Research and Development of a WebRTC Application in an

Effort to Send Data Using Covert Channels by Image Filtering

An Abstract of a

Thesis Presented to the

Department of Computer Science

Western Illinois University

In Partial Fulfillment

of the Requirements for the Degree

Master of Computer Science

By

Dennis McMeekan

May, 2021

ABSTRACT

“WebRTC is an open-source web-based application technology, which allows users to send real-time media without the need for installing plugins” [1]. This type of technology has become a main-stay in all industries, and more specifically WebRTC being open-source has allowed for researchers and developers across the world to discover new advancements and heights of real-time communication without prior installations or requirements. Although this has provided a great source of real-time communication, there are still concerns with this being a relatively new application. This study will look further into data integrity regarding these types of applications, along with briefly discussing the issue of solving IP leaks through a distributed hash table. To further develop this topic, a simple WebRTC application has been created with the purpose of sending a bit based on a delay in data being received from one peer to another, focusing on the bitrate, round-trip-time, framerate, and error rate. Furthermore, this issue will then be mitigated to ensure that individuals developing a WebRTC application can further prepare for defense against such attacks or misusage.

APPROVAL PAGE

This thesis by **Dennis McMeekan** is accepted in its present form by the Department of Computer Science of Western Illinois University as satisfying the thesis requirements for the degree Master of Computer Science.

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**CHAPTER ONE**

**INTRODUCTION**

In a cultural and technology environment that is continuously evolving, real-time communication is more essential than ever for individuals to complete daily tasks such as school, work, and personal communication. “Live chat has become the leading digital contact method for online customers, as a staggering 46% of customers prefer live chat compared to just 29% for email, and 16% for social media” [2]. With the reach of internet to all points of the world, it is realistic to see that real-time calls between two or more individuals will be the main product for online communication methods. In recent years, WebRTC applications have been used to establish real-time communication between two or more peers. This application provides limitless advantages to web developers across the entire world, but with these advantages, there are also disadvantages. The main focus of this study is to determine the security factors that may be exploited with WebRTC and mitigating these issues. The emphasis for the research and project portion was data integrity, along with a brief survey on IP leaks. Data integrity is an issue because of WebRTC’s open-source model, clients hold the ability to alter the actual data that is being sent from one peer to another using the API provided. It has been found that through the altering of data, a delay can be implemented in real-time on one client’s side, and then based on that delay the receiving client can receive a piece of information (a bit) based on the delay. This means that with no knowledge to the administrator or server side, a message or data can be sent secretly from one peer to another. This was discovered using WebRTC’s API and different test elements such as the bitrate, round-trip-time, and framerate in an effort to determine the error rate. Beyond this, IP leaks is highly discussed as a security flaw with WebRTC applications, as in most cases the user’s public IP address is used directly. This is commonly addressed with the

use of a VPN (Virtual Private Network), but in almost all cases this can be a costly effort and can be limited in the data limitations of the client.

no protocols have been established on proper use of these type of applications. With this idea on the forefront, we wanted to capitalize on the security aspects of WebRTC, focusing on data integrity. This is the reliability of secure data transfer from one individual to another. It was established that by implementing a delay in data transfer from one client to another, a bit can b

sent and received based on this delay by the other client. This is vital security flaw, as data can be transferred secretly through clients without any control by the administrator. There are prevention methods with this, by implementing random delays on the server or administrative side. This will greatly increase the error rate.

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