Forensics Analysis

From Incident Response to Digital Forensics

Ondřej Šrámek · Czechitas · 2026

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Linktree

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GMON, GNFA, GCTI

- Worked in the public sector and commercial sector
- 12+ years in the field, primarily Incident Response, DFIR, Threat Hunting and Threat Intelligence

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Agenda

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Disclaimer

Environment Setup

Digital Forensics

Data Acquisition

Artifact Analysis

Memory Analysis

AI in Forensic Analysis

Forensics Challenge

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Disclaimer

> *"With great power there must also come great responsibility!" — Spider-Man*

In the following lesson you will get a lot of useful information. Their misuse or use by the dark side could mean significant disruption to future forensic investigations.
Consider this lesson and presentation as **need to know**, **TLP:RED**

Write Down Your Notes

Context matters!

- Paper vs. Flipchart vs. DFIR-IRIS
- MISP/OpenCTI/Case Management (The Hive)
- Map findings to MITRE ATT&CK TTPs
- (Super)Timeline!

Environment

Windows vs. Linux vs. macOS

Your (Forensic) Environment

Your analysis machine should be **isolated**

- **No AV** — extracted files vs. AV/EDR
- Watch out for malware execution
- Created for **Windows** → SIFT / macOS / WIN-FOR
- Created for **macOS** → WIN-FOR / macOS / Linux
- Collaboration
- Malware analysis / IR / CTI

Our Setup

Tool	Purpose
KAPE	Artifact collection from Windows
DumpIt	Memory dump
Splunk / Timeline Explorer	Analyze collected artifacts
Volatility	Memory analysis
Kali / Remnux / SIFT	Analysis environment

Digital Forensics

This is NOT Forensics

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This is How It Works

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Evidence Gathering

General Approach

- **Hash** of evidence (log, disc image, ...)
- Source (device) + Path (log/file gathered)
- Owner
- Timestamp (when gathered)
- Malware in archive with password **infected**
- Physical specifics
  - Handover protocol
  - Photography of evidence
  - Evidence bag (antistatic)

What Are We Looking For?

Artifacts vs. Confirmation of Presence

Goals / Tasks

Following Incident Response

- Root Cause / Impact Analysis
- Confirm Hypothesis
  - Presence of specific files (Crime / Exfiltration)
  - Website visit (Crime / Hack)
  - Actions done (Crime / Hack)
- Root Cause
- Attacker's Path

Preparation

- OSINT
- CTI
- RFI (Request for Information)
- Files, Paths
- Timestamps
- Others

Data Acquisition

Memory, disc, ...

Disc Image

Mobile Device Acquisition

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Full Scale vs. Artifact Extraction

Sometimes full scale is **not needed** (no lawsuit)

- Grab the necessary files
- Limited impact (blocked by AV/EDR)
  - Browser History, Downloaded Files, ...
  - Grab via KAPE, CyLR, Velociraptor or other agent
- **Always note path and hash**
- Context!

Artifact Collection

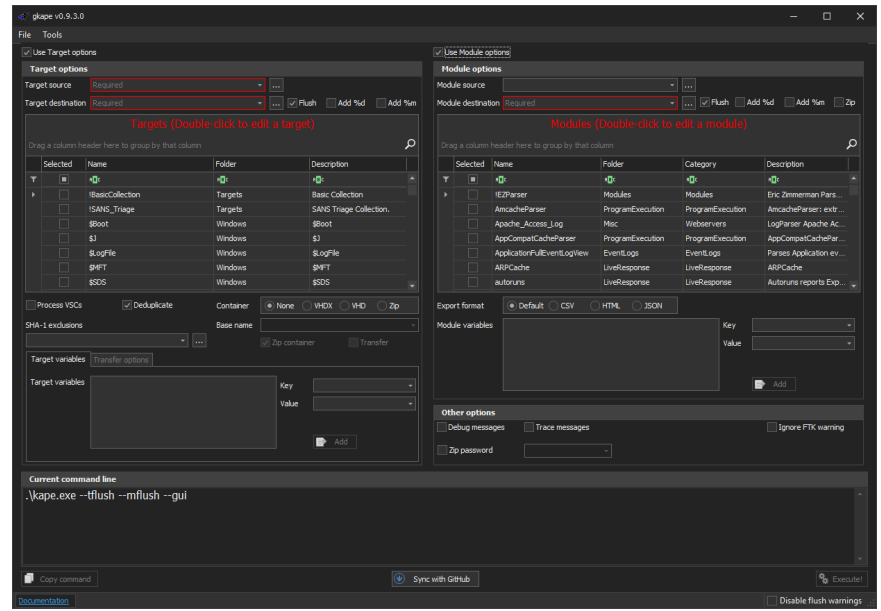
KAPE

Artifact parser and Extractor — official site

Targets — what will be grabbed

- Virtual disc
- Mounted system
- Live

Modules — how to process data



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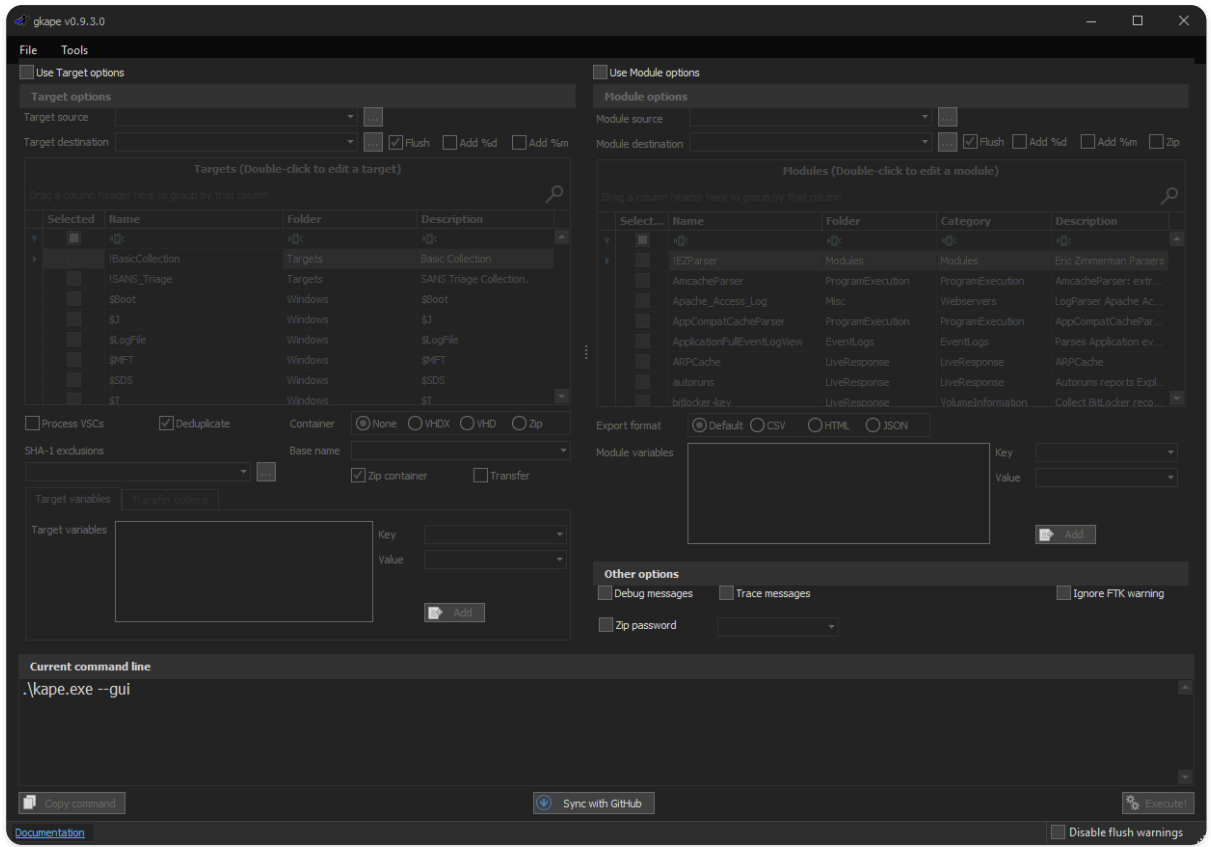
KAPE GUI



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KAPE — Configuration

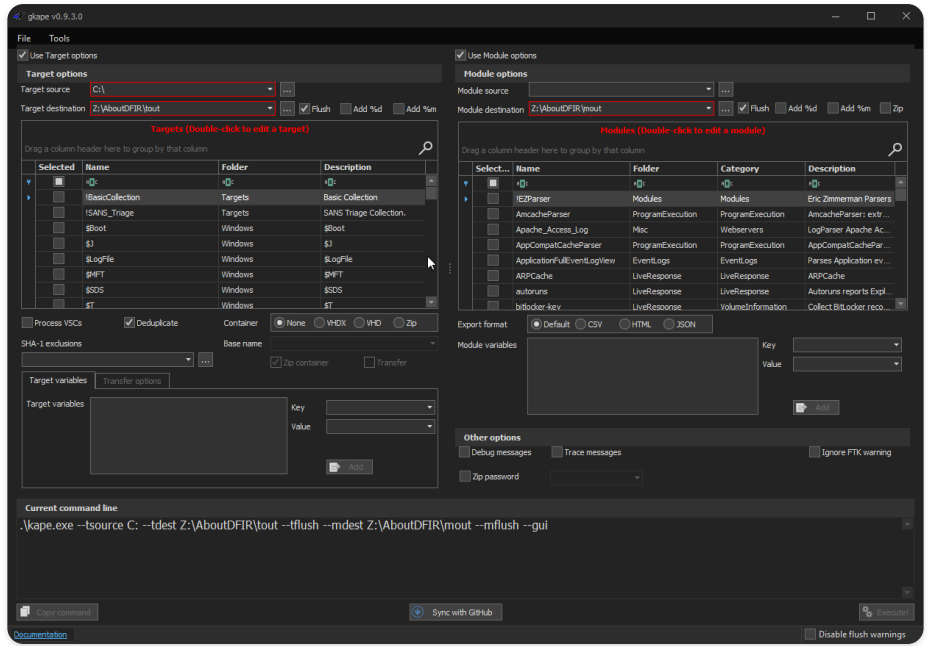
Run as **Admin**, sync with GitHub

Target

- `!SANS_Triage`
- `!BasicCollection`
- Container: **None**

Module

- `!EZParser`
- Export format: **JSON**



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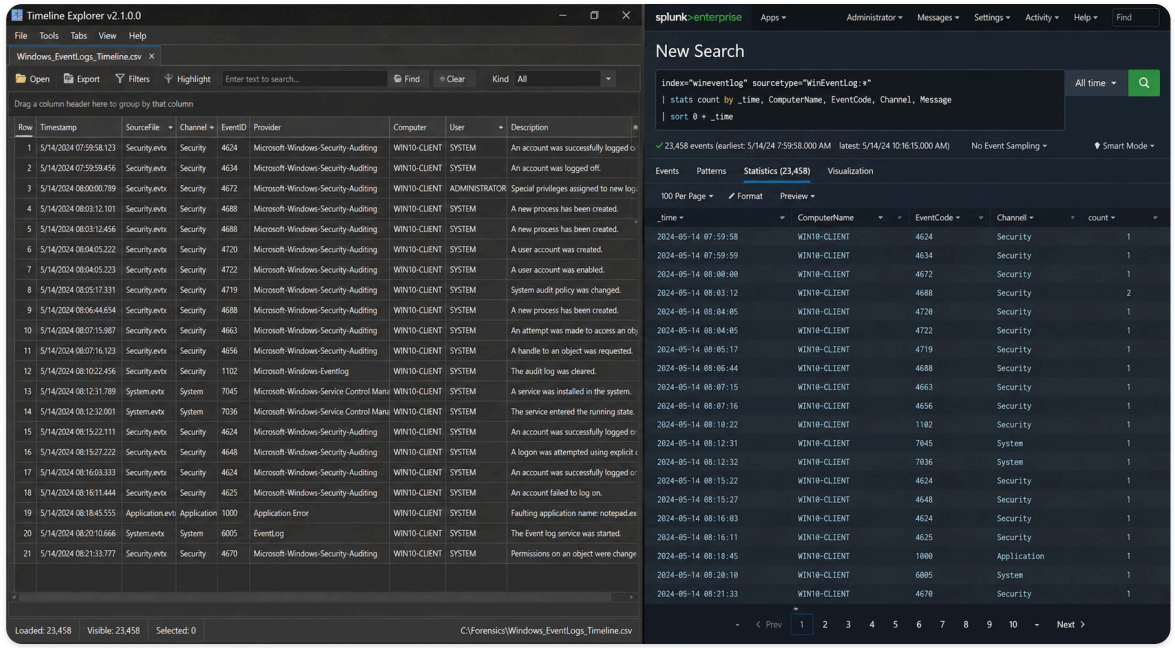
From KAPE to Splunk / Timeline Explorer

1. Take the output (JSON), zip and transfer to your Splunk (Kali)
2. Import → Create a separate index
3. **Splunk time!**

If you have CSV (as KAPE output), open it in **Timeline Explorer**

Splunk / Timeline Explorer - Demo time



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Artifact Analysis

From Data to CTI

Gathering the Evidence

Document everything

- Screenshot
- Copy line of the event
- IoCs (files, IPs, domains, URLs, ...)
- OSINT / CTI
- **Hash!** — MD5 + SHA1 + SHA256
  - `md5sum | sha1sum | sha256sum`
- From event to MITRE
  - Categorize each (attacker's) step to MITRE TTP

Defanging

Defanging is a security practice that modifies potentially malicious indicators to make them **non-functional while still readable**.

Original	Defanged
`https://example.com`	`hxxps[://]example[.]com`
`https://example.com/login.php`	`hxxps[://]example[.]com/login[.]php`
`8.8.8.8`	`8[.]8[.]8[.]8`
`1.1.1.1:53`	`1[.]1[.]1[.]1[:]53`
`name.surname@example.com`	`name[.]surname@example[.]com`

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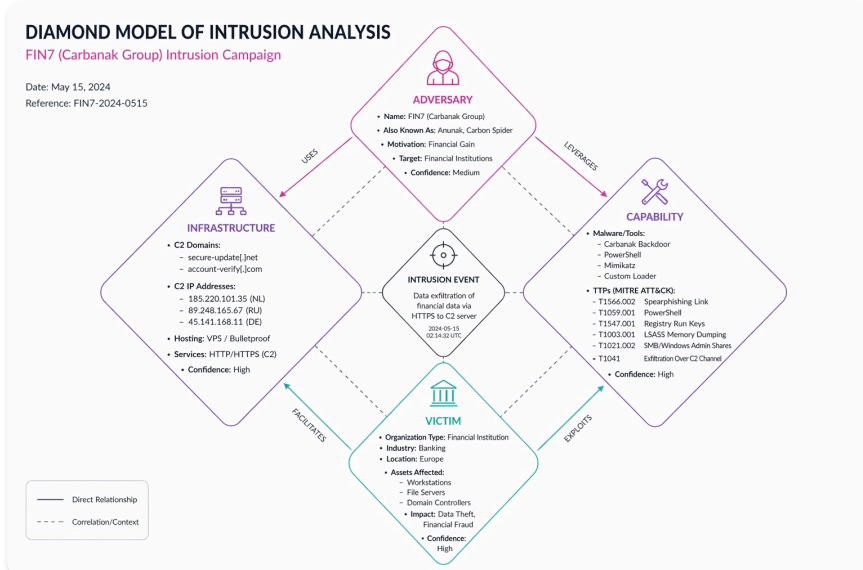
Diamond Model

Overlaps between attacks — two identical parts



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ACH — Analysis of Competing Hypotheses

Prepare information for CTI / attribution

1. Write down hypotheses
2. Confirm (support) / deny (refute) with gathered evidence

Memory Analysis

Volatility

App for memory analysis — **Python based**

- TryHackMe Room — Volatility
- TryHackMe Room — Memory Forensics

Memory Analysis — Key Plugins

Category	Plugin
Processes	`(windows|linux|mac).pslist`, `pstree`, `psxview`
Connections	`(windows|linux|mac).netstat`, `netscan`
Commands (CLI)	`(windows|linux|mac).cmdline`, `cmdscan`
File Dump	`(windows|linux|mac).pslist --pid XXXX --dump`
Network traffic	Via Network Miner Pro (Cap Loader)

Volatility — Demo time

```
$ python3 vol.py -f memory.raw windows.pstree
```

```
Volatility 3 Framework 2.7.0
Progress: 100.00
PDB scanning finished
```

PID	PPID	ImageFileName	Offset(V)	Threads	Handles	SessionId	Wow64	CreateTime
4	0	System	0x9b2d8040	164	-	N/A	False	2024-05-14 08:15:22.000000
108	4	Registry	0x9b317330	4	-	N/A	False	2024-05-14 08:15:22.000000
372	4	smss.exe	0x9b31e6c0	2	-	N/A	False	2024-05-14 08:15:22.000000
452	556	csrss.exe	0x9b348080	11	-	0	False	2024-05-14 08:15:22.000000
500	556	wininit.exe	0x9b355a80	3	-	0	False	2024-05-14 08:15:22.000000
556	444	services.exe	0x9b35f0c0	9	-	0	False	2024-05-14 08:15:22.000000
564	444	lsass.exe	0x9b36b080	12	-	0	False	2024-05-14 08:15:23.000000
684	556	svchost.exe	0x9b377080	24	-	0	False	2024-05-14 08:15:23.000000
728	556	svchost.exe	0x9b3a8080	17	-	0	False	2024-05-14 08:15:24.000000
832	556	fontdrvhost.exe	0x9b3c2080	5	-	0	False	2024-05-14 08:15:24.000000
916	556	spoolsv.exe	0x9b3d5080	13	-	0	False	2024-05-14 08:15:24.000000
1072	1052	explorer.exe	0x9b456b80	48	1,201	1	False	2024-05-14 08:15:27.000000
├─ 2156	1072	cmd.exe	0x9b4c5080	4	198	1	False	2024-05-14 08:16:03.000000
└─ 2892	2156	notepad.exe	0x9b4d4080	2	87	1	False	2024-05-14 08:16:11.000000

```
... (output truncated) ...
```

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Forensics Challenge

section

Information

- Alert triggered on **Windows 2008 R2 Server**
- Brute force attack detected
- Adversary has likely pentesting skills
- Gathered evidence can be found:
  - `Evidence\Windows2k8_KAPE_CSV.zip` (Timesketch)
  - `Evidence\Windows2k8_KAPE_JSON.zip` (Splunk)
  - `Evidence\Windows2k8_Mem_Dump.zip` (Volatility) — collected later than KAPE
  -
- Password is **infected**

Find the Answers

When? What? Where? Why? (Who?) and How?

Evidence may contain compromise of the server including persistence:

- Scanning
- Exploitation
- Persistence
- C2 communication

It Is Not a Competition

- Try everything
- OSINT on the findings
- Defanging of IoCs
- Diamond Model
- Create a hypothesis → ACH
- Present your findings
- It is **not needed** to find everything the attacker did
- CTF

Hints

Find something 100% suspicious

- C2 Communication
- Weird process / binary

Leverage the knowledge

- What happened before
- What happened after

Document → Create a big picture

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Feedback

Executive Summary

- Prepare for the answers
- **Facts!** Not assumptions (evidence)
- Lessons Learned / Hardening if needed

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(Real World) Examples

Apple Watch

Police use Apple Watch health data as evidence in murder case

Fitness data was submitted as evidence.

Husband buries wife alive, smashes Apple Watch to stop her calling for help

Browser History

MURDER OF KARI BAKER

One of the earlier cases using digital evidence was the murder of Kari Baker. In 2010, Baker's husband, Matt Baker was convicted of his wife's murder and sentenced to 65 years in prison. In 2006, Texas elementary school teacher, Kari Baker was found dead from a supposed suicide by sleeping pills. Baker had forged a suicide note for police. When police searched his computer, the history revealed searches for "overdosing on sleeping pills". That, along with physical evidence of the pills was enough to convict Baker.

Pacemaker

ROSS COMPTON

One of the most interesting pieces of digital evidence was used in the Ross Compton case. In 2016, Compton set fire to his Middletown, Ohio home as a part of an insurance fraud scam. During the investigation of the fire, Compton, who has a pacemaker with an external pump, told police he was asleep when the fire started. He told police when he woke up and saw the fire, he packed a suitcase, broke his bedroom window with a cane, and escaped. During the investigation, police ordered the data from Compton's pacemaker and consulted with a cardiologist who found that Compton could not have escaped the fire based on data from his pacemaker. Compton also submitted forged medical records that did not match the pacemaker data. The pacemaker data included heart rate, pacer demand, and heart rhythms which were used as evidence to prove insurance fraud and arson.

Serial Killer Sent a Floppy

Fast forward to 2004, when Rader made a fatal mistake. He sent a floppy disk to the police, believing it was untraceable. However, he was wrong.

Digital forensics experts were able to recover deleted data from the disk, which led them to a computer at a local church.

GPS Data

In the days following April's disappearance, investigators turned to digital forensics to build their case against Bridger.

They discovered that he had attempted to destroy evidence by deleting files and wiping his computer's hard drive.

But digital forensics experts were able to recover critical data, including images of April and internet searches related to child abduction and murder.

Digital forensics also played a role in linking Bridger's vehicle to the crime scene. By analyzing GPS data from his car, investigators were able to place him at the scene of April's abduction and track his movements afterward.

AI in Forensic Analysis

AI in Forensic Analysis — Use Cases

- **Log parsing & timeline reconstruction** — processing large volumes of data in seconds
- **Anomaly detection** — spotting unusual patterns in network traffic or user behaviour
- **Malware classification** — clustering artifacts by behaviour or code similarity
- **MITRE ATT&CK mapping** — automatically tagging findings to tactics and techniques
- **Natural language queries** — ask questions over your data (Copilot for Security, Elastic AI Assistant)

AI in Forensic Analysis — Limitations & Risks

- **Hallucinations** — AI output cannot be treated as evidence without verification
- **Chain of custody** — AI must not modify original evidence
- **Admissibility** — courts require reproducibility and full auditability
- **Training data bias** — may produce false positives or miss novel threats

> Rule of thumb: AI is an analyst's assistant, not an expert witness.

Summary

Overview

- **Grab memory if possible!**
- Disc is big and takes time — consider grabbing only the artifacts
- **Do not rush, document!**
- **Defang!**
- Match findings to MITRE ATT&CK
- Diamond Model

Other Courses

Course	Provider
Forensic Training	CESNET (FLAB)
Introduction to Memory Analysis	CZ.NIC
Digital Forensics	CIRCL
Practice rooms	TryHackMe · LetsDefend
Certifications	SANS (GIAC) · EC-Council
Mobile OS Images	Public Images

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Other Challenges

General

- THM, Case B4DM755
- THM, KAPE
- THM, Timeline Analysis

Windows

- THM, Compromised Windows
- THM, Windows Forensics 1

macOS

- THM, macOS Basics

Resources

Resource	Description
SIFT	SANS Investigative Forensics Toolkit
Remnux	Linux distro for malware analysis
WIN-FOR	Windows forensics environment
EZ-Tools	Eric Zimmerman's forensic tools
KAPE	Artifact parser and extractor
Autopsy	Open source digital forensics platform
SANS Cheat Sheet Booklet	Quick reference for forensic analysts

Q&A

Thank You for Your Attention!

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Feedback

Feedback form

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