CYBERARK \ LABS

White Phoenix

Beating Intermittent Encryption

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CyberArk Labs Mission

Vulnerability Research

Malware/Breach Analysis

“Think like an attacker.”

CyberArk Labs

Publications

Open-Source Tools

Security Conferences

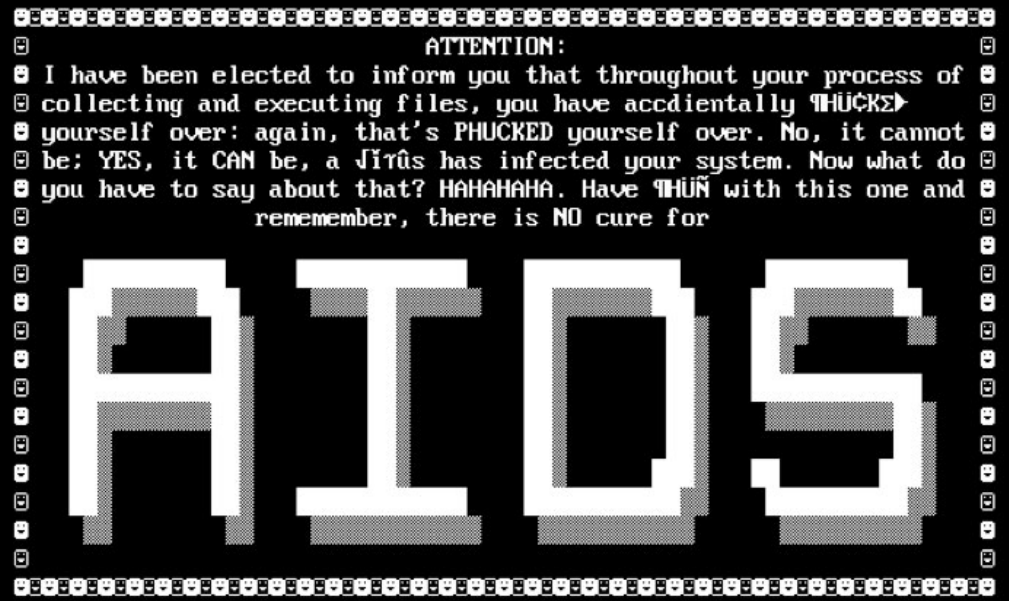
Agenda

- A brief history of ransomware.
- Intermittent Encryption
  - BlackCat Ransomware
- PDF 101 – Stream Objects
- White Phoenix + Demo

A Brief History of Ransomware

1989: PC Cyborg
(aka The AIDS Virus)

- Replaced Autoexec.bat
  - After 90 days, Encrypted file names on c:/
  - Asked to ‘renew the license’
    - $189 to a PO box in Panama
  - Dr. Joseph Popp was arrested by Scotland Yard later that year and charged with blackmail



Ransomware Evolution

Lockers

- Early-2000's
- i.e. WinLock
  - Locks out of PC
- Easily removed
  - Boot into safe-mode
  - Remove registry key

Crypters

- Mid-2000's
- i.e. GPCoder
  - Encrypts individual files
- Not so easily removed
  - Required decryption key

Crypto-Currency (2009)

Bitcoin

- Secure
- Instant
- Not Regulated
- Pseudo-Anonymous
- Perfect for EXTORTION!

RaaS (2015)

- Allows individuals with little technical expertise to launch ransomware attacks
- Offers support and customer service
- Customized to target specific industries or organizations

Double Extortion (2019)

- Encrypts AND exfiltrates data
- Double the pay!

Today’s Ransomware

Intermittent Encryption

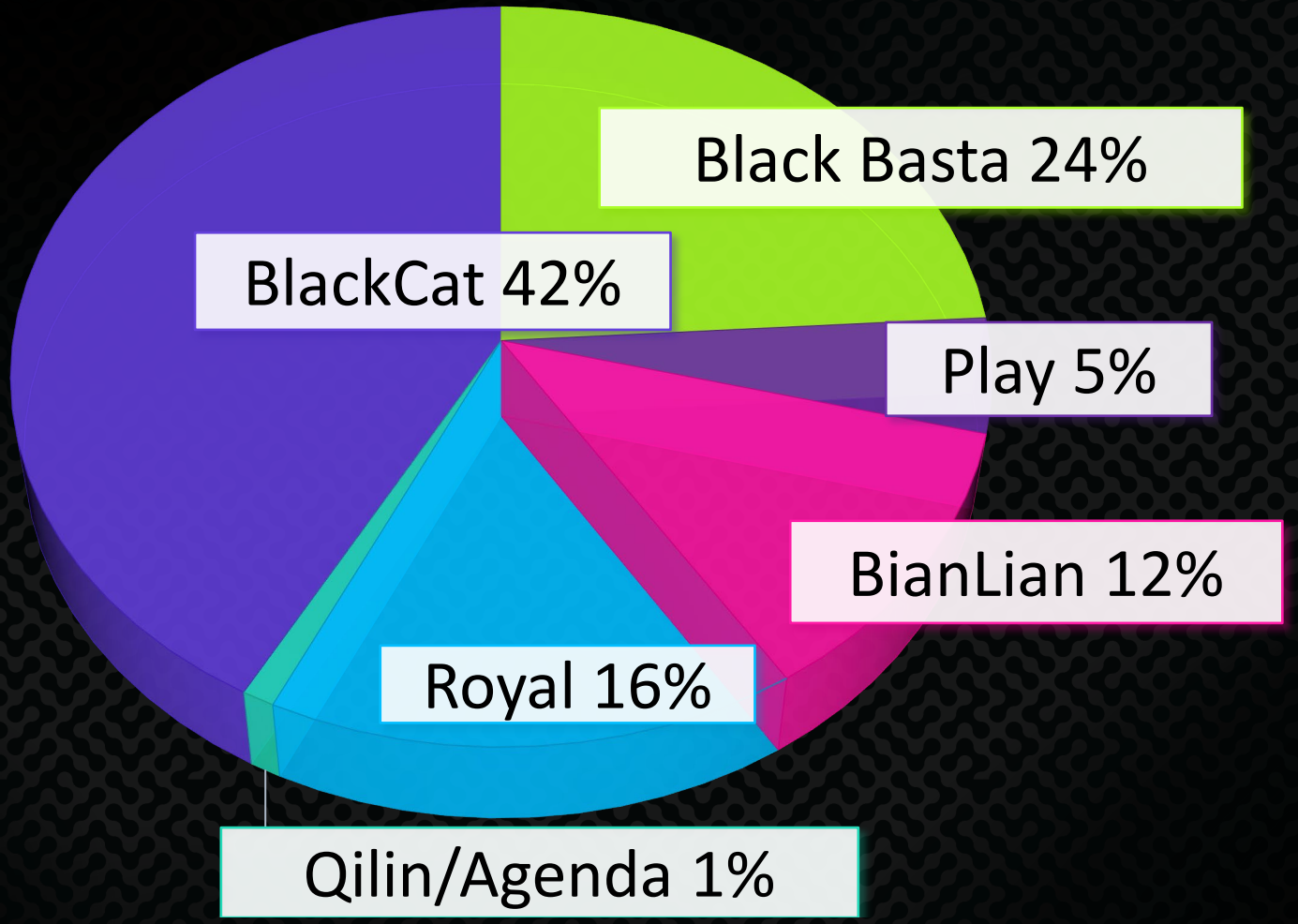
Speed

- Potentially Stopped Prematurely
- More Files = Higher Chance For Payment

Defense Evasion

- Avoid Detection
- Obfuscation

Telemetry


Black Basta 24%
BlackCat 42%
Play 5%
BianLian 12%
Royal 16%
Qilin/Agenda 1%

Blackcat

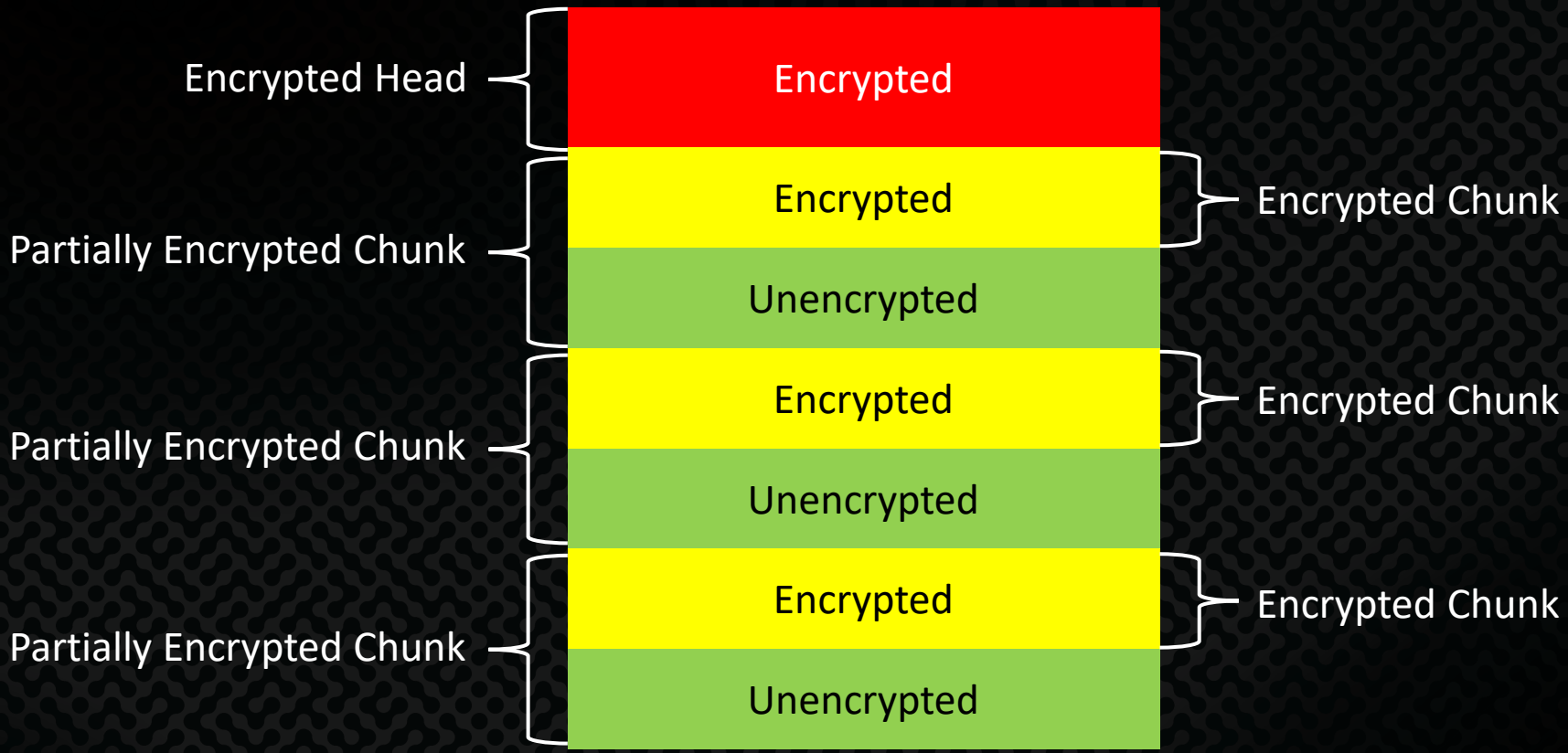
- Among the most successful RaaS
- “Most Sophisticated”
- Highly configurable
  - 6 Encryption modes

AUDIENCE

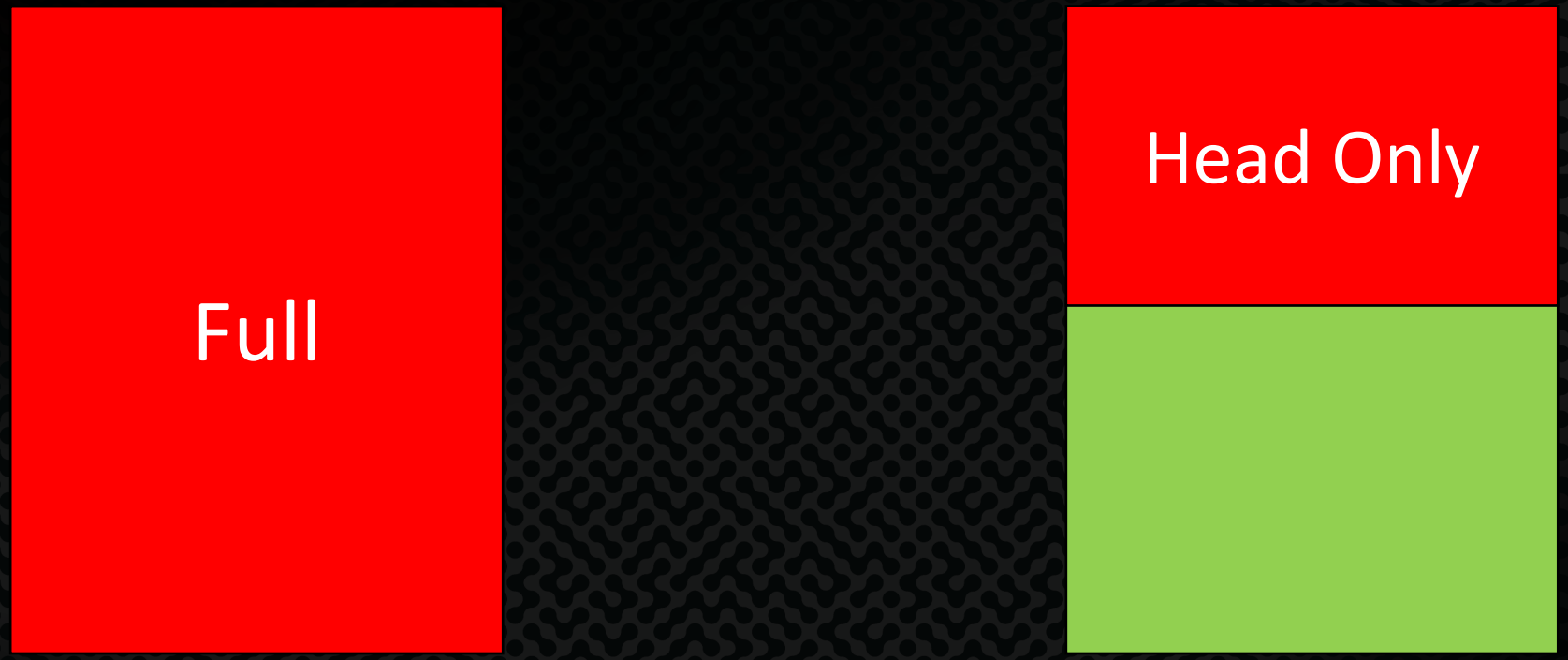
ADVISORY

TECHNICAL CONTENT

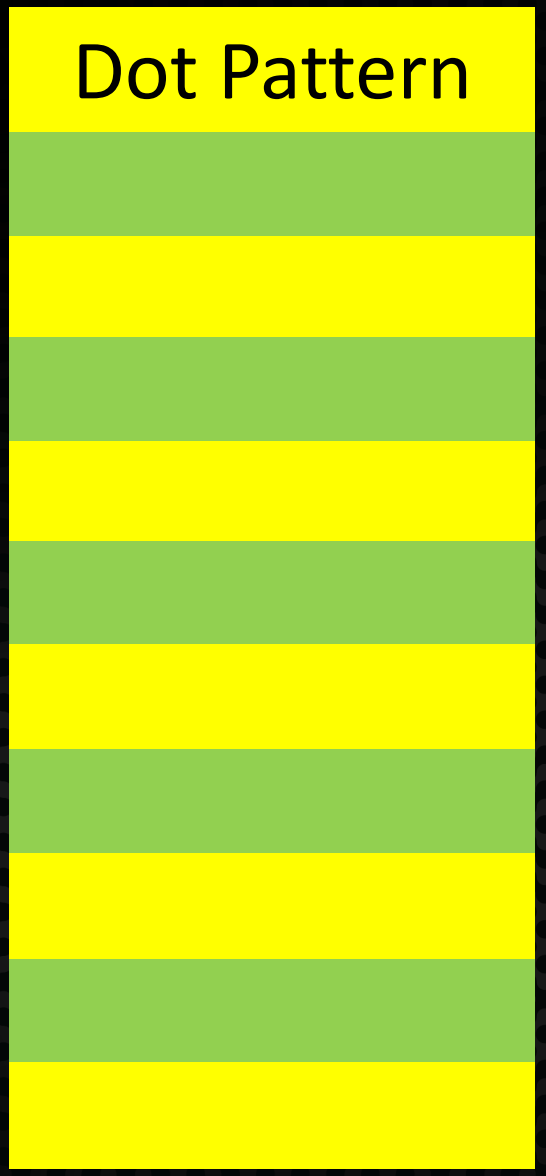
BlackCat Encryption Mode Structure

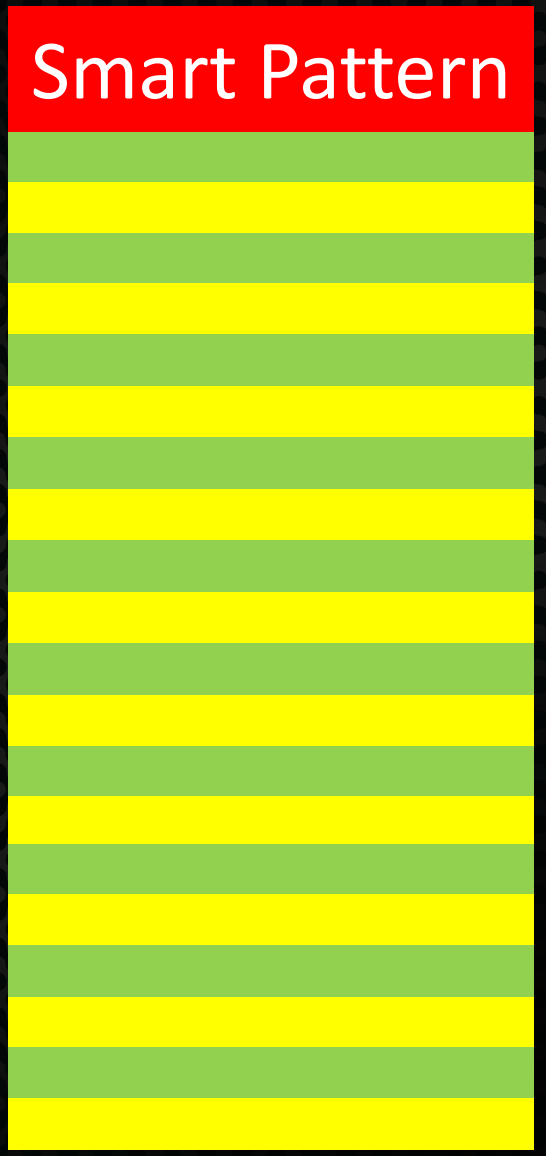


Encryption Modes 1 & 2

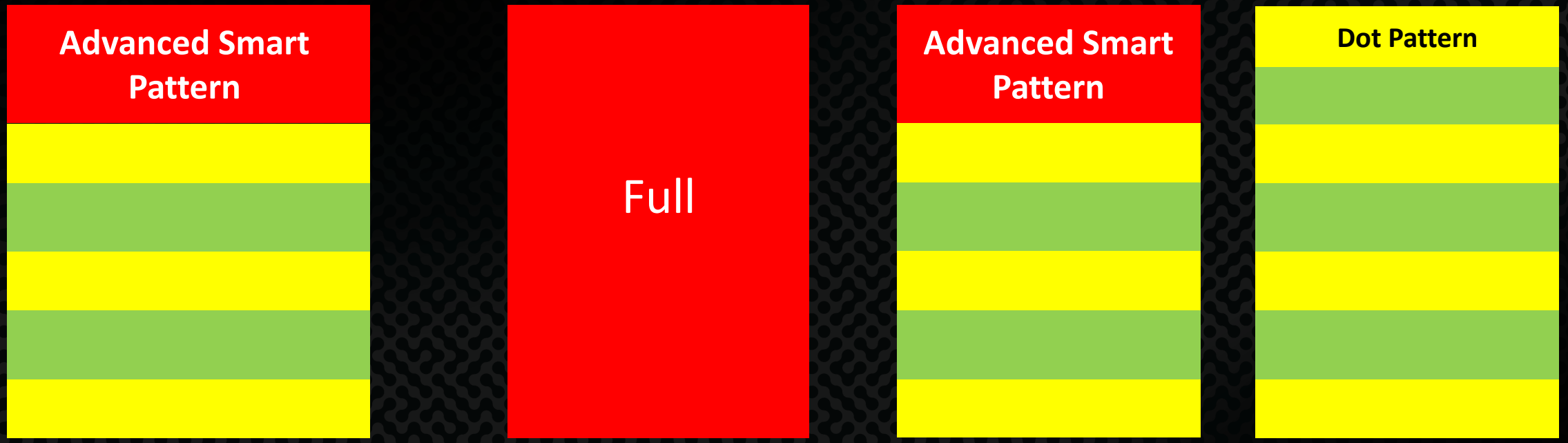


Encryption Modes 3 & 4





Encryption Modes 5 & 6



Anatomy of a PDF

- Head
- Body
- Footer

```
4 0 obj
<</Filter/FlateDecode/Length 182>>
stream
xæmÏOVT,@DLEENOðûÀ|‡w¬SOëiª«,xðOR DC4
GS¢C„y²¨¾?´JA‡æ8<ÞoACKÞSOiê5Å¦„dEMò²€W·SYNÃ‹éÁ$DLE%n¬SYN?„ÕACK
ENOcŠDC1EMEOTá´ºŒLÞf<SI}ˆòŽ=DC3ª¦NUL~<ýñ&fF$qýòGÉ;W¶ÖÐZI€î
Ê¤gS#ôDC3åÇ³i"tãtñàÂu›Ì/BSj¦ãSTXËDC3º-SåŠ¾§¼SOH"l1Þ
endstream
endobj
```

This is an example

```
0 g
/GS8 gs
0 G
[(This is an)3( e)-3(xam)-5(p)3(le o)-7(f a )-2(sim)-3(p)3(le t)-3(ex)-3(t )] TJ
ET
Q
q
0.00000912 0 612 792 re
W* n
BT
/F1 11.04 Tf
1 0 0 1 228.17 709.66 Tm
0 g
0 G
[(o)-5(b)3(jec)-2(t)] TJ
ET
Q
q
0.00000912 0 612 792 re
W* n
BT
/F1 11.04 Tf
1 0 0 1 256.37 709.66 Tm
0 g
0 G
[( )] TJ
ET
Q
q
0.00000912 0 612 792 re
W* n
BT
/F1 11.04 Tf
1 0 0 1 258.89 709.66 Tm
0 g
0 G
[(in)5( a )-3(P)-4(D)-4(F)] TJ
ET
```

[(This is an)3(e)-3(xam)-5(p)3(le))]

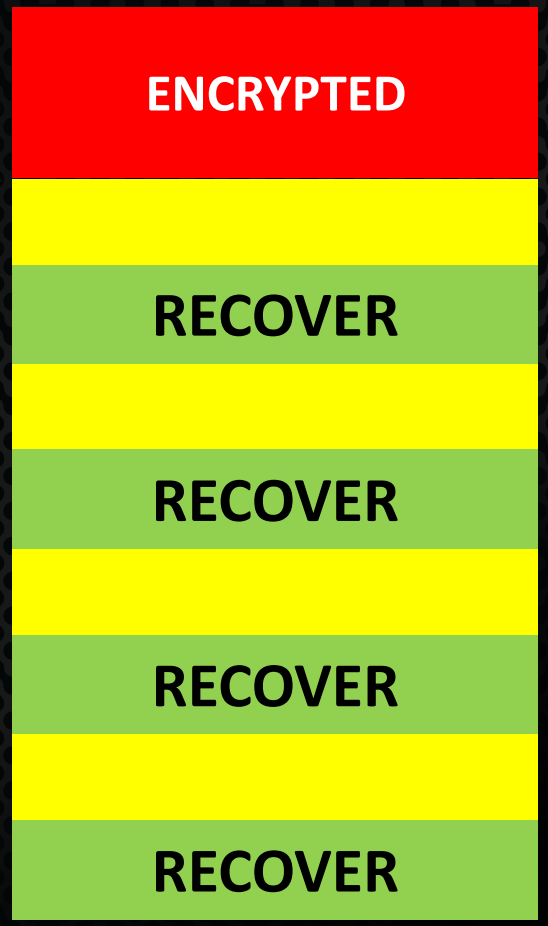
White Phoenix

White Phoenix

- Recovers data after intermittent encryption
- Primarily support PDFs
- Some support for office + zip

Recovery Logic

- Many Formats Composed Of Blocks
- Potentially Unencrypted Blocks
- Recover Content From Blocks With Data



Summary

- Intermittent Encryption = Partial Encryption
- Files Are Made Of Blocks
- **We Can Recover Some Data**


Blog Post
GitHub