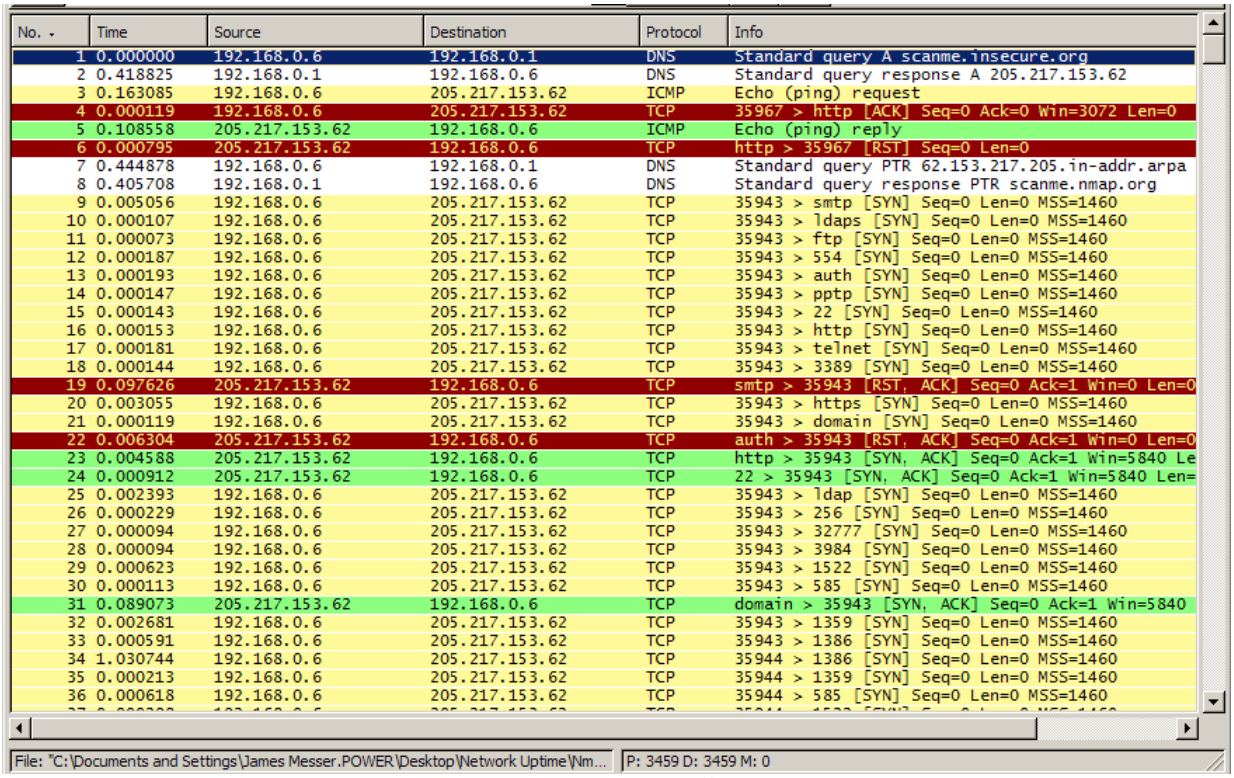
In the Wireshark analysis, it is also observed that the same client makes several IP address requests to the router from time to time. This is because the assigned IP addresses are temporary and expires after a certain time, however, if the device is still connected to the network, another IP request is made and assigned the same IP that it already had and can follow connected to the network. This temporary assignment does not affect streaming performance since it is performed at high speed so that the user does not notice that their IP address has expired [1] [2].

In video streaming, because the IP Webcam application creates a web server to transmit the video, all the content of the streaming is inside a web page and therefore it is necessary to use the HTTP protocol. It can be seen in the packet captures of Wireshark that the HTTP protocol is mainly used when the user performs some action within the web interface of the video streaming either to enable sensors, or to verify the status of the video.

The web interface is used as the controller of the video parameters and therefore the HTTP protocol will only be used when any changes are made within the web interface of the application.

The transmission control protocol or TCP is one of the fundamental protocols on the Internet and in addition the main within the video streaming application. This protocol creates connections between two devices through which a data stream can be sent. The protocol guarantees that the data will be delivered to its destination without errors and in the same order in which they were transmitted. This protocol is responsible for transmitting the video streaming packets in a secure way and for this must first be logged in. In the captures of the data packets it is possible to be seen in red the moments in which the TCP protocol was restarted and just below grays a TCP session is observed. The transmitter sends synchronization packets and the receiver responds to packets with an ACK packet. After having made the connection between the two devices, through the TCP protocol, the data packets of the transmitted video are sent until the TCP protocol is restarted and the session is closed between the devices. It can also be seen in the source and destination IP addresses that a direct communication

between the two devices takes place in the TCP protocol [2] [3].



No.	Time	Source	Destination	Protocol	Info
1	0.000000	192.168.0.6	192.168.0.1	DNS	Standard query A scanme.insecure.org
2	0.418825	192.168.0.1	192.168.0.6	DNS	Standard query response A 205.217.153.62
3	0.163085	192.168.0.6	205.217.153.62	ICMP	Echo (ping) request
4	0.000119	192.168.0.6	205.217.153.62	TCP	35967 > http [ACK] Seq=0 Ack=0 Win=3072 Len=0
5	0.108558	205.217.153.62	192.168.0.6	ICMP	Echo (ping) reply
6	0.000795	205.217.153.62	192.168.0.6	TCP	http > 35967 [RST] Seq=0 Len=0
7	0.444878	192.168.0.6	192.168.0.1	DNS	Standard query PTR 62.153.217.205.in-addr.arpa
8	0.405708	192.168.0.1	192.168.0.6	DNS	Standard query response PTR scanme.nmap.org
9	0.005056	192.168.0.6	205.217.153.62	TCP	35943 > smtp [SYN] Seq=0 Len=0 MSS=1460
10	0.000107	192.168.0.6	205.217.153.62	TCP	35943 > ldaps [SYN] Seq=0 Len=0 MSS=1460
11	0.000073	192.168.0.6	205.217.153.62	TCP	35943 > ftp [SYN] Seq=0 Len=0 MSS=1460
12	0.000187	192.168.0.6	205.217.153.62	TCP	35943 > 554 [SYN] Seq=0 Len=0 MSS=1460
13	0.000193	192.168.0.6	205.217.153.62	TCP	35943 > auth [SYN] Seq=0 Len=0 MSS=1460
14	0.000147	192.168.0.6	205.217.153.62	TCP	35943 > pptp [SYN] Seq=0 Len=0 MSS=1460
15	0.000143	192.168.0.6	205.217.153.62	TCP	35943 > 22 [SYN] Seq=0 Len=0 MSS=1460
16	0.000153	192.168.0.6	205.217.153.62	TCP	35943 > http [SYN] Seq=0 Len=0 MSS=1460
17	0.000181	192.168.0.6	205.217.153.62	TCP	35943 > telnet [SYN] Seq=0 Len=0 MSS=1460
18	0.000144	192.168.0.6	205.217.153.62	TCP	35943 > 3389 [SYN] Seq=0 Len=0 MSS=1460
19	0.097626	205.217.153.62	192.168.0.6	TCP	smtp > 35943 [RST, ACK] Seq=0 Ack=1 Win=0 Len=0
20	0.003055	192.168.0.6	205.217.153.62	TCP	35943 > https [SYN] Seq=0 Len=0 MSS=1460
21	0.000119	192.168.0.6	205.217.153.62	TCP	35943 > domain [SYN] Seq=0 Len=0 MSS=1460
22	0.006304	205.217.153.62	192.168.0.6	TCP	auth > 35943 [RST, ACK] Seq=0 Ack=1 Win=0 Len=0
23	0.004588	205.217.153.62	192.168.0.6	TCP	http > 35943 [SYN, ACK] Seq=0 Ack=1 Win=5840 Le
24	0.000912	205.217.153.62	192.168.0.6	TCP	22 > 35943 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=
25	0.002393	192.168.0.6	205.217.153.62	TCP	35943 > ldap [SYN] Seq=0 Len=0 MSS=1460
26	0.000229	192.168.0.6	205.217.153.62	TCP	35943 > 256 [SYN] Seq=0 Len=0 MSS=1460
27	0.000094	192.168.0.6	205.217.153.62	TCP	35943 > 32777 [SYN] Seq=0 Len=0 MSS=1460
28	0.000094	192.168.0.6	205.217.153.62	TCP	35943 > 3984 [SYN] Seq=0 Len=0 MSS=1460
29	0.000623	192.168.0.6	205.217.153.62	TCP	35943 > 1522 [SYN] Seq=0 Len=0 MSS=1460
30	0.000113	192.168.0.6	205.217.153.62	TCP	35943 > 585 [SYN] Seq=0 Len=0 MSS=1460
31	0.089073	205.217.153.62	192.168.0.6	TCP	domain > 35943 [SYN, ACK] Seq=0 Ack=1 Win=5840
32	0.002681	192.168.0.6	205.217.153.62	TCP	35943 > 1359 [SYN] Seq=0 Len=0 MSS=1460
33	0.000591	192.168.0.6	205.217.153.62	TCP	35943 > 1386 [SYN] Seq=0 Len=0 MSS=1460
34	1.030744	192.168.0.6	205.217.153.62	TCP	35944 > 1386 [SYN] Seq=0 Len=0 MSS=1460
35	0.000213	192.168.0.6	205.217.153.62	TCP	35944 > 1359 [SYN] Seq=0 Len=0 MSS=1460
36	0.000618	192.168.0.6	205.217.153.62	TCP	35944 > 585 [SYN] Seq=0 Len=0 MSS=1460

File: "C:\Documents and Settings\James Messer.POWER\Desktop\Network Uptime\Nm... P: 3459 D: 3459 M: 0

Fig. 1. WLAN Network Traffic [1].

IV. Conclusions

By means of the analysis made based on the configuration of a WLAN network and the results observed in the continuous transmission of video through this network, it is possible to conclude the following: The streaming service presents great advantages so it is not necessary previous download of multimedia data files for viewing, as these are loaded into the buffer and playing at the same time. Thanks to this technology, several client devices can access the data at the same time and that the servers perform a broadcast type transmission for all the devices that are in the network.

The number of clients that the server supports must be limited by the pool of IP addresses that the router provides to the devices, since access to the video is done through IP addresses and by limiting the number of concurrent users has the web server; the quality of service is maintained.

Using a network exclusively for the streaming service allows all the bandwidth to be focused on the video and control packets of the stream, allowing a transmission with less delay and allowing more simultaneous clients within the stream.

Through the analysis of network traffic, during a stream, it is observed that several TCP sessions are being opened to send the video packets which, in this case, are controlled through a web interface, so there are HTTP packets within the TCP session. Once a certain number of packets have been sent, the TCP session is closed and a new TCP session is reopened to continue sending the video packets.

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