GRR: FIND ALL THE BADNESS!

Who am I

GRR Developer, Google IR team

OS X Security

Former lives: pentesting, IR, security audits etc.

Live forensics

GET /beacon HTTP/1.1
Host: evil.com

from Joe’s machine


Joe


GET /beacon HTTP/1.1
Host: evil.com
Joe is on vacation with 3G internet

New malware report BEAR EAGLE SHARK LASER is out: check all the things

New malware report BEAR EAGLE SHARK LASER is out: check all the things

50+ IOCs for Win/Mac and “all the things” is the machines of a highly mobile global organisation with 50k+ employees

GRR: GRR Rapid Response

Open source live forensics

Scalable

Raw memory, raw disk

Stable, low-impact client

2-party authorization workflow

Hunting, binary collection

much more….


GET /beacon HTTP/1.1
Host: evil.com
Joe is on vacation with 3G internet

SANS: “a combination of description, location, and interpretation”

I prefer

“that stuff I want”

Chrom(e|ium), Firefox, IE, Safari: 3 OSes

%%users.localappdata%%\Google\Chrome\User Data*\Archived History

%%users.localappdata%%\Google\Chrome\User Data*\History

%%users.localappdata%%\Chromium\User Data*\Archived History

%%users.localappdata%%\Chromium\User Data*\History

%%users.homedir%%/Library/Application Support/Google/Chrome/*/Archived History

%%users.homedir%%/Library/Application Support/Google/Chrome/*/History

%%users.homedir%%/Library/Application Support/Chromium/*/Archived History

%%users.homedir%%/Library/Application Support/Chromium/*/History

%%users.homedir%%/.config/google-chrome/*/Archived History

%%users.homedir%%/.config/google-chrome/*/History

%%users.homedir%%/.config/chromium/*/Archived History

%%users.homedir%%/.config/chromium/*/History

%%users.localappdata%%\Mozilla\Firefox\Profiles*\places.sqlite

%%users.appdata%%\Mozilla\Firefox\Profiles*\places.sqlite

%%users.homedir%%/Library/Application Support/Firefox/Profiles/*/places.sqlite

%%users.homedir%%/.mozilla/firefox/*/places.sqlite

%%users.localappdata%%\Microsoft\Windows\Temporary Internet Files\Content.IE5\index.dat

%%users.localappdata%%\Microsoft\Windows\Temporary Internet Files\Low\Content.IE5\index.dat

%%users.localappdata%%\Microsoft\Microsoft\Windows\History\History.IE5\index.dat

%%users.localappdata%%\Microsoft\Microsoft\Windows\History\Low\History.IE5\index.dat

%%users.localappdata%%\Microsoft\Microsoft\Windows\History\History.IE5*\index.dat

%%users.localappdata%%\Microsoft\Microsoft\Windows\History\Low\History.IE5*\index.dat

%%users.localappdata%%\Microsoft\Feeds Cache\index.dat

%%users.appdata%%\Roaming\Microsoft\Windows\IEDownloadHistory\index.dat

%%users.localappdata%%\Microsoft\Windows\WebCache\WebCacheV*.dat

%%users.localappdata%%\Apple Computer\Safari\History.plist

%%users.appdata%%\Roaming\Apple Computer\Safari\History.plist

%%users.homedir%%/Library/Safari/History.plist

add in browser cache locations = 67 paths

%%users.localappdata%%\Google\Chrome\User Data*\Application Cache\Cache*

%%users.localappdata%%\Google\Chrome\User Data*\Cache*

%%users.localappdata%%\Google\Chrome\User Data*\Media Cache*

%%users.localappdata%%\Google\Chrome\User Data*\GPUCache*

%%users.localappdata%%\Chromium\User Data*\Application Cache\Cache*

%%users.localappdata%%\Chromium\User Data*\Cache*

%%users.localappdata%%\Chromium\User Data*\Media Cache*

%%users.localappdata%%\Chromium\User Data*\GPUCache*

%%users.homedir%%/Caches/Google/Chrome/*/Cache/*

%%users.homedir%%/Library/Caches/Google/Chrome/*/Cache/*

%%users.homedir%%/Library/Caches/Google/Chrome/*/Media Cache/*

%%users.homedir%%/Library/Application Support/Google/Chrome/*/Application Cache/Cache/*

%%users.homedir%%/Library/Application Support/Google/Chrome/*/GPUCache/*

%%users.homedir%%/Library/Caches/Google/Chrome/PnaclTranslationCache/*

%%users.homedir%%/Caches/Chromium/*/Cache/*

%%users.homedir%%/Library/Caches/Chromium/*/Cache/*

%%users.homedir%%/Library/Caches/Chromium/*/Media Cache/*

%%users.homedir%%/Library/Application Support/Chromium/*/Application Cache/Cache/*

%%users.homedir%%/Library/Application Support/Chromium/*/GPUCache/*

%%users.homedir%%/Library/Caches/Chromium/PnaclTranslationCache/*

%%users.homedir%%/.cache/google-chrome/*/Cache/*

%%users.homedir%%/.cache/google-chrome/*/Media Cache/*

%%users.homedir%%/.cache/google-chrome/PnaclTranslationCache/*

%%users.homedir%%/.config/google-chrome/*/Application Cache/*

%%users.homedir%%/.config/google-chrome/*/Cache/*

%%users.homedir%%/.config/google-chrome/*/Media Cache/*

%%users.homedir%%/.config/google-chrome/*/GPUCache/*

%%users.homedir%%/.cache/chromium/*/Cache/*

%%users.homedir%%/.cache/chromium/*/Media Cache/*

%%users.homedir%%/.cache/chromium/PnaclTranslationCache/*

%%users.homedir%%/.config/chromium/*/Application Cache/*

%%users.homedir%%/.config/chromium/*/Cache/*

%%users.homedir%%/.config/chromium/*/Media Cache/*

%%users.homedir%%/.config/chromium/*/GPUCache/*

%%users.localappdata%%\Microsoft\Windows\Temporary Internet Files\Content.IE5**

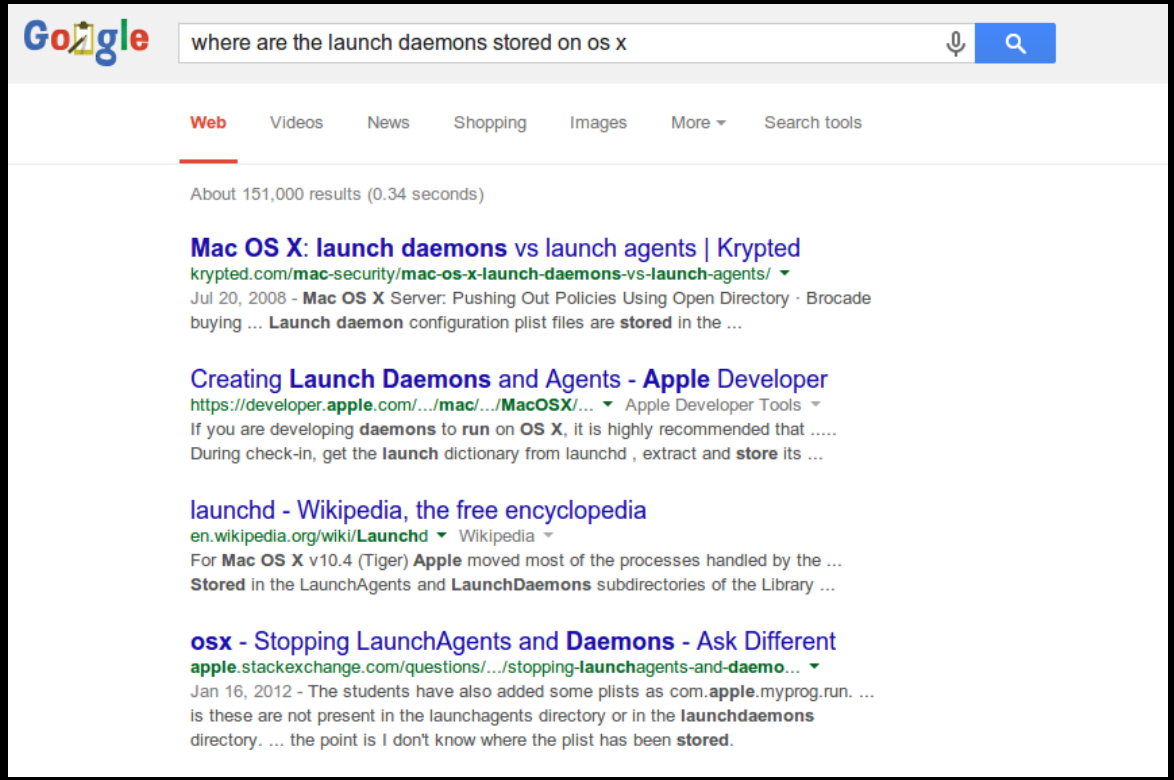
%%users.localappdata%%\Microsoft\Windows\Temporary Internet Files\Low\Content.IE5**

%%users.localappdata%%\Apple Computer\Safari\cache.db

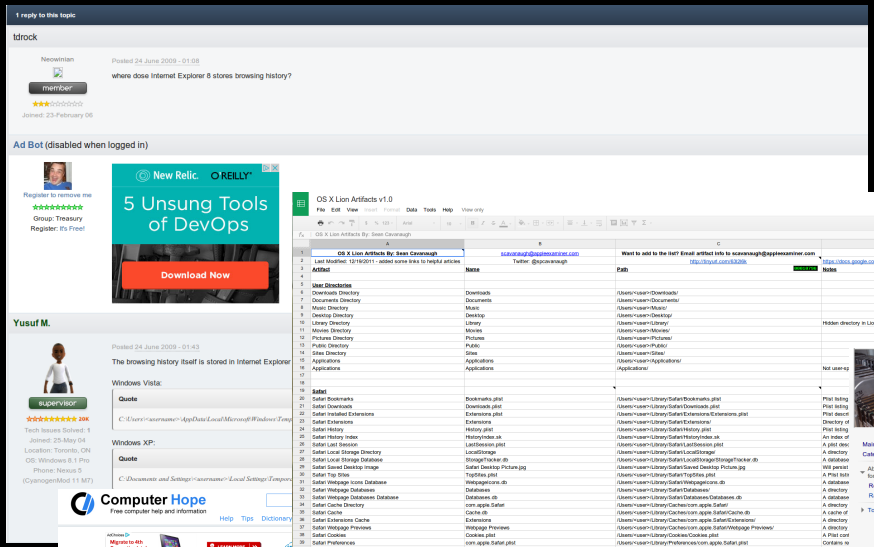
%%users.homedir%%/Library/Caches/com.apple.Safari/cache.db

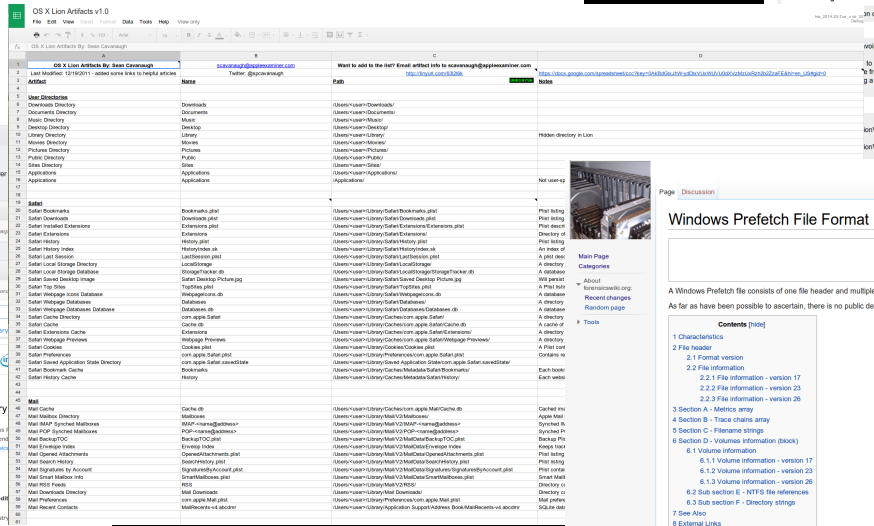
What we think we do

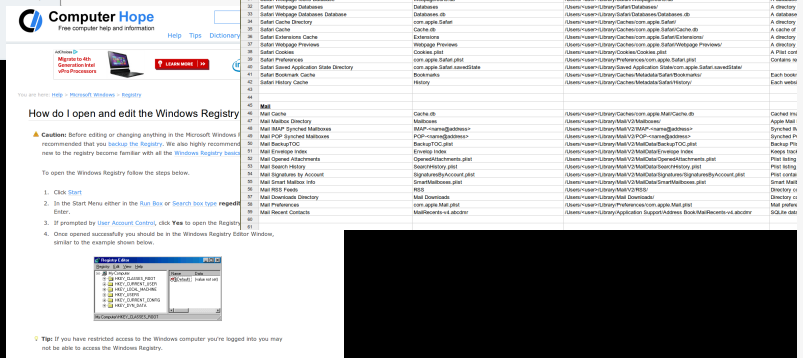
What actually happens

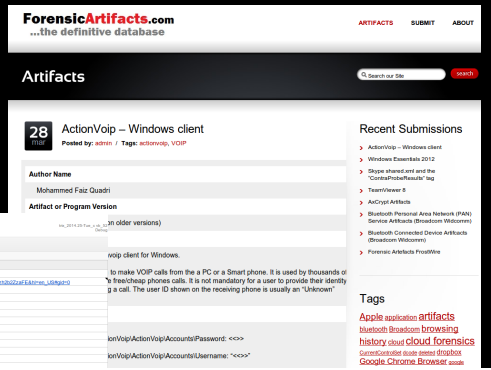


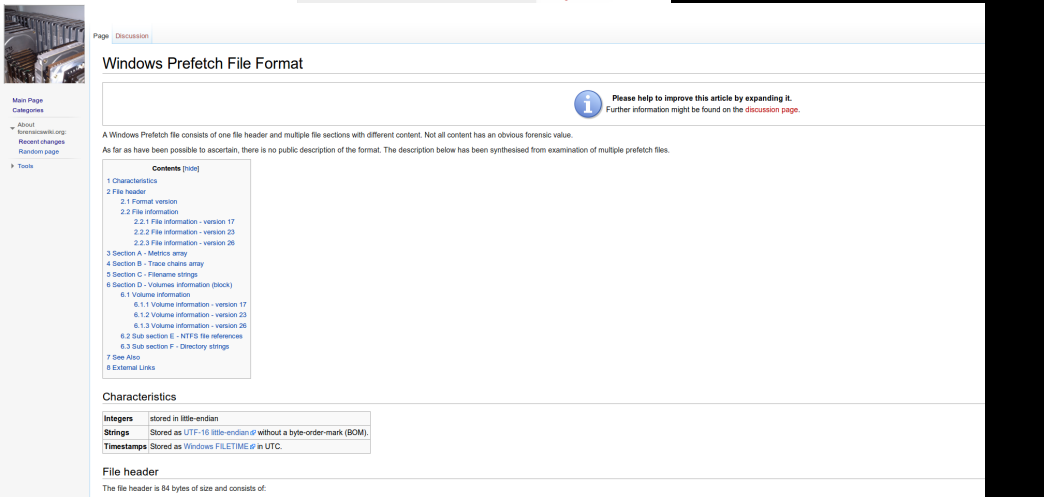
Not (easily) machine readable











Problems:
brain storage capacity, format

a centralized, free, community sourced, knowledge base of forensic artifacts that the world can use both as an information source and within other tools

Didn’t we build this already?

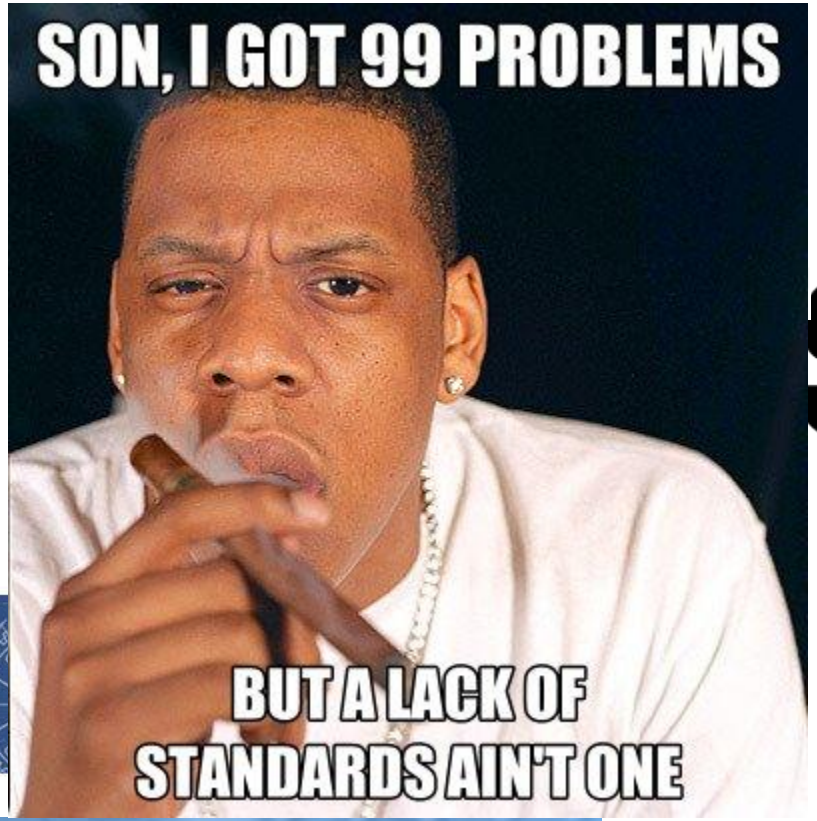
OPEN VULNERABILITY ASSESSMENT LANGUAGE
OVAL™

IODEF

Cybox™

Veris

OpenIOC
An Open Framework for Sharing Threat Intelligence
Sophisticated Threats Require Sophisticated Indicators



yara

STIX™

IDMEF

MAEC

Security Content Automation Protocol
SCAP

IOC vs artifact

IOC: `If filename “temp.exe” contains string “evil” or is signed by “stolen cert”` -> you’re owned

Artifact: security event log is at

`C:\Windows\System32\winevt\Logs\Security.evtx`

As seen in the wild

HardDrive\Documents and Settings\USERNAME\Local Settings\Application Data\Google\Chrome\User Data\Default\History

HKU\S-1-5-21-xxxxxxxxx-xxxxxxxxx-xxxxxxxxx-xxxx\Software\Microsoft\Windows\CurrentVersion\Uninstall\Dropbox\InstallLocation

/Users/<user>/Library/Mail Downloads/

/home/user/.local/share/Trash/

What do I do with these?

HardDrive\Documents and Settings\USERNAME\Local Settings\Application Data\Google\Chrome\User Data\Default\History

HKU\S-1-5-21-xxxxxxxxx-xxxxxxxxx-xxxxxxxxx-xxxx\Software\Microsoft\Windows\CurrentVersion\Uninstall\Dropbox\InstallLocation

/Users/<user>/Library/Mail Downloads/

/home/user/.local/share/Trash/

Common language for interpolation

%%users.localappdata%%\Google\Chrome\User Data*\History

HKEY_USERS**%%users.sid%%**
\Software\Microsoft\Windows\CurrentVersion\Uninstall\Dropbox\InstallLocation

%%users.homedir%%/Library/Mail Downloads/

%%users.homedir%%/.local/share/Trash/

Artifact

```
name: ApplicationEventLog
doc: Windows Application Event log.
collectors:
- collector_type: FILE
  args: {path_list: ['%%environ_systemroot%%\System32\winevt\Logs\AppEvent.evt']}
conditions: [os_major_version >= 6]
labels: [Logs]
supported_os: [Windows]
urls: ['http://www.forensicswiki.org/wiki/Windows_Event_Log_(EVT)']
```

Artifact repository: get it here

~130 artifacts, 30 parsers:

https://code.google.com/p/grr/source/browse/#git%2Fartifacts

Review, bug reports, patches etc. very welcome

Collection/Definition Demo

Challenges

Testing

Populating the knowledge base

Dependency Logic

New malware report BEAR EAGLE SHARK LASER is out: check all the things

What we have to work with

C:\Windows\System32\zuur9x.dll

C:\Windows\System32\winimlog.dll

C:\Windows\System32\abdfdc32.dll

….

d4e088ba921c0420428b1f73d5caad23

415710a29ffb55e53044fc1914509872

….

HKLM\Software\Classes\CLSID\{EFFAABBE-0718-4453-9993-0AFE888D6F0C}\InprocServer32

What to collect?

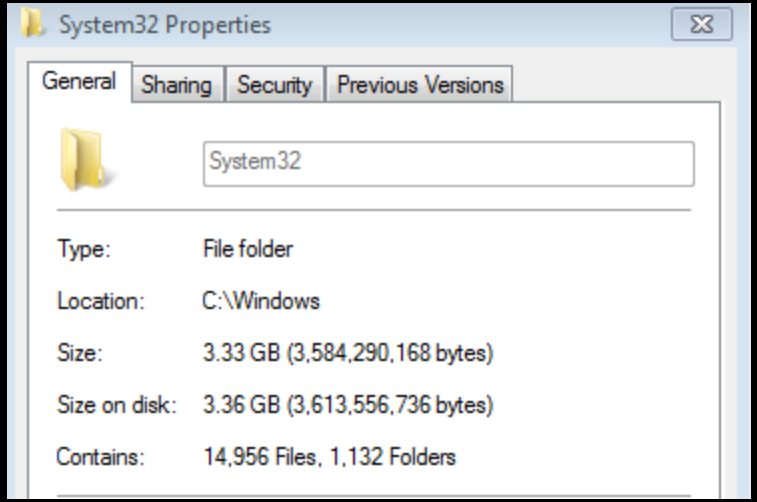
Why not all system32 executables?

%%environ_systemroot%%\System32**{exe,dll}

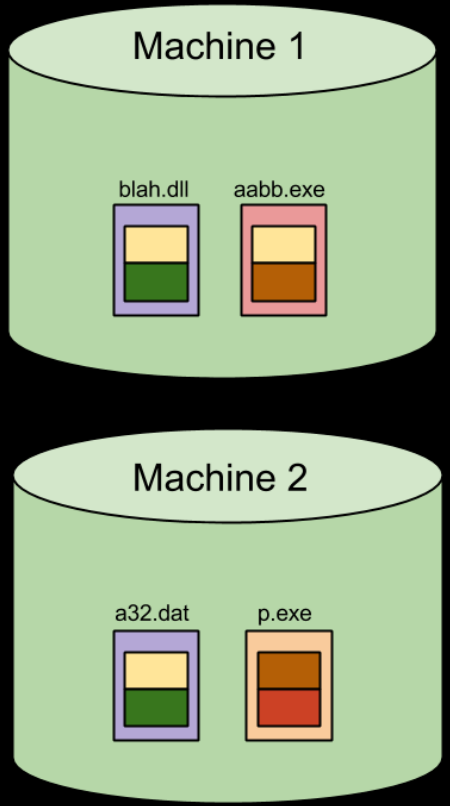
Pros/cons

+ leak less intelligence
+ collect currently unknown malware
– lots of files

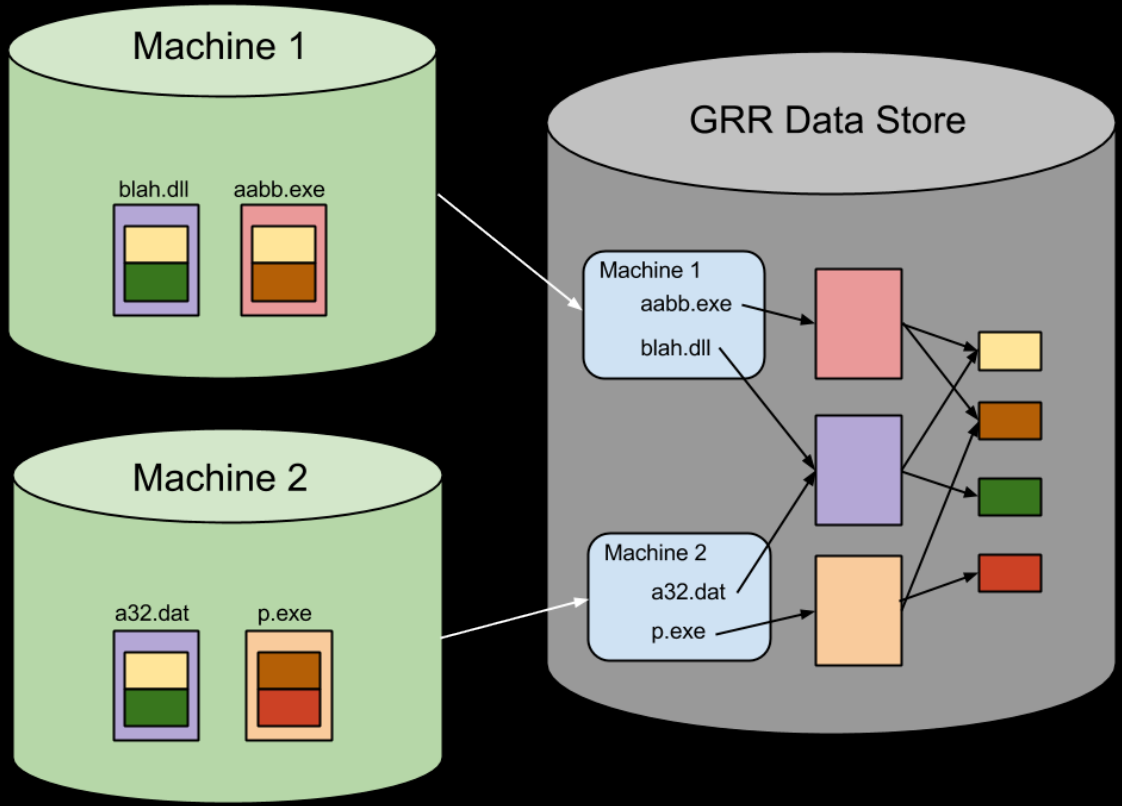
Is that really practical?



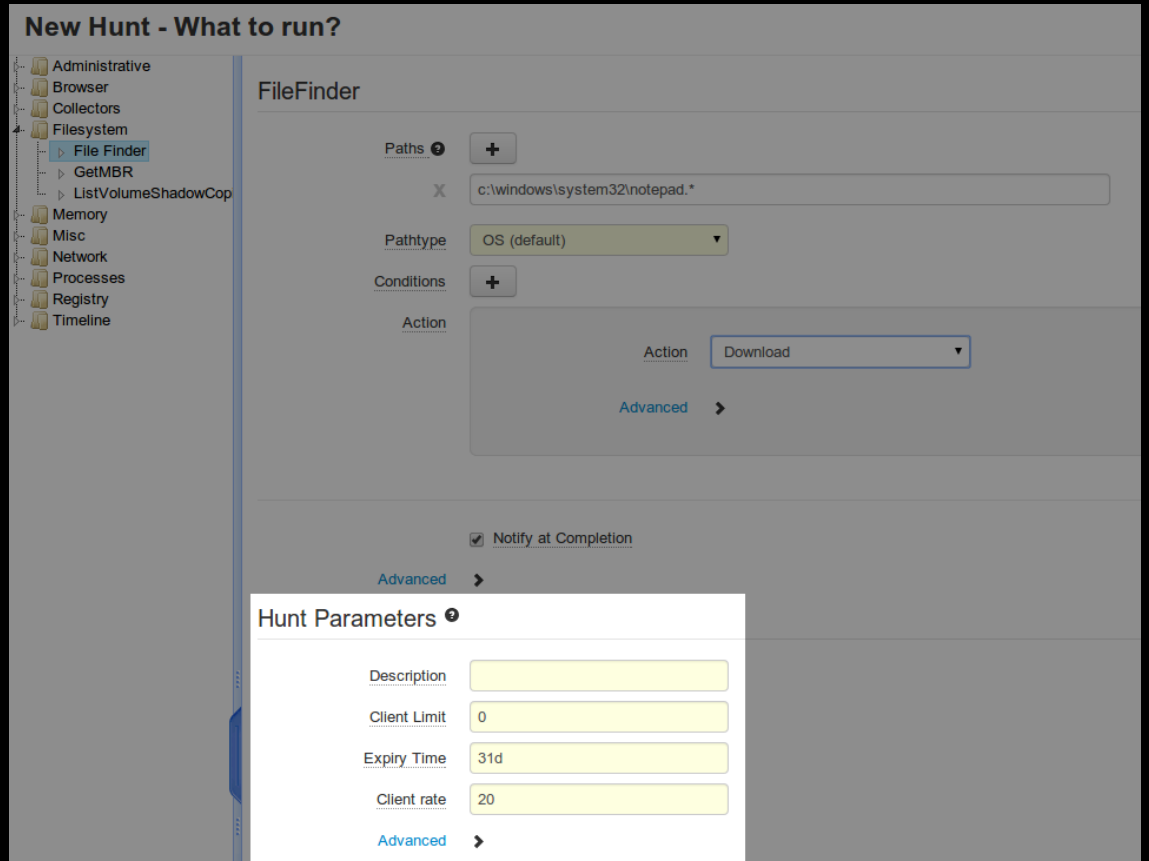
File-level and block-level de-dup



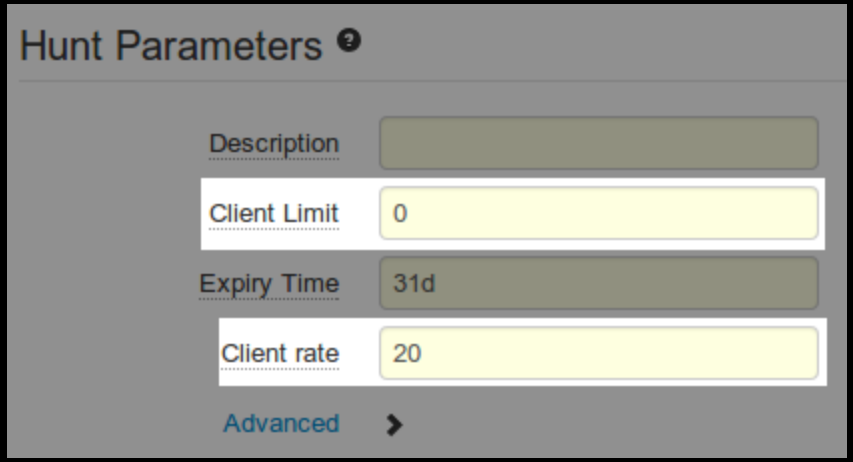
File-level and block-level de-dup



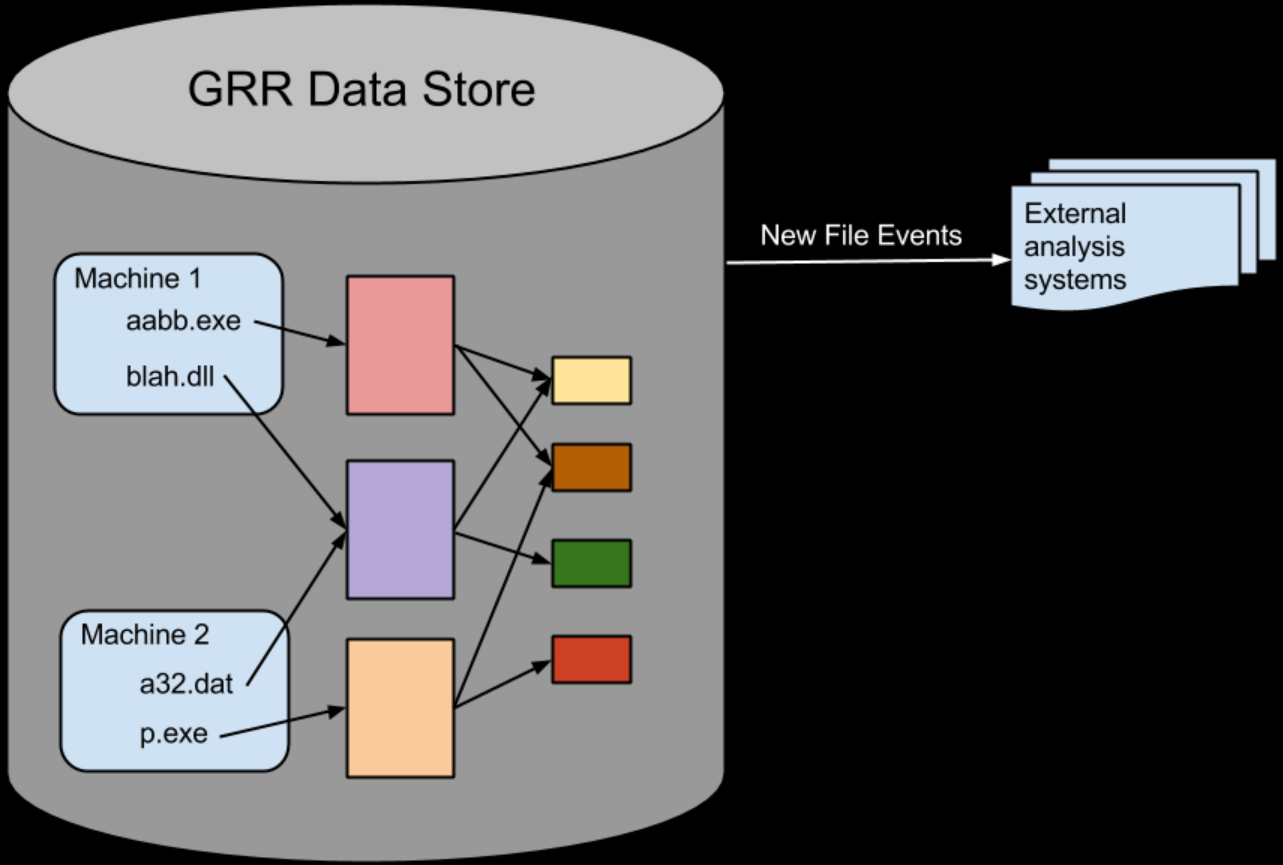
Client limits for hunt testing

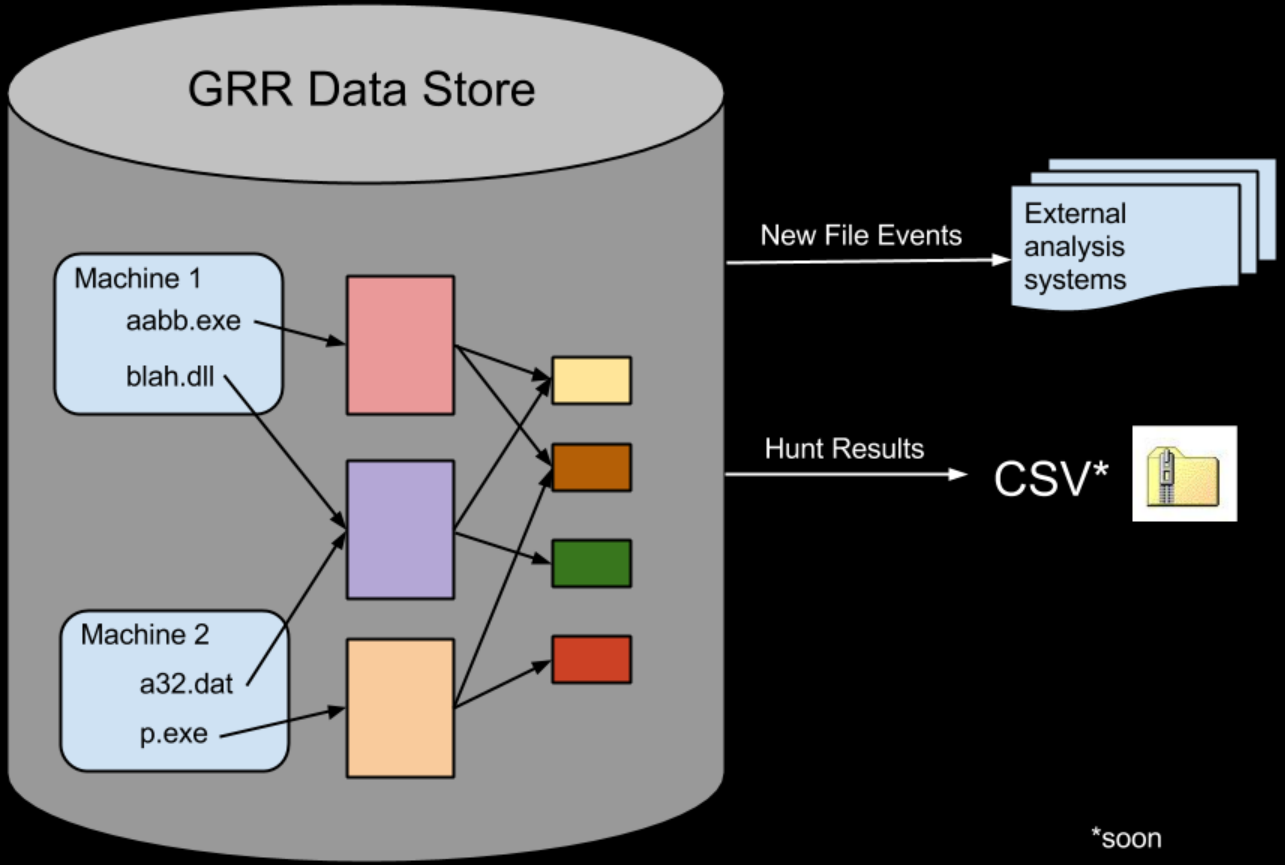


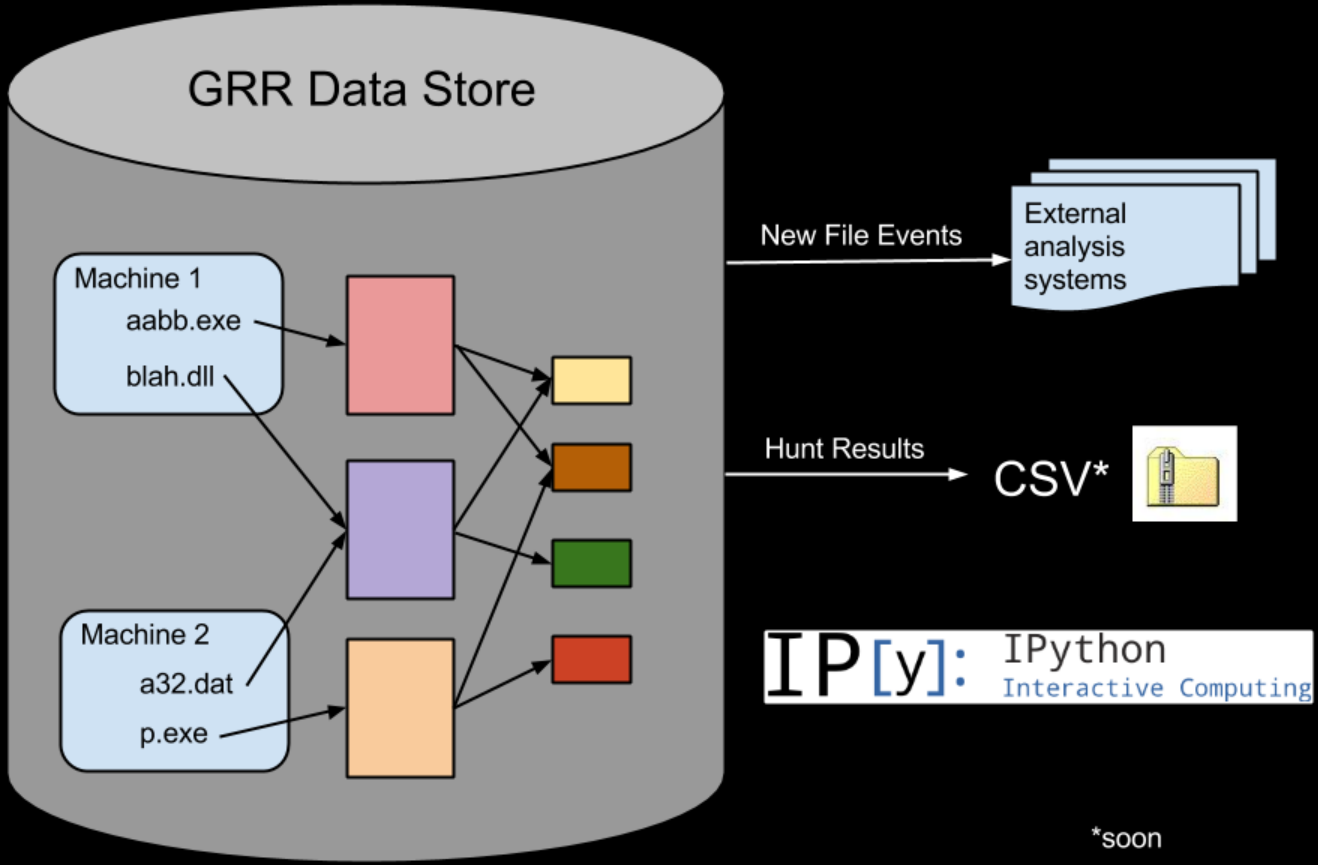
Client limits for hunt testing



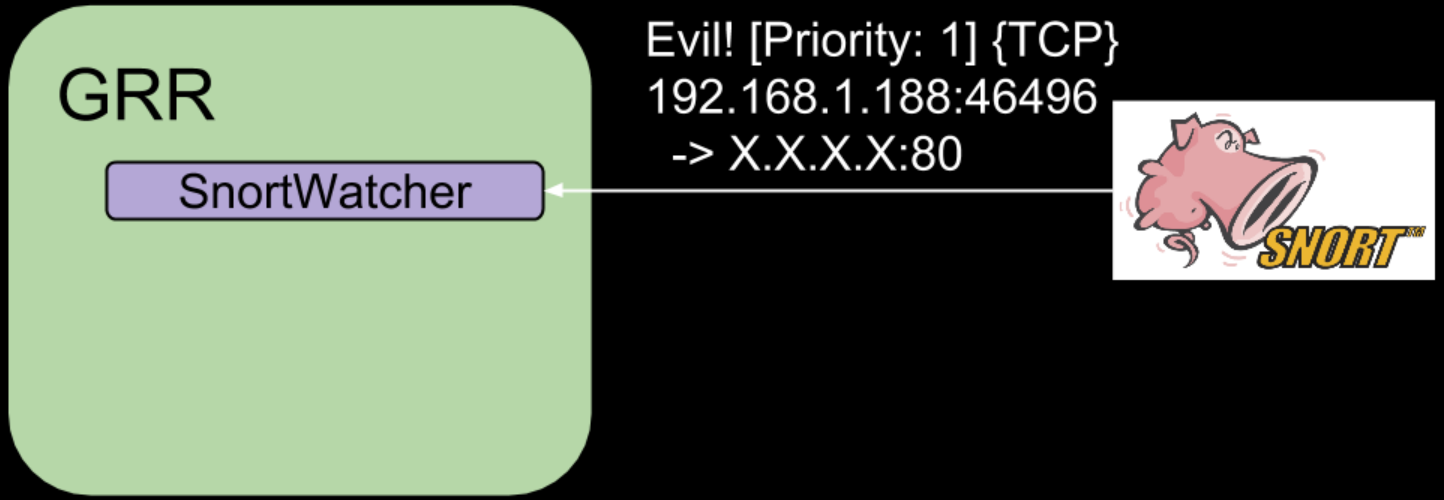
Output

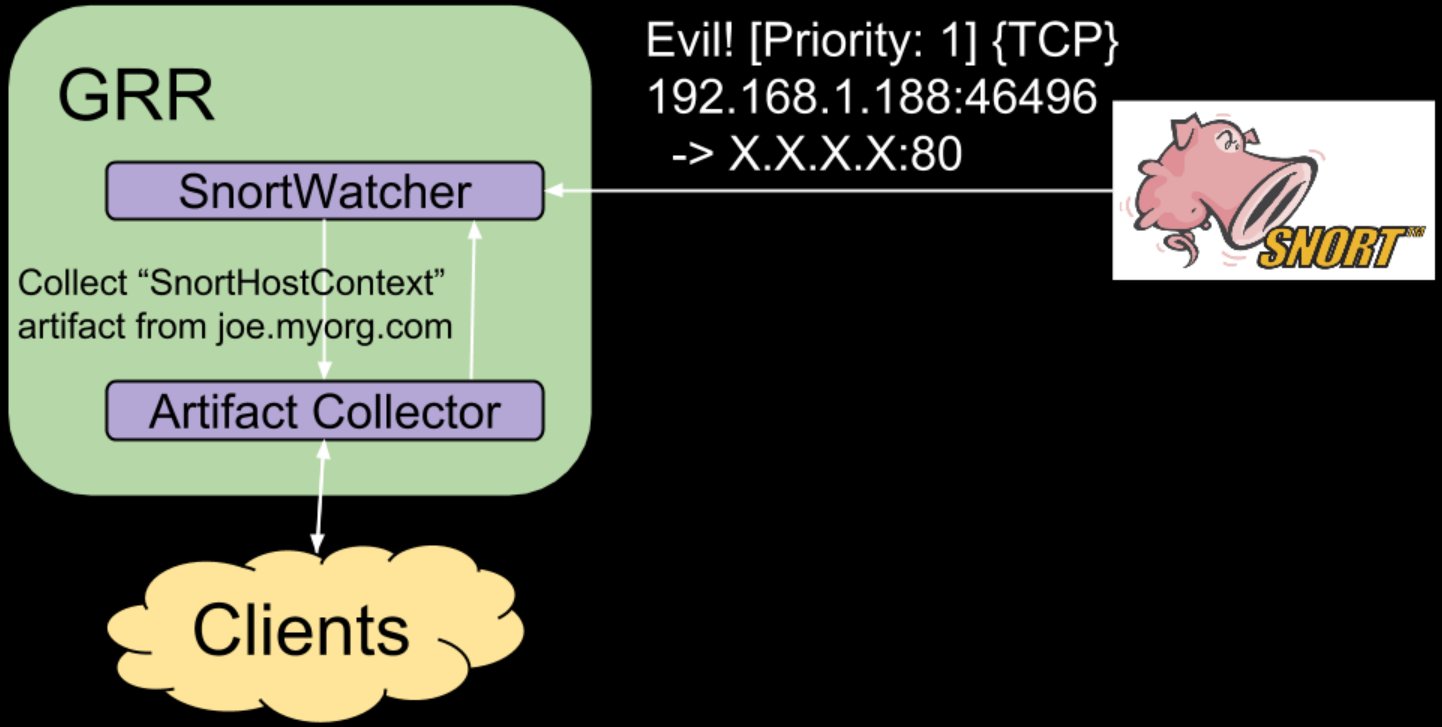

GRR Data Store
Machine 1
aabb.exe
blah.dll
Machine 2
a32.dat
p.exe
New File Events
External
analysis
systems

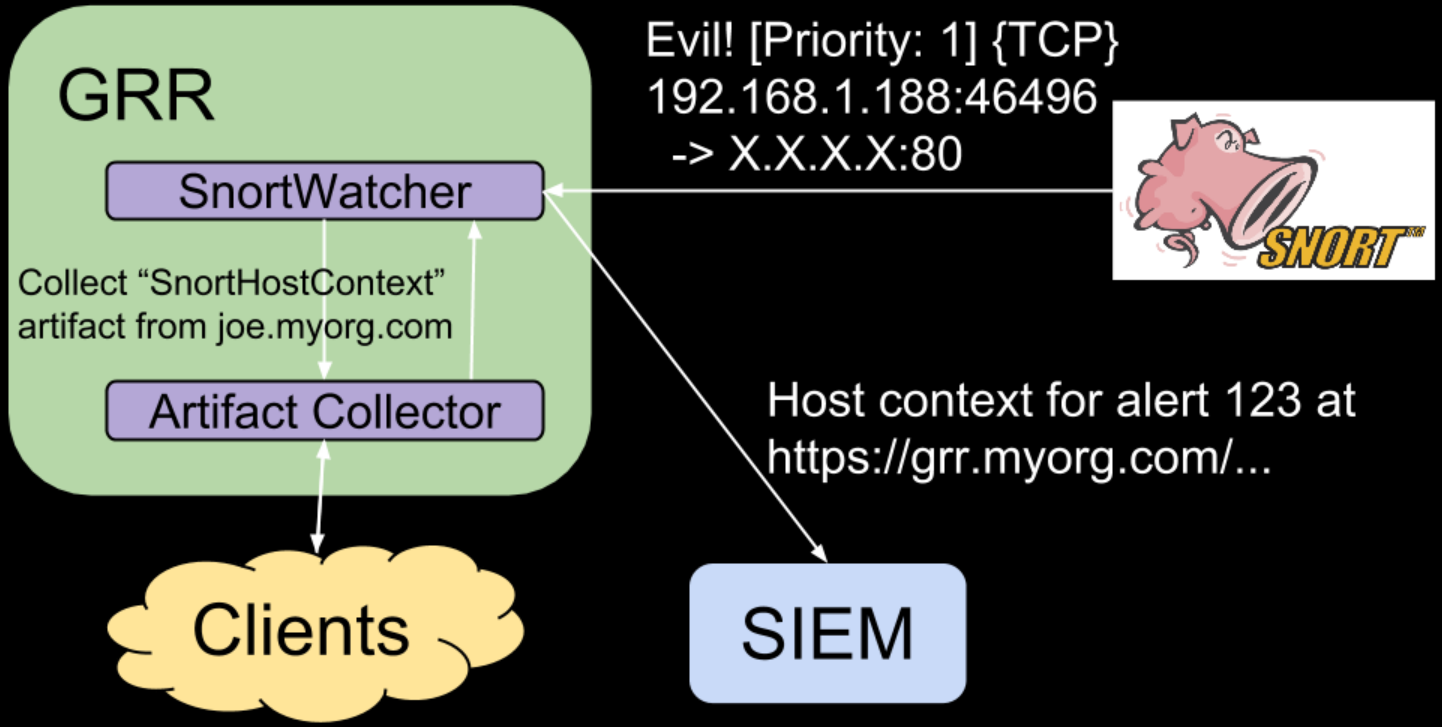

GRR Data Store
Machine 1
aabb.exe
blah.dll
Machine 2
a32.dat
p.exe
New File Events
External analysis systems
Hunt Results
CSV*
*soon


GRR Data Store
Machine 1
aabb.exe
blah.dll
Machine 2
a32.dat
p.exe
New File Events
External analysis systems
Hunt Results
CSV*
IP[y]: IPython Interactive Computing
*soon

Input


GRR
SnortWatcher
Evil! [Priority: 1] {TCP}
192.168.1.188:46496
-> X.X.X.X:80
SNORT


GRR
SnortWatcher
Collect “SnortHostContext”
artifact from joe.myorg.com
Artifact Collector
Clients
Evil! [Priority: 1] {TCP}
192.168.1.188:46496
-> X.X.X.X:80
SNORT


GRR
SnortWatcher
Collect “SnortHostContext” artifact from joe.myorg.com
Artifact Collector
Clients
Evil! [Priority: 1] {TCP} 192.168.1.188:46496 -> X.X.X.X:80
SNORT
Host context for alert 123 at https://grr.myorg.com/...
SIEM

What’s coming for GRR

Artifacts: debug, own repo, UI, performance

Rekall and rekall-grr integration

Opensource datastore performance

Server/client load indicators

Hunting by labels

Links/Contacts

GRR: code.google.com/p/grr/ (artifacts whitepaper will be posted here)

Artifacts repository (for now): https://code.google.com/p/grr/source/browse/#git%2Fartifacts

Rekall Memory Forensics: http://www.rekall-forensic.com/

Contact: grr-dev@googlegroups.com