Crimeware and Botnets

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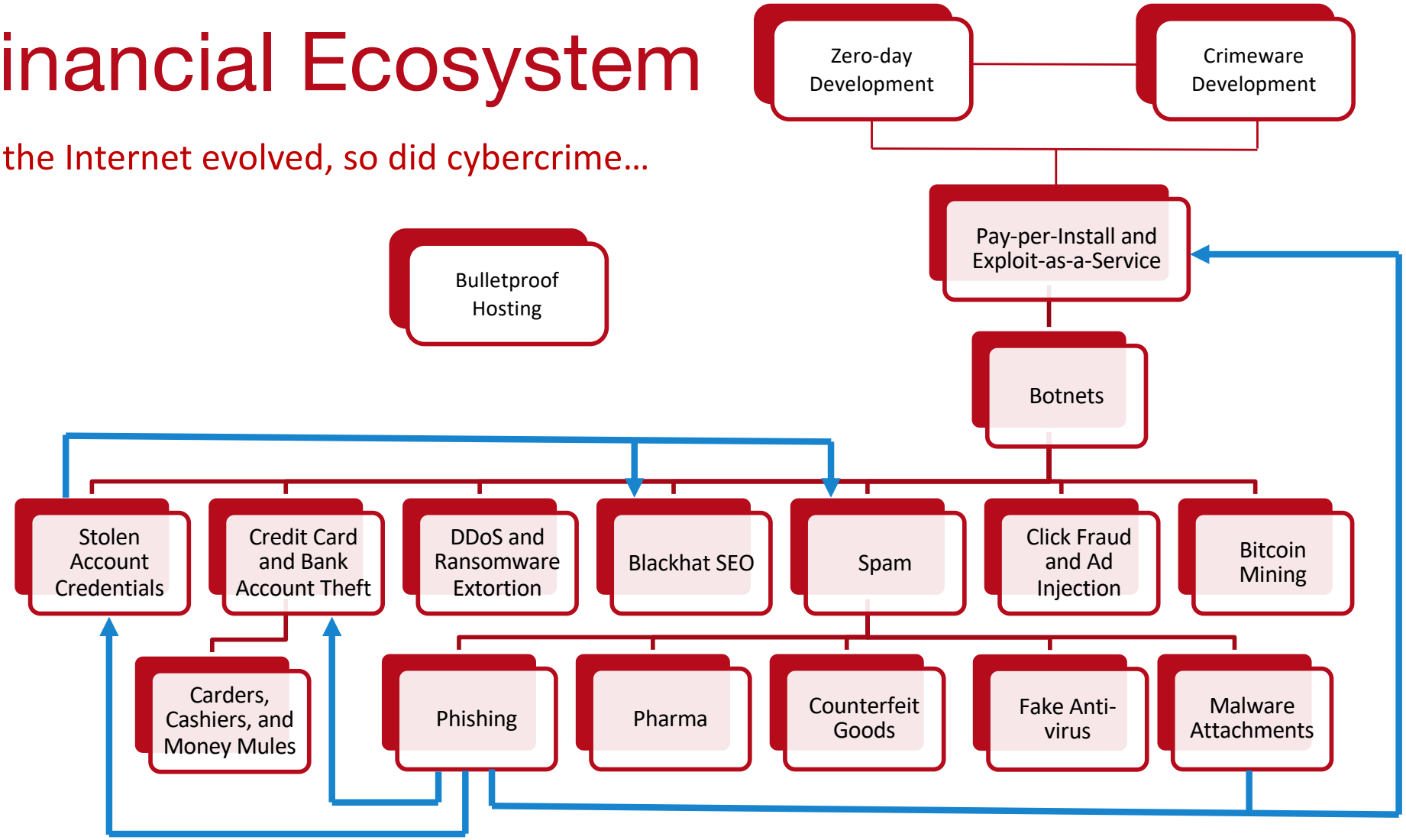
Internet Crime as a Financial Ecosystem

As the Internet evolved, so did cybercrime…

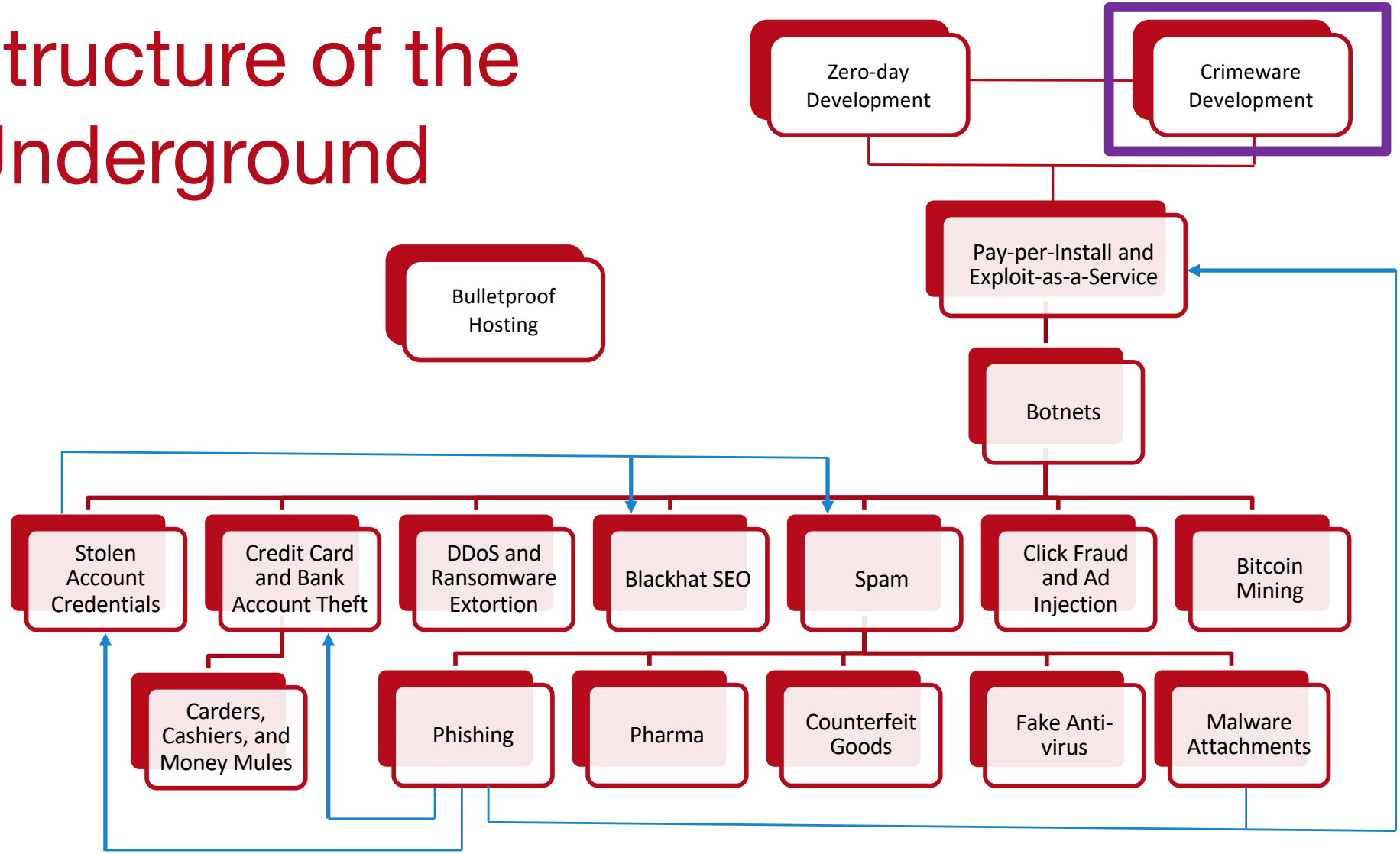


- Liberal “slide borrowing” from C. Wilson @ NEU
- Most content from recent papers by Savage/Voelker et al.

Malware, Spyware, Adware, Ransomware, Trojans, RATs, Bots…

CRIMEWARE

Structure of the Underground



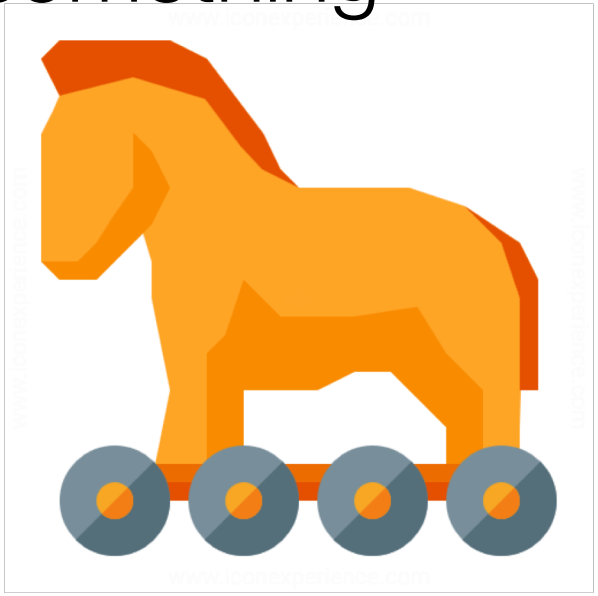
Types of Crimeware

- Concealment and control
  - Trojans, backdoors, root kits
- Infection and propagation
  - Viruses and worms
- Stealing and spying
  - Spyware, keyloggers, screen scrapers
- Profit
  - Dialers, scareware, ransomware, ad injection and clicking, droppers, crypto currency mining, credential and account theft, …
- Botnets

Note
A given piece of crimeware may exhibit multiple types of behavior!

Trojans

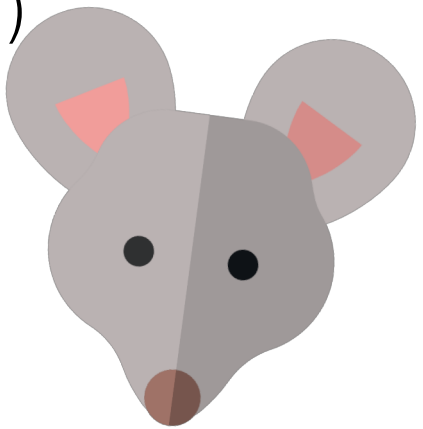
- Software that appears to do something useful
  - A game
  - An e-card
  - A needed video codec
  - A browser toolbar



- But actually harms the system in some way
  - Malicious activity is often masked
  - User only sees the “advertised” functionality

Backdoors

- Malware that opens a secret entry point into a system
- Many possible implementations
  - Create a specific user account with a predefined password
  - Enable guest access
  - Turn-on existing remote admin functionality (e.g. remote desktop, telnet)
  - Open a listening port and wait for commands
- Trojan + backdoor = Remote Access Trojan (RAT)
  - Common tools used by spies and stalkers



Rootkits

- Tool that gives an attacker continued privilege escalation
  - Typically installed after exploiting the kernel or gaining root privileges
  - Modifies the OS to make privilege escalation permanent

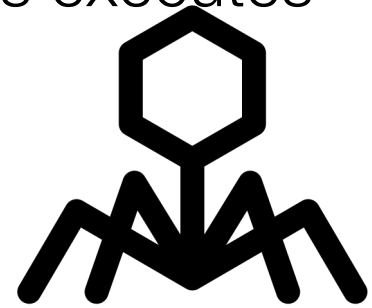
- Emphasis on evasion
  - Rootkit makes itself (and possibly other malware) undetectable
  - Hides processes, files, network sockets
  - In other words: the OS can no longer be trusted
- Very challenging to remove
  - Erasing the OS and reinstall from scratch might work

Types of Rootkits

- User-level rootkit
  - Replaces system utilities like ps, ls, ifconfig, etc.
  - Replaces key system libraries like libc
  - Annoying, but detectable by AV and utils like tripwire
- Kernel-level rootkits
  - Modify or replace key OS kernel functionality
  - Sometimes implemented as a kernel module or device driver
  - Mitigation: kernel-driver signing (required by 64-bit Windows)
- Bootkits
  - Replace the boot loader or Master Boot Record (MBR)
  - Loads before the OS and modifies it as it loads
- Hypervisor-level rootkits, firmware/BIOS rootkits, …

Viruses and Worms

- Virus
  - Self-replicating code that infects other programs
  - When an infected program is run, the virus executes and spreads
  - Very rare today, fallen out of fashion



- Worm
  - Self-replicating program, does not require a host

Worm Considerations

- Vector of infection
  - Infect victim, mail copies to everyone in address book
  - Infect removable drives, e.g. USB keys
  - Infect shared network drives
  - Scan for vulnerable hosts on the internet and exploit them
  - Attempt to crack remote access passwords
- Spreading behavior: slow or fast? Noisy or stealthy?
- Payload
  - Some have no payload, just spread
  - Others are backdoors, bots, spyware, etc.

Famous Worms

Name	Year	Description
Morris Worm	1988	Exploited bugs in sendmail and fingerd, crashed the internet
ILOVEYOU	2000	Email attachment, estimated $5.5-10 billion in damages
Code Red	2001	Exploited MS Index Server, infected 340k servers in 14 hours
Nimda	2001	Used exploits in IE and IIS, spam and network drive infections
SQL Slammer	2003	Exploited MS SQL Server, entire vulnerable population infected in 10 minutes
MyDoom	2004	1 million infections, turned into a DDoS botnet

Spyware

- Crimeware that passively observes user w/o their knowledge
  - Surprisingly, often used in personal relationships
- Examples:
  - Keyloggers stealthily record all keystrokes
  - Screen scrapers record everything on the screen
- Often used to steal credentials and accounts
  - Personal information like social security number
  - Bank accounts, credit cards
  - Webmail, social networking, etc.
- Modern examples may record audio or webcam video
  - Often used for extortion

$$$

- Dialers
  - Old school scam
  - Modem: call expensive 1-900 numbers
  - Cell connection: send SMS to “premium messaging” services
- Scareware
  - Fake anti-virus
- Ransomware
  - Encrypt the victim’s files, demand payment for the decryption key
  - Often relies on cryptocurrency to avoid banks
  - Likelihood of receiving the key, even if you pay, is not great

$$$, continues

- Ad fraud
  - Inject ads into the users browser, or onto their desktop
  - Surreptitiously click on ads on the attacker's own website
- Droppers
  - Install crimeware from other attackers for a fee
  - Pay-per-install services
- Crypto currency mining (coinhive, cryptojacking…)

Computers don’t just infect themselves…

CRIMEWARE DISTRIBUTION

Building a Botnet

- Botnets are a key enabler of cybercrime
  - Very lucrative to be a botmaster ;)
- How do you build a botnet?
  - Compromise hundreds of thousands of machines
  - Infect them with bot software
- How do you compromise enough machines?

Methods of Compromise

1. Malware email attachments
   - Leverages social engineering
   - Attachment may be a malware program in disguise, or…
   - May leverage an exploit in another piece of software
2. Scanning
   - Connect to servers and probe them for known vulnerabilities
   - Brute force remote access credentials, e.g. SSH
3. Exploiting browser bugs
   - Known as drive-by exploits or drive-by downloads
   - Get the victim to visit a webpage containing exploits

Malware Attachments

- Send spam containing malicious attachments
- Use social engineering to trick users into downloading & opening the attachments

Misleading Icons and File Extensions

funny.jpg

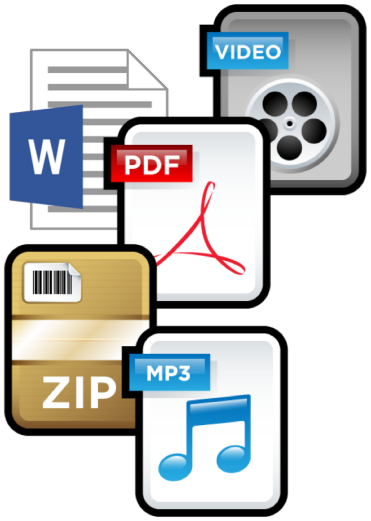
contract.docx

Scripting Languages

VisualBasic script macros

Flash and JavaScript

Exploitable Vulnerabilities



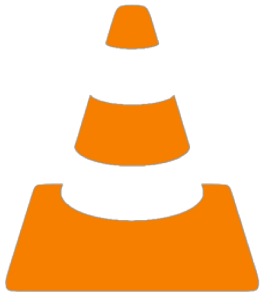
Any complex file format can potentially trigger exploitable bugs and contain shellcode

Often enhanced by social engineering and phishing/spear-phishing attacks

Application Exploit Examples

CVE-2016-2334

Heap-based buffer overflow in the ExtractZlibFile method in 7zip and p7zip allows remote attackers to execute arbitrary code via a crafted HFS+ image



CVE-2016-5108

Buffer Overflow in Processing QuickTime IMA Files

Scanning

- Automatically connect to systems & attempt to exploit
- Port scans and fingerprinting
  - Which services are open and what software is running?
  - Port 80/443 – HTTP(S)
  - Port 139/445 – Windows file sharing (SMB; Server Message Block)
  - Now faster by way of ZMap & variants
- Password brute force cracking
  - Port 22 – SSH
  - Port 23 – Telnet
  - Port 3389 – Windows Remote Desktop Protocol (RDP)

Mirai

- First large-scale IoT botnet
  - Released in August 2016, Infected ~500k devices within few days
  - 500Gbps attack targeting Liberia & 1 underwater fiber optic cable
  - 665Gbps attack against Brian Krebs (non-amplified attack!)
- Trivial infection mechanism
  - Hardcoded list of 60 default login/passwds for IoT devices
  - Wireless Access Points (WAPs), IP cameras, Digital Video Recorders (DVRs), etc.
- Writers caught and sentenced Sept 2018
  - 3 twenty-somethings from NJ, PA and LA
  - Rented out slices of their botnet for attacks (incl. one on Krebs)
  - 5 years probation, 2500 hours comm service, $127,000

Partial Mirai Credential List

Username	Password
666666	666666
888888	888888
admin	*(none)*
admin	1111
admin	1111111
admin	1234
admin	12345
admin	123456
admin	54321
admin	7ujMko0admin
admin	admin
admin	admin1234

Username	Password
admin	meinsm
admin	pass
admin	password
admin	smcadmin
admin1	password
administrator	1234
administrator	admin
guest	12345
guest	guest
root	*(none)*
root	00000000
root	1111

Username	Password
root	1234
root	12345
root	123456
root	54321
root	666666
root	7ujMko0admin
root	7ujMko0vizxv
root	888888
root	admin
root	anko
root	default
root	dreambox

The promise of IoT! Imagine what's coming next?