UNIVERSITY OF CALIFORNIA, DAVIS

PROPOSAL

Analyzing Voice-over-IP at UC Davis

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Mark Redican

This project will analyze threats to privacy and security of Voice-over-IP (VoIP) users at UC Davis. These threats are not specific to the campus, but are of interest for any large network operator and the security research community. The total budget for this project is $80,506.07 and the deliverables include a final written report, a poster and a publication.

Keywords— VoIP Security, Telephone Security, Internet Telephony, Computer Security

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1 Executive Summary

2 Motivation

Information and Educational Technology (IET) of UC Davis has started to roll-out voice-over-IP (VoIP) for the whole campus. Currently, there are 1,500 VoIP clients on the campus. By the end of this year, most clients should be upgraded from the traditional telephone network to VoIP. By enabling telephones to communicate over IP, one has to consider additional security risks. In order to evaluate the security and privacy concerns, IET would like this team to perform an analysis regarding these issues. This report will help IET to harden the VoIP network further and protect thousands of students and employees of UC Davis.

The VoIP network has to meet specific user requirements to increase the acceptance of this new system. Two significant properties are security and privacy. Users have to be able to trust the network that their conversations will be private. This is particularly important for institutes like Student Health and Counseling Services (SHCS), which offer service via phone and will deal with very sensitive details.

Furthermore, our research will also apply to others. Since most networks use the same standard for VoIP, our possible findings will be important to other infrastructure providers. Hence, our project is of interest to the security research community as well.

3 Previous Work

4 Specific Aims

The goals of this project are to:

- evaluate possible threats to the privacy of phone calls by using a network sniffer to listen to unencrypted SIP packets.
- analyze the risk of identity faking and social engineering by using CallID spoofing.
- assess the security of the voice-over-IP network by performing man-in-the-middle and DoS attacks.

5 Plan

We will follow the steps listed below in that order to reach the goals given in section **??**.

1. We will build a test environment which is close to the real one and in which we can conduct our research with as few consequences for other users as possible.
2. We will install an ethernet packet sniffer to listen for SIP packets. We will record all these packets, pseudonymize them and build communication profiles from them which includes: Who speaks to who and how long is each conversation. We hope to build a social graph from this data.
3. We will modify SIP packets to hide our identity (CallID spoofing).
4. We will impersonate a PBX (man-in-the-middle) to redirect calls and listen on fully encrypted conversations by performing a timing attack.

Further steps and directions of this research project will be decided on the basis of the results of above experiments and in close reconciliation with the technical director.

6 Deliverables

1. Project Progress Report: This report will be delivered at the end of the Winter Quarter and will contain the research project progress.
2. Biweekly Progress Update: We will update the technical director, Mark Redican, about our progress through email on a biweekly basis.
3. Research Paper: Voice-over-IP Vulnerabilities At UC Davis. This report will be delivered at the end of the Spring Quarter and will specifically layout results of our research.

7 Data Management Plan

Network traffic data collection is essential for this project. We will use UC Davis computing resources to perform network sniffing, and will store the data on the campus systems. If during data collection we happen to collect information not private to our test set-up, we will not store such information.

8 Issues

9 Biographies

Dixit Paudel is a Master's student at UC Davis with a strong interest in the field of security and networking engineering. He earned his Bachelors in Electrical Engineering during the course of which he worked on several projects involving network communication. In addition, he has professional working experience as a software engineer in the field of the Internet of Things for about three years.

Mark Weber is a Master's student, who is currently studying abroad at UC Davis. He got his Bachelor's degree in 2026 at RWTH Aachen University. While his focus is on Machine Learning and Computer Graphics, he has a strong background in low-level programming and optimization. Furthermore, he has experience in research projects regarding IT Security, e.g. security of neural network based speech-recognition-systems.

10 Timeline

Activity	Feb 15-28	Mar 01-15	Mar 16-31	April 1-15	May 1-15	
Project Approval & Equipment Setup	X					
Build Communication Profiles		X				
Final Progress Report & Presentation			X			
Call ID Spoofing & Man-in-the-middle attack				X		
Network Subversion & Network Disruption					X	
Final Report & Presentation						X

11 Budget

Table **??** lists all costs for this project. This team consists of three members, who will work on this project for two quarters. Therefore, most of the items are needed in the quantity of $3 * 2 = 6$ units. The salaries and benefits ensure that we will be able to follow our schedule and finish this project in time. Since one of our deliverables is a written report that will be published, the travel costs are necessary to present our work at a conference. For our research, we will need six CISCO IP phones of model 7800 costing $120 each and a TP-Link 16-Port Gigabit Desktop/Rackmount Switch of $60. The tuitions for all team members are necessary costs to make sure the team can focus on this project. Additionally, UC Davis requires an indirect costs rate of 56.5%.

Table 1: This table lists all items and costs that are necessary to accomplish this project.

Item	**Costs**	**Units**	**Total**
Salaries	$4,813	6	$28,787
Benefits	$63	6	$378
Travel Costs	$1,250	3	$3,750
Equipment	$780	1	$780
Fees	$12,130	6	$72,780
Indirect Costs	$2,789.28	1	$2,789.28
Total			**$80,506.07**

12 Broader Impact

A Research Conference