Embedded devices, an AntiVirus-free safe hideout for Malware

# IS YOUR GAMING CONSOLE SAFE?

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# About

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# Introduction

- Embedded systems(gaming consoles, smartphones, etc.) have enough hardware for malware to survive and perform it's job

- There are not so many publicly disclosed issues of malware on these devices which make people think that they are safe

- The possibilities of malware on embedded systems and the resulting effects will be shown in this presentation with some real world examples, along with some possible defenses

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## Background Knowledge
- The pirate scene of Gamine consoles and Smartphones
- The current state of malware on embedded devices
- The mindset of the general public

## The attacker's point of view
- Gaming consoles as an attacking tool
- Malware on Console Gaming systems
- Malware injection on Smartphone applications

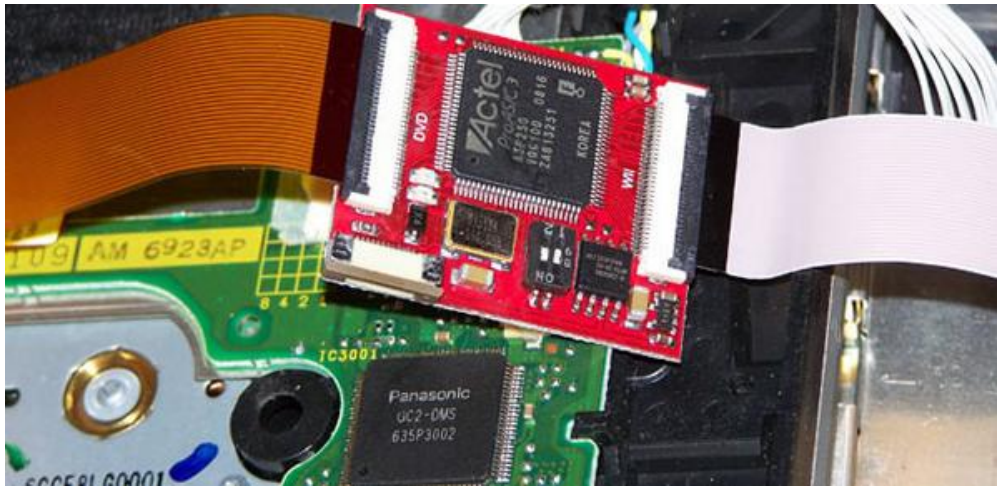
## Preparation - Our defenses
- Manufacturers : Steps to take when designing a new device
- Service, Security companies : Measurements in Software or Policies
- Users : Precautions for the general users

# Background Knowledge

# The pirate scene of Gamine consoles and Smartphones

# Payed software being illegally downloaded

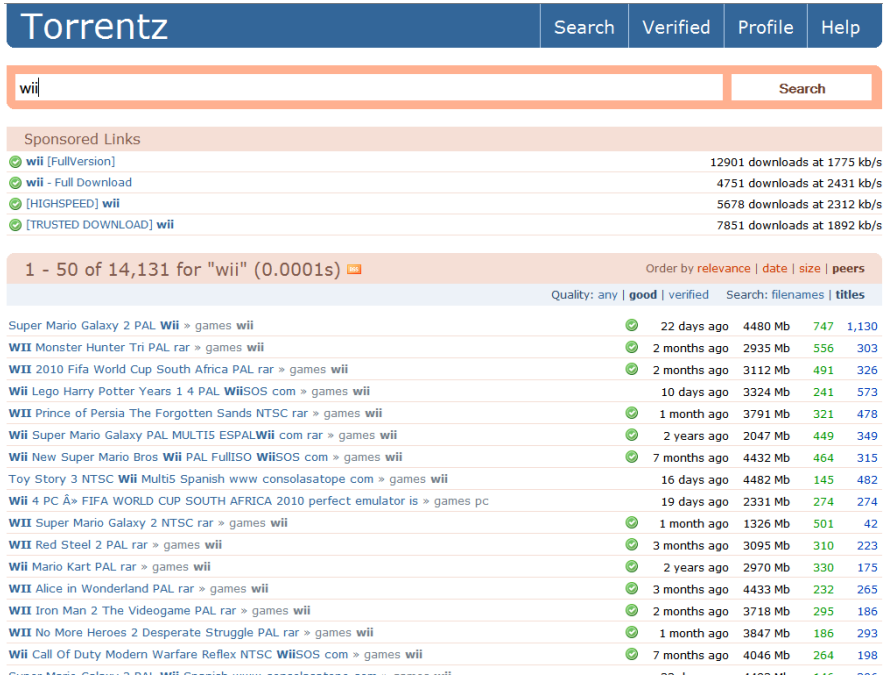
- Most embedded devices implement anti pirate Measures by some means, but these protections are eventually bypassed

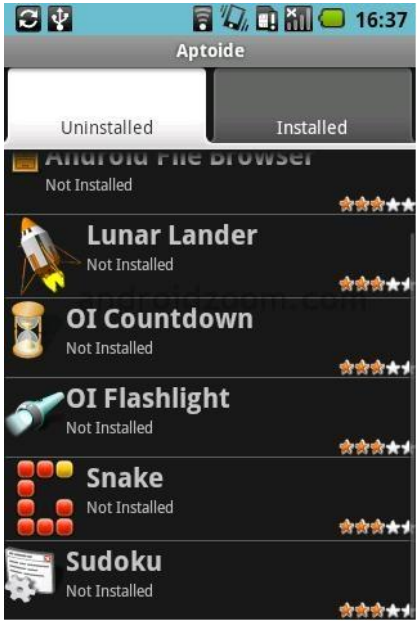




# The distribution of illegal software

- Just like PC software, illegal software is Being distributed without any restrictions via P2P, torrents, web storage
- Easily accessible by the general public



# The current state of malware on embedded devices

# Malware on Gaming Consoles

- Disguises itself as a useful homebrew application, and lures users to install it

- Disguises itself as an essential bypassing tool or crack, and upon installation, eventually causing havoc or wrecking the device

# Malware on Smartphones

- Worm that targets jailbroken iphones using a default password

- Traditional malware techniques incorporated in Windows Mobile and Blackberry

- Social Engineering worm that collects phone information on Symbian Smartphones

- Trojaned Windows Mobile Games

- Toaster Rootkit

- Android Rootkit

# The mindset of the general public

# User’s thoughts of malware on embedded devices

- Users not being suspicious just by the fact that that they're using ‘normal’ apps that don’t look 'fishy'

- Most people do not even give a second thought before installing downloaded software, and merely just check that the application works

# However...

- These devices are capable of bringing similar negative effects of PC malware, and the boundary of these devices and the PC is getting very thin due to the evolution of hardware

- Most recent Gaming Consoles contain hardware to connect to the network, so an almost ideal environment if provided for malware to survive and perform it's task.

# The mindset of an attacker

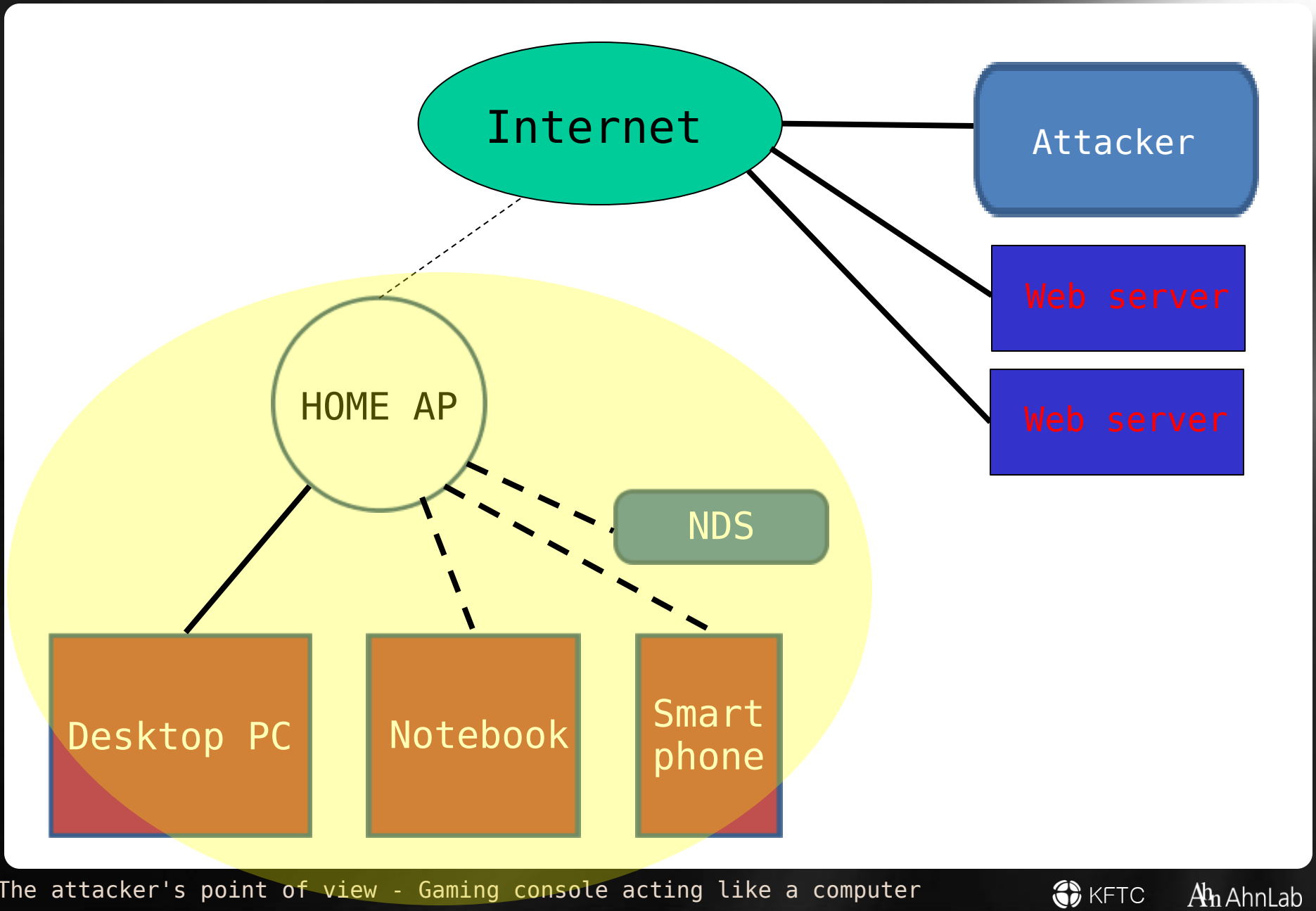
# Gaming Consoles as an attacking Tool

# The hardware and software development environment

- Most embedded devices contain a high quality CPU, I/O devices, and network devices

- SDKs not officially provided by the manufacturer, but users can create legit software that runs on the device(via homebrew) with a custom development environment

# Hacking with NDS



# Hacking with NDS

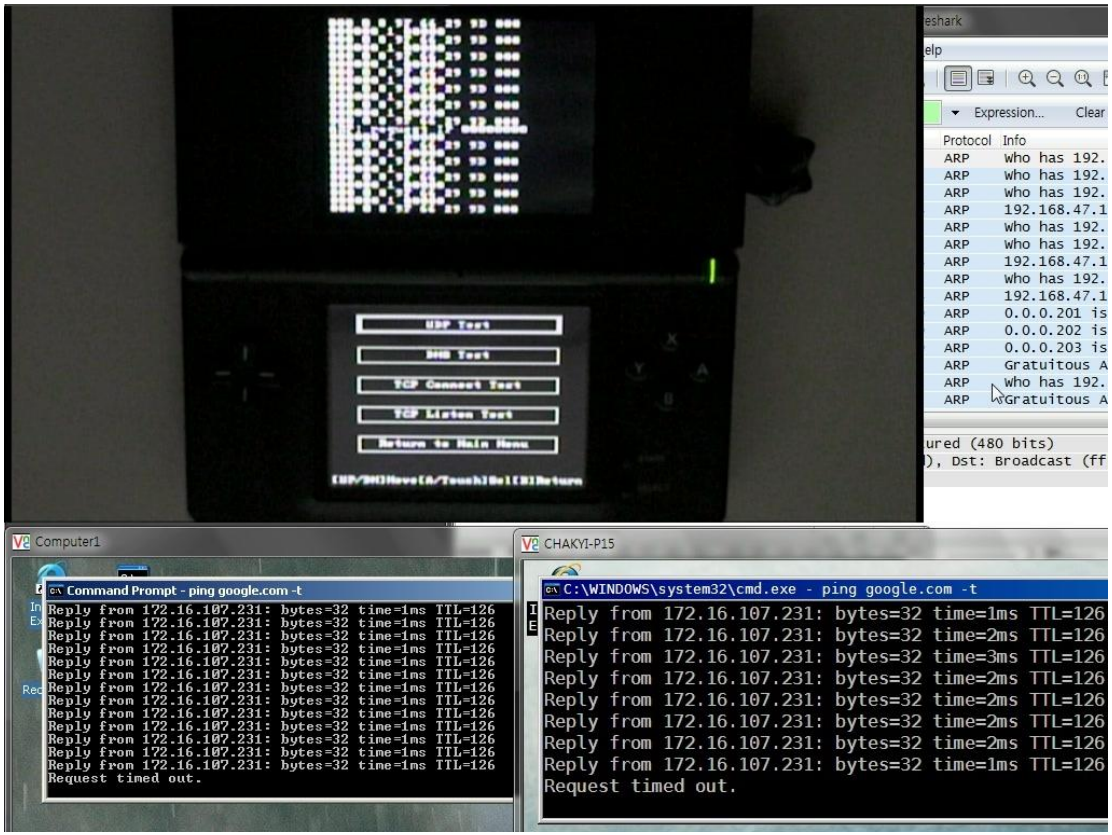
- Attacking and taking control of a PC

- Demo : Using NDS to attack a PC on the network with a public remote exploit

# Hacking with NDS

- Attacking the network

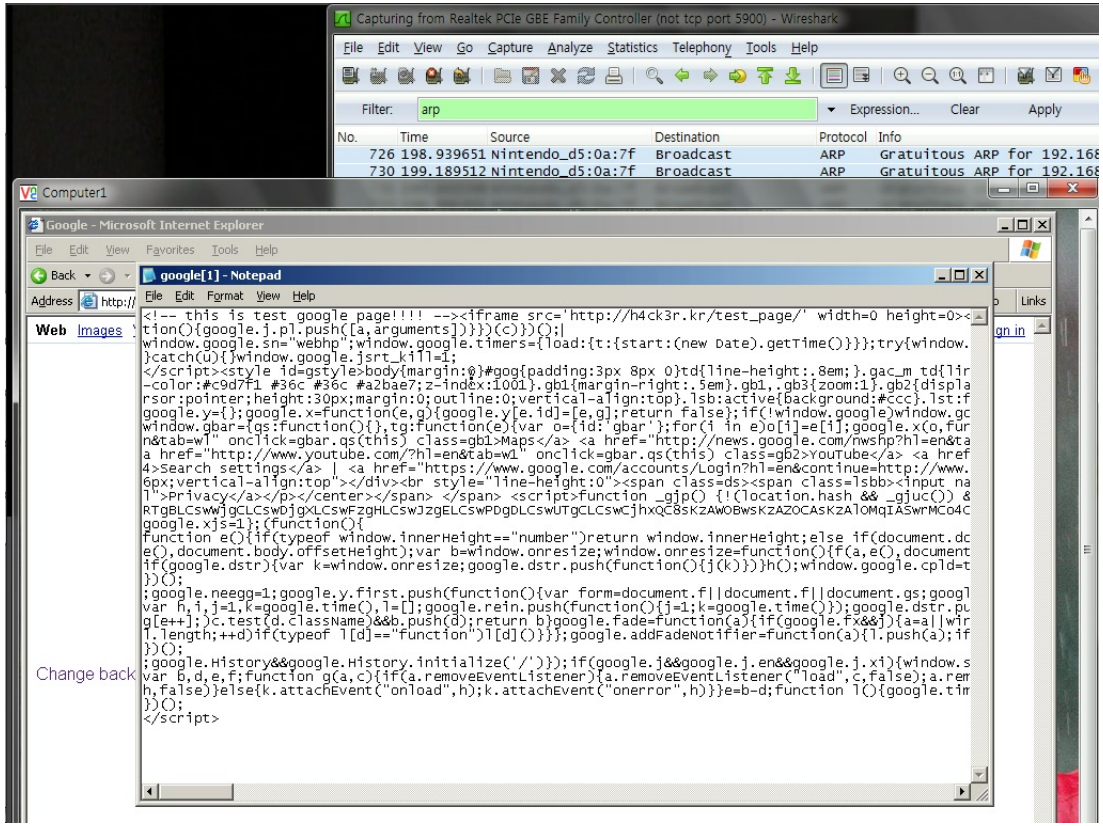
- Demo : Using NDS to bring down a network



# Hacking with NDS

- Injecting malicious code in network packets

- Demo : Using NDS to inject malicious code by modifying packets



# Malware on Console Gaming systems

# Piracy in the gaming industry

| Subcategory Name | Torrents |
|---|---|
| Dreamcast | 846 |
| Game fixes/patches | 856 |
| GameCube | 353 |
| GNU/Linux | 160 |
| Mac | 337 |
| Mobile phones | 306 |
| Nintendo DS | 8399 |
| Other platforms | 1309 |
| Palm, PocketPC & IPAQ | 151 |
| PS 2 | 7900 |
| PS X | 1706 |
| PSP | 10332 |
| ROMS / Retro | 1379 |
| Sega Saturn | 71 |
| Video Demonstrations | 343 |
| Wii | 9154 |
| Windows | 49047 |
| Windows - Kids Games | 838 |
| windows/mac | 6 |
| XBox | 339 |
| XBox 360 | 646 |

2nd place among the current gaming console systems, closely following PSP

# The inner workings of games running on Wii

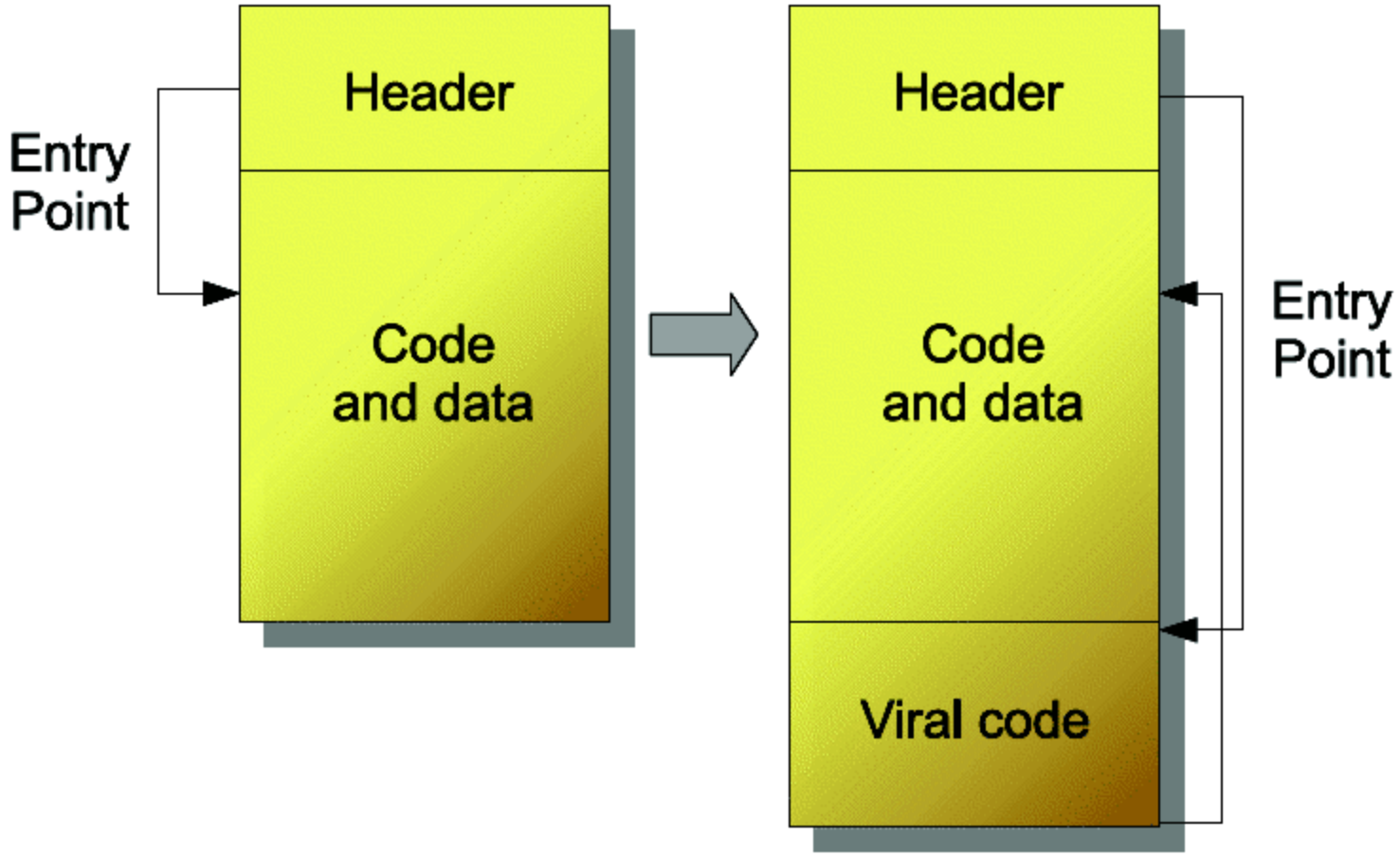
- executables files are files with .dol extension
- they are essentially a stripped down version of an elf file
- system menu -> apploader -> .dol
- .dol files(and sometimes .rel files) contain all code needed for the game to run

# How custom code can be injected

- Merge 2 dol files
- Update header information
- Inject code that transfers execution to the game .dol after the execution of the injected .dol
- Fix a few problematic parts in the binary

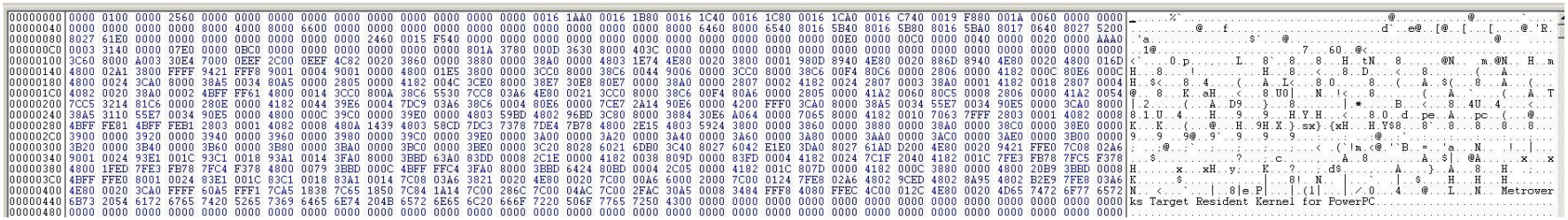
| Start | End | Length | Description |
|---|---|---|---|
| 0x0 | 0x3 | 4 | File offset to start of Text0 |
| 0x04 | 0x1b | 24 | File offsets for Text1..6 |
| 0x1c | 0x47 | 44 | File offsets for Data0..10 |
| 0x48 | 0x4B | 4 | Loading address for Text0 |
| 0x4C | 0x8F | 68 | Loading addresses for Text1..6, Data0..10 |
| 0x90 | 0xD7 | 72 | Section sizes for Text0..6, Data0..10 |
| 0xD8 | 0xDB | 4 | BSS address |
| 0xDC | 0xDF | 4 | BSS size |
| 0xE0 | 0xE3 | 4 | Entry point |
| 0xE4 | 0xFF | | padding |

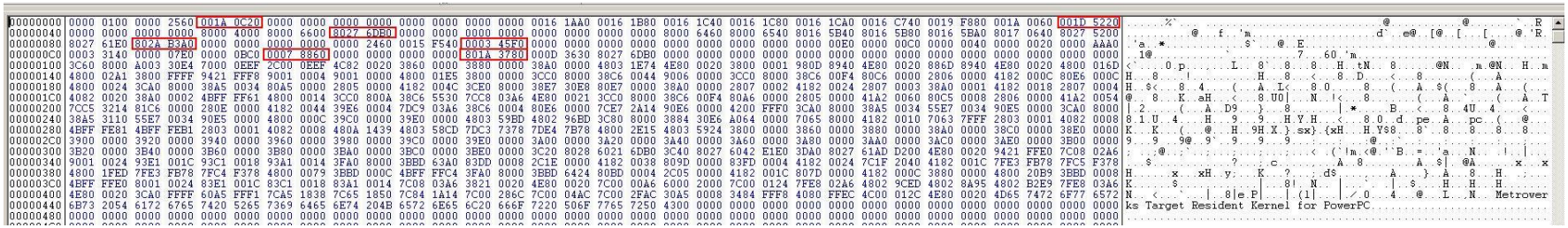
# Basic infection process



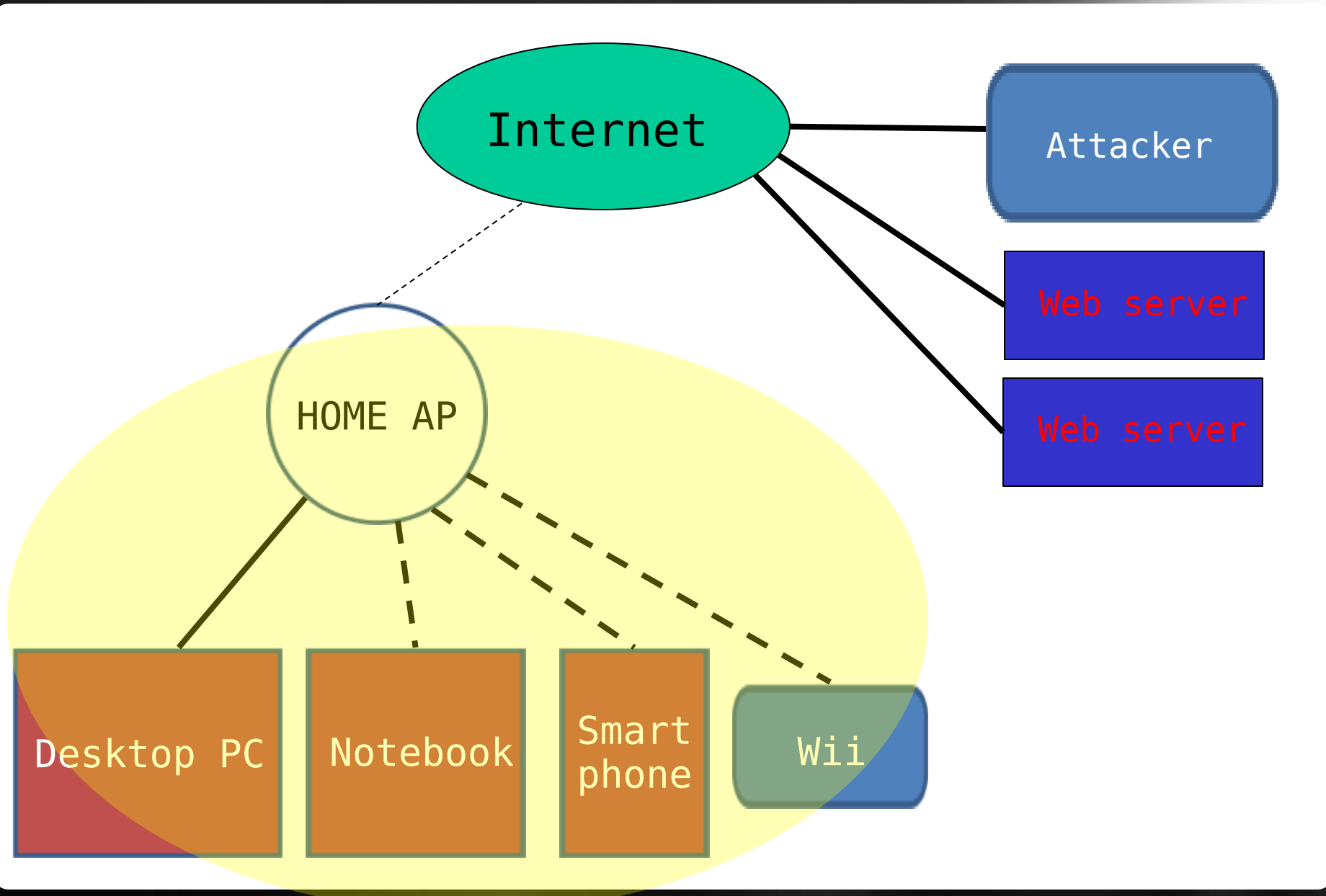
# How custom code can be injected

- Demo1 : POC of malware injection on Nintendo Wii games
  Demo2





# Malware on Wii

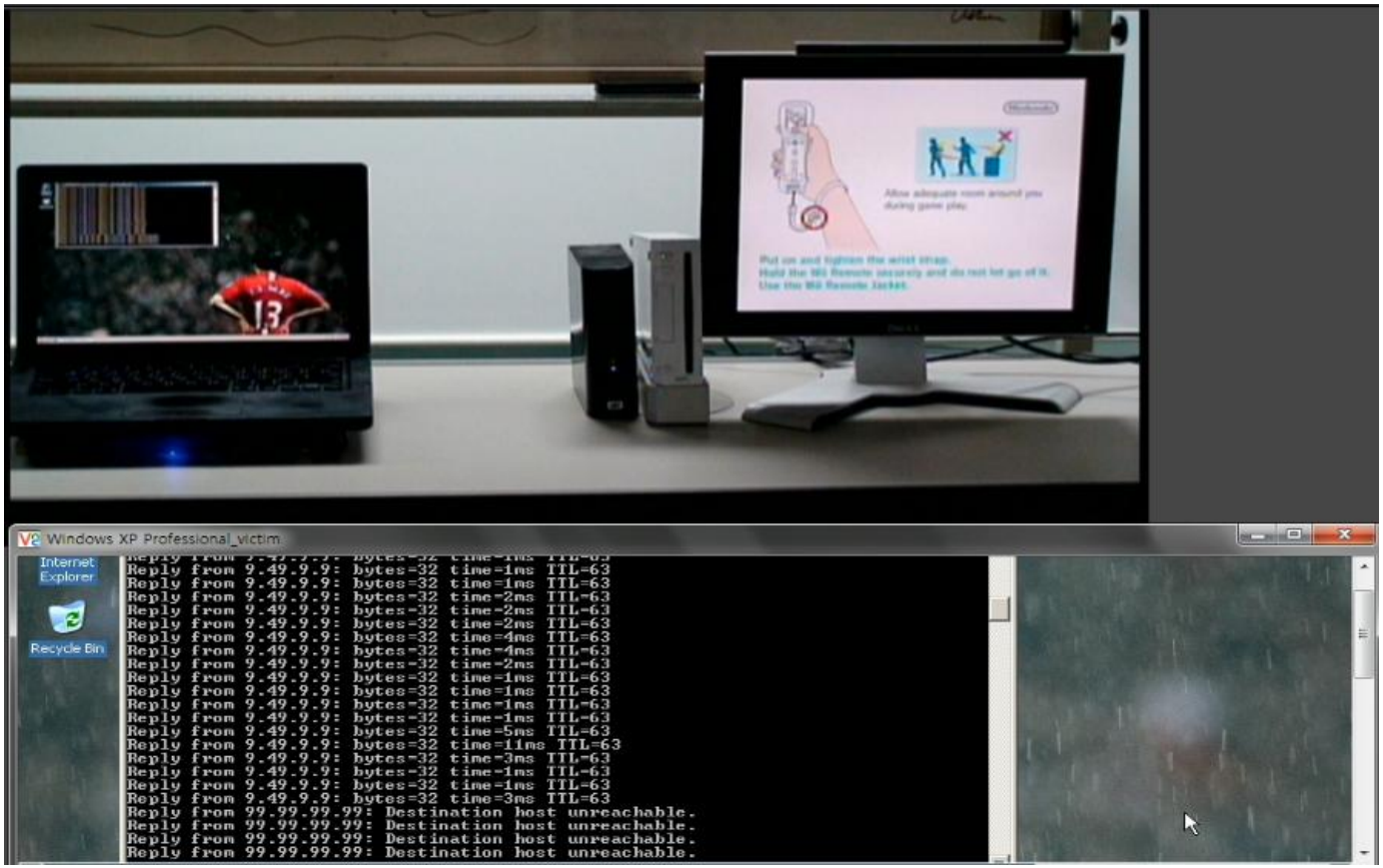


# Malware on Wii

- Demo : Malware(**attack remote host**) in live action while the game is playing

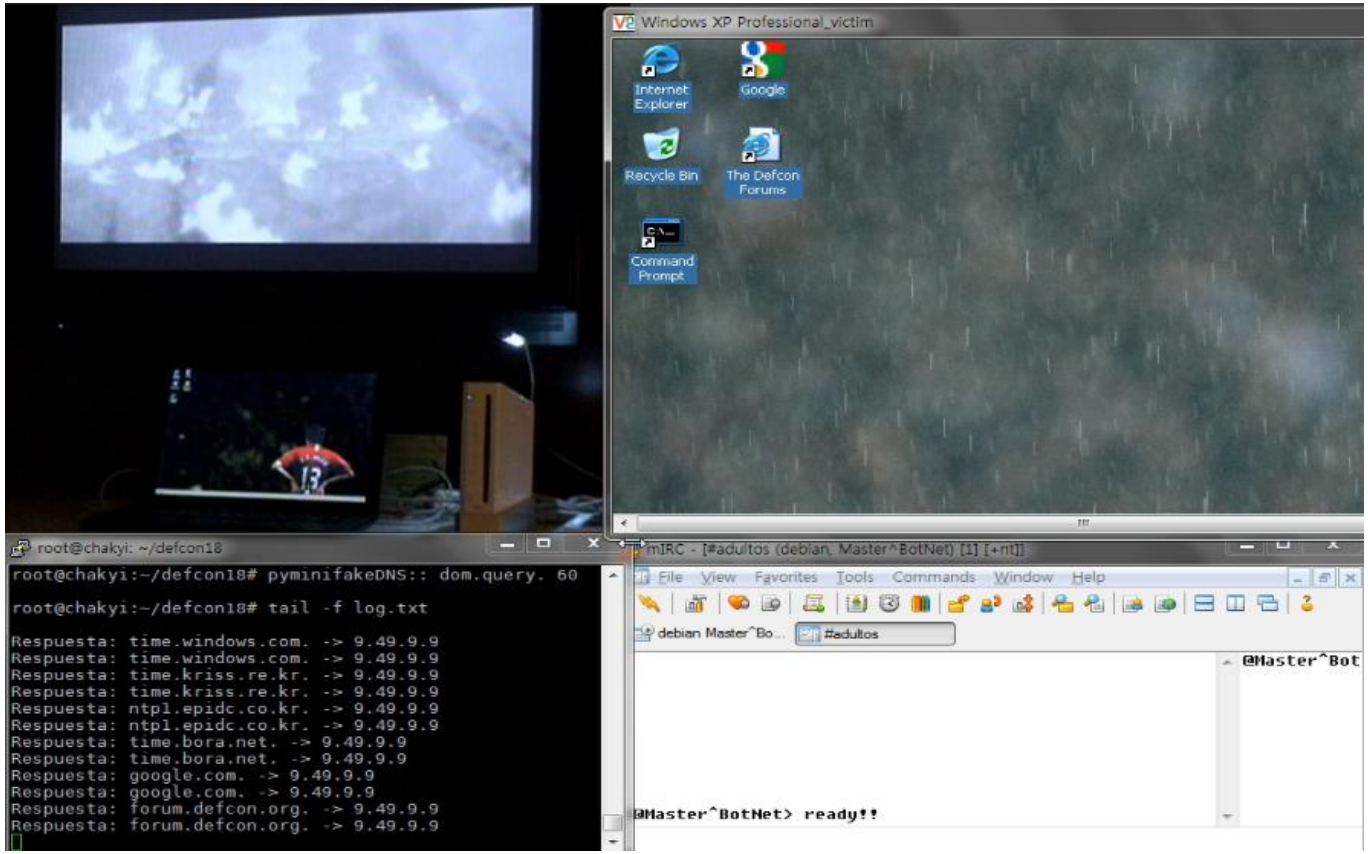
# Malware on Wii

- Demo : Malware(**network down**) in live action while the game is playing



# Malware on Wii

- Demo : Malware(**attack ap & dns pharming**) in live action while the game is playing



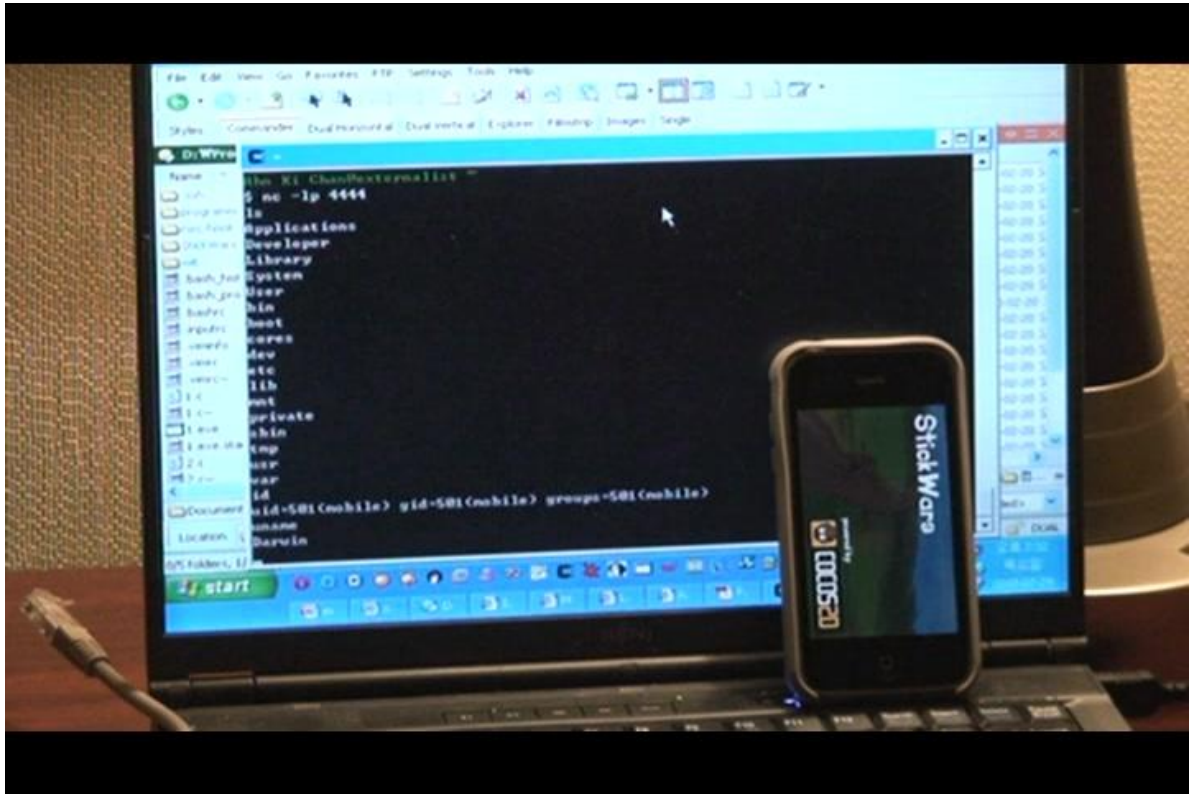
# Malware injection on Smartphone applications

# Malware on iPhone

- Executables are Mach-O binaries

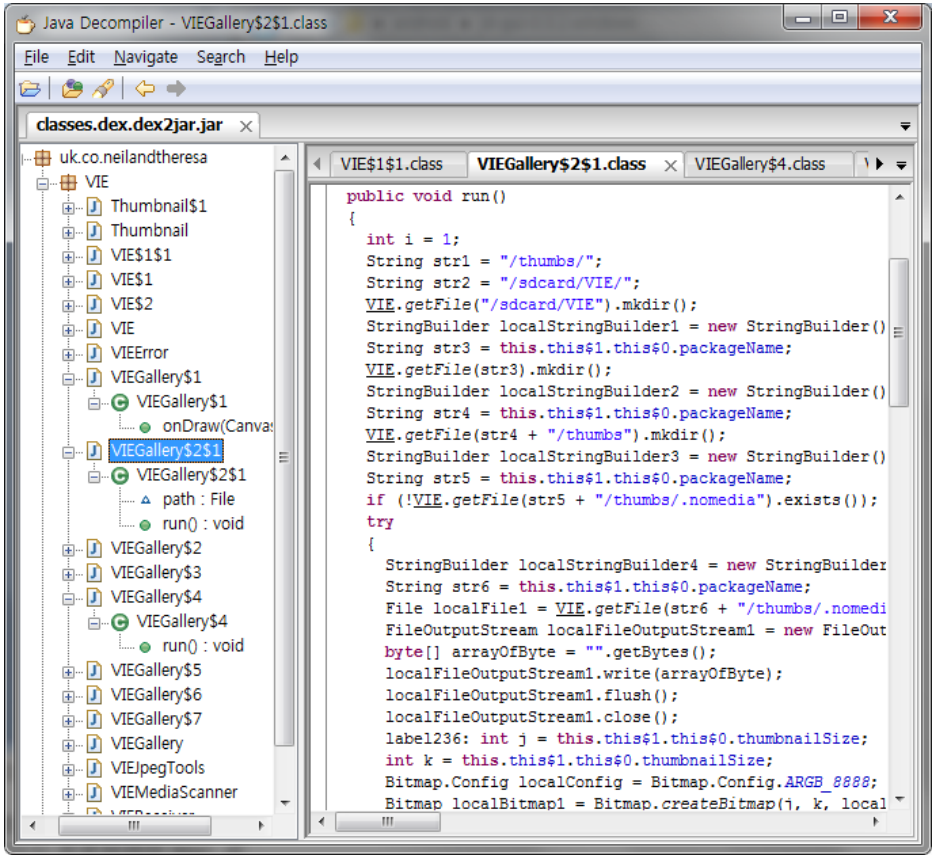
- Lots of malware papers on MAC viruses are public

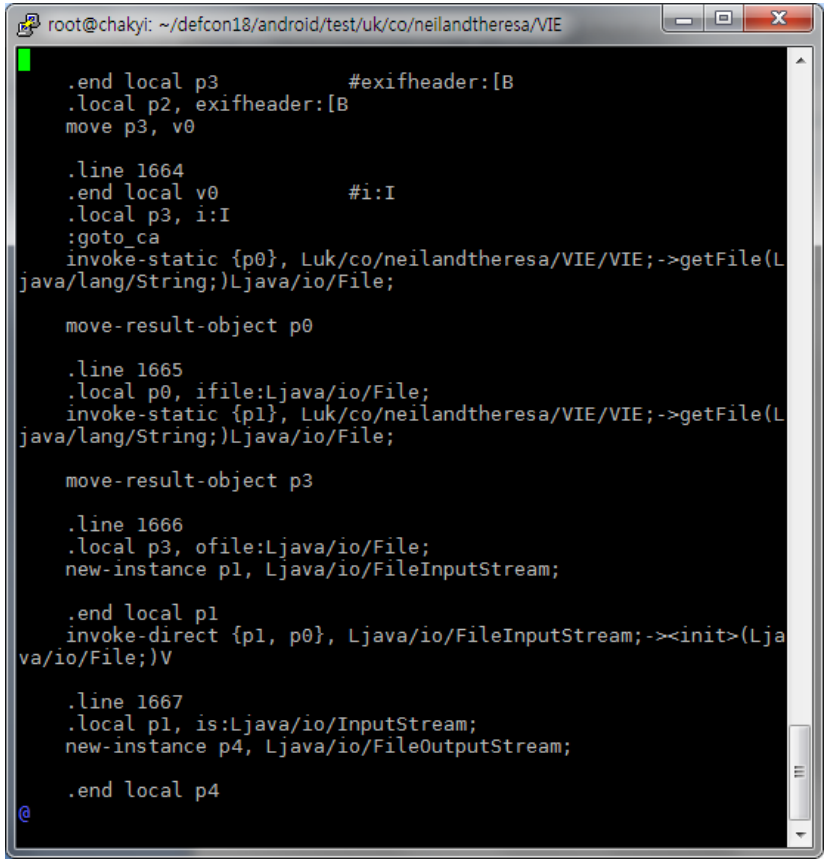
- Demo1
- Demo2
- Demo3



# Malware on Android

- Demo



# How to Defend

# Defenses

- Manufacturers : Steps to take when designing a new device

-Security Companies : Measurements in Software or Policies ( Demo )

- Users : Precautions for the general users

# Conclusion

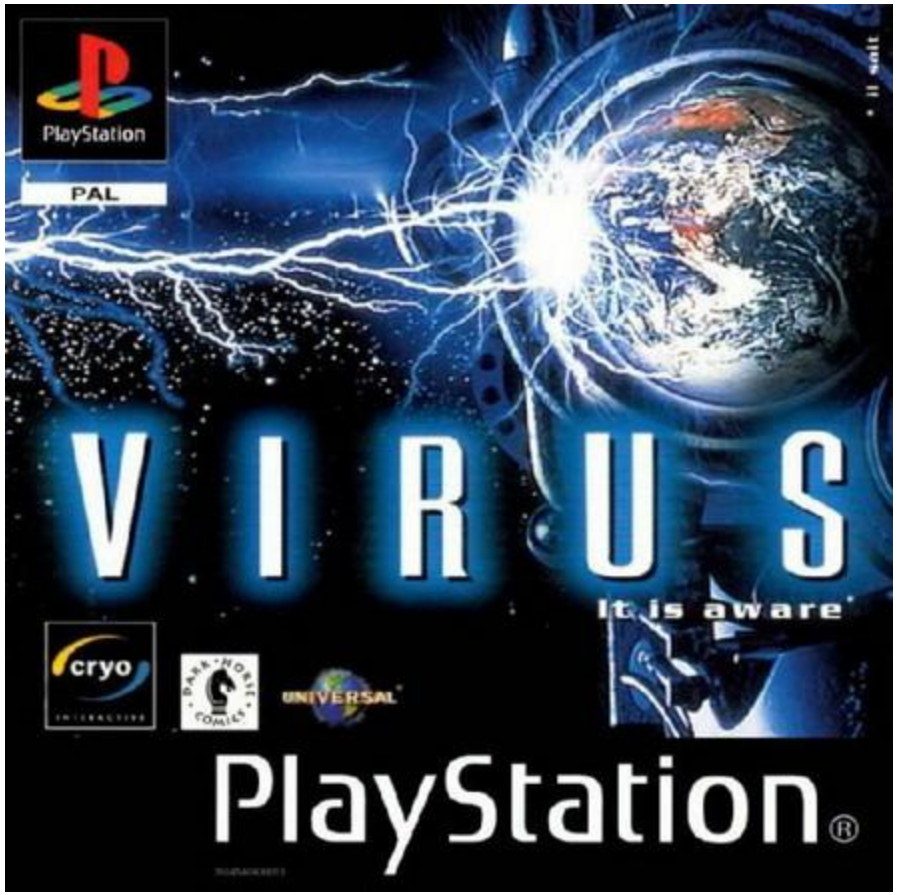
# Conclusion

- There are no doubts that malware can run on embedded devices, and there may already be some running in the wild

- These malware can be equally strong as those on PC, so one must be fully aware of their potential

- Not only Gaming Consoles of Smartphones, but any other future embedded device may become a target, so users should be careful and be prepared

# Download Games at your own risk!



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# Question?

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