Malware Cheat Sheet

Packers

Introduction

Packing is a technique originally designed to **compress executables**. These days mostly used for **obfuscation** and anti-debugging. **Malware** usually (>90%) **rely on compression and encryption** to **escape detection** from antivirus software.

A *packer* is the program that **transforms** an *original executable* into *packed data* which can be used by an *unpacking stub* to **reproduce** the original executable. A *packed executable* **combines** the unpacking stub and packed data to produce the original executable at runtime.

Operation

1. Packer consumes an input executable
2. **Transformation**. The executable is transformed, usually via **compression** and encryption
3. **Unpacking stub creation**. The unpacking stub is created, it reverses the transformation, reconstructs the import table and hands over execution to the original executable via a **tail jump**
4. **Combination**. The unpacking stub and executable are combined into a packed executable with the unpacking stub as the entry point

Transformation types

- **Compressors** - compress the executable
- **Crypters** - encrypt the executable
- **Bundlers** - bundles several files
- **Protectors** - protects original code from debugging

Packer types

Monomorphic packers **always produce the same output and binary**. They are trivial to detect and can be statically unpacked.

Polymorphic packers **always produce different output which results in the same binary**. May **hinder signature-based detection** (but can be **possible if** done dynamically), static unpacking is likely not possible. May be produced by adding junk code, in-line random data, generate code etc.

Metamorphic packers **always results in modified binaries**. Much like polymorphic packers.

Atomicity

An *atomic* packer unpacks the **whole original executable at once** and can be unpacked manually.

An *incremental* packer unpacks **a unit of code at a time such** as a basic block, single instruction etc. The entire original executable is never in memory. Impossible to unpack manually.

Packer examples

UPX (Ultimate Packer for eXecutables)

- **Supports a large number of formats of executable files**.
- **Provides compression** at the level of WinZip/zip/gzip, and better
- **Fast in-place unpacking**, which does not require additional memory
- Written in **C + +**
- Extensible
- Uses **GNU**
- Uses compression library NRV, UCL

ASPack

- **Paid** packer of executable **Windows files**.
- Packaging **code**, data and **resources**
- Handles **EXE**, **DLL** and **OCX**
- Quick
- Compression ratio is **40-70%**
- Compatible with C++, Visual Basic, Delphi etc. for Win32

FSG - *F*ast *S*mall *G*ood

- **Free** packer of executable **Windows files**
- **158B** loader
- **TLS support**
- **Written in Assembly**
- Ideal for small applications in Assembly

WinUpack (Ultimate PE Packer)

- **Free** packer for executable **Windows files**
- Compresses resources
- Uses LZMA

Morphine

- Its main use if for **avoiding antivirus** detection
- **Obfuscates unpacking code**
- **Polymorphic engine** with random data
- Uses a PE loader to **complicate memory dumping**
- Open source

- **Allows recursive usage**

Unpacking

One may use **static unpacking** if the packing procedure is known - to extract the binary immediately from the packed executable.

For more advanced packers, one uses **dynamic unpacking** to evaluate the executable until the executable is unpacked in memory. It can then be extracted from the memory using a dump and a import table fixer (PETools and ImportReconstructor).

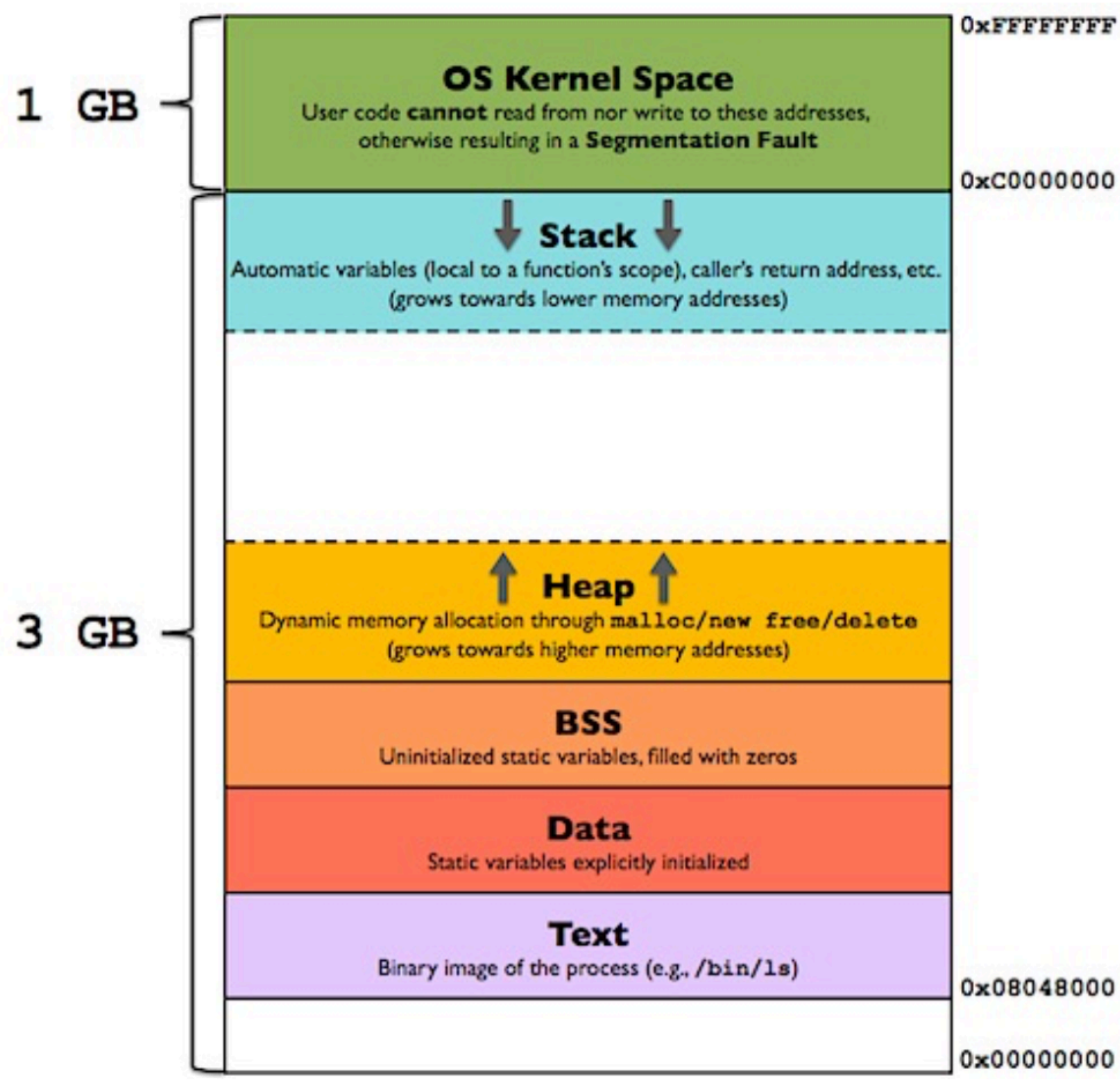
Assembly

Calling conventions

Description	STDCALL	FASTCALL	CDECL
Parameters	Pushed **onto the stack**, **caller** must **clean** up after call	Pushed **onto the stack**, **callee** must **clean** up after call	First two parameters in `ECX` and `EDX`, **rest onto the stack**. **Caller** must **clean** up after call
Return value	EAX	EAX	EAX
Non-volatile registers	EBP, ESP, EBX, ESI, EDI	EBP, ESP, EBX, ESI, EDI	EBP, ESP, EBX, ESI, EDI

Memory layouts

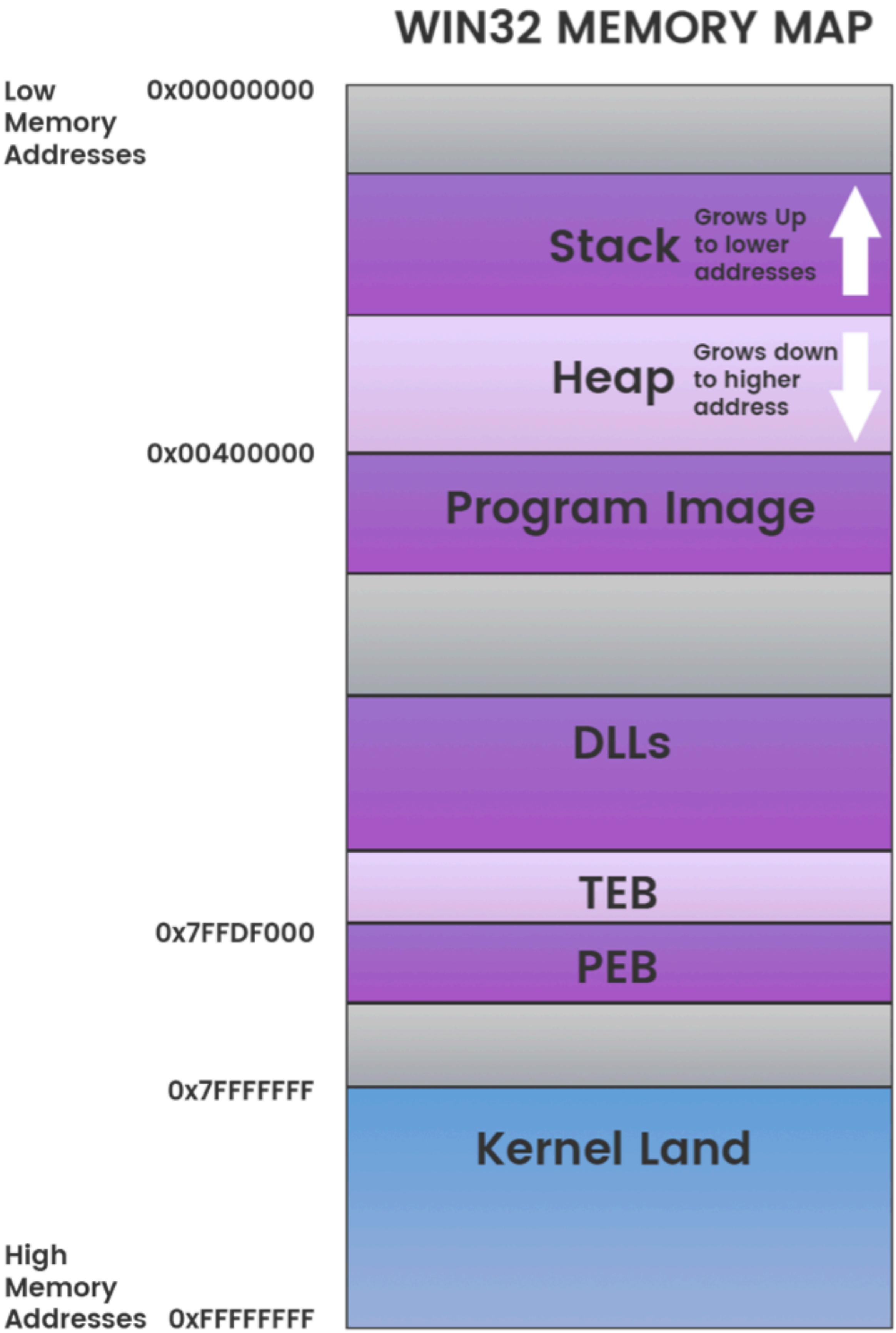
Linux



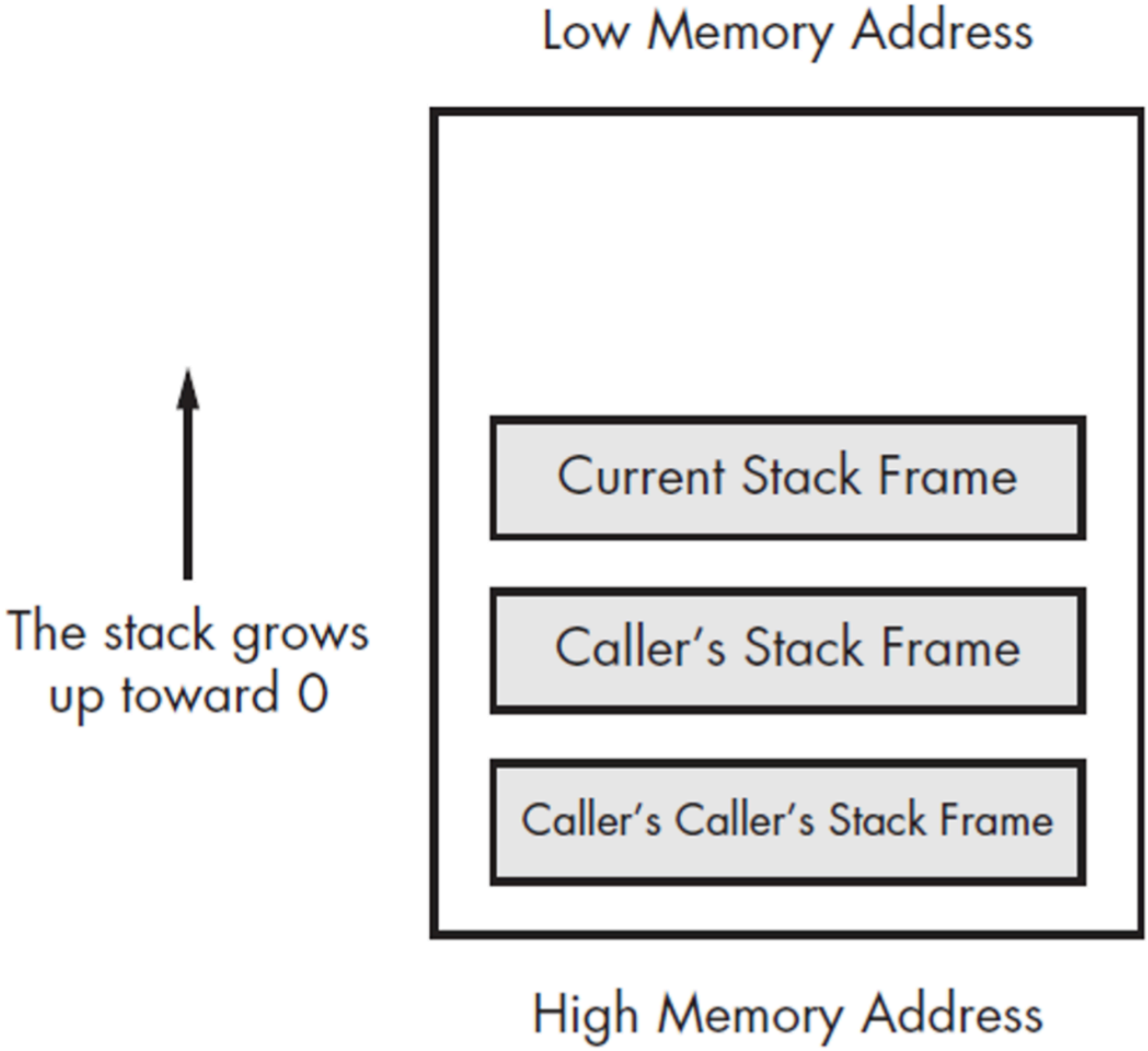
The main four parts of a linux program are:

1. **Stack** - "grows downwards" from **high addresses, local scope** etc.
2. **Heap** - "grows upwards" from **lower addresses**, dynamic memory etc.
3. **Data / BSS** - **static variables**, either uninitialized (zeroed) or explicitly initialized
4. **Text** - **binary image of the process**

Windows


WIN32 MEMORY MAP
Low Memory Addresses
0x00000000
Stack
Grows Up to lower addresses
Heap
Grows down to higher address
0x00400000
Program Image
DLLs
TEB
0x7FFDF000
PEB
0x7FFFFFFF
Kernel Land
High Memory Addresses
0xFFFFFFFF

Stack frames



The **most recent stack frame is at the bottom of the stack**, with its caller before it etc.

Each stack frame contains (in order):

1. **Local variables**... (ESP points to the last one)
2. **Old EBP** (EBP - stack base pointer points here)
3. Return address - points to the instruction after `call`
4. **Arguments**...

Botnets

Introduction

A botnet is a **network of computers** made up of **machines infected** with a malicious backdoor. The controlling server, **command and control center** (C&C, C2, CCC) **communicates** with the bots over a **C&C channel**.

Botnets are used for sending **spam**, performing DDoS attacks, **identity theft** etc.

Types of botnet architecture

- **Centralized** - the C&C communicates **directly with the bots**
- **Decentralized** (P2P, peer-to-peer) - the C&C communicates with **one bot which then spreads the message** to other bots
- **Hybrid** - a **mixture** of the both

Botnet communication channels

- IRC-oriented
- IM-oriented
- Web-oriented
- Other

Lifecycle

1. Botnet **conception** - **designed** and implemented
2. Botnet **recruitment** - infecting machines
3. Botnet **interaction** - registering with C&C
4. Botnet **marketing** - renting, selling source code etc.
5. Attack **execution**

Throughout its life it **may deploy hiding mechanisms** such as **multi-hopping**, **fast-flux proxies**, **ciphering**, **spoofing** etc.

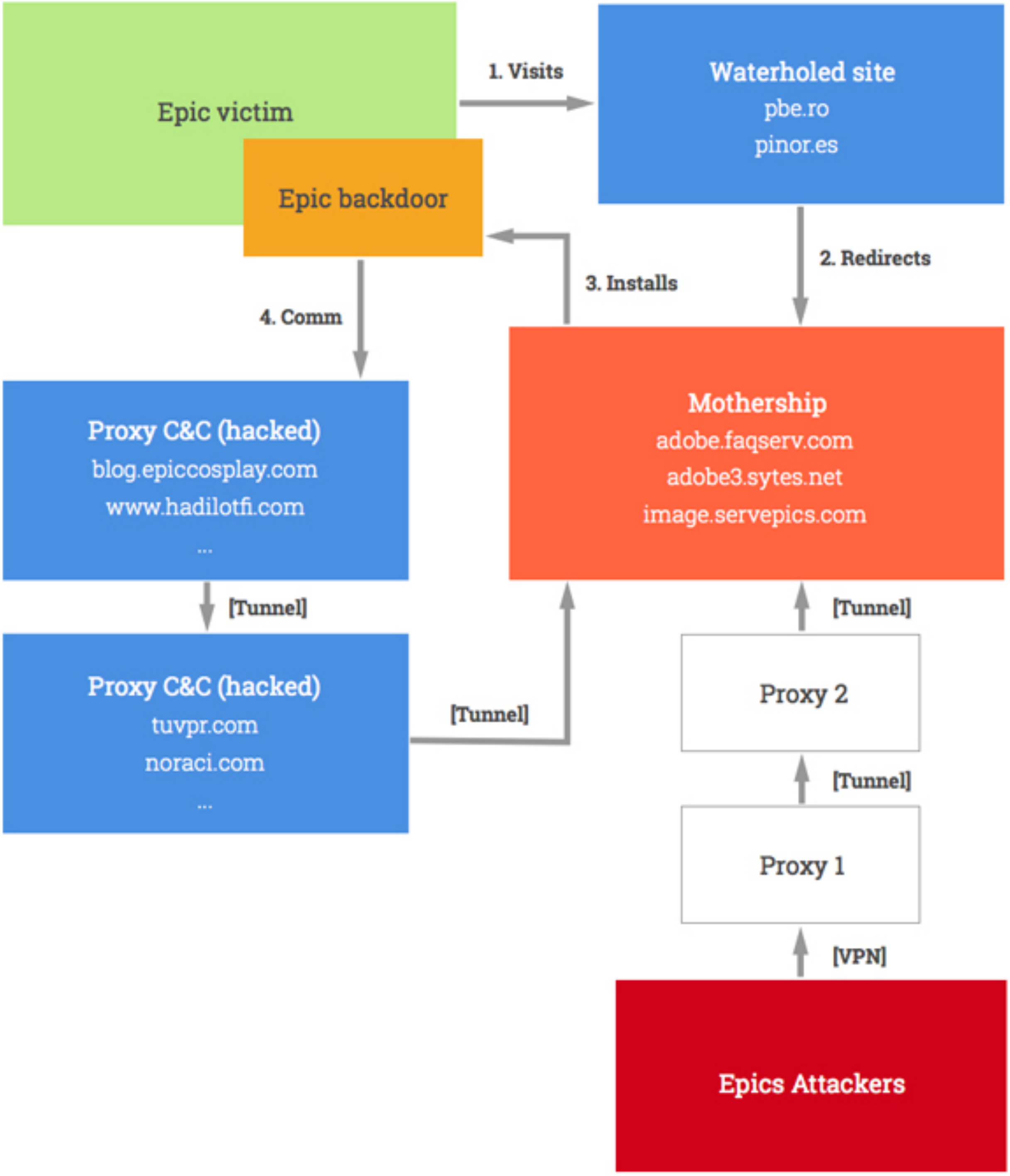
Background radiation

Non-productive network traffic can be seen as **background radiation**. There are different reasons for the radiation:

- **Benign radiation** from **misconfiguration**.
- **Malicious radiation** from flooding **backscatter** - a DoS attack may use **spoofed addresses** and result in the **target responding to requests**, which can detected
- **Malicious radiation** from vulnerability scans

As for **backscatter**, it can be analysed using **darknets**, **honeypots** or both to **observe internet activity** and **malicious scans**.

Epic Turla



Incident response

Digital forensics

Steps

1. **Preparation**
    1. Ensure that there are **dedicated people and tools** to deal with the incident response
2. **Detection / identification**
    1. IDS, firewall, sandbox etc. to **report security issues**
3. **Containment**
    1. **Minimize damage**, isolate compromised devices / VMs, put them on a Security Domain instead of the Internet
4. **Investigation**
    1. **Collect incident-related data**, such as network traffic, files, logs
5. **Analysis**
    1. The incident response team analyzes the data to **report information losses** and indicators of comprimise (**IOCs**).
6. **Remediation**
    1. The incident response team writes a **recommendation for the IT** - what VMs to clean, what keys to exchange etc.
    2. The IT department carries out the recommendations
7. **Prevention**
    1. The incident response team **recommends incident prevention steps**
    2. The IT department carries them out
8. **Lessons learned**
    1. Write an **incident report**
    2. **Analyse** the team's **performance**
    3. Write missing **documentation**

Phishing

Introduction

Phishing is the process of attempting to **acquire sensitive information** by **acting like a trustworthy party**. It's a form of social engineering technique.

Topologies

- **Traditional phishing** uses a **DNS server** to be able to exchange the IP of the hacker's server. The website lifetime is about **60 hours**
- **A rock-phish** topology uses a **DNS server** to resolve a domain to **any number of proxy bots** which in turn communicate with the hacker's server. The website lifetime is about **170 hours**.
- **A fast-flux phishing** topology uses a **DNS server** to resolve a domain to **any number of dynamic pools of proxy bots** which in turn communicate with the hacker's server. The website lifetime is about **200 hours**.

Malware

Types of malware

- **Worms** - **automatic propagation** without human assistence, spreads itself over network channels
- **Viruses** - **human-assisted propagation** such as an email attachment, tries to replicate itself
- **Trojans** - **hides** its malicious operations as a program that performs some desirable function for the user
- **Rootkits** - **modifies the OS** to hide its existence
- **Backdoor** / trapdoor - used for **remote control**
- **Logic bomb** - execute a **malicious** behaviour **once certain conditions are met**, such as when a program is ran in the target environment

Worm

1. **Dormant phase** - on victim's device, **waiting to be activated**
2. **Propagation phase** - **copies itself** to other disks, emails etc.
3. **Triggering phase**
4. **Execution phase** - **payload is executed**

Cyber Kill Chain

Phases of the Intrusion Kill Chain

Reconnaissance	Research, identification, and selection of targets
Weaponization	Pairing remote access malware with exploit into a deliverable payload (e.g. Adobe PDF and Microsoft Office files)
Delivery	Transmission of weapon to target (e.g. via email attachments, websites, or USB drives)
Exploitation	Once delivered, the weapon's code is triggered, exploiting vulnerable applications or systems
Installation	The weapon installs a backdoor on a target's system allowing persistent access
Command & Control	Outside server communicates with the weapons providing "hands on keyboard access" inside the target's network.
Actions on Objective	The attacker works to achieve the objective of the intrusion, which can include exfiltration or destruction of data, or intrusion of another target