GRR Rapid Response

An exercise in failing to replace yourself with a small script.

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Agenda

- Why GRR?
- What we built
- Demo 1
- Key Design decisions
- Demo 2
- Roadmap

Why GRR?

- Tell me if this machine is compromised
- Joe saw something weird, check his machine
- Why did a packet containing "foooooo" go from A to B?
- Forensically acquire 25 machines for analysis

Why GRR?

- Tell me if this machine is compromised
  - (while you're at it, check 20000 of them)
- Joe saw something weird, check his machine
  - (p.s. Joe is on holiday in Cambodia and on 3G)
- Why did a packet containing "fooooo" go from A to B?
  - (by the way, we're not sure what A was)
- Forensically acquire 25 machines for analysis
  - (p.s. they're in 5 continents and none are Windows)

Things We Want

- Make our open tools "enterprise" capable
- Remote access to investigate machines
- Scale to 100K+ machines easily
- Work over the Internet securely
- Work across OSX/Linux/Windows

Things We Want

- Automation should be easy
    - and shouldn't be tied to a vendor's product
- Should be my memory
    - Remember the details about artifacts
    - Know anomalies
- Allow multiple people to work a case at once
- Customizable

What We Wanted

What We Built

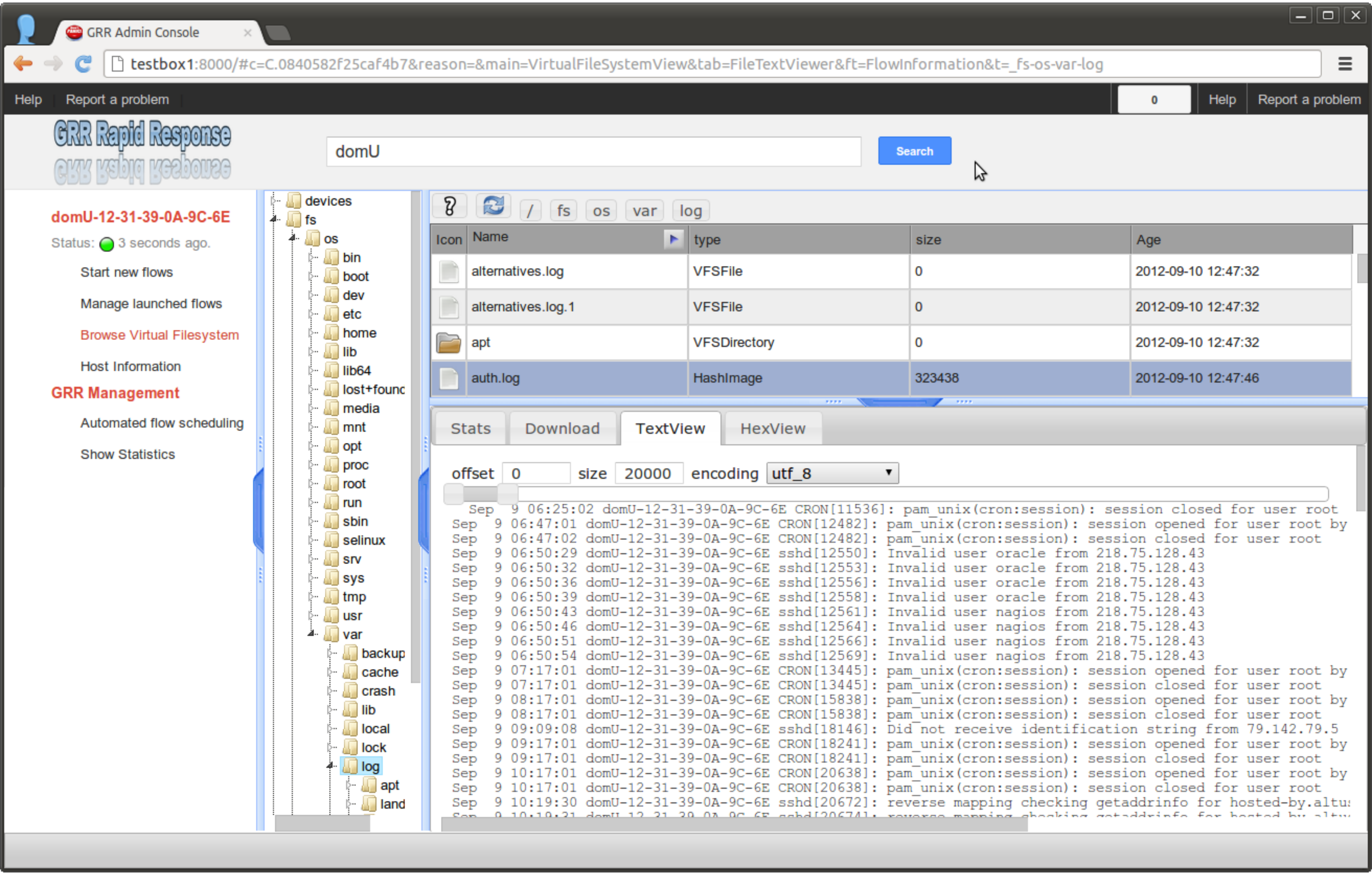
What We Built

- Agent based system (Windows, OSX, Linux)
- Communicates over the Internet on HTTP
- Scalable backend
- Ajax UI
- Enables most common IR/Forensics tasks

- Open source (Apache/GPL Dual Licensed)
- Mongo NoSQL backend
- Python compiled to exe/elf/mach-o
- Comms over encrypted, signed protobufs

Demo Time

- Install a new agent
- Collect some artifacts
- Show filesystem view
- View browser history
- List processes extracted from memory



Icon	Name	type	size	Age
	alternatives.log	VFSFile	0	2012-09-10 12:47:32
	alternatives.log.1	VFSFile	0	2012-09-10 12:47:32
	apt	VFSDirectory	0	2012-09-10 12:47:32
	auth.log	HashImage	323438	2012-09-10 12:47:46

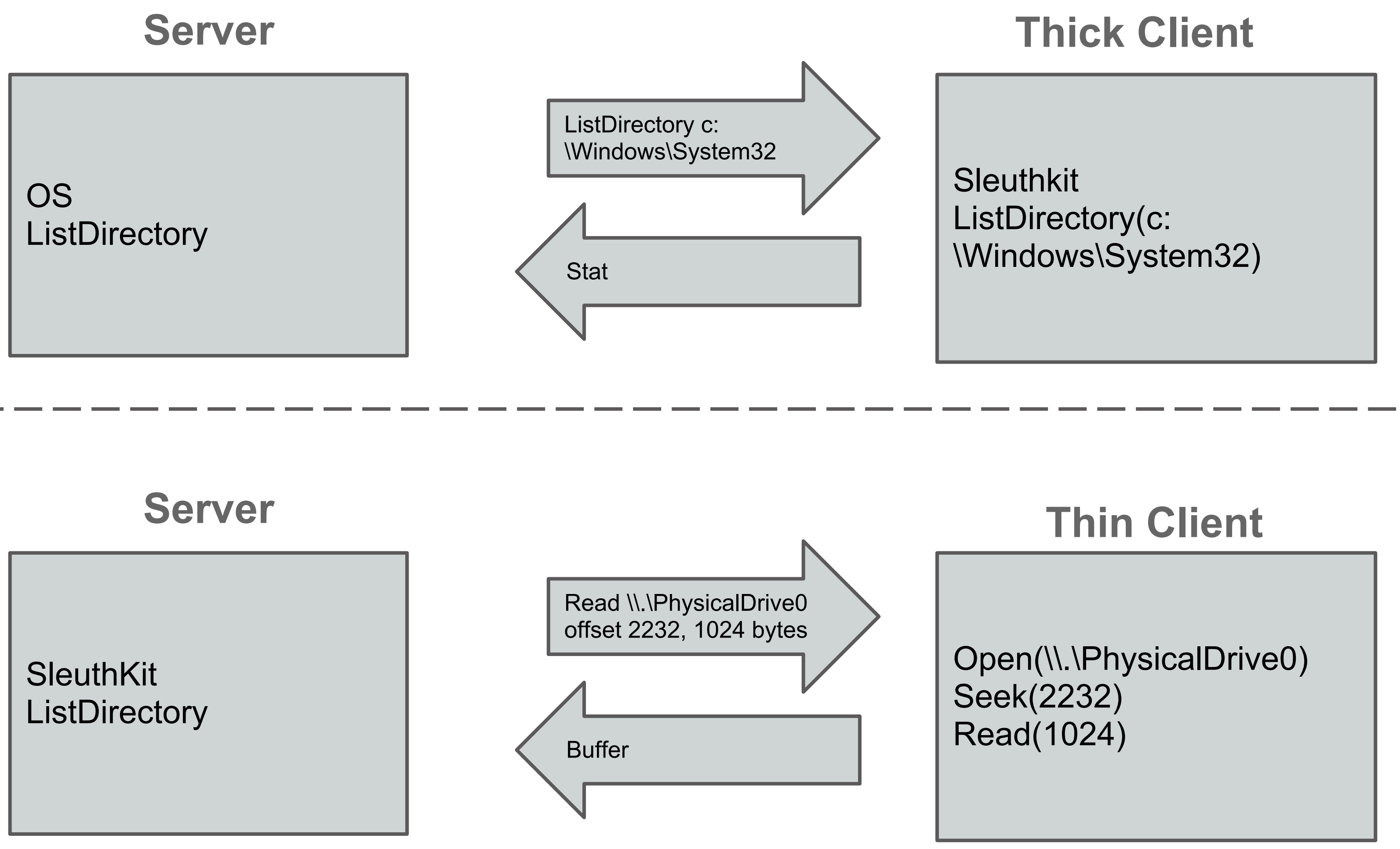
offset 0 size 20000 encoding utf_8

```
 Sep  9 06:25:02 domU-12-31-39-0A-9C-6E CRON[11536]: pam_unix(cron:session): session closed for user root
Sep  9 06:47:01 domU-12-31-39-0A-9C-6E CRON[12482]: pam_unix(cron:session): session opened for user root by
Sep  9 06:47:02 domU-12-31-39-0A-9C-6E CRON[12482]: pam_unix(cron:session): session closed for user root
Sep  9 06:50:29 domU-12-31-39-0A-9C-6E sshd[12550]: Invalid user oracle from 218.75.128.43
Sep  9 06:50:32 domU-12-31-39-0A-9C-6E sshd[12553]: Invalid user oracle from 218.75.128.43
Sep  9 06:50:36 domU-12-31-39-0A-9C-6E sshd[12556]: Invalid user oracle from 218.75.128.43
Sep  9 06:50:39 domU-12-31-39-0A-9C-6E sshd[12558]: Invalid user oracle from 218.75.128.43
Sep  9 06:50:43 domU-12-31-39-0A-9C-6E sshd[12561]: Invalid user nagios from 218.75.128.43
Sep  9 06:50:46 domU-12-31-39-0A-9C-6E sshd[12564]: Invalid user nagios from 218.75.128.43
Sep  9 06:50:51 domU-12-31-39-0A-9C-6E sshd[12566]: Invalid user nagios from 218.75.128.43
Sep  9 06:50:54 domU-12-31-39-0A-9C-6E sshd[12569]: Invalid user nagios from 218.75.128.43
Sep  9 07:17:01 domU-12-31-39-0A-9C-6E CRON[13445]: pam_unix(cron:session): session opened for user root by
Sep  9 07:17:01 domU-12-31-39-0A-9C-6E CRON[13445]: pam_unix(cron:session): session closed for user root
Sep  9 08:17:01 domU-12-31-39-0A-9C-6E CRON[15838]: pam_unix(cron:session): session opened for user root by
Sep  9 08:17:01 domU-12-31-39-0A-9C-6E CRON[15838]: pam_unix(cron:session): session closed for user root
Sep  9 09:09:08 domU-12-31-39-0A-9C-6E sshd[18146]: Did not receive identification string from 79.142.79.5
Sep  9 09:17:01 domU-12-31-39-0A-9C-6E CRON[18241]: pam_unix(cron:session): session opened for user root by
Sep  9 09:17:01 domU-12-31-39-0A-9C-6E CRON[18241]: pam_unix(cron:session): session closed for user root
Sep  9 10:17:01 domU-12-31-39-0A-9C-6E CRON[20638]: pam_unix(cron:session): session opened for user root by
Sep  9 10:17:01 domU-12-31-39-0A-9C-6E CRON[20638]: pam_unix(cron:session): session closed for user root
Sep  9 10:19:30 domU-12-31-39-0A-9C-6E sshd[20672]: reverse mapping checking getaddrinfo for hosted-by.altu:
Sep  9 10:19:31 domU-12-31-39-0A-9C-6E sshd[20674]: reverse mapping checking getaddrinfo for hosted-by.altu
```

Key Design Decisions

- Thin vs thick client
- Asynchronous Flows
- Axis of Time

Example: Directory Listing



Thin Client vs Thick Client

- No client updates for new functionality
- Raw data stored for future analysis.
- Reduced attacker visibility
- Reduced attacker subversion options

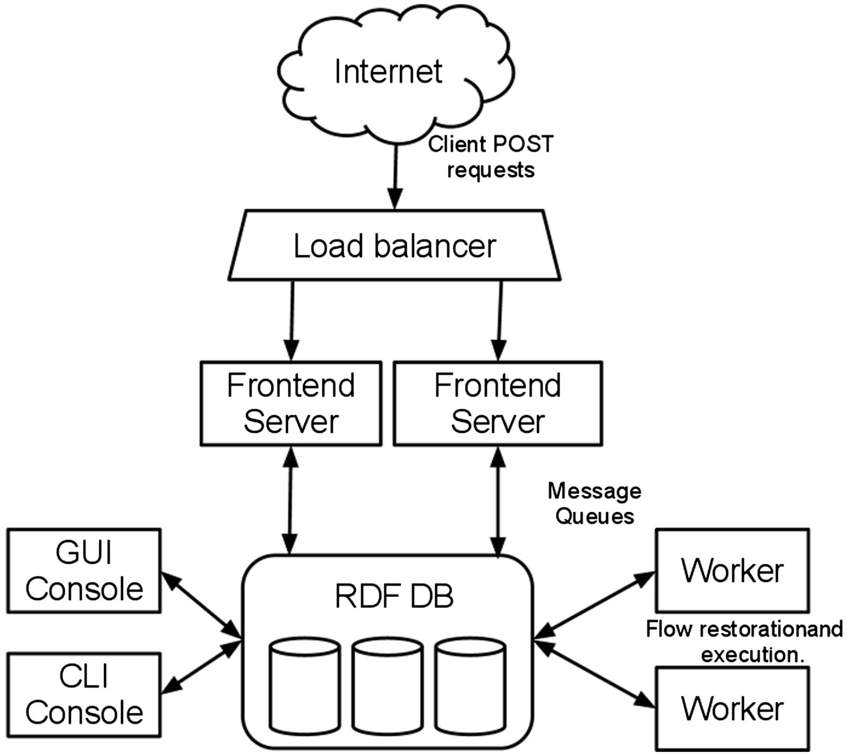
- Decreased network traffic
- Decreased server complexity

Decision: Let's do both

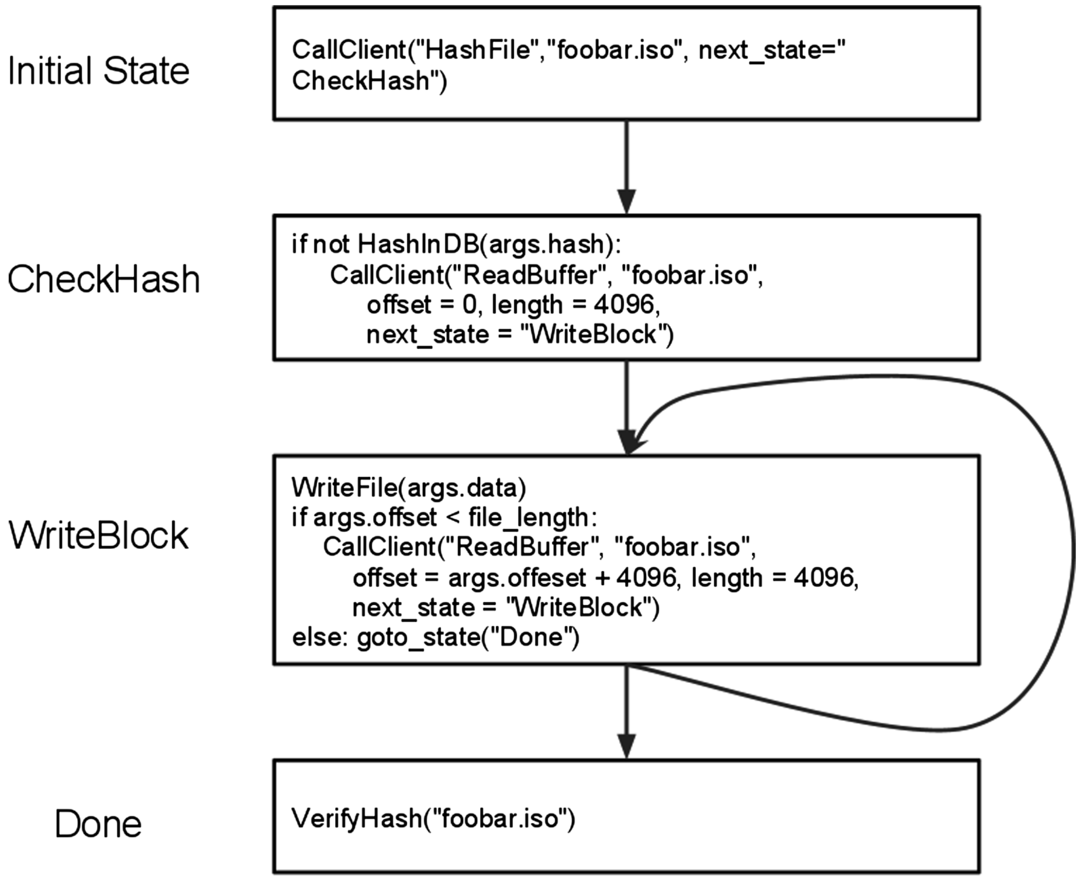
Scale - Asynchronous Flows

- Plan for 500,000+ clients
- Collect 8GB memory from 1k clients at once

- Individual clients cannot "hold" resources
- Only limited by CPU/Memory/Disk available
- Grow as needs grow



Scale - Asynchronous Flows



```
CallClient("HashFile","foobar.iso", next_state="
CheckHash")
```

```
if not HashInDB(args.hash):
    CallClient("ReadBuffer", "foobar.iso",
        offset = 0, length = 4096,
        next_state = "WriteBlock")
```

```
WriteFile(args.data)
if args.offset < file_length:
   CallClient("ReadBuffer", "foobar.iso",
      offset = args.offeset + 4096, length = 4096,
      next_state = "WriteBlock")
else: goto_state("Done")
```

```
VerifyHash("foobar.iso")
```

Axis of Time

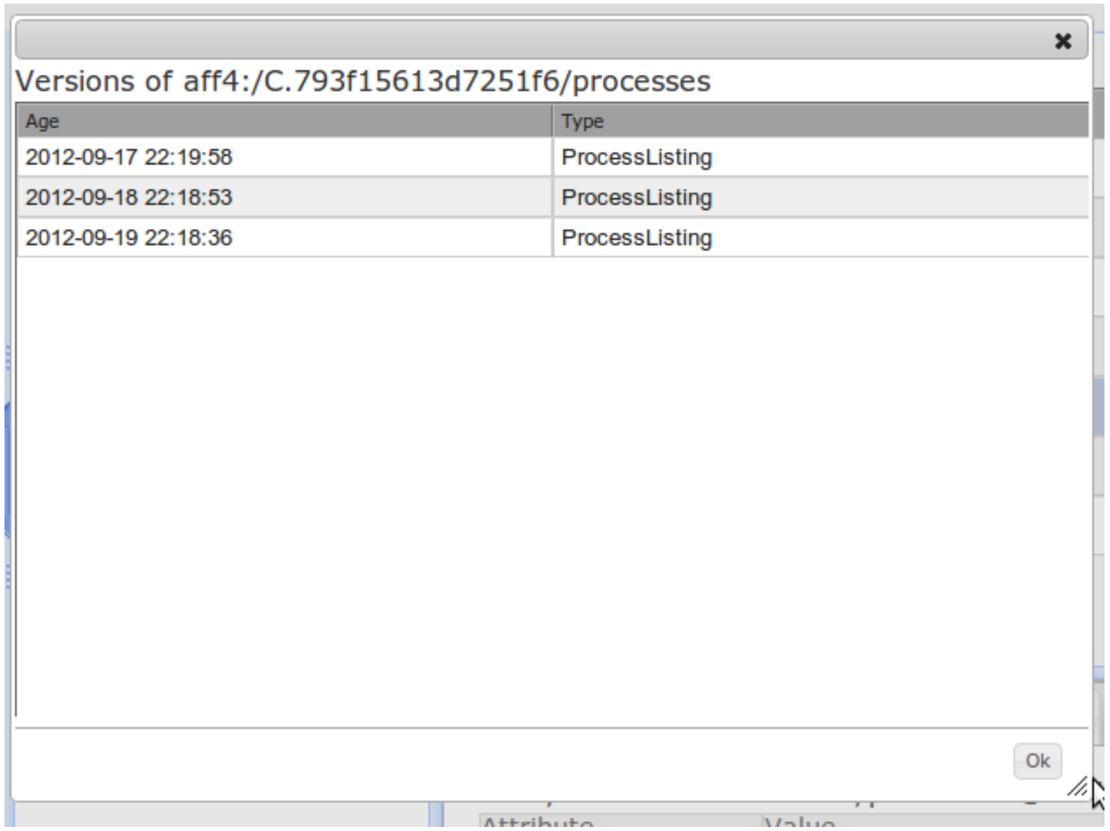
- Live forensics is a smear
- With scalable storage comes snapshots

- Historical record of artifacts
- Enables statistical analysis

- What has changed on this system this week?
- What are the new services in my enterprise?

Axis of Time

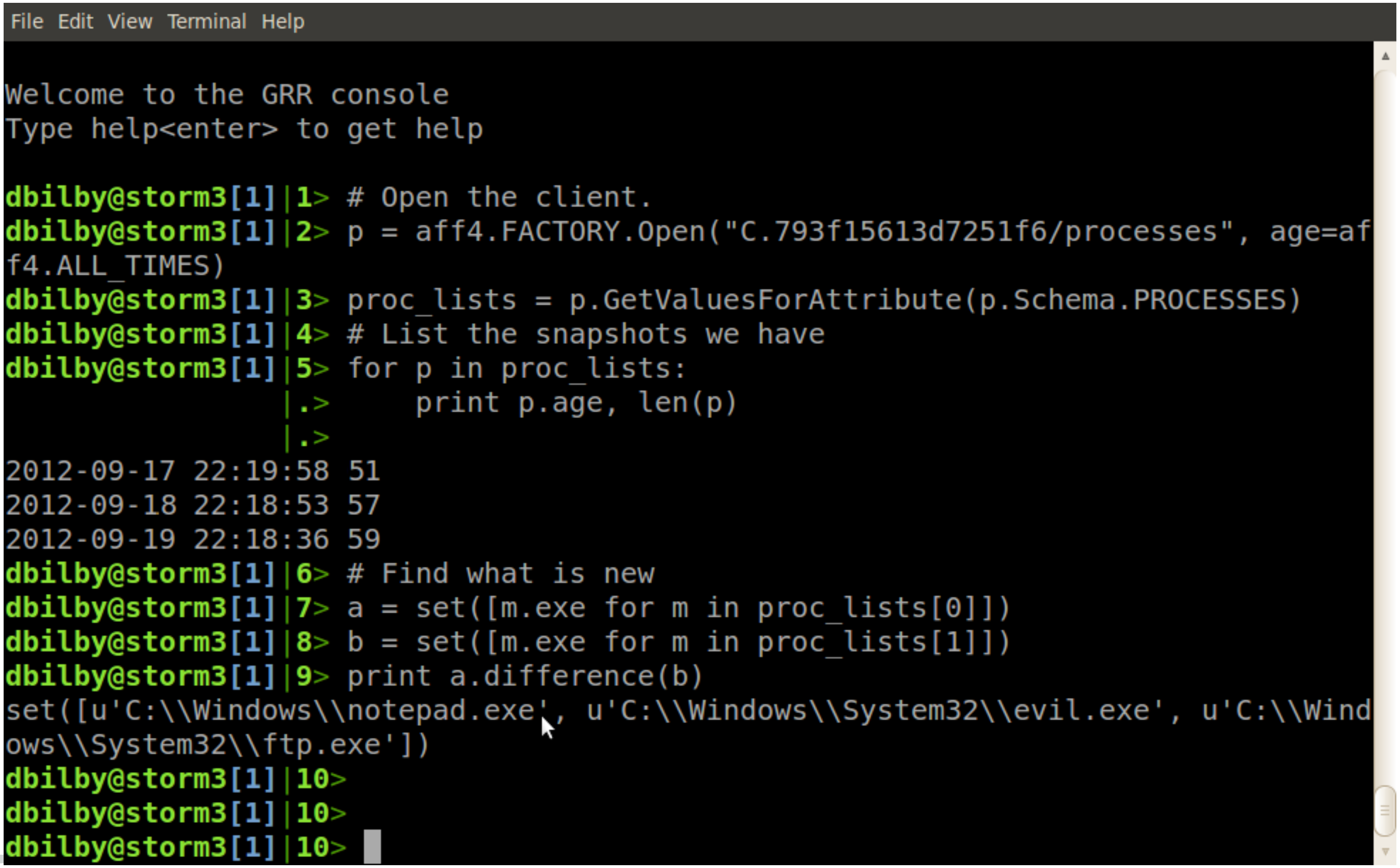
- Keep as much history as you have storage
- Files, processes, boot sectors, mutexes, registry keys...



Versions of aff4:/C.793f15613d7251f6/processes

Age	Type
2012-09-17 22:19:58	ProcessListing
2012-09-18 22:18:53	ProcessListing
2012-09-19 22:18:36	ProcessListing

Console Screenshot



```
Welcome to the GRR console
Type help<enter> to get help

dbilby@storm3[1]|1> # Open the client.
dbilby@storm3[1]|2> p = aff4.FACTORY.Open("C.793f15613d7251f6/processes", age=af
f4.ALL_TIMES)
dbilby@storm3[1]|3> proc_lists = p.GetValuesForAttribute(p.Schema.PROCESSES)
dbilby@storm3[1]|4> # List the snapshots we have
dbilby@storm3[1]|5> for p in proc_lists:
                 |.>     print p.age, len(p)
                 |.>
2012-09-17 22:19:58 51
2012-09-18 22:18:53 57
2012-09-19 22:18:36 59
dbilby@storm3[1]|6> # Find what is new
dbilby@storm3[1]|7> a = set([m.exe for m in proc_lists[0]])
dbilby@storm3[1]|8> b = set([m.exe for m in proc_lists[1]])
dbilby@storm3[1]|9> print a.difference(b)
set([u'C:\\Windows\\notepad.exe', u'C:\\Windows\\System32\\evil.exe', u'C:\\Wind
ows\\System32\\ftp.exe'])
dbilby@storm3[1]|10>
dbilby@storm3[1]|10>
dbilby@storm3[1]|10>
```

Features

- Windows, Linux, OSX clients
- Open source memory drivers Linux, OSX, Windows
- Detailed monitoring of client CPU/Memory impact
- Auto update mechanism
- Volatility integration

- Secure comms infrastructure designed for Internet deployment
- Web UI
- Scriptable console access

- Retrieve files
- Search memory
- Timeline events
- Schedule recurring actions
- Reporting

Demonstration

- Hunt
- Enterprise resource monitoring

Roadmap

A long road ahead....

- Testing testing testing
- Simplification of management
- UI overhaul
- Timelining (log2timeline python)
- Artifact parsers
- Anomaly detection
- Memory analysis
- ...

Contributors

Michael Cohen, Andreas Moser, Darren Bilby, Germano Caronni, Joachim Metz, Jordi Sanchez, Kristinn Guðjónsson, Elizabeth Schweinsberg....

Built on the shoulders of giants...

SleuthKit, Volatility, AFF4, Log2timeline...

Questions?

Live Demo: http://bit.ly/GRR_Demo

Documentation: http://grr.googlecode.com/git/docs/user_manual.html

Code at: code.google.com/p/grr

Mailing lists: groups.google.com/grr-users
groups.google.com/grr-developers