Extracting typing history in Unix Memory Image

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Contents

- Introduction to bash history
- history management
- Extracting bash history
- Case study
- Conclusion

Bash

- Bourne-again shell
- GNU 프로젝트를 위해 Brian Fox가 작성한 유닉스 셸
- GNU OS, Linux, Mac OS X 기본 셸
- Cygwin이나 MinGW로 윈도에서 사용 가능
- 명령 히스토리, 디렉터리 스택, $RANDOM POSIX 형식 명령어 치환, 명령어 자동 완성

Bash

- When started as an interactive login shell:
    - /etc/profile, ~/.bash_profile, ~/.bash_login, /.profile
- When a login shell exits : ~/.bash_logout
- When started as an interactive shell : ~/.bashrc

History Storage

- 사용자 명령어를 저장하여 추 후 해당 명령어를 바로 실행 시킬 수 있게 함
  - ![HISTORY NUMBER]
- 시간 값은 정의되어 있지 않으며, 실행한 명령어를 ~/.bash_history에 순차적으로 기록
- Mac OS X는 500개의 히스토리를 기록

History Storage

- The history list is an array of history entries

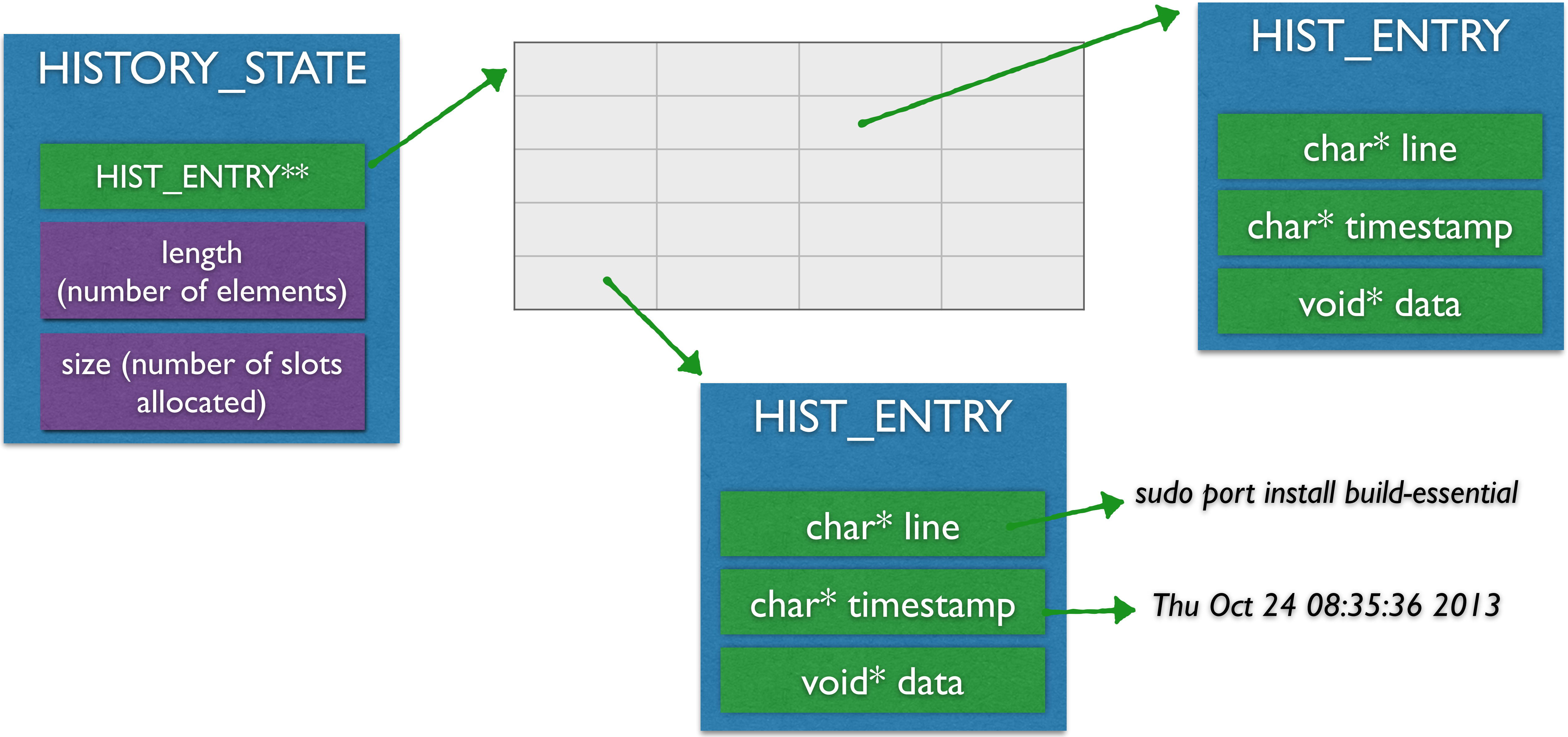
```
typedef void * histdata_t;

typedef struct _hist_entry {
  char *line;
  char *timestamp;
  histdata_t data;
} HIST_ENTRY;
```

reference : http://linux.die.net/man/3/history

```
/*
 * A structure used to pass around the current state of the history.
 */
typedef struct _hist_state {
  HIST_ENTRY **entries; /* Pointer to the entries themselves. */
  int offset;           /* The location pointer within this array. */
  int length;           /* Number of elements within this array. */
  int size;             /* Number of slots allocated to this array. */
  int flags;
} HISTORY_STATE;
```

History Storage



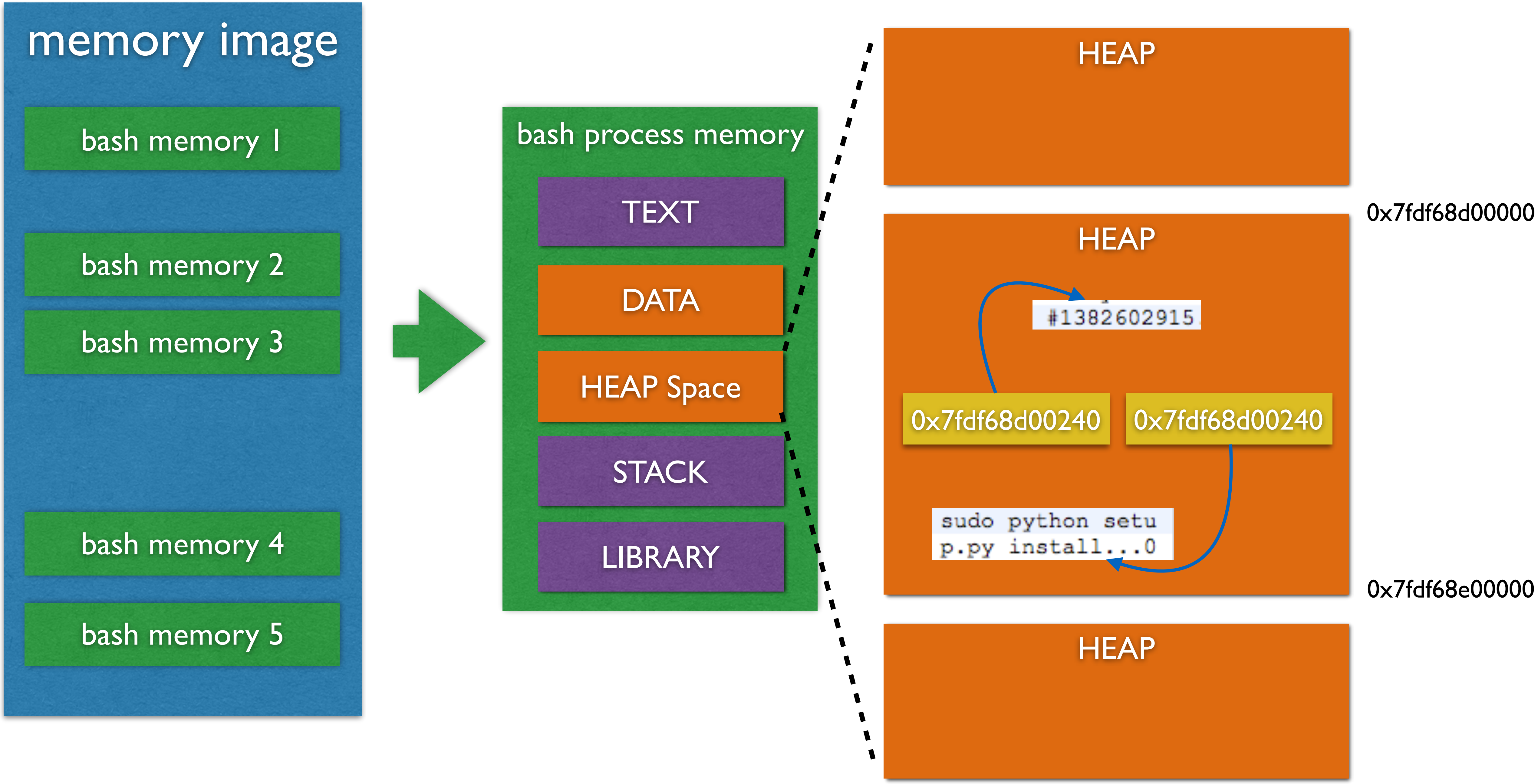
sudo port install build-essential

Thu Oct 24 08:35:36 2013

Extracting bash history

- 1. Live Forensics
  - ~/.bash_history 파일 추출
  - History Functions 이용 (GNU History library)
- 2. Memory Forensics
  - 맵핑된history 파일 추출
  - bash 프로세스 영역에서 HIST_ENTRY 추출

Extracting bash history



memory image

bash memory 1

bash memory 2

bash memory 3

bash memory 4

bash memory 5

bash process memory

TEXT

DATA

HEAP Space

STACK

LIBRARY

HEAP

HEAP

0x7fdf68d00000

```
#1382602915
```

0x7fdf68d00240

0x7fdf68d00240

```
sudo python setu
p.py install...0
```

0x7fdf68e00000

HEAP

Extracting bash history

- DEMO

Case Study

- 히스토리 타임스탬프 대부분이 동일한 이유
- history -c 명령 이 후에도 추출 가능한가
- 원격 접속 세션에서 history -c 실행

Case Study

- 히스토리 타임스탬프 대부분이 동일한 이유?
  - 히스토리 파일에 시간 정보가 없음
  - 프로세스가 히스토리 파일을 로드하고, 로드 시간으로 파일 내의 모든 히스토리 시간 정보를 저장
- 즉, 신규 입력된 명령어 이전의 히스토리의 시간 정보를 명령어 실행 시간으로 오해하면 안됨.

Case Study

- 히스토리 타임스탬프 대부분이 동일한 이유?

```
0x6DCB74A8  11746     1     255   0 com.apple.audio.      _netbios(501,20)     (501,20) Fri Nov 15 04:45:30 2013
0x161C0C9E8 11767     1     255   0 com.apple.WebKit      _netbios(501,20)     (501,20) Fri Nov 15 04:48:47 2013
0x163B0AA80 11935   247     255   0      Terminal     chainbreaker(501,20)     (501,20) Fri Nov 15 05:19:13 2013
0x1F8E8F000 11944 11935     255   0        login      chainbreaker(0,20)       (0,20) Fri Nov 15 05:19:22 2013
0x16110E950 11945 11944     255   0        bash       chainbreaker(501,20)     (501,20) Fri Nov 15 05:19:22 2013
0x8917D7E0  11987   303     255   0      mdworker        _spotlight(89,89)     (89,89) Fri Nov 15 05:23:47 2013
0x18E5ED000 11988 11945     255   0         sudo      chainbreaker(0,20)       (0,20) Fri Nov 15 05:23:48 2013
0x87DFF748  11989 11988     255   0       osxpmem        chainbreaker(0,0)     (0,0) Fri Nov 15 05:23:48 2013
0x8657E540  11990  8781     255   0      thnuclnt     chainbreaker(501,20)     (501,20) Fri Nov 15 05:24:06 2013
```

```
11945    bash Fri Nov 15 05:19:22 2013 python vol.py -i ../test.mem -o lsof
11945    bash Fri Nov 15 05:19:22 2013 python vol.py -i ../test.mem -o ps -x 1541
11945    bash Fri Nov 15 05:19:22 2013 ls
11945    bash Fri Nov 15 05:19:22 2013 file 1541-bash-
11945    bash Fri Nov 15 05:19:22 2013 file 1541-bash-*
11945    bash Fri Nov 15 05:19:22 2013 rm 1541-bash-*
11945    bash Fri Nov 15 05:19:22 2013 python vol.py -i ../test.mem -o ps | grep securityd
11945    bash Fri Nov 15 05:19:22 2013 python vol.py -i ../test.mem -o ps -x 14
11945    bash Fri Nov 15 05:19:22 2013 ls
11945    bash Fri Nov 15 05:19:22 2013 ls
11945    bash Fri Nov 15 05:19:22 2013 clear
11945    bash Fri Nov 15 05:19:22 2013 ls
```

Case Study

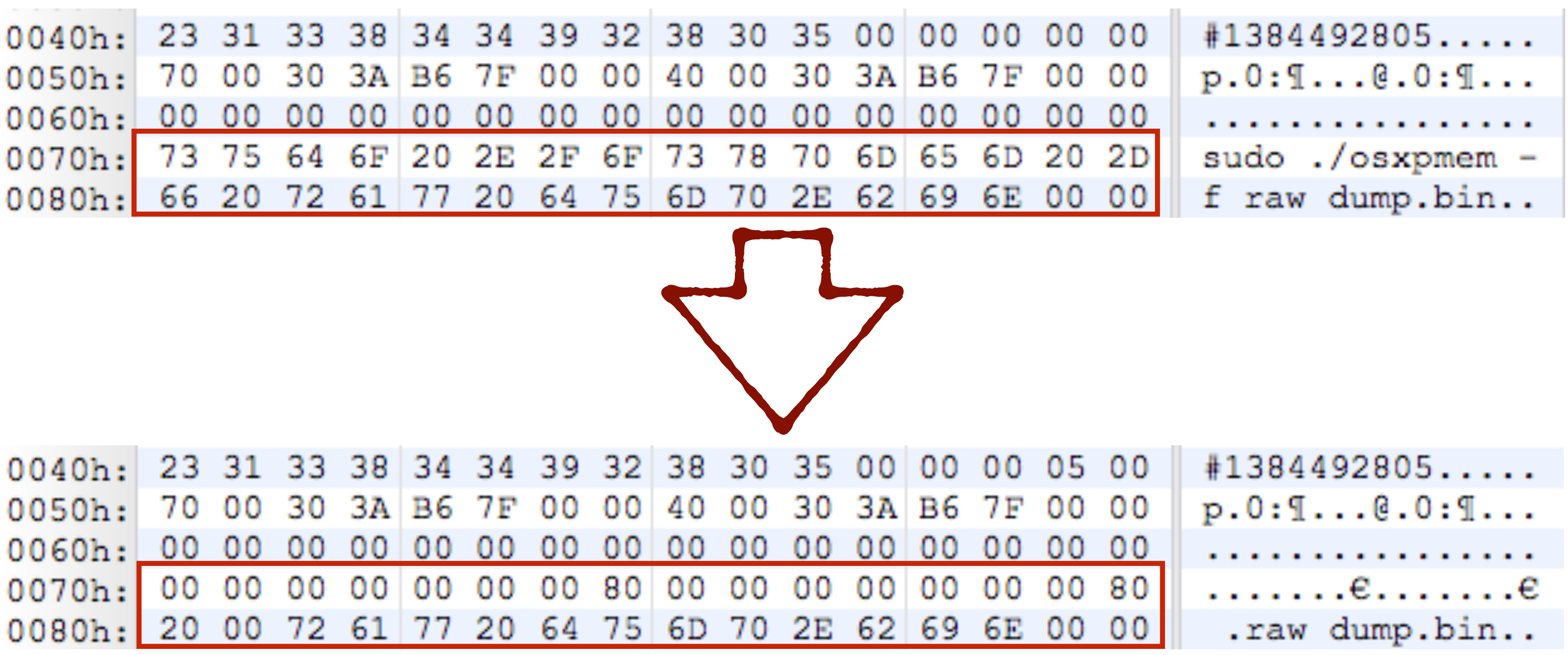
- history -c 명령어 이 후 추출 가능 여부
- 실험 방법
  - bash 프로세스 실행
  - 메모리 덤프 후 히스토리 추출
  - history -c 명령 실행 후, 히스토리 추출
- 결론 : 시간 정보만 존재하고 명령어 삭제

Case Study

- history -c 명령어 이 후 추출 가능 여부

```
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:19:22 2013
11945    bash Fri Nov 15 05:23:41 2013 ./osxpmem -f raw historyc.bin
11945    bash Fri Nov 15 05:23:48 2013 sudo ./osxpmem -f raw historyc.bin
11945    bash Fri Nov 15 05:23:29 2013 ls
11945    bash Fri Nov 15 05:20:05 2013
```

Good bye my history O_o



```
0040h: 23 31 33 38 34 34 39 32 38 30 35 00 00 00 00 00  #1384492805.....
0050h: 70 00 30 3A B6 7F 00 00 40 00 30 3A B6 7F 00 00  p.0:¶...@.0:¶...
0060h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0070h: 73 75 64 6F 20 2E 2F 6F 73 78 70 6D 65 6D 20 2D  sudo ./osxpmem -
0080h: 66 20 72 61 77 20 64 75 6D 70 2E 62 69 6E 00 00  f raw dump.bin..
```

```
0040h: 23 31 33 38 34 34 39 32 38 30 35 00 00 00 05 00  #1384492805.....
0050h: 70 00 30 3A B6 7F 00 00 40 00 30 3A B6 7F 00 00  p.0:¶...@.0:¶...
0060h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0070h: 00 00 00 00 00 00 00 80 00 00 00 00 00 00 00 80  .......€.......€
0080h: 20 00 72 61 77 20 64 75 6D 70 2E 62 69 6E 00 00   .raw dump.bin..
```

Typing a new command

Certain points (input a 'history -c')

Case Study

- 원격으로 붙은 쉘에서 history -c 를 실행
- 실험 방법
  - bash 프로세스 여러 개 실행
  - 하나의 bash 프로세스에서 history -c 실행
  - 메모리 덤프 후 분석
- 결론 : 해당 bash history 내역만 삭제

Case Study

```
chainbreaker@testmachine:~/volafox$ python vol.py -i ../dump2.bin -o bash_history
[+] PID : 328, PROCESS: bash, HISTORY COUNT: 40
[+] PID : 586, PROCESS: bash, HISTORY COUNT: 19
[+] PID : 619, PROCESS: bash, HISTORY COUNT: 0
[+] PID : 769, PROCESS: bash, HISTORY COUNT: 4
PID PROCESS         TIME (UTC+0) CMD
328    bash Fri Nov 15 06:11:12 2013 ls
328    bash Fri Nov 15 06:12:24 2013 python vol.py -i ../after.bin -o uname
328    bash Fri Nov 15 06:11:39 2013 cd volafox
328    bash Fri Nov 15 05:31:35 2013 cd /tmp/
328    bash Fri Nov 15 06:11:04 2013 ls
328    bash Fri Nov 15 05:32:27 2013 sudo ./osxpmem -f raw after.bin
328    bash Fri Nov 15 06:13:09 2013 clear
328    bash Fri Nov 15 06:11:07 2013 sudo mv after.bin ~
328    bash Fri Nov 15 05:31:27 2013 cat ~/.bash_history
328    bash Fri Nov 15 05:31:36 2013 ls
328    bash Fri Nov 15 06:11:39 2013 ls
328    bash Fri Nov 15 05:32:18 2013 ls -al
328    bash Fri Nov 15 06:11:20 2013 sudo chown n0fate:staff after.bin
328    bash Fri Nov 15 06:11:27 2013 sudo chown chainbreaker:staff after.bin
328    bash Fri Nov 15 05:31:11 2013 ls
328    bash Fri Nov 15 05:31:11 2013 ./osxpmem -f raw historyc.bin
328    bash Fri Nov 15 05:31:11 2013 sudo ./osxpmem -f raw historyc.bin
328    bash Fri Nov 15 05:31:11 2013 ls
328    bash Fri Nov 15 05:31:11 2013 ls -al
328    bash Fri Nov 15 05:31:11 2013 sudo mv *.bin ~
328    bash Fri Nov 15 05:31:11 2013 cd ~
328    bash Fri Nov 15 05:31:11 2013 sudo chown chainbreaker:staff *.bin
328    bash Fri Nov 15 05:31:11 2013 chmod 664 *.bin
328    bash Fri Nov 15 05:31:11 2013 ls -al
328    bash Fri Nov 15 05:31:11 2013 cd volafox
328    bash Fri Nov 15 05:31:11 2013 python vol.py -i ../dump.bin -o ps
328    bash Fri Nov 15 05:31:11 2013 python vol.py -i ../dump.bin -o bash_history
328    bash Fri Nov 15 05:31:11 2013 python vol.py -i ../historyc.bin -o bash_history
```

1. Type 'history -c'

```
328    bash Fri Nov 15 05:31:11 2013 sudo reboot
328    bash Fri Nov 15 06:11:12 2013 cd ~
328    bash Fri Nov 15 05:32:15 2013 lsa
328    bash Fri Nov 15 05:32:11 2013 sudo chown -R root:wheel OSXPMem
328    bash Fri Nov 15 05:32:02 2013 chown -R root:wheel OSXPMem
328    bash Fri Nov 15 06:13:17 2013 history
328    bash Fri Nov 15 05:32:15 2013 cd OSXPMem/
328    bash Fri Nov 15 06:11:44 2013 python vol.py -i ../after.bin -o ps
328    bash Fri Nov 15 06:12:47 2013 python vol.py -i ../after.bin -o ps
328    bash Fri Nov 15 06:11:36 2013 sudo chmod 644 after.bin
328    bash Fri Nov 15 06:12:44 2013 python vol.py -i ../after.bin -o kextstat
328    bash Fri Nov 15 06:13:51 2013 history
586    bash Fri Nov 15 05:31:43 2013 cd Downloads/
586    bash Fri Nov 15 05:31:41 2013 cd ~
586    bash Fri Nov 15 05:31:41 2013 python vol.py -i ../dump.bin -o bash_history
586    bash Fri Nov 15 05:31:41 2013 cd volafox
586    bash Fri Nov 15 05:31:41 2013 python vol.py -i ../dump.bin -o ps
586    bash Fri Nov 15 05:31:41 2013 ls -al
586    bash Fri Nov 15 05:31:41 2013 sudo chown chainbreaker:staff *.bin
586    bash Fri Nov 15 05:31:41 2013 chmod 664 *.bin
586    bash Fri Nov 15 05:31:41 2013 ls
586    bash Fri Nov 15 05:31:41 2013 ls
586    bash Fri Nov 15 05:31:41 2013 sudo mv *.bin ~
586    bash Fri Nov 15 05:31:41 2013 ./osxpmem -f raw historyc.bin
586    bash Fri Nov 15 05:31:41 2013 sudo ./osxpmem -f raw historyc.bin
586    bash Fri Nov 15 05:31:43 2013 ls
586    bash Fri Nov 15 05:31:41 2013 python vol.py -i ../historyc.bin -o bash_history
586    bash Fri Nov 15 05:31:41 2013 sudo reboot
586    bash Fri Nov 15 05:31:41 2013 ls -al
586    bash Fri Nov 15 05:31:48 2013 tar xvf OSXPMem-RC1.tar
586    bash Fri Nov 15 05:31:54 2013 mv OSXPMem /tmp
769    bash Fri Nov 15 06:14:08 2013 cd OSXPMem/
769    bash Fri Nov 15 06:14:22 2013 sudo ./osxpmem -f raw dump2.bin
769    bash Fri Nov 15 06:14:01 2013 cd /tmp/
769    bash Fri Nov 15 06:14:01 2013 ls
chainbreaker@testmachine:~/volafox$
```

2. Start a new bash

Q & A

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