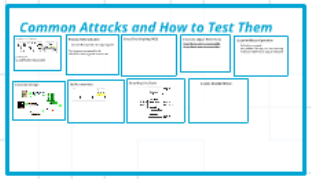
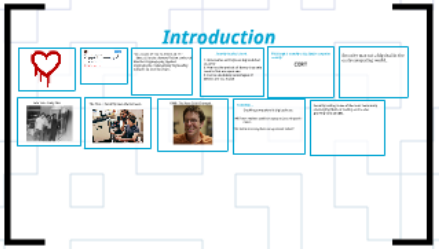
CS1699: Lecture 23: Security Testing





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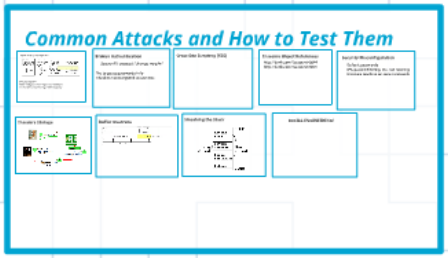

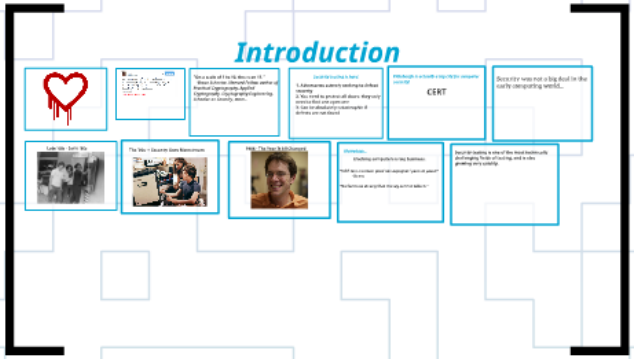

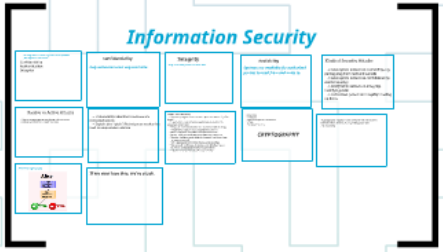

Introduction

"On a scale of 1 to 10, this is an 11."
-Bruce Schneier, Harvard Fellow, author of Practical Cryptography, Applied Cryptography, Cryptography Engineering, Schneier on Security, more..

Security testing is hard.

1. Adversaries actively seeking to defeat security
2. You need to protect all doors; they only need to find one open one
3. Can be absolutely catastrophic if defects are not found

Pittsburgh is actually a big city for computer security!

CERT

Security was not a big deal in the early computing world...

Late '60s - Early '80s

The '80s -> Security Goes Mainstream

1988 - The Year It All Changed

Nowadays...

Cracking computers is big business.

"Nihil tam munitum quod non expugnari pecunia possit"
-Cicero

"No fort is so strong that money cannot take it."

Security testing is one of the most technically challenging fields of testing, and is also growing very quickly.

Carol
@Carols10cents

Following

Re: heartbleed, (ﾉ °□°) ﾉ ⌒┻━━┻ (ﾉ °□°) ﾉ ⌒┻━━┻ (ﾉ °□°) ﾉ ⌒┻━━┻ (ﾉ °□°) ﾉ ⌒ ┻━━┻ (ﾉ °□°) ﾉ ⌒┻━━┻ (ﾉ °□°) ﾉ ⌒ ┻━━┻ (ﾉ °□°) ﾉ ⌒┻━━┻

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Information Security

Security service needs to provide three qualities (the InfoSec or CIA Triad):

Confidentiality
Authentication
Integrity

Confidentiality

Only authorized users may read data.

Integrity

Only authorized parties can write data.

Availability

Systems are available for authorized parties to read from and write to.

Kinds of Security Attacks

-> ***Interruption*** **(attack on availability, e.g. pulling plug from network switch)**
-> ***Interception*** **(attack on confidentiality; eavesdropping)**
-> ***Modification*** **(attack on integrity; modifying data)**
-> ***Fabrication*** **(attack on integrity; making up data)**

Passive vs Active Attacks

-> Passive: eavesdropping, monitoring, traffic analysis
-> Active: modification or creation of data

-> Vulnerability: identified weakness of a controlled system
-> Exploit: (aka "sploit") Technique or mechanism used to compromise a system

Kinds of malicious code:
* **Bacteria - program that consumes system resources (e.g. fork bomb)**
* **Logic bomb - code within a program which executes an unauthorized function**
* **Trapdoor - secret undocumented access to a system or app**
* **Trojan horse - system that pretends to be another**
* **Virus - replicates itself WITH human intervention**
* **Worm - replicates itself WITHOUT human intervention**
* **Zombie - malicious code which is triggered (e.g. time of day, remote command)**
* **RAT - Remote Administration Tool (e.g. BackOrifice)**
* **Bot network - collection of zombies controlled by master**
* **Spyware - surreptiously monitors your actions**
* **DOS (Denial of service) attacks (e.g. via LOIC)**

Protections:
* Firewalls
* Operating System Permissions
* CDNs
* Well-written code

CRYPTOGRAPHY

Cryptography (crypto) is absolutely vital to the modern infrastructure of the web, especially public-key cryptography.

Public-Key Cryptography

If we ever lose this, we're stuck.

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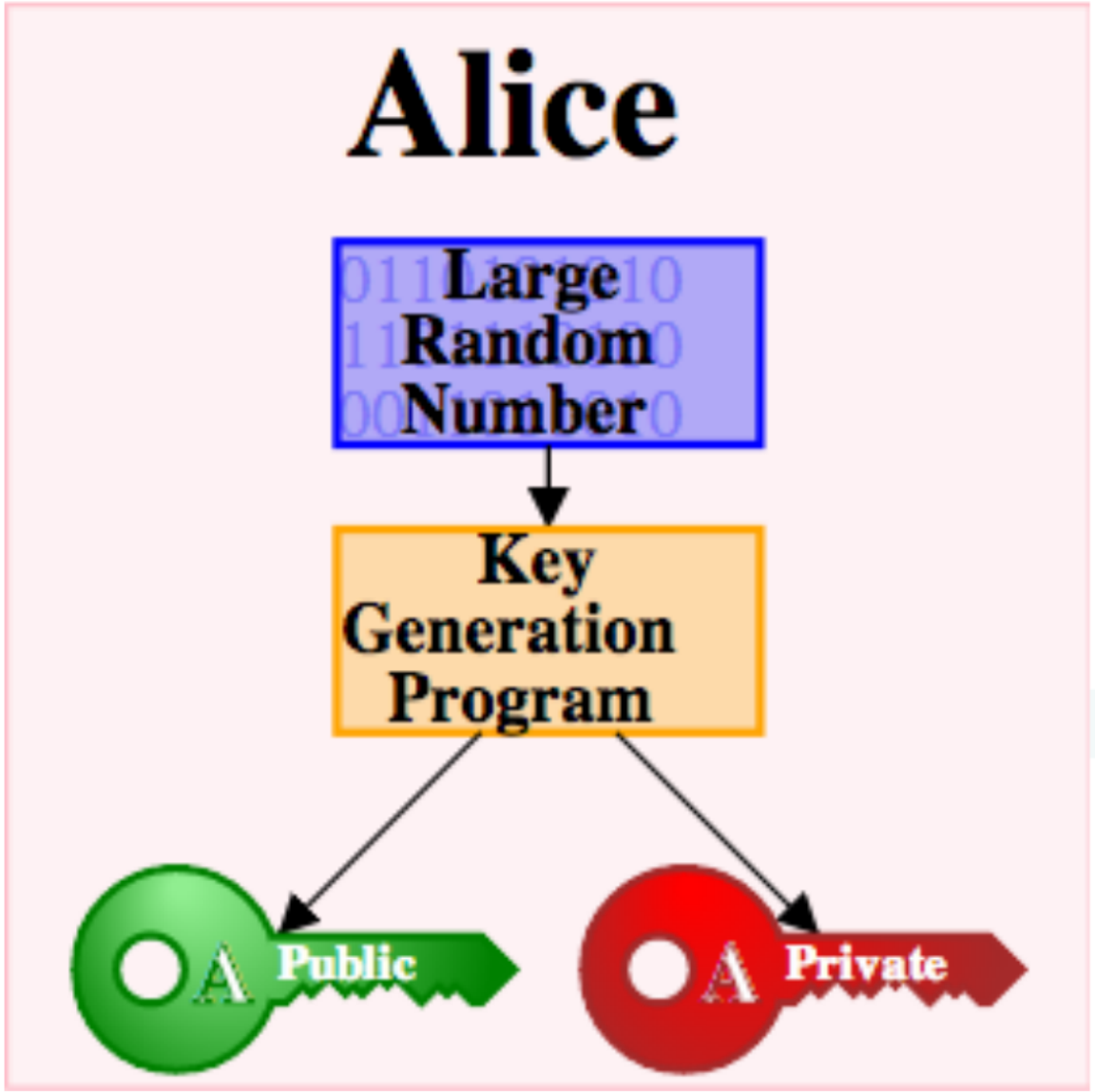

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Common Attacks and How to Test Them

Injection (e.g. SQL injection)

Test your inputs!
Static analysis; ensure inputs are sanitized
Use Haskell or another type-safe language

Broken Authentication

Session ID exposed; "change my p/w"

Try to guess passwords/info
Check for unencrypted session IDs

Cross-Site Scripting (XSS)

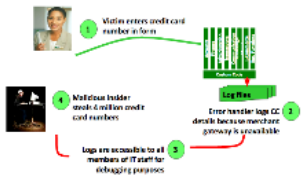
Insecure Object References

http://bank.com/?account=9844
http://bank.com/?account=9845

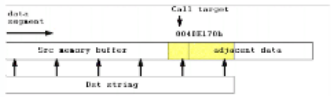
Security Misconfiguration

Default passwords
IPS, packet filtering, etc. not running
Insecure machine on secure network

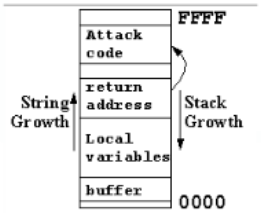
Insecure Storage



Buffer Overruns

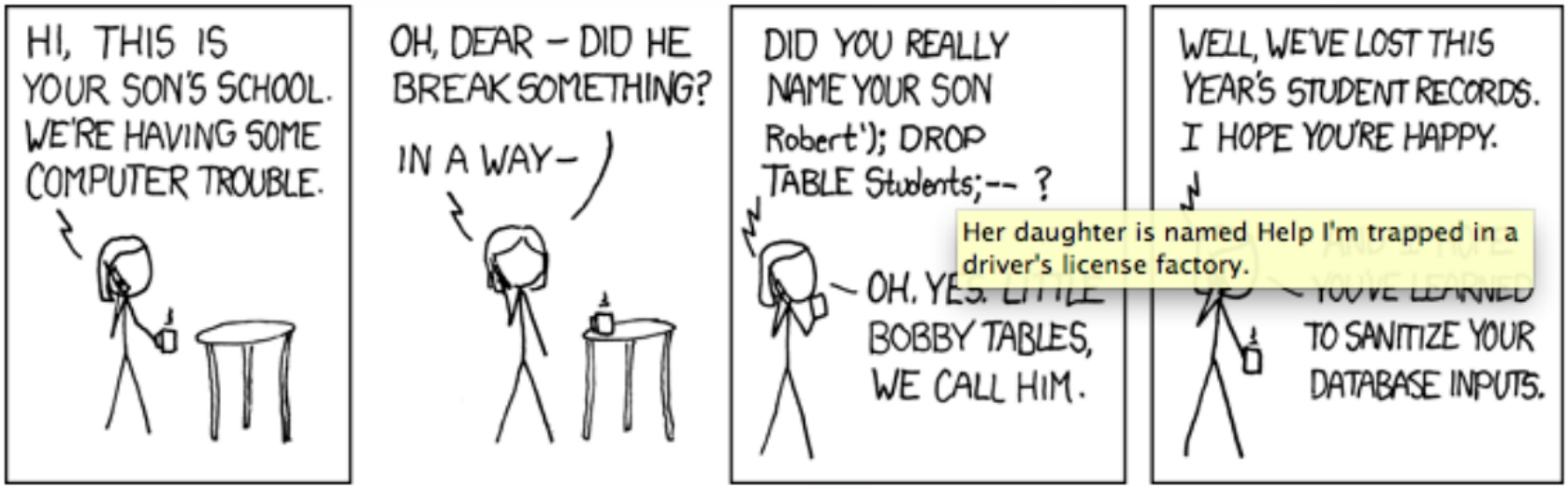


Smashing the Stack



SOCIAL ENGINEERING!

Injection (e.g. SQL injection)



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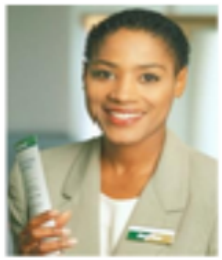
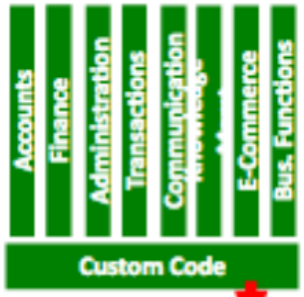


1 Victim enters credit card number in form

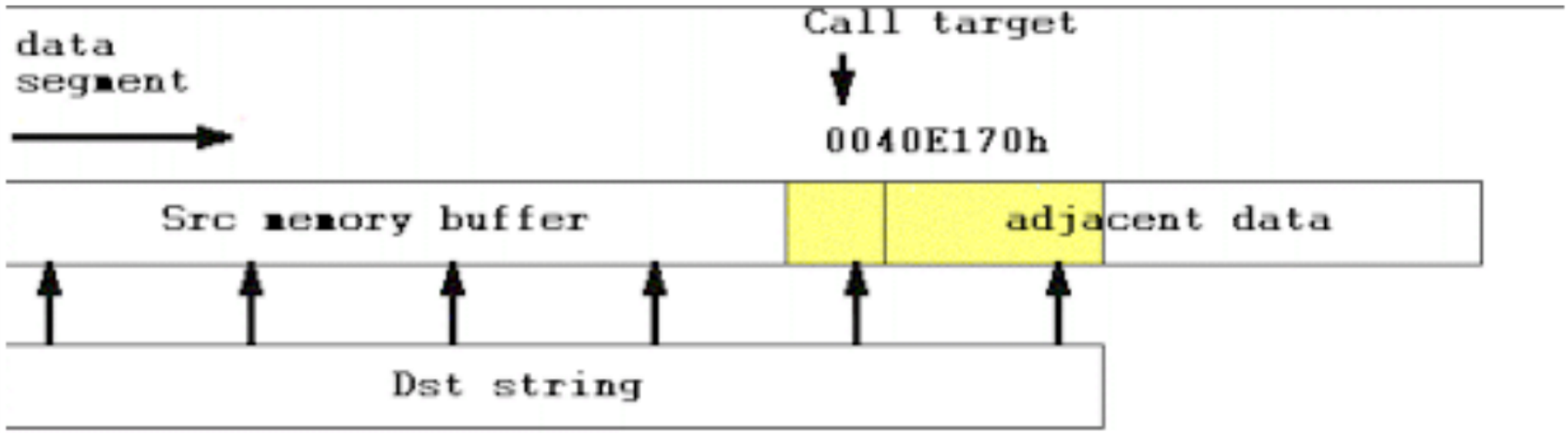


4 Malicious insider steals 4 million credit card numbers

Error handler logs CC details because merchant gateway is unavailable 2

Logs are accessible to all members of IT staff for debugging purposes 3

Buffer Overruns



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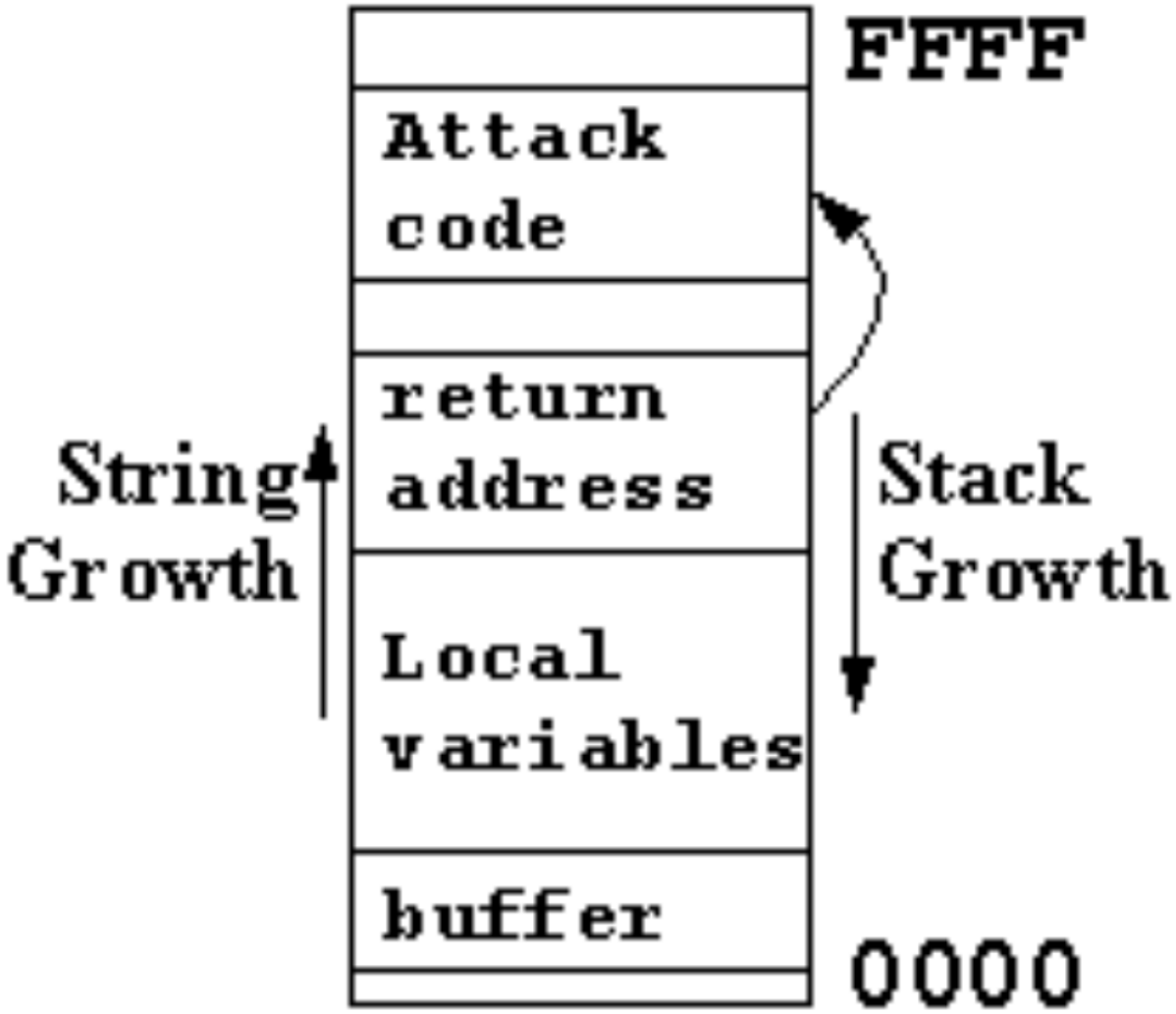

SOCIAL ENGINEERING!

Tools for Security Testing

nmap
valgrind
Nessus
John the Ripper

Remember...

It's about risks. Before developing a security plan, think about the costs and benefits.

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