Breaking cloud isolation

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wallarm
research

Short BIO

- bug hunter (Facebook, Google, Nokia, etc)
- security researcher
- CEO and lead security expert of 

Clouds

- Between business functions and hardware
- Between application code and environment

Shared hostings

- Grandfather of clouds ;)
- Many technologies that were made here became basis of clouds

The basics: cloud aliases

- Same application with different data - SaaS
- Same hardware with different platform - PaaS, IaaS
- It’s easy to determine technology point of next *aaS marketing

The basics: resource sharing

- Filesystems
- Network services
- Execution context at OS

The basics: resource sharing

- Filesystems
  - files contents
  - files names <- don’t forget about that: sess_abcdefg
  - file descriptors <- so IMPORTANT
- Network services
- Execution context at OS

File sharing

- Different application instances on the same filesystem
- Sensitive files
  - cross-instances content (application code,
  - temporary, reports and other race conditions

File sharing

- Different application instances on the same filesystem
- Sensitive files
  - authentification such as sessions
  - uploaded files
  - temporary, reports and other race conditions

File sharing

- Different application instances on the same filesystem
- How to protect:
  - different chroot and user for each?
  - only 65535 uids at OS =)
  - control chuid() for forks

File sharing

- Different application instances on the same filesystem
- Required LFI/Path traversal bug first at SaaS
- Typically for SaaS, shared hostings fixed that at late 90th ;)

File descriptors

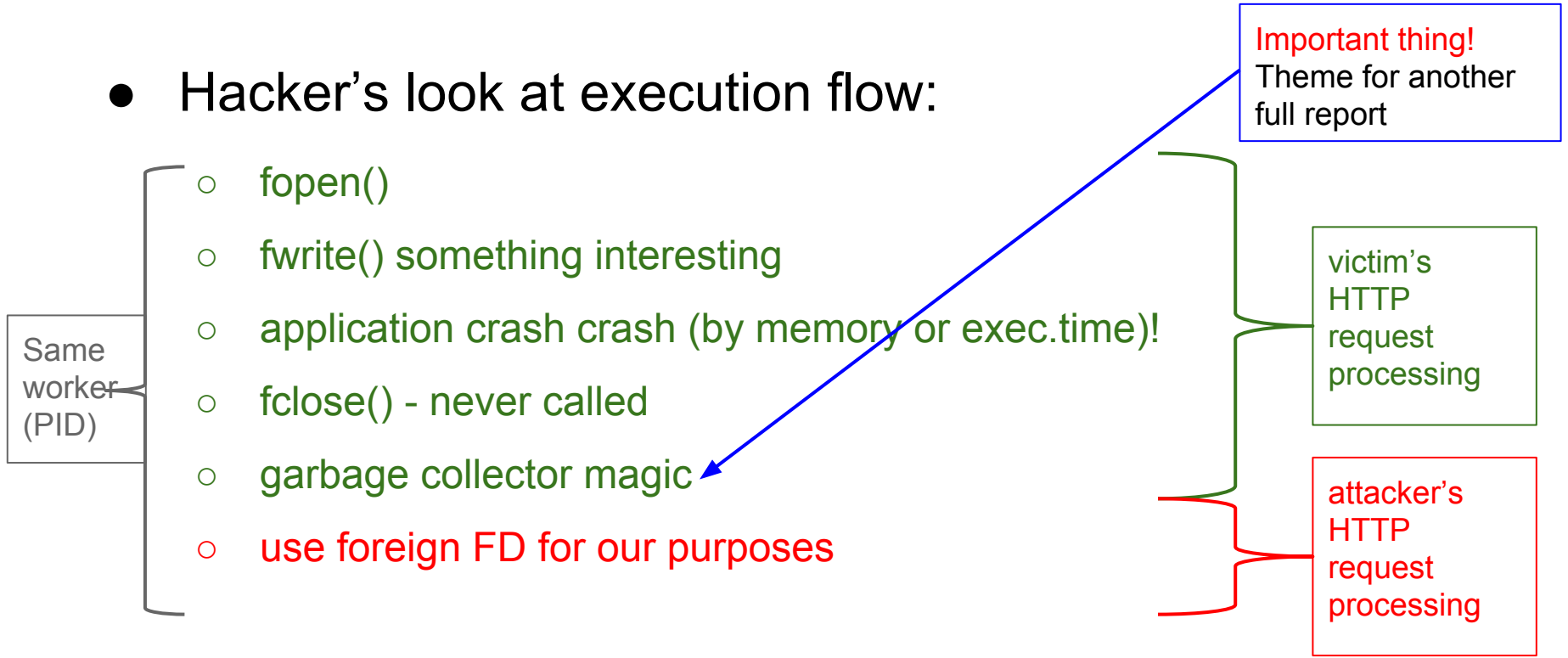
- Important when you open FD before fork or after - privileges for chuid() programs
- API for all interpreters (Ruby,Python,PHP,...)
- Typical cases:
  - descriptor for database connection (already authed)
  - descriptors for log files and journals

Difficult case from a wild (our practice SaaS security audit)

- Code prototype:
  - fopen()
  - do something, such as fwrite(), flush(), …
  - fclose()

Difficult case from a wild (our practice SaaS security audit)

- Hacker's look at execution flow:
  - fopen()
  - fwrite() something interesting
  - application crash crash (by memory or exec.time)!
  - fclose() - never called
  - garbage collector magic
  - use foreign FD for our purposes



The basics: resource sharing

- Filesystems
- Network services
  - databases tables (MySQL, Oracle, Postgres, …)
  - noSQL values (memcached, Tarantool, Redis, Couch, MongoDB, ...)
  - custom services (monitoring, billing, management)
- Execution context at OS

Network resource sharing

- Authentification
  - Privileged ports protection (<1024)
  - Host-based <- SSRF power here
  - Plain/text (login+passwords) <- MITM here
  - Challenge/response (SASL and others)

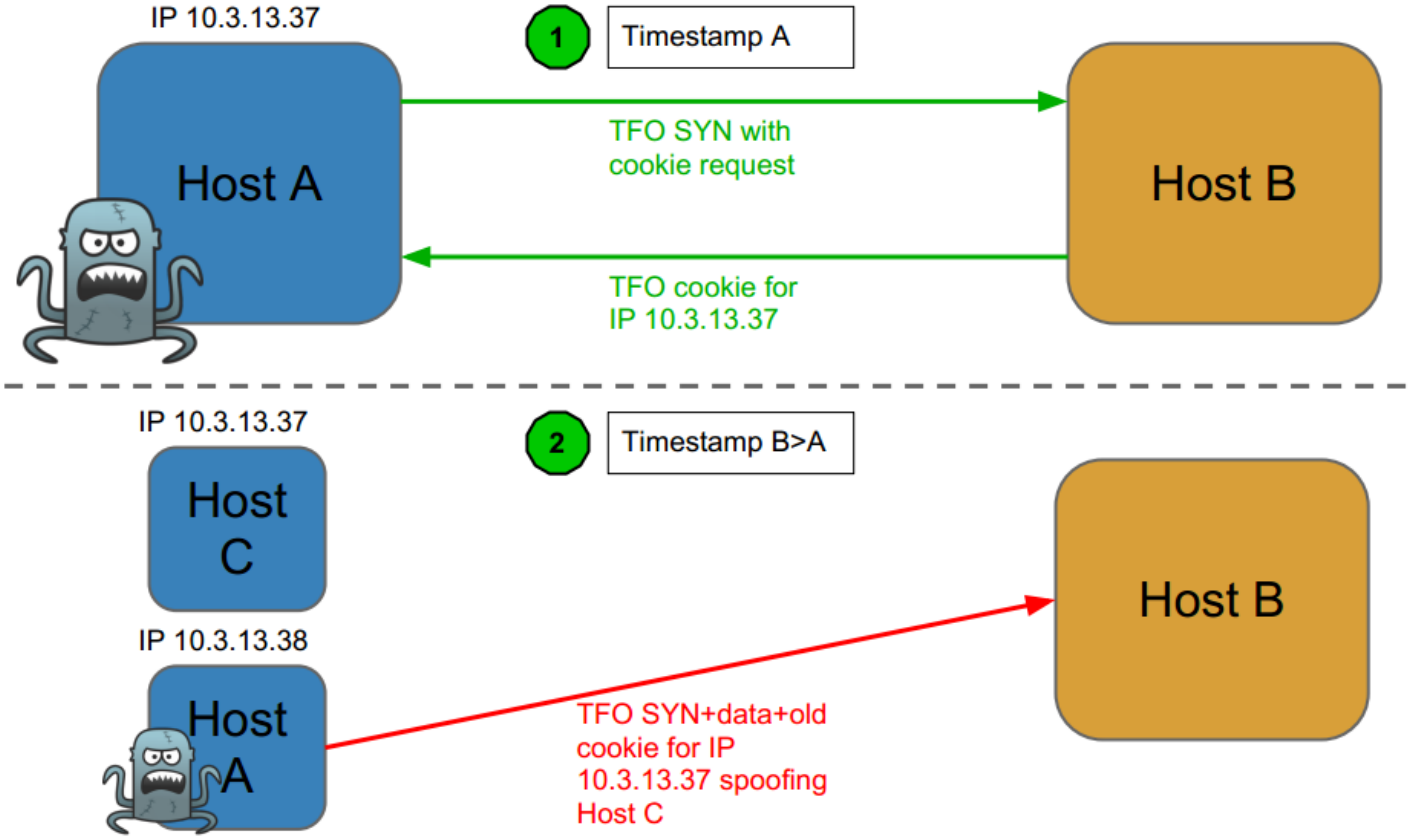
Network resource attack ways

- Spoofing
  - Classic UDP - rare from Internet, common from intranet (from cloud node) - net.ipv4.<all>.rp
  - TCP Fast Open secret leak at clouds (IP reusing)
- Unprivilege (<1024) local port reusing
- SSRF classics - bypassing host-based auth

Classic UDP spoofing nowdays

- Packet routes betwee INTERFACES!
  - By default at Debian/RHel ;)
  - Use sysctl net.ipv4.<all>.rp to disable
- UDP services at loopback interface are really common
- TFTP - netboot images, gain control at new nodes at (P|I)aaS (SNMP also, but community str there)
- Memcached (by default 11211 TCP and UDP both)

TCP fast open spoofing at clouds



Local port reusing

- Required RCE first of course
- 3rd party privileged application on non-privileges ports
- Crash them then open this port. I think you can do that! Fuzz it guys, FuZ5!!!
- Get some provate data from others

Local port reusing

- Cases from a wild
  - monitoring
  - management systems
  - privileged daemon for anything
  - different integration daemons
  - different databases - SQL/noSQL

Classic SSRF

- From the Internet to Intranet
- Sometimes better than many A01 injections
- Internal API and others - are you forget about auth there?
- Intranet resources: monitoring/wiki/etc - vlan!

FastCGI SSRF features

- Local port for fastcgi is bad
- Use unix sockets for that
- In other cases applications can comminicate locally by each others
- For PHP-FPM admin_value provide RCE

https://github.com/ONsec-Lab/scripts/blob/master/fastcgipacket.rb

The basics: resource sharing

- Filesystems
- Network services
- Execution context at OS
  - classic race condition at daemon init scripts
  - depletion entropy of urandom ???

What the problem?

- Look at CVE-2013-1048 first - that really cool
- $ install utility has great error - race condition between create file and set privileges
- Good way:
  - fd = open(...)
  - fchmod(fd,...)

/dev/random concept

- Just only CONCEPT
- Attacker’s worker read all /dev/random
- Victim’s worker read /dev/urandom consists of hashes from /dev/random readed before by attacker
- Attacker now know victim’s randoms
- There are many limitation of cource...

The end

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