

INTRODUCTION TO SOFTWARE BUSINESS PRODUCT MANAGEMENT

Week 2 Day 1

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for
Oakland University



WEEK 1 RECAP



The background is a dense, overlapping collage of rectangular sticky notes in various colors including teal, purple, olive green, and blue. Each sticky note features a large, bold, black question mark. Overlaid on the right side of the image are several thin, white, parallel diagonal lines that sweep from the bottom left towards the top right.

QUESTIONS FROM LAST
WEEK?



SECURING & ENCRYPTING DATA



CLEARTEXT VS. CIPHERTEXT

The background is a solid dark red color. It is covered with a dense, repeating pattern of various black geometric shapes. These shapes include circles, triangles, squares, rectangles, and lines of different lengths and orientations. Some shapes are simple outlines, while others are more complex, like zig-zags or wavy lines. The overall effect is a busy, abstract, and somewhat chaotic pattern.

HASHING

LAYER OF VALIDATION OF DATA

SECURES BOTH ENDS OF TRANSMISSION

ANYONE CAN VALIDATE!

PROTECTS ORIGINAL SECRET

IRREVERSIBLE

VALUE OF HASHING

Several thin, white, parallel lines of varying lengths and angles are positioned on the right side of the slide, creating a modern, abstract graphic element.



POPULAR HASHING ALGORITHMS

- ▶ MD5
- ▶ SHA-1 (compromised)
- ▶ SHA-2
- ▶ SHA-3
- ▶ LM/NTLM hash (for Windows passwords)

LET'S TRY SOME HASH!

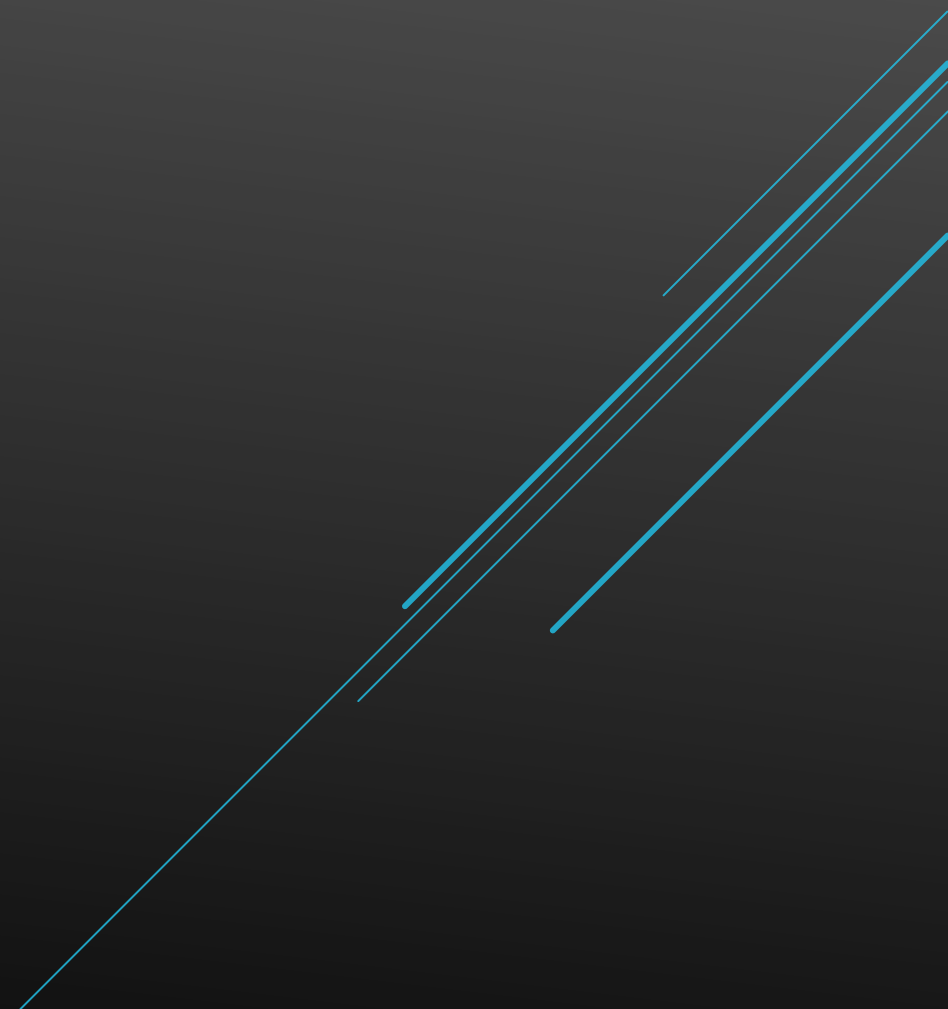
<https://gchq.github.io/CyberChef/>

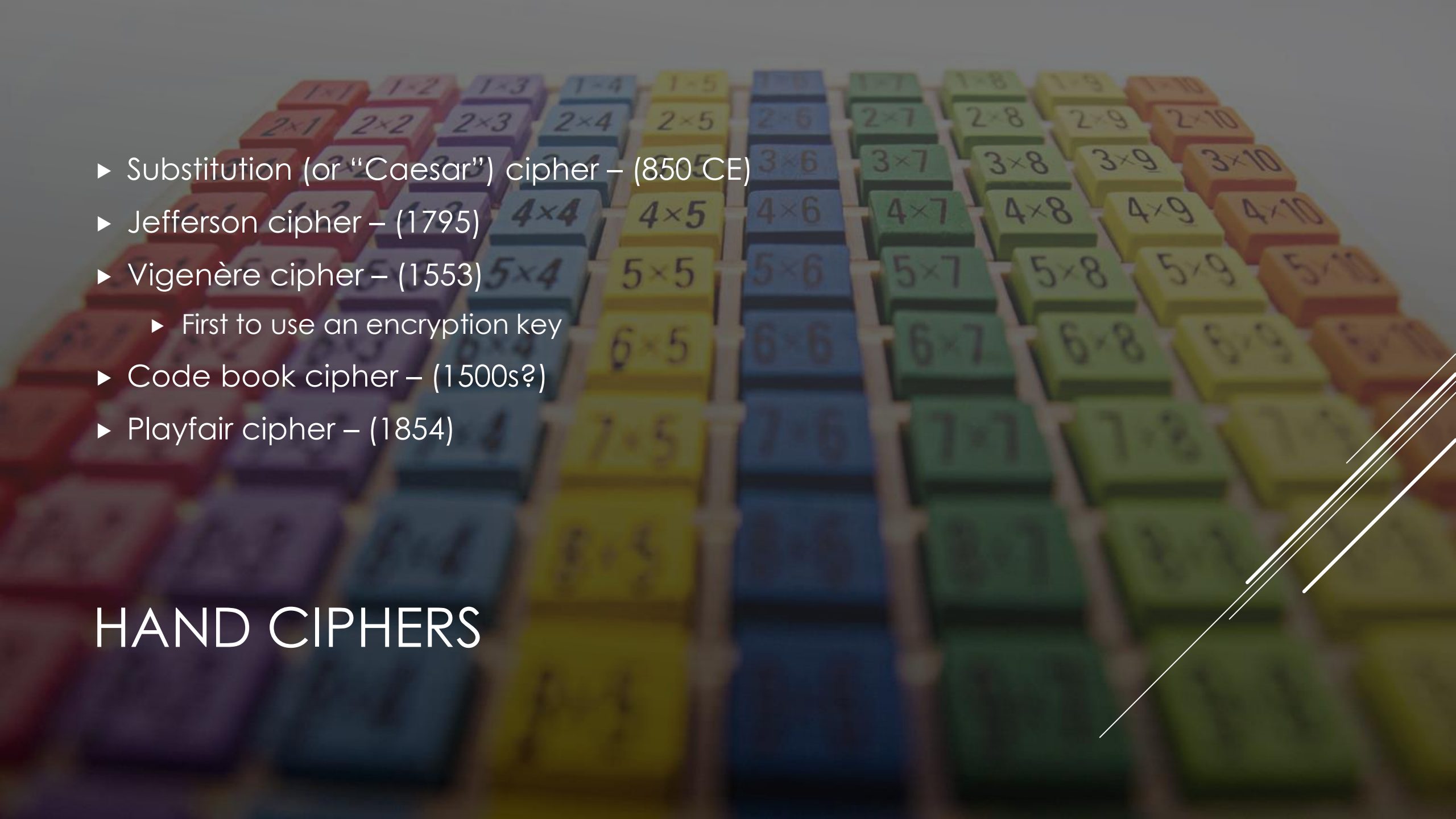


WHAT IS ENCRYPTION?



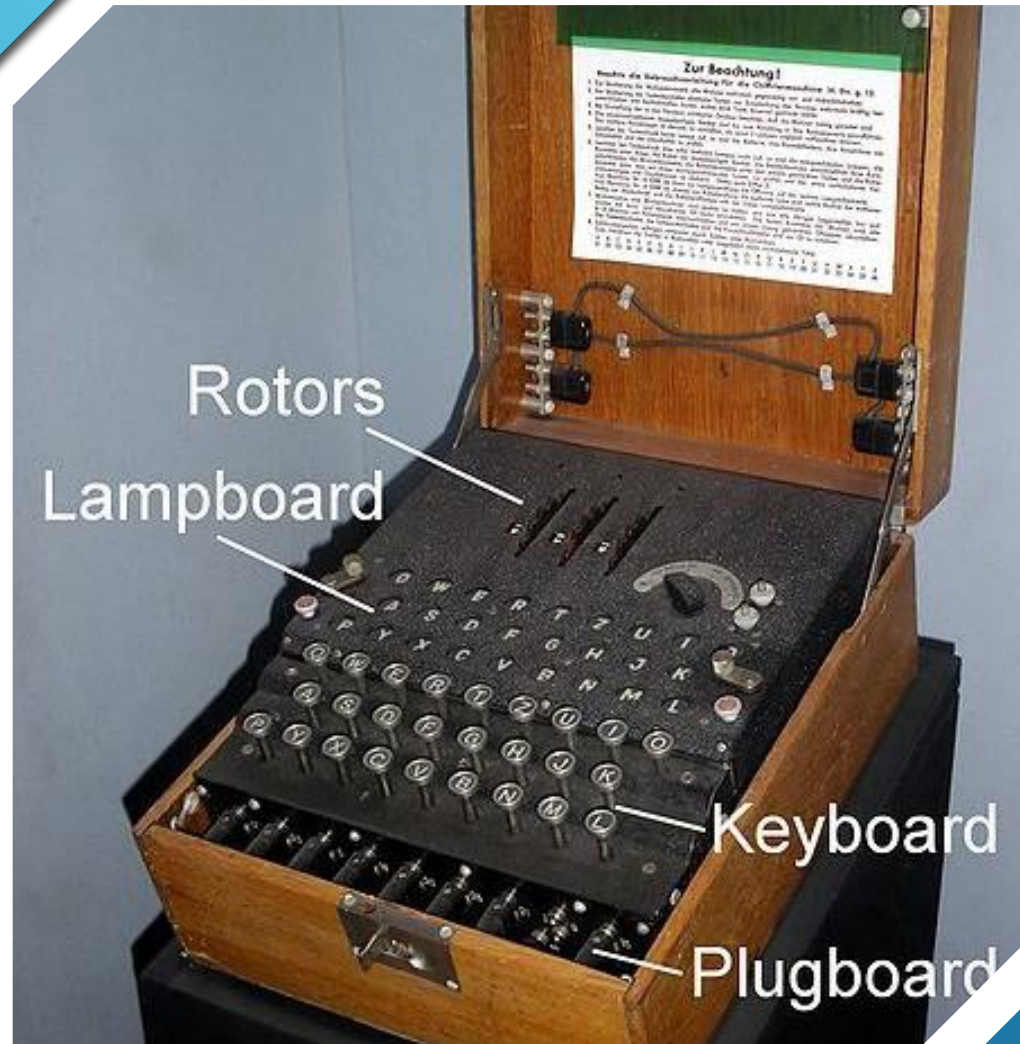
ENCRYPTION HISTORY



- 
- ▶ Substitution (or “Caesar”) cipher – (850 CE)
 - ▶ Jefferson cipher – (1795)
 - ▶ Vigenère cipher – (1553)
 - ▶ First to use an encryption key
 - ▶ Code book cipher – (1500s?)
 - ▶ Playfair cipher – (1854)

HAND CIPHERS

WARTIME CRYPTOGRAPHY



MESSAGE HELLOWORLD

UNENCRYPTED LETTER

UKW

3rd Wheel

2nd Wheel

1st Wheel

ETW

STECKER

Index 6

Index 24

Index 10

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6
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ENCRPYTED

ENCRYPTED LETTER #N/A



10 MINUTE BREAK

PASSWORD CRACKING

A black and white photograph of a woman in a dark dress operating a large, complex mechanical cipher machine. She is leaning over the machine, adjusting a rotor. The machine is composed of several large metal cabinets filled with intricate mechanical components, including rotors and wiring. The background shows more of the machine's structure, with rows of similar components. The overall scene suggests a historical setting of cryptographic work.

ONE-TIME PADS





VENONA PROJECT



WHY DO WE ENCRYPT?



The background is a vibrant blue with various abstract patterns. There are large, irregular organic shapes in different shades of blue. Some areas have a fine dotted pattern, while others have a pattern of small white plus signs. On the right side, there are several thin, white, parallel diagonal lines. Small, white, wavy lines are scattered throughout the composition.

WHAT DO WE ENCRYPT?

HOW DO WE
ENCRYPT TODAY?

A series of several thin, white, parallel diagonal lines extending from the bottom right corner towards the center of the slide.

- ▶ Rivest-Shamir-Adleman (RSA) – (1977)
 - ▶ Based on prime number factorization
- ▶ Advanced Encryption Standard (AES) 256
 - ▶ Block cipher

POPULAR MODERN CRYPTOGRAPHY ALGORITHMS

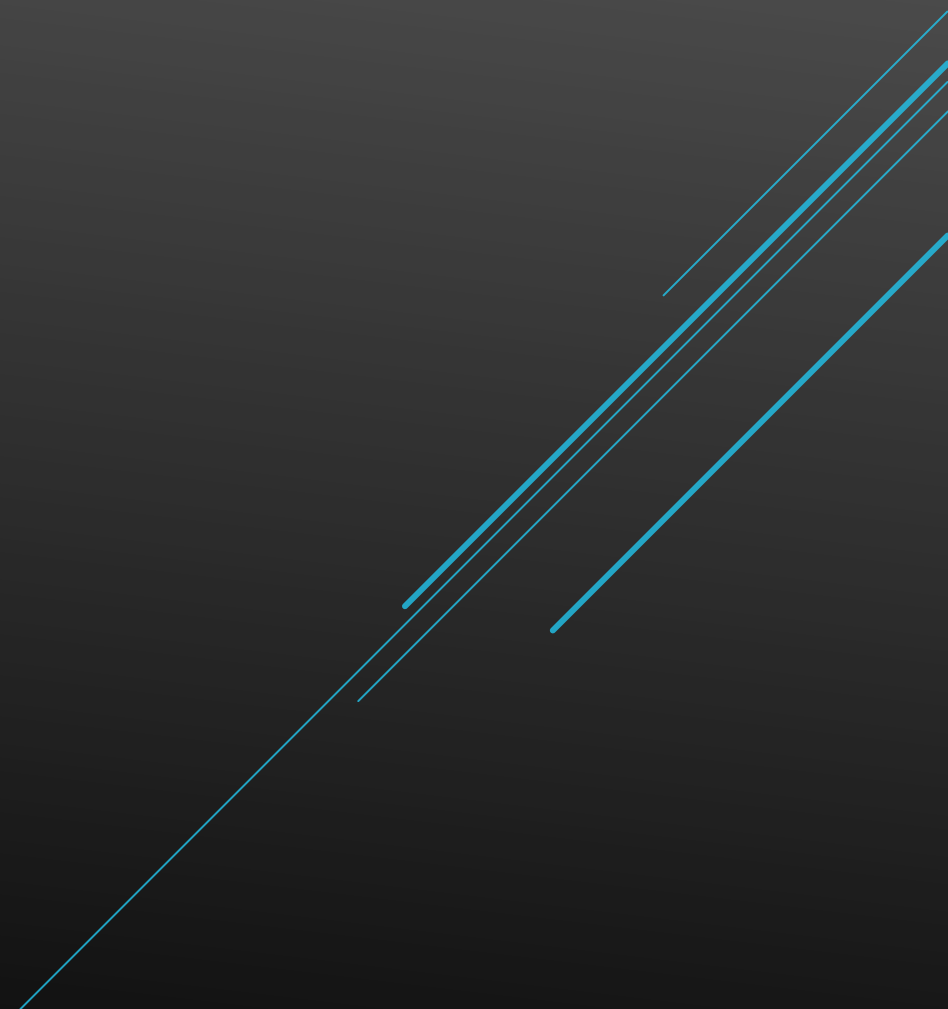
- ▶ AES
 - ▶ Supports key sizes of 128, 192, 256
- ▶ Key sizes improve the strength of cryptographic protection
- ▶ 2048 & 4096 key sizes
 - ▶ Large keys
 - ▶ Hard to brute force

KEYSPACE/KEYLENGTH/KEYSIZE

A series of several parallel white lines of varying lengths and slopes, located in the bottom right corner of the slide, creating a modern, abstract graphic element.

CRYPTOGRAPHIC STANDARDS

<https://csrc.nist.gov/Projects/cryptographic-standards-and-guidelines>



THE THREE STATES OF DATA

AT REST



IN TRANSIT



IN USE



STATES OF DATA

DATA AT REST

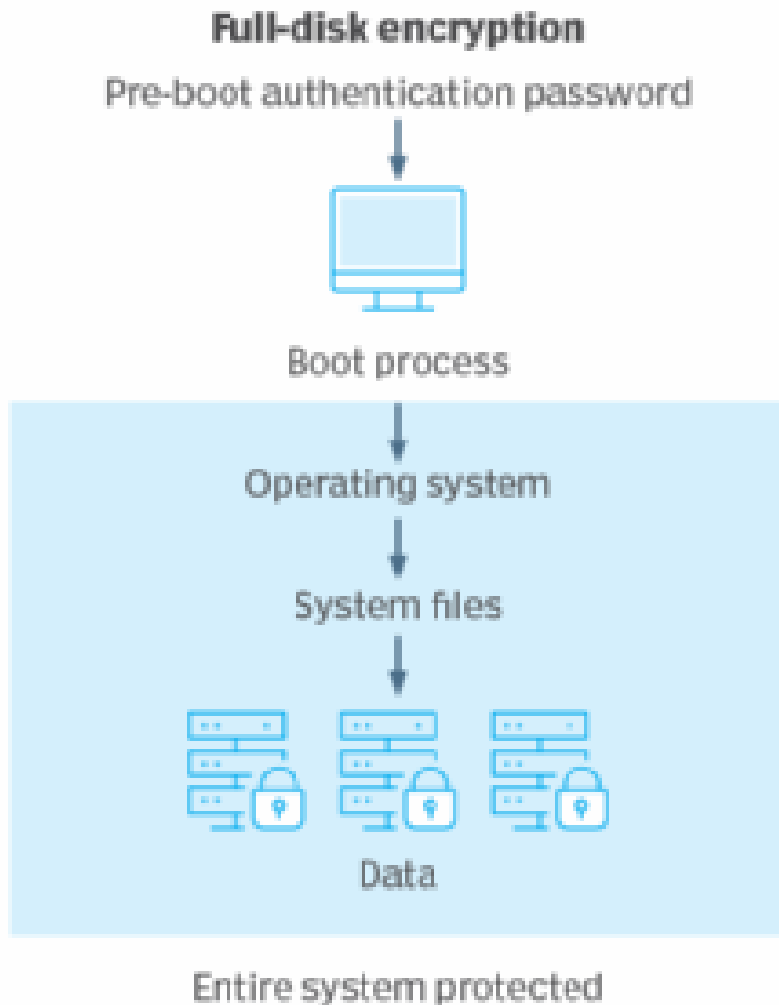


DATA IN TRANSIT



DATA SECURITY

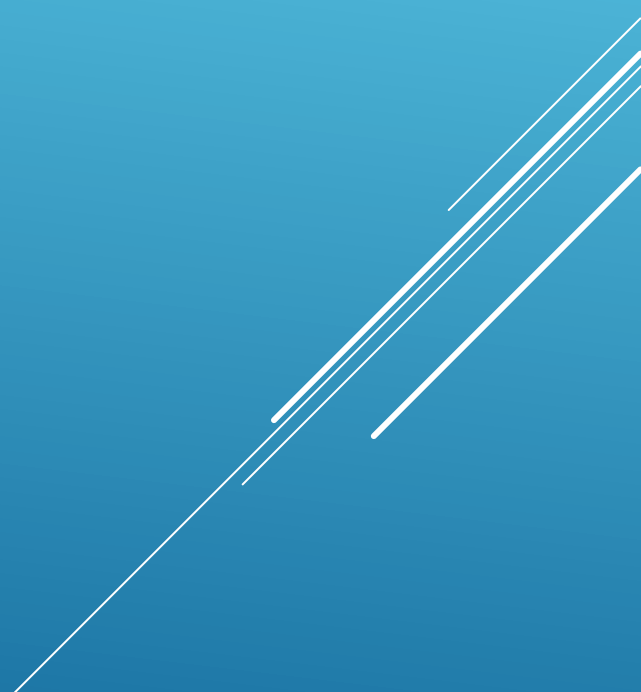
How the FDE process works



FULL DISK ENCRYPTION



SYMMETRIC KEY ENCRYPTION



Symmetric encryption



Secret key



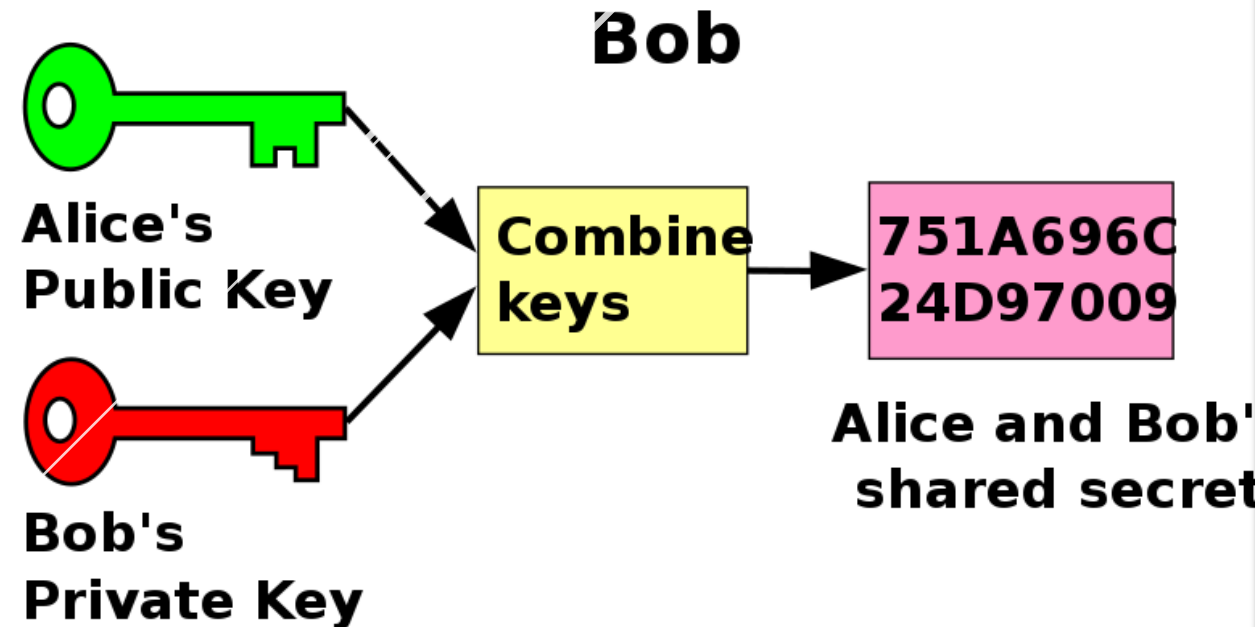
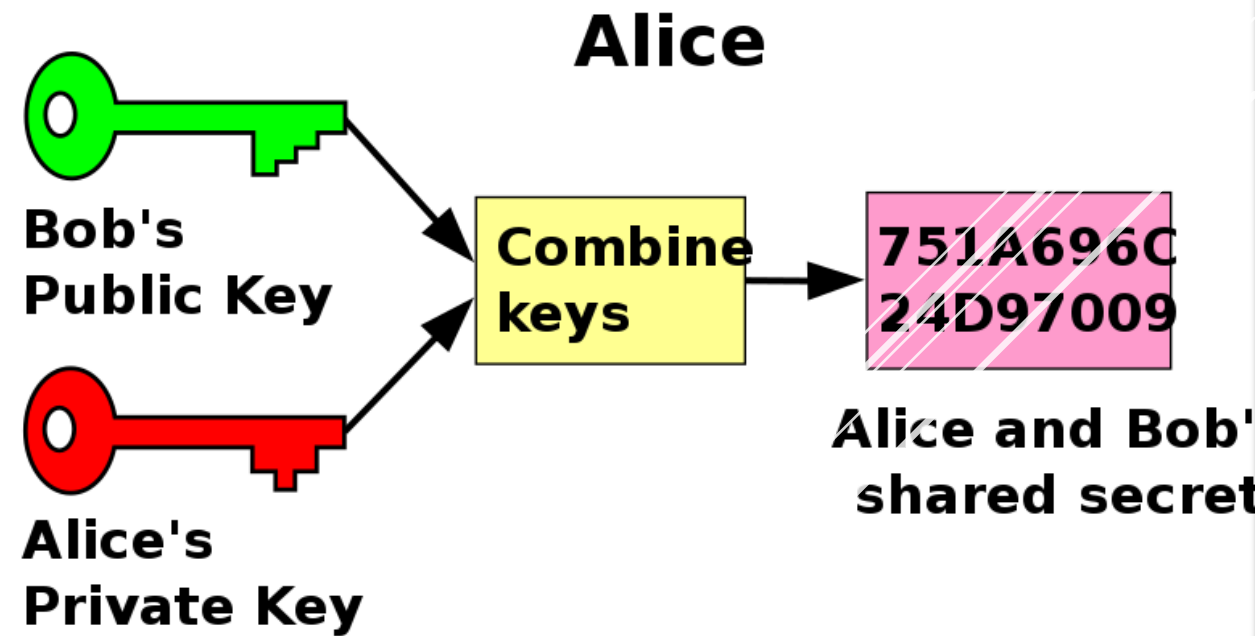
ASYMMETRIC KEY ENCRYPTION





SECURE KEY EXCHANGE?

PUBLIC KEY CRYPTOGRAPHY

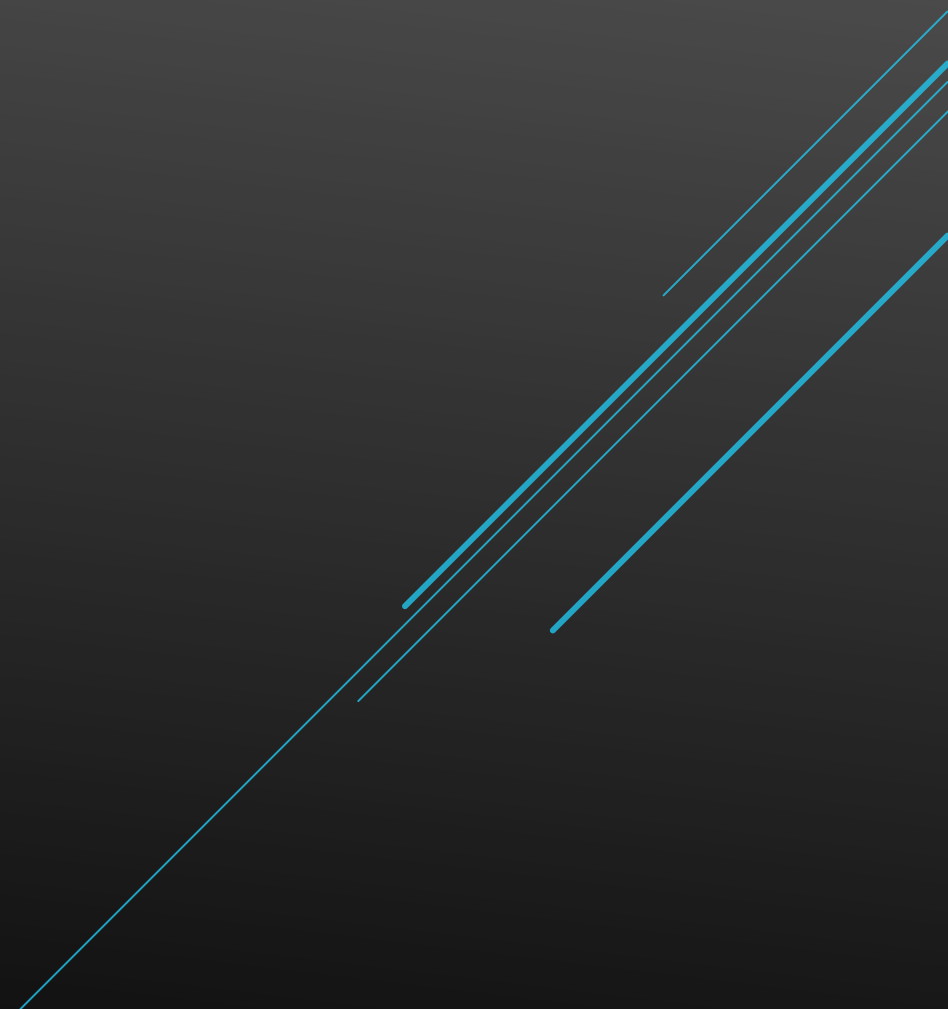




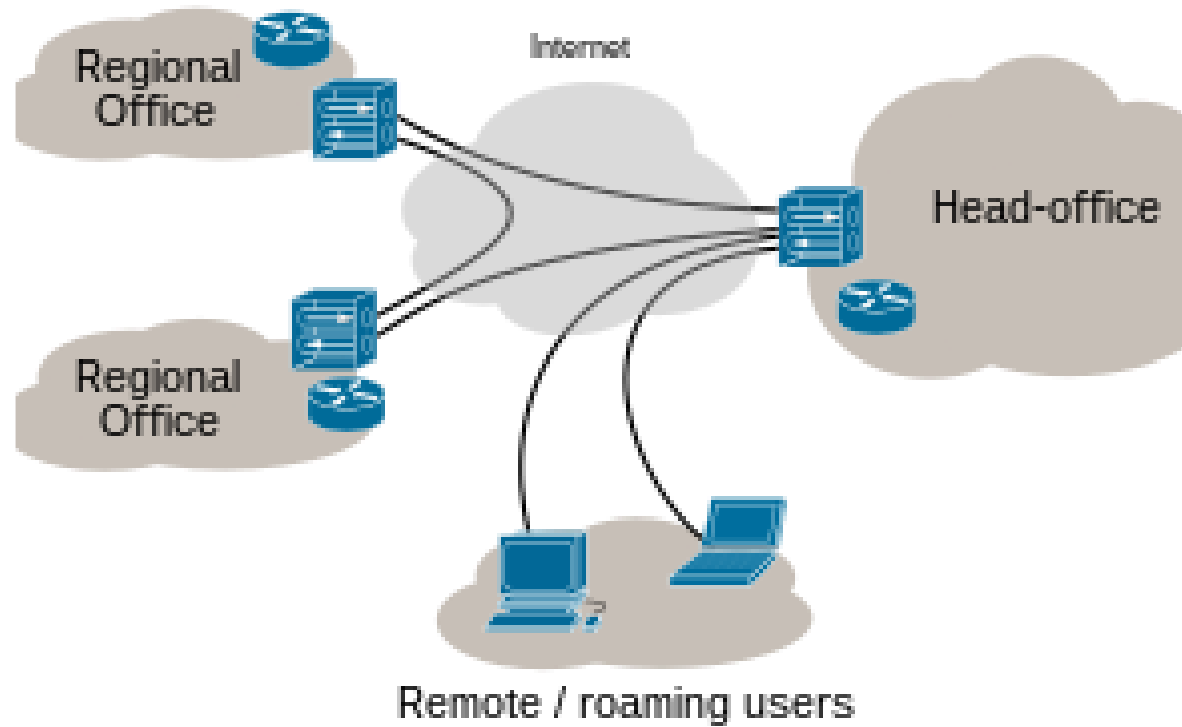
10 MINUTE BREAK

Three parallel white lines of varying lengths are positioned in the bottom right corner, slanted diagonally upwards from left to right.

SECURING NETWORK CONNECTIONS IN PRACTICE



Internet VPN

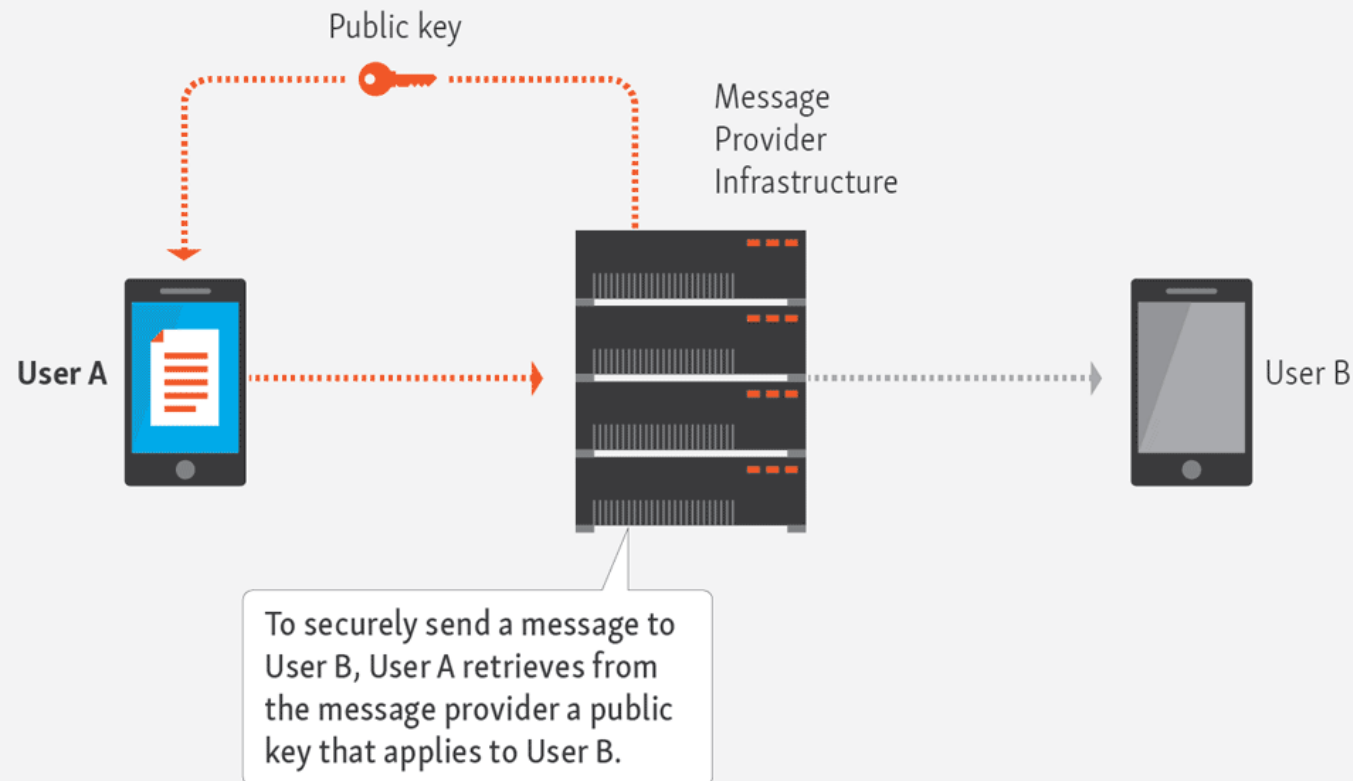


VIRTUAL PRIVATE NETWORKS

THIS IS HOW END-TO-END ENCRYPTION WORKS

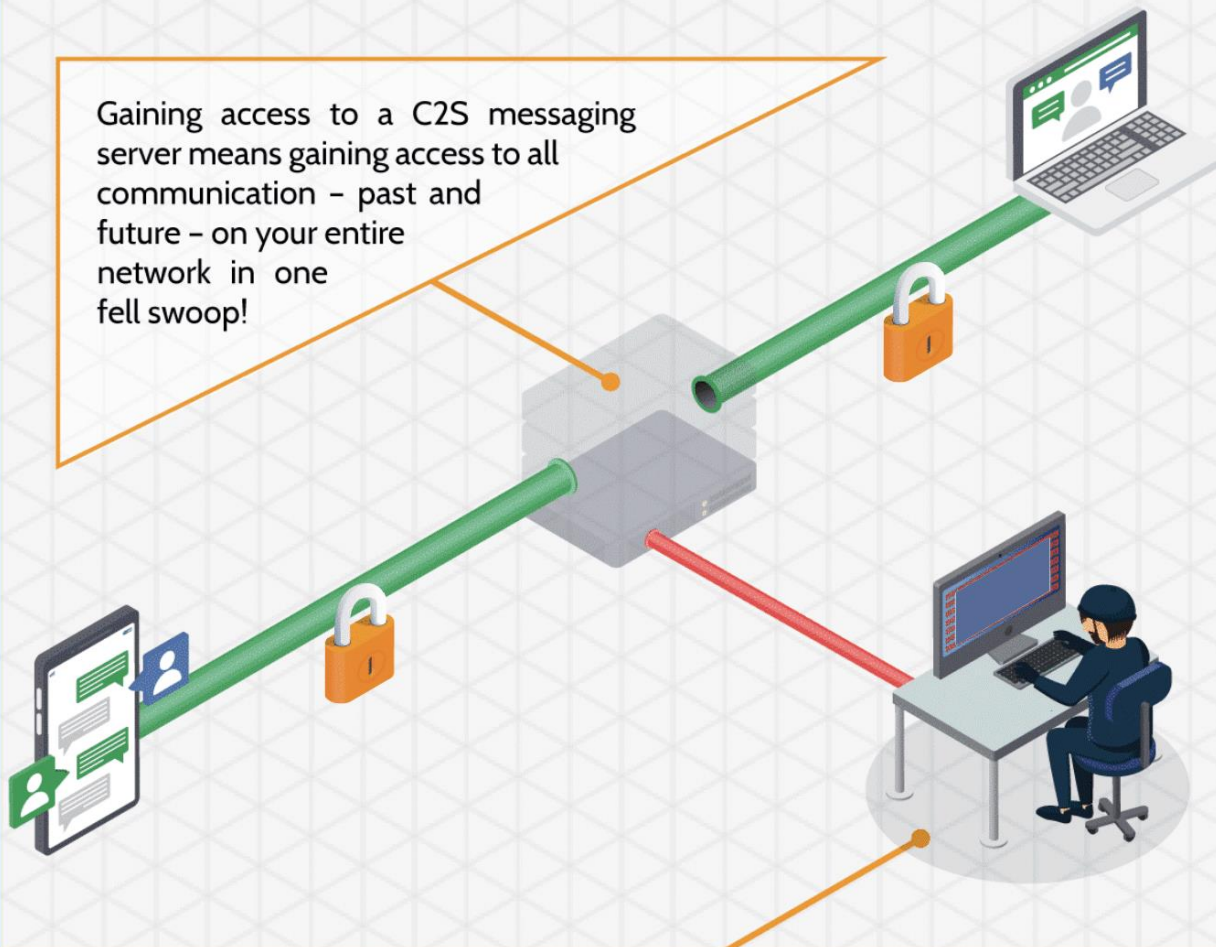


A major selling point for instant-messaging providers is some form of content encryption. But does this technology fully protect your privacy?



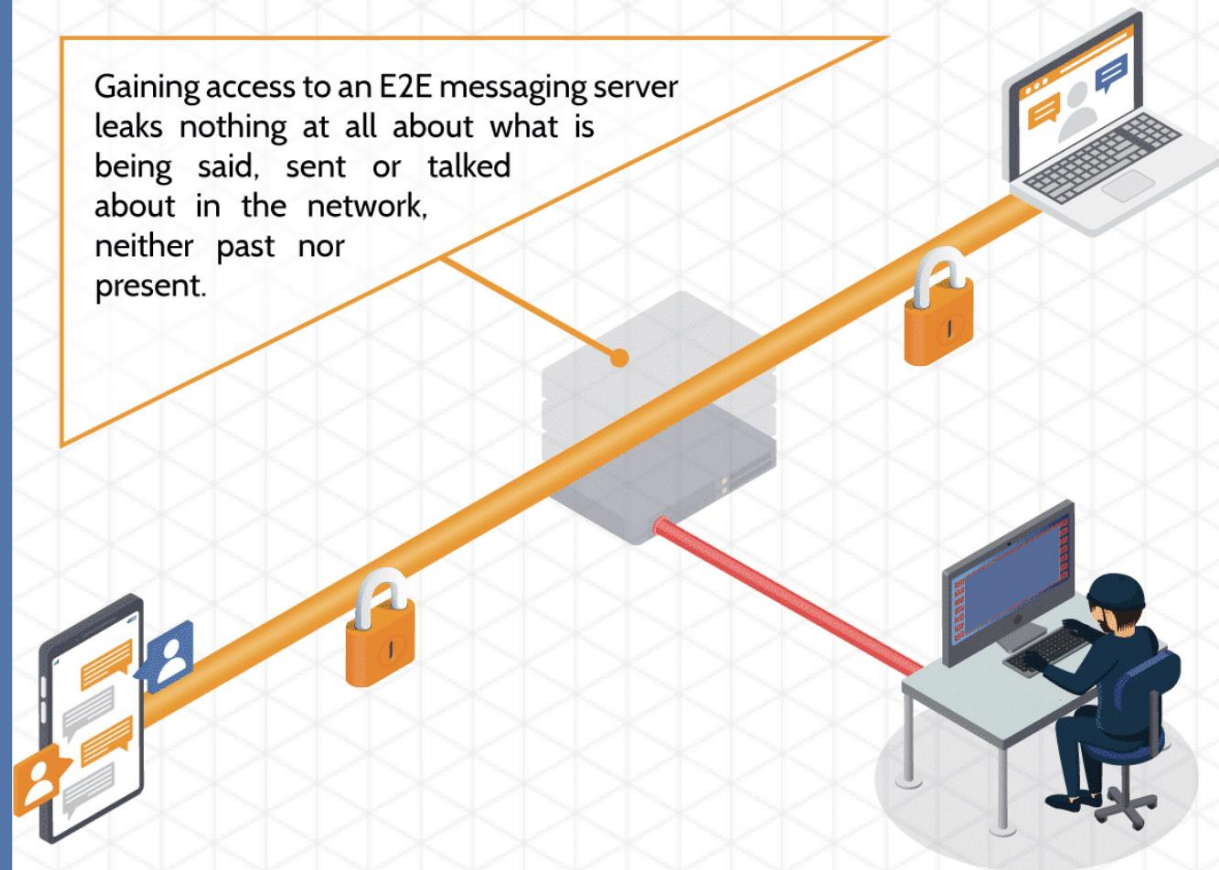
CLIENT-TO-SERVER ENCRYPTION

Gaining access to a C2S messaging server means gaining access to all communication – past and future – on your entire network in one fell swoop!



END-TO-END ENCRYPTION

Gaining access to an E2E messaging server leaks nothing at all about what is being said, sent or talked about in the network, neither past nor present.





WHY DO WE
CARE ABOUT
TRUST?





WHAT IS A
SECURITY
CERTIFICATE?



Provides trust



Allows a secure connection



Encrypts data



HTTPS

WHAT DOES A SECURITY CERTIFICATE DO?

- ▶ X.509 certificate
- ▶ Provides Transport Layer security
- ▶ Free!
- ▶ Trusted?

CERTIFICATE AUTHORITIES

HOW DO WE KNOW WHO
WE CAN AND CAN'T
TRUST?



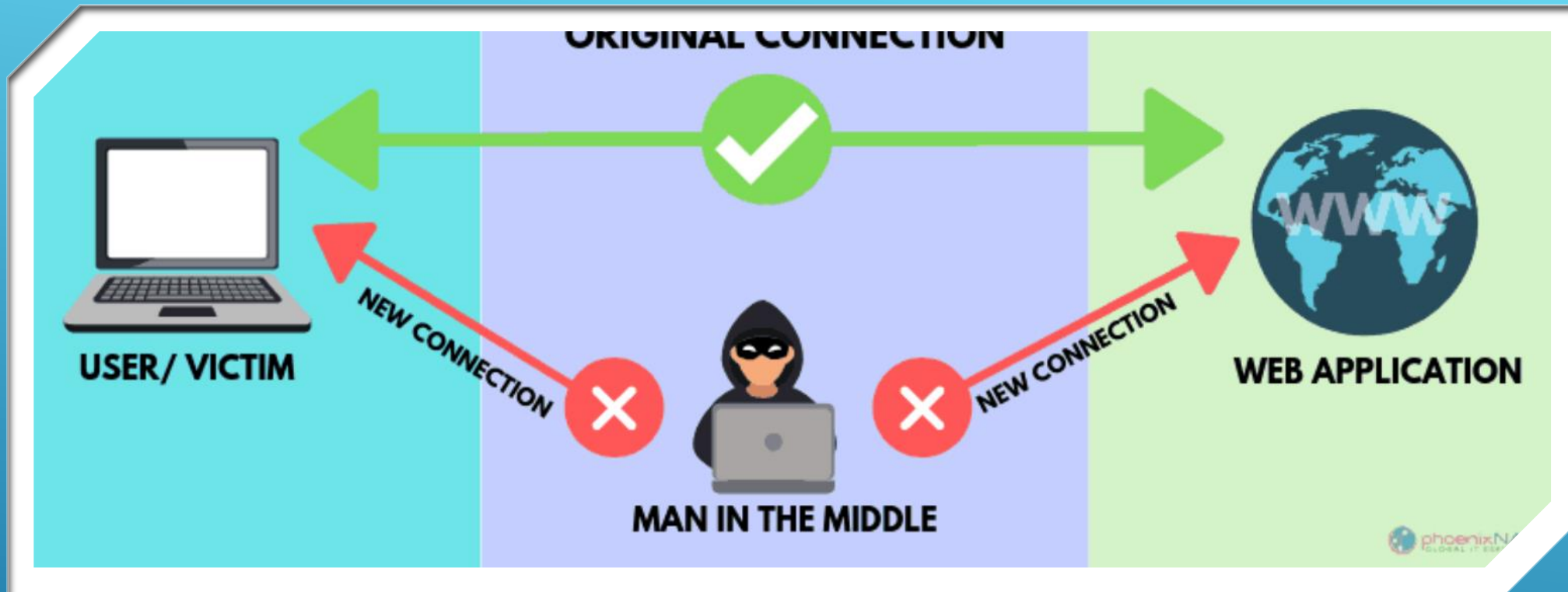
AUDIT YOUR FAVORITE WEBSITE!

<https://www.sslshopper.com/ssl-checker.html>



THREATS TO POOR ENCRYPTION

- ▶ Cleartext passwords
- ▶ Password cracking
- ▶ Man-In-The-Middle (MITM) attack
- ▶ Rainbow Tables
- ▶ Hash collisions



MAN-IN-THE-MIDDLE

http password.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

http

Source	Destination	Protocol	Length	Info
192.168.0.100	224.0.0.251	MDNS	152	Standard query 0x0041 PTR _%9E5E7C8F47989526C9BCD95D24084F6F0B27C
192.168.0.104	224.0.0.251	MDNS	437	Standard query response 0x0000 PTR Y-Series-896e8e3a4462f9a459a9f
192.168.0.104	224.0.0.251	MDNS	404	Standard query response 0x0000 PTR Y-Series-896e8e3a4462f9a459a9f
192.168.0.104	224.0.0.251	MDNS	389	Standard query response 0x0000 PTR Y-Series-896e8e3a4462f9a459a9f
192.168.0.1	224.0.0.1	IGMPv3	60	Membership Query, general
192.168.0.107	18.192.172.30	TCP	74	52356 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval
18.192.172.30	192.168.0.107	TCP	74	80 → 52356 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1440 SACK_P
192.168.0.107	18.192.172.30	TCP	66	52356 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=2163476701 TSe
192.168.0.107	18.192.172.30	HTTP	605	POST /userinfo.php HTTP/1.1 (application/x-www-form-urlencoded)
18.192.172.30	192.168.0.107	TCP	66	80 → 52356 [ACK] Seq=1 Ack=540 Win=30208 Len=0 TSval=773377626 TS
18.192.172.30	192.168.0.107	HTTP	342	HTTP/1.1 302 Found (text/html)
192.168.0.107	18.192.172.30	TCP	66	52356 → 80 [ACK] Seq=540 Ack=277 Win=64128 Len=0 TSval=2163476852
192.168.0.107	18.192.172.30	HTTP	460	GET /login.php HTTP/1.1

Wireshark · Packet 402 · http password.pcapng

Accept-Language: en-US,en;q=0.5\r\n
Accept-Encoding: gzip, deflate\r\n
Content-Type: application/x-www-form-urlencoded\r\n
> Content-Length: 36\r\n
Origin: http://testphp.vulnweb.com\r\n
Connection: keep-alive\r\n
Referer: http://testphp.vulnweb.com/login.php\r\n
Upgrade-Insecure-Requests: 1\r\n
\r\n
[\[Full request URI: http://testphp.vulnweb.com/userinfo.php\]](http://testphp.vulnweb.com/userinfo.php)
[HTTP request 1/2]
[\[Response in frame: 404\]](#)
[\[Next request in frame: 406\]](#)
File Data: 36 bytes

HTML Form URL Encoded: application/x-www-form-urlencoded

- Form item: "uname" = "vijaymehta"
 - Key: uname
 - Value: vijaymehta
- Form item: "pass" = "maxelladiviner"
 - Key: pass
 - Value: maxelladiviner

49 busted in Europe for Man-in-the-Middle bank attacks

11 JUN 2015

4

Data loss, Law & order, Malware, Phishing, Security threats

REAL-WORLD MITM ATTACK

REVIEW DAY 1



QUESTIONS?





PREVIEW DAY 2