Rapid Evidence Acquisition Project for Event Reconstruction (REAPER)

Joshua James
Centre for Cybercrime Investigation
University College Dublin

The Goal of REAPER

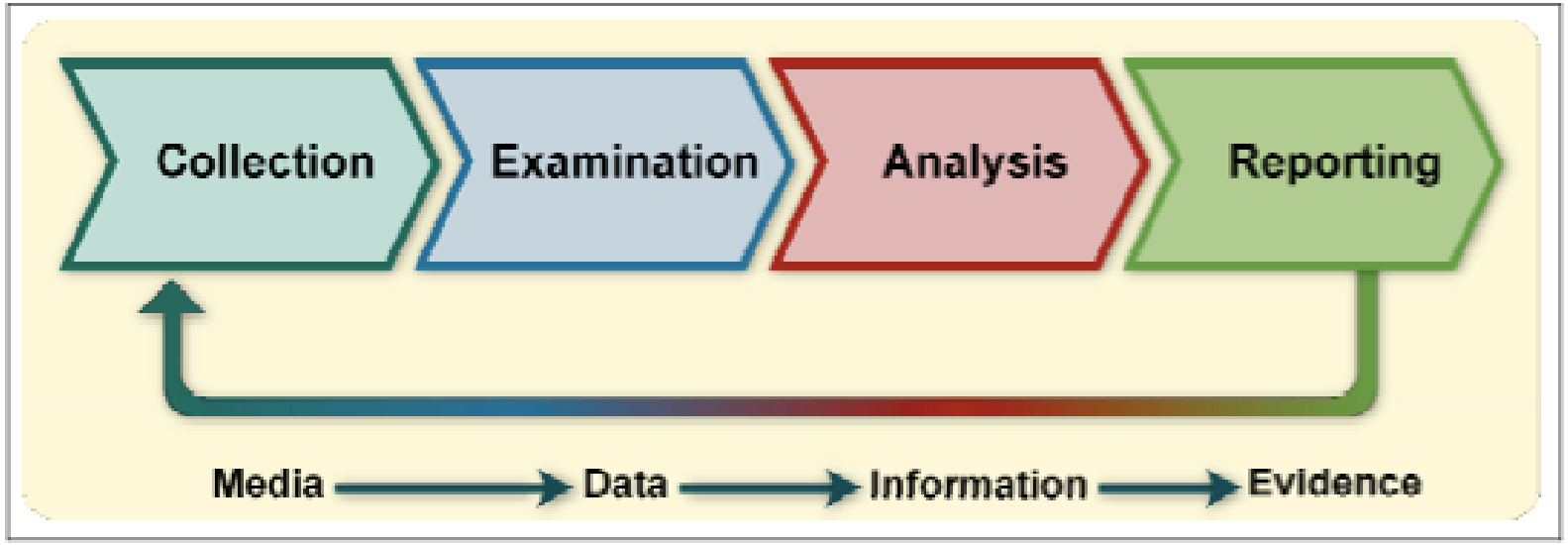
- To reduce digital crime at the global level
- How: by allowing digital investigators to conduct quality investigations regardless of training or budget

Focus

- Usability
- Automation
- Cost Reduction

History of REAPER

- Started in 2008
- Focused on low cost, highly automatic digital forensic investigations primarily for developing countries



REAPERlive

- REAPERlive
  - Specifically for offline automatic media acquisition, processing and analysis
  - Automatic documentation and case management
  - Runs from a bootable external hard drive on suspect system
  - No user input required after boot

Media Acquisition

```
I: REAPER system drive detected - /dev/sda
P: Mounting REAPER system drive - /dev/sda2
I: Mount successful
I: REAPER evidence drive detected - /dev/sdb
P: Mounting REAPER evidence drive - /dev/sdb2
I: Mount successful
P: Activating swap space at /dev/sdb1
Setting up swapspace version 1, size = 1028120 kB
no label, UUID=eceaa81a-40bc-423a-9cd6-e8a6c686c1a4
I: REAPERsys mounted OK
I: REAPERevi mounted OK
P: Setting up environment...
I: Logging directory found
P: Creating log file /logs/Case-3974860963/Case-3974860963.log
I: '/media/REAPERsys' looks good for chroot.
P: Starting the imaging process...
P: Hashing drive /dev/hda - SHA256...

real    4m8.763s
user    0m36.830s
sys     0m40.095s
I: SHA256 Hash of /dev/hda is:
 e1034911f407badafe413645a0fd694e28768fa17ef925b538af0ab
P: Imaging /dev/hda to /images/hda-3974860963.dd... (thi
[13% of 4096Mb] 18176 blocks (568Mb) written. 00:03:06 r
```

Image acquisition using DD

Verification of collected images

```
no label, UUID=eceaa81a-40bc-423a-9cd6-e8a6c686c1a4
I: REAPERsys mounted OK
I: REAPERevi mounted OK
P: Setting up environment...
I: Logging directory found
P: Creating log file /logs/Case-3974860963/Case-3974860963.log
I: '/media/REAPERsys' looks good for chroot.
P: Starting the imaging process...
P: Hashing drive /dev/hda - SHA256...

real    4m8.763s
user    0m36.830s
sys     0m40.095s
I: SHA256 Hash of /dev/hda is:
 e1034911f407badafe413645a0fd694e28768fa17ef925b538af0ab3eaf78eb2
P: Imaging /dev/hda to /images/hda-3974860963.dd... (this may take a while)
[99% of 4096Mb] 131072 blocks (4096Mb) written. 00:00:00 remaining.
131087+1 records in
131087+1 records out

real    3m51.524s
user    0m0.592s
sys     0m18.133s
P: Confirming Hash...
```

Sample Technical Log

```
I: Case Data file Case-2138360924.data created
Wed Jun 17 06:36:30 UTC 2009
I: Using '/media/REAPERsys' looks good for chr
I: REAPER_image script started at:
Wed Jun 17 06:36:30 UTC 2009
I: REAPER_image script - v0.1 - 12/5/2009
Wed Jun 17 06:36:30 UTC 2009
P: Hashing drive /dev/hda - SHA256...
I: SHA256 Hash of /dev/hda is:
 e1034911f407badafe413645a0fd694e28768fa17ef92
Wed Jun 17 06:38:23 UTC 2009
P: Imaging /dev/hda to /images/hda-2138360924.
I: SHA256 Hash of /images/hda-2138360924.dd is
e1034911f407badafe413645a0fd694e28768fa17ef925
Drive hash:
e1034911f407badafe413645a0fd694e28768fa17ef925
File hash
```

```
REAPERlive logging started at:
Wed Jun 17 06:36:30 UTC 2009
REAPERControl Script - v0.3 - 25/5/2009
REAPER_detectDrive Script - v0.3 - 17/6/2009
REAPER_setENV Script - v0.2 - 17/5/2009

I: Manually set REAPER drive serial numbers:
I: REAPERsys drive serial: 6RYBXWPA
I: REAPERevi drive serial: 6RYBXDXF
I: REAPER drives detected and mounted...
/dev/sda2 on /media/REAPERsys type ext3 (rw)
/dev/sdb2 on /media/REAPERevi type xfs (rw)
/dev on /media/REAPERsys/dev type none (rw,bind)
/proc on /media/REAPERsys/proc type none (rw,bind)
none on /media/REAPERsys/dev/pts type devpts (rw)
/tmp on /media/REAPERsys/tmp type none (rw,bind)
/media/REAPERevi on /media/REAPERsys/evidence type none (rw,bind)
/dev on /media/REAPERsys/dev type none (rw,bind)
/proc on /media/REAPERsys/proc type none (rw,bind)
none on /media/REAPERsys/dev/pts type devpts (rw)
/tmp on /media/REAPERsys/tmp type none (rw,bind)
/media/REAPERevi on /media/REAPERsys/evidence type none (rw,bind)

I: Detected suspect drives are:

Disk /dev/hda: 4295 MB, 4295467008 bytes
255 heads, 63 sectors/track, 522 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Disk identifier: 0x00010001

   Device Boot      Start         End      Blocks   Id  System
/dev/hda1   *           1         521     4184901    7  HPFS/NTFS
<------------------------------------------------------------>
```

Evidence Processing

Collected evidence automatically sent to OCFA for processing
(can be started or restarted later)

```
column "rowsha1.id"
NOTICE:  CREATE TABLE / PRIMARY KEY will create implicit index "suspendedmeta_pk
ey" for table "suspendedmeta"
CREATE TABLE
CREATE TABLE
CREATE TABLE
CREATE TABLE
CREATE TABLE
CREATE TABLE




Please restart apache for all changes to take effect
I: Starting OCFA case monitor
I: Creating symlink to case conf file in OCFAROOT/etc
ln: creating symbolic link `/usr/local/digiwash/etc/Case-2138360924.conf': File
exists
P: Processing hda-1346800195.dd...
I: The Source does not appear to match the current computer
I: File id 1346800195 is not equal to session id 2138360924
P: Processing hda-2138360924.dd...
I: Image source looks valid - 2138360924
I: Submitting evidence to OCFA in case Case-2138360924
_
```

OCFA

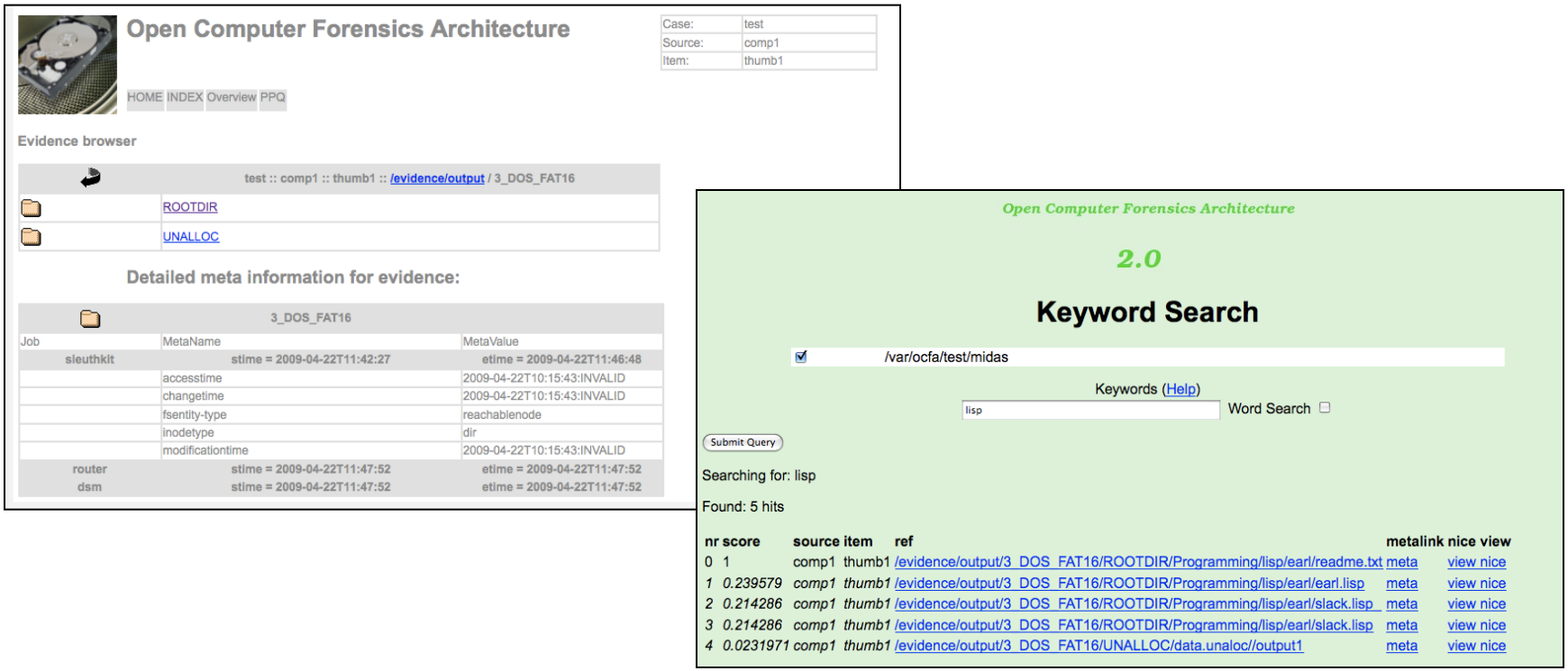
Open Computer Forensics Architecture

- Written by the Dutch National Police Agency
- Processes evidence
  - Disk images or single files
  - Extracts metadata
  - Indexes data
  - Compiles searchable database
- Modular
  - New modules can be written to parse new and different types of data

http://OCFA.sourceforge.net

Media Analysis

- OCFA provides a simple web-based browser and keyword search



Media Analysis

- REAPERview
  - an Automatic Event Reconstruction (AER) project
  - Automatically associates sets of data with user activities
  - Quickly gathers data from various sources to verify findings
  - Gives an overall picture of what a user was doing on the machine
  - Experimental - Still in first stages of development

AER Project Webpage

REAPERdesktop

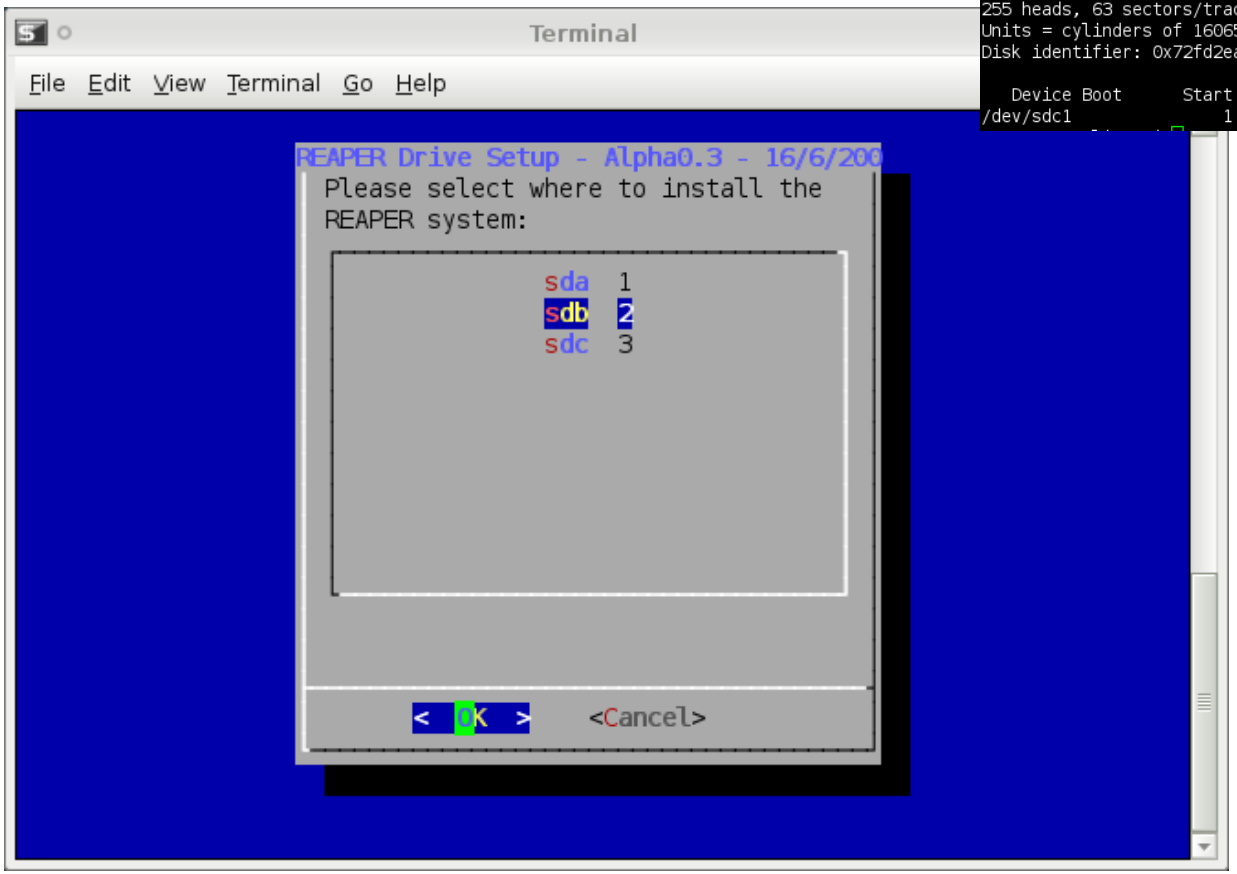
- REAPERlive Desktop
  - Secure forensic desktop for evidence analysis, reporting and setup of REAPER components
  - Downloaded as ISO or USB image
  - If user already has Debian or Ubuntu, able to download the makeREAPERliveDesktop script
    - Customizable – investigator can add custom tools

http://REAPER.CybercrimeTech.com

REAPERlive Desktop

Setup REAPER Drives

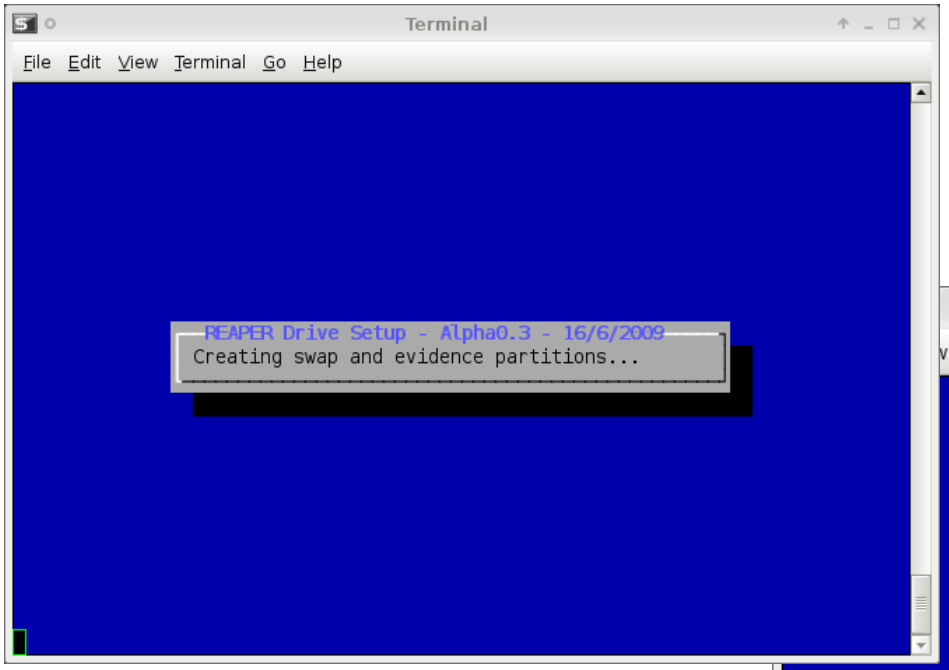
Investigator selects what drives to install REAPER on



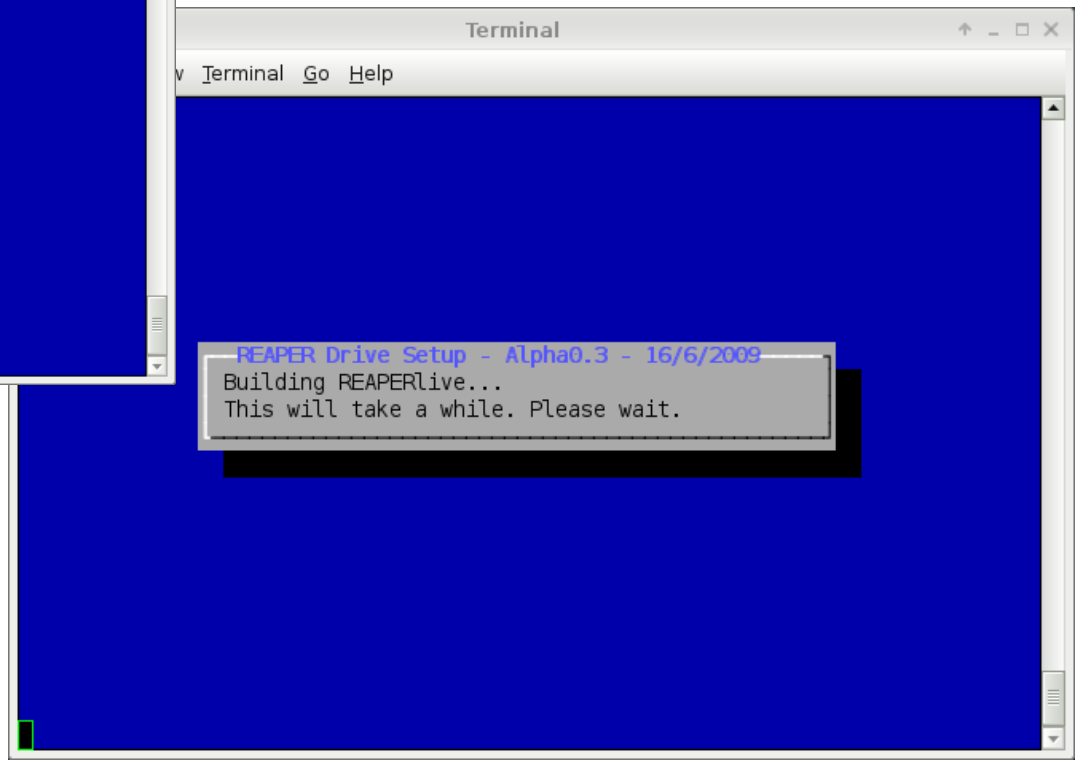

```
Disk /dev/sdb: 250.0 GB, 250059350016 bytes
240 heads, 63 sectors/track, 32301 cylinders
Units = cylinders of 15120 * 512 = 7741440 bytes
Disk identifier: 0x00093736

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1       32301   244195528+   7  HPFS/NTFS

Disk /dev/sdc: 250.0 GB, 250059350016 bytes
255 heads, 63 sectors/track, 30401 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Disk identifier: 0x72fd2eaa

   Device Boot      Start         End      Blocks   Id  System
/dev/sdc1               1       30401   244196001    7  HPFS/NTFS
```

Pre-REAPER partition example

Setup REAPER Drives



The remaining processes require no user intervention



REAPERlive

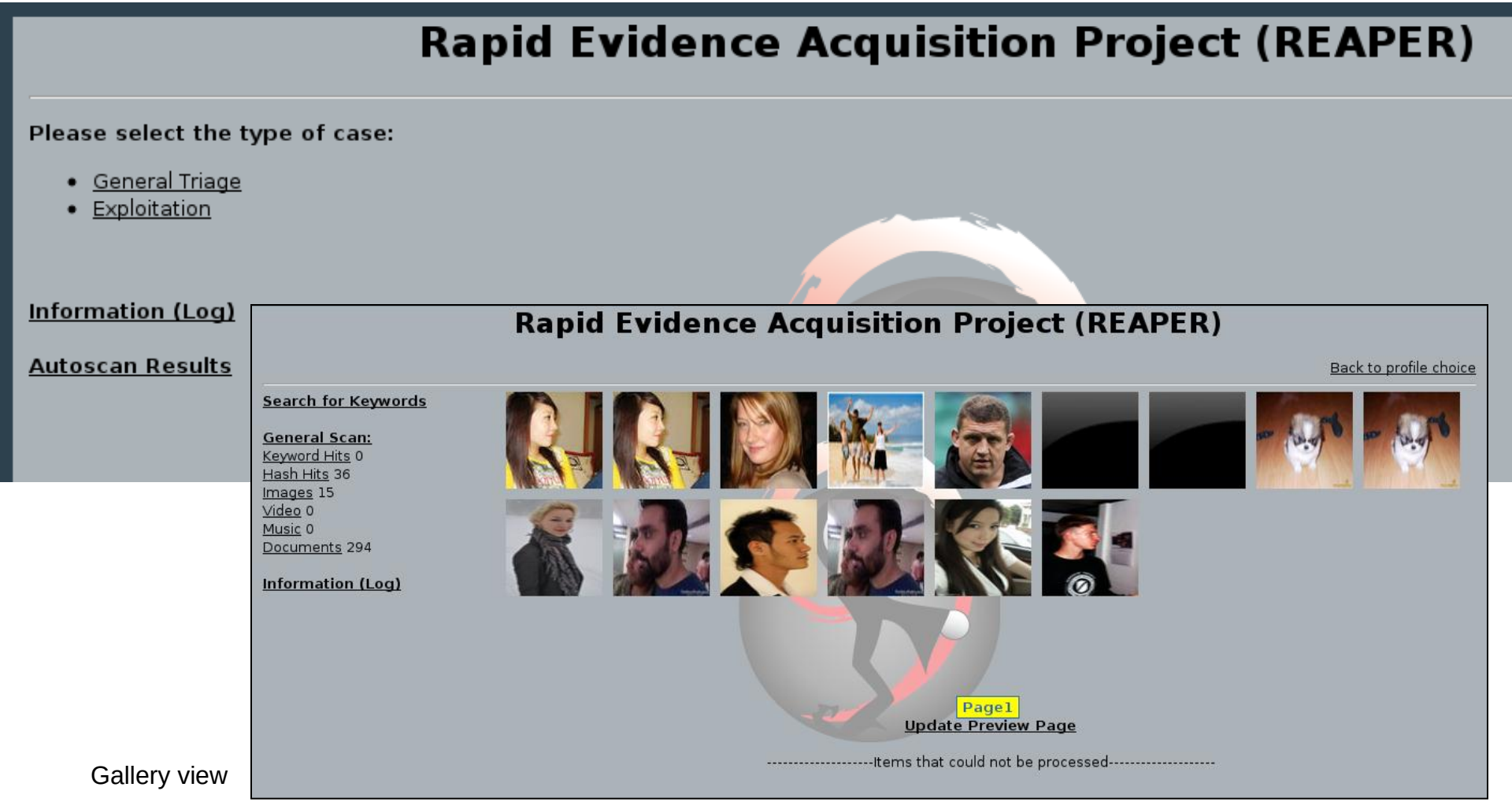
- Useful for having a non-expert acquire, document and pre-process media
- Still needs expert for analysis
- Useful for eDiscovery

REAPER Preview

- Written with customs officers in mind
- REAPERlive Preview
  - Fast and Simplistic Preview
    - Pictures
    - Movies
    - Documents
- From boot to preview in 3 minutes or less

REAPER Preview

Preview case type profiles



Gallery view

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Automated Network Triage

- Developed by Martin Koopmans of the Netherlands Police (Hollands-Midden)
- ***"A process of sorting computer systems into groups, based on the amount of relevant information or evidence found on these computer systems"***
- Client-server based triage using gPXE

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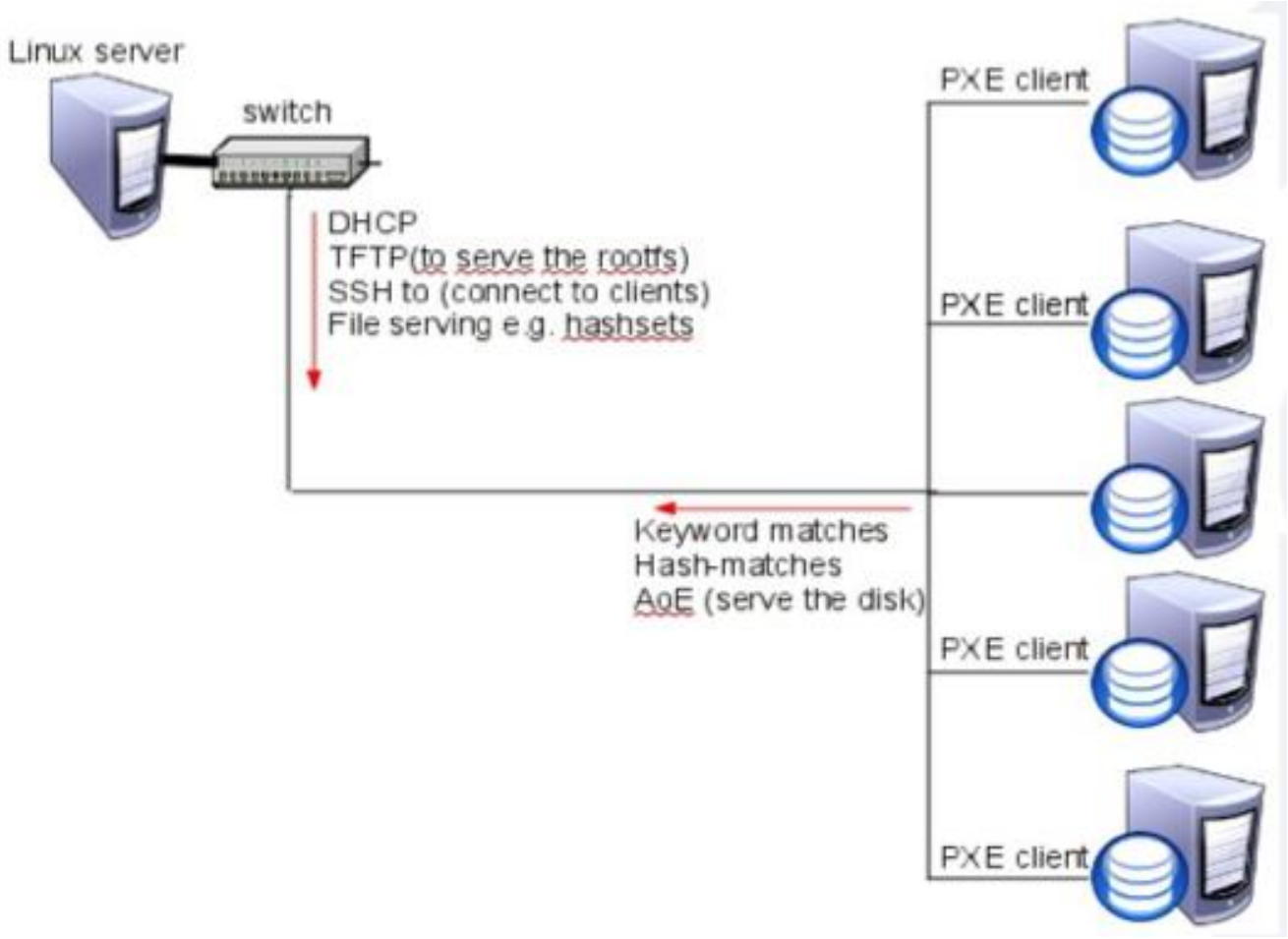
Automated Network Triage



REAPER: Observations

- Digital forensic investigations are not only a technical problem
- Difference in the investigation needs of developed and developing countries
- Difference in the investigation needs at national and divisional levels
- How to investigate differs based on case

REAPER Tools

Management

- Needs
- Processes
- Structure

Technology

- Support Management
- Support Investigators
- Well Integrated

Knowledge

- Training
- Decision Matrix
- Law

REAPER: Future

- REAPER currently being developed to include:
  - Architecture for conducting an organizational needs analysis and process abstraction
  - Open digital forensic investigation and related training.
  - Expert level decision tree to assist non-experts
  - Open ‘framework’ type tools that allow an organization to automate their identified technology-related needs in a software independent manner

Case Study

- Currently evaluating a three-tier investigation process
  - On scene
  - Local Station
  - Forensics Laboratory
- Needs:
  - Expert level knowledge
  - Non-expert level knowledge

For any questions or comments

please email:

Joshua@CybercrimeTech.com

http://CybercrimeTech.com