CSE 571S: Network Security, Fall 2018

Instructor: <u>Ning Zhang</u>, zhang.ning@wustl.edu

Meeting: TuThu 10:00 pm - 11:30 pm

Classroom: Lopata 202

Course Description

This course covers principles and techniques in securing computer networks. Real world examples will be used to illustrate the rationales behind various security designs. There are three main components in the course, preliminary cryptography, network protocol security and network application security. Topics include IPSec, SSL/TLS, HTTPS, network fingerprinting, network malware, anonymous communication, and blockchain. The class project allows students to take a deep dive into a topic of choice in network security.

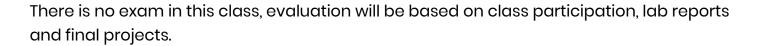
Textbook

There is no textbook for the class. We will use research papers for some of the topics. However, the following references can be helpful.

- Network Security: Private Communication in a Public World (2nd Edition) by Charlie Kaufman, Radia Perlman, and Mike Speciner
- <u>Computer Security: A Hands-on Approach</u> by Wenliang Du

• A Graduate Course in Applied Cryptography by Dan Boneh and Victor Shoup

Grading



Labs	55% (14 + 14 + 14 + 13)	

Schedule

Slides, Lab Assignments and QA are in the WUSTL backboard system.

Date	Topics	Reading	HW/Lab Assignment
8/28/2018	Course Overview, Security Fundamentals	Reflections on Trusting Trust	
8/30/2018	Network Protocol Attacks - Packet/IP/TCP	A Look Back at "Security Problems in the TCP/IP Protocol Suite" IP spoofing demystified	TCP/IP Attack Lab (1 week)

9/11/2018	Block Cipher, Modes of Operations	Kaufman Ch 4	Blockcipher lab (1 weeks)
9/13/2018	Key Exchange, DH	Kaufman Ch 6, 7	
9/18/2018	Assymmetric Crypto	Kaufman Ch 6, 7	
9/20/2018	Hash Functions, MAC	Kaufman Ch 5	MD5 - Collision Lab (1 week)
9/25/2018	Authentication	Kaufman Ch 9	
9/27/2018	PKI, CA	Kaufman Ch 15	
10/2/2018	IPSec	Kaufman Ch 17,18	
10/4/2018	TLS	Kaufman Ch 19	PKI Lab (1 week)
10/9/2018	HTTPS		
10/11/2018	Web Security		
10/16/2018	Fall Break - No class		
10/18/2018	DNS, DDoS		Term Project Topic Selection
10/23/2018	Firewall / Intrusion Detection	Kauffman Ch 23	
10/25/2018	Network Scan and Fingerprinting		
10/30/2018	Project lightning talk		Term Project Status Report
11/1/2018	Blockchain	<u>bitcoin</u>	
11/6/2018	Blockchain Attack and Defense		
11/8/2018	Limitation of Blockchain		

11/15/2018 Attack and Defend

Attack and Defense

11/20/2018 Limitation of Smart

Contract

Term Project
Project Status

Report

11/22/2018 Thanksgiving Break -

No class

11/27/2018 IoT Security

11/29/2018 IoT Security

12/4/2018 loT Security / Final

Project Presentation

12/6/2018 Final Project

Presentation

12/19/2018 Project Report Due

Labs



- Lab2 focus on experiencing frequency attack and cipher mode
- Lab3 focus on expoloring hash function collision
- Lab4 focus on deploying PKI and how it stops man-in-the-middle attack

Projects

pages). The class project can also be improvement on an existing security tool. The development should be source controlled using tools, such as git. Students are expected to spend at least six to eight hours on the class labs and projects every week. Some of the ideas for projects are listed below

- Build an IoT device locator in the Internet using tools from <u>Zmap</u> project
- Automatic vulnerability discovery using protocol specification
- Automatic context recovery of network services in operating system
- Adversarial learning on network systems
- Security Measurement on services on the Internet
- Build a covert channel over the network using various services
- Building physical communication covert channel by misuing IoT devices
- Automatic context recovery of network services in operating system
- Build specialized finger printing mechanisms to for a type of device
- Analyze security of a real world product, it can be cyber-physical systems like car or loT devices like smart coffee machine.
- YOUR IDEA

Ethics

With greater power, comes greater responsibility. In this course, we will be learning about and exploring some vulnerabilities that could be used to attack systems. Students are expected to behave responsibly and ethically. You may not attack any system prior approval of the site owners, and may not use anything you learn in this class to disrupt services or harm others. If you have any doubts about whether or not something you want to do is ethical and legal, you should check with the course instructor.