A Different Kind of Crypto:
Crypto Algorithms Designed for Payload Obfuscation
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He enjoys exploit-development, tactical red team strategizing and rare exfiltration paths.
This presentation is technical but presented at a high level for those with little to no cryptography experience.

I will be describing the problem space and identifying solutions.

It will vary from in-depth to a high-level overview.
OVERVIEW

- AV Evasion
- Crypto Vs Payload Crypto
- Automating Obfuscation
HOW DOES ANTI-VIRUS WORK?

- Signature Based Detections...
- Sandboxing...
- Dynamic Code Analysis...
WHAT ARE SIGNATURES?
SIGNATURE PITFALLS

- Code Obfuscation...
- Encrypted Payloads...
- Easily Bypassed...
WHAT IS A SANDBOX?

- Running code in a isolated manner...
- Checking it’s behavior while running...
- Malicious network behavior identification...
Sandbox Pitfalls

- Execution/Analysis takes time...
- Can’t check all possible conditions...
- It is a run-time environment. It’s detectable...
WHAT IS DYNAMIC CODE ANALYSIS?

- Automated Reverse Engineering...
- Look for suspicious code...
- Examples: FireEye, Trustlook, Fidelis
Encrypted Payloads...
2-Stage Payloads...
It’s hard to detect ALL encryption routines..
WHAT IS A PAYLOAD?

- It’s the exploit’s counterpart...
- Post-Exploitation Run-time...
- It’s the bot in the malware...
Many AV products check the drive...
Many anti-virus solutions check the network..
It’s computationally expensive to scan RAM...
Keep it encrypted until it’s in RAM...
WHAT IS PAYLOAD ENCRYPTION?

- Hiding your executable payload in plain sight...
- It’s decrypted when AV is not looking...
WHAT IS CRYPTOGRAPHY?

- Classical Cryptography...
  - Designed for messages written by hand..
  - Developed before automation...

- Modern Cryptography
  - Designed for electronic messages...
  - Sufficiently complex to deter automated analysis.
Confusion - No one part of the cipher text depends on one part off the key. Multiple bytes of the key affect each byte of the cipher text.

Diffusion - Plaintext is scattered via permutation..

Guessing plain text won’t get you the key!
Most shared-key algorithms consist of permutations of bytes.
There are known standard permutations tables...
The add to the **confusion** of the algorithm...
ONE WAY FUNCTIONS

- Big numbers can make math hard, even for computers...
- Some math is easy to compute, but hard to undo...
- Ever break a plate? It’s hard to put back together...
- How easy is it to factor 12702047 by hand?
- I can tell you it’s factors are 3571 and 3557...
- I got 12702047 by multiplying 3571 X 3557...
MODERN CRYPTO

- Public key or key exchange algorithm used to transmit key.
- Key is hashed into proper size...
- Cipher is converted into a stream cipher...
- Encrypted transmission begins...
- Keys are constantly renegotiated...
WHY IS THIS IRRELEVANT TO HIDE PAYLOADS?

- The target HAS to decrypt the message...
- Most payload crypters that use “modern” algorithms, use static keys, defeating the purpose...
- We are solving an entirely different problem space than traditional crypto...
WHAT ELSE?

- We don’t care about long term cryptanalysis...
- We’re only hiding when the anti-virus is looking...
- We want to hide the ENCRYPTION algorithm...
WHY NOT STANDARD CRYPTO?

- If you use a standard algorithm, library or kernel function, you will get caught.. STANDARD == SIGNATURE
- Shared-key algorithms have known permutation tables detectable by dynamic code analysis.
Instead of Confusion/Diffusion we want obscurity

- It is harder to detect the unknown
- Easy to implement---in many ways
APPLYING CLASSIC CRYPTO

- Caesar Cipher (ROT-13/ROT-N)
- Substitution Ciphers...
- Viginaire Cipher..
  - Use a word as a “key” and alternate through the key shifting letters by the respective values (a->1, b->2..)
CAESAR CIPHER
SUBSTITUTION CIPHER

Attack Carthage on Tuesday

Wggwze Zwtghwuy fc Gkybrwq
# VIGINAIRE CIPHER

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Instead of shifting we XOR.

XOR is the practice of changing bits...

XORS are easily reversed...

We can easily do both a caesar cipher or even a viginaire cipher..

Substitution ciphers can be done on the byte levels..
TEXTBOOK RSA

- Not secure but we don’t care (More on that later)...
- Decrypt data be raising it to a power mod n..
  - Hard to reverse but not impossible..
- Very innocuous and easy to obfuscate...
Known Plaintext Attack

- Make sure you’re solving the correct problem. 
- Since the encryption key is public, it is possible to guess it.
When you learned to multiply... $4 \times 3 = 4 + 4 + 4$

If you don't care about efficiency there is an infinite way to calculate the same thing...

If it's looking for $a^b \mod p$ you can calculate $a \times a \times a \times a \times a \ldots \mod p$ ...

Want to hide mod p? Divide and find the remainder...
PUTTING IT TOGETHER

- Fooling a computer (with a short time limit) versus fooling a person — Delay your code execution!
- Automating the process and avoiding future signatures...
- Some signatures will exist... but not specific to encryption...
- Algorithm randomization will make it harder to detect...
PUTTING IT TOGETHER

- Automatically generating payload ciphers to evade signature and reversing based controls.
- Using a two staged payloads to evade dynamic code analysis.
Glassdoor Exfiltration Toolkit

- Project announced at DerbyCon 2014...
- Open source Post-Exploitation Framework..
- Automated payload generation and obfuscation...
- Known and new exfiltration methods...
- Target 1.0 release expected August 2014...
Thank you to our friends, family, employers, & BlackHat Sao Paulo, DerbyCon, CircleCityCon, LaDosaNostra...