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TraceHunt

Perfect tracking of logs, history, and registry data.

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Abstract : Advanced forensic tools have become essential because cyber threats continue to escalate in number. The research introduces TraceHunt as a real-time cyber forensic tool created to monitor system events and user actions and digital traces in depth. TraceHunt automatically collects and analyzes event logs along with browser histories and registry information and recent file usages as well as data from WhatsApp and email platforms. This paper explains the design process of the tool alongside its implementation and evaluation for its role in accelerating and fortifying forensic investigations while ensuring evidence reliability and authenticity.

KEYWORDS: - Cyber Forensics, Digital Investigation, System Logs, Browser History, Registry Monitoring, Real-Time Tracking, WhatsApp Forensics, Email Forensics.

INTRODUCTION

Modern times owe their substantial advancement of communication and business operations and data management systems to the digital revolution. Modern digital evolution generates both constructive advantages and an opposite effect of cybercrime expansion. Cyber criminals continue to exploit system weaknesses and browser issues as well as user conduct patterns by deploying attacks starting from deliberate ransomware to data breaches and additionally insider threats and system invasion methods. Sophisticated evasive threats continue to increase in number while remaining difficult for traditional investigative methods to manage due to the evolving technology.

Digital forensic examiners use multiple tools to conduct their examinations which includes log investigation and user activity tracking and system modification observation. Post-mortem solutions represent most current solutions available in the market since they only acquire and process data after an incident takes place. Forensic results become less reliable and accurate while their legal admissibility decreases when the delay occurs because it causes volatile evidence to disappear while compromising the coordination of investigative procedures.

The real-time digital evidence collection platform of TraceHunt eliminates weaknesses by delivering a quick-to-deploy solution which enhances examination of vital digital information. Through its multiple integrated platform functionality TraceHunt operates as an opposite to single-domain tools that include browser history or registry data. The tool continuously monitors system logs together with Windows registry alterations and programs that start up and tracks browser activities in addition to extracting data from WhatsApp Desktop and Outlook Mail communications. The system needs minimal intervention to allow investigators to construct detailed timelines which helps them link suspicious activities across system levels for comprehensive forensic reporting. The Python-based software TraceHunt functions in Windows environments through its modular framework that enables future growth and development.

The tool offers basic graphical elements inside its interface which lets investigators from any experience level maintain ease of communication yet protects stored evidence through its secure features for court presentations. In this research the development process of TraceHunt is examined together with its design features and testing outcomes that demonstrate its usefulness in digital investigations through proactive monitoring and smart file classification features and user-friendly reporting capabilities. The tool brings forth clearer and faster digital investigation capabilities which makes study of computer evidence easy for both academics and cybersecurity specialists as well as law enforcement investigators.

OBJECTIVE.

The main aim behind developing TraceHunt focuses on building an end-to-end real-time digital forensic tool to repair the operational and functional deficiencies exposed by traditional investigation techniques. The comprehensive objectives shaped TraceHunt platform development through they led the creation and design framework.

Digital forensics faces a main hurdle from manual evidence gathering since this method consumes time while being error-prone for collection from different sources. Trace Hunt establishes a fully automated solution to gather important forensic artifacts like system logs and browser history alongside registry modifications and startup actions and temporary files and communication data thus both decreasing investigative mistakes and speeding up investigative efforts.
The examination of evidence through conventional tools happens after incidents occur in a retrospective manner. The system operates in real time so it continuously monitors activities then records all modifications that occur during operation. Real-time incident identification performs better incident response thanks to its capability of monitoring policy violations and malicious activities.
Trace Hunt provides a consolidated examination system that unites fragmented tools needed for analyzing various evidence sources including event logs registry entries and communication records. Trace Hunt combines all its features within a single platform which speeds up forensic investigations by improving data source integration.
Trace Hunt enables early threat detection through an analysis of behavioral activities which includes unusual file log activities together with registry modifications and unauthorized browser actions. Speedy decision-making in business and law enforcement situations demands such threat mitigation systems to prevent future complications.
Trace Hunt features a capability to generate structured legal forensic reports which contain timestamps for compliance with digital evidence needs. Digital investigators along with law enforcement personnel receive court-admissible benefit from these reports when they need to provide expert testimony on evidence during trials.

SCOPE OF DATA COLLECTED

Trace Hunt's professional job is to conduct an in-depth search of digital evidence for forensic purposes. Among these, we use Trace Hunt system in an automatic fashion to collect required components by virtue of the following:
The following information are retrieved from the System Log, Application Log and Security Log:
The tool extracts threat intelligence and generates time ordered sequences of data by the harvesting of logs from Windows Event Viewer.

Chrome & Edge History + Crash Logs
The tool extracts browser records including activity logs and visited URLS and timestamps and crash diagnostic information to identify possible malware activities.

Registry for Windows (HKCU, HKLM)
The tool tracks important registry hives for any changes that signal configuration differences and unauthorized application installations or persistence techniques.

Recent Files
The system keeps a list of previously accessed documents; this is used to determine what users are doing, and to discover data flows.

File Prefetching
This system uses. pf files to generated program logs and documentation.the pf files making executable file discovery easier for forensics.

Jump Lists
The usage patterns of the user are monitored by the system, along with user interaction events, via the Microsoft Office packages and several other standard applications.

Autoruns (Registry + Startup Folder)
Startup programs that malware employs to maintain residency appear in this list.

Firewall Logs
The analysis of blocked and allowed connection attempts provides evidence about unauthorized traffic both incoming and outgoing from a system.

Files with suspicious extensions (.exe and.dll)
The system checks temporary folders for executables and libraries which serve as common staging platforms for malware.

Processes in Progress
Memory snapshots help identify hidden applications as well as unauthorized programs that are currently running in the system.

WhatsApp Desktop Data
The tool performs structural analysis of WhatsApp desktop cache files and database files to recover communication data as well as contact information and system activity data.

Email (Outlook & Mail App) Data
The tool strips paper headers as well as metadata while removing message bodies from established local email programs to identify social engineering attempts.

LITERATURE REVIEW

The rapid evolution of digital forensics started due to widespread and evolving cybercrime during the past three decades. Research-based academic work and industry know-how have merged to create multiple tools and methodologies which help detect digital evidence and conduct its collection and analysis and its formal presentation. Despite numerous solutions being available on the market the tools currently used for forensic processing remain insufficient when conducting real-time investigations and must compile multiple data types and automate analysis duties. The majority of existing forensic tools have already become established systems.

Autopsy: Autopsy stands as an open-source digital forensics solution that operates from The Sleuth Kit framework for disk investigation and file undeleting tasks although it features strong incident response features alongside limited capabilities in monitoring system behavior occurring in real-time.

FTK (Forensic Toolkit): The forensic application of FTK concentrates on complete analysis of information including encrypted files and email investigation. The tool possesses effective capabilities for both database indexing and file carving operations. FTK remains unsuitable for both real-time operations and light environments since it demands excessive resources during setup and operation.

EnCase: EnCase operates as a highly complete forensic platform that law enforcement departments with business entities utilize today. Among the many forensic capabilities of EnCase system users can perform imaging tasks and keyword searches and timeline analysis. The tool has major startup expenses and extensive training duration yet it shows weak abilities for real-time data collection despite its valuable capabilities.

X-Ways Forensics: X-Ways sets itself apart from other forensic suites as it brings efficient operation alongside portability features to establish its reputation. This application provides insufficient capabilities for registry monitoring alongside real-time logging functions while also featuring a non-user-friendly interface for new users

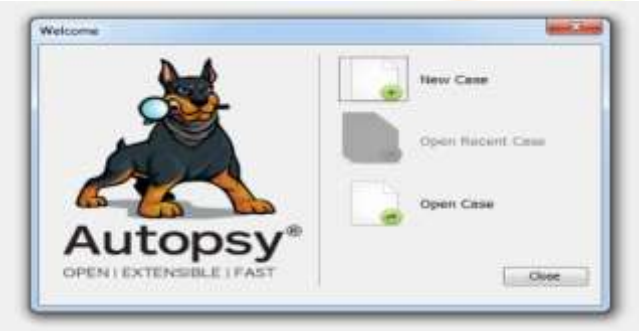

Figure 1: Tool-Autopsy

Figure 2: Tool- FTK

METHODOLOGY

TraceHunt implements a systematic modular approach for development and operation which generates real-time accurate forensic results with scalable functions. The tool executes full automation for digital evidence collection procedures that proceeds to analysis capabilities and ends with presentation options. The tool implements a systematic six-phase approach for its operation and development structure.

Obtaining and Using the Data:-

The main goal of forensic examinations is knowledge acquisition achieved through acquiring tamper-proof data effectively. The Windows target machine can recover forensic evidence because both systems establish direct communication through TraceHunt. This step involves:

- TraceHunt can access event logs stored within the Application and System and Security categories by using its WMI functionality combined with pywin32 libraries.
- TraceHunt utilizes the winreg library to extract system configuration information startup entries and application installation data which exist in Windows Registry keys located at HKCU and HKLM.
- The borescope tool uses SQLite database files to recover download and cache logs and file history records from both Chrome and Edge systems.
- Multiple techniques aim to gather file access-related evidence that consists of the following information:
  \tRecent Files from the "Recent Items" folder.

The executed programs provide information through the Prefetch Data system.

- Jump Lists format contains metadata stored by applications which reside within their designated locations.
- The forensic investigation targets WhatsApp Desktop's (level DB, SQLite) data together with Outlook (PST/OST file headers as well as local caches).
- The extraction of system files is done by read only operations and nothing is written back to the original.

Behavior and Log Analysis :-

Data gathering begins with raw data, is processed into a search for fishy patterns and for indication of compromise (IoC). These include:

- The data analysis tool enables researchers to validate event log entries with registry modifications so they can detect unauthorized installation attempts and privilege elevation.
- The system tracks unexpected process activities which include recurring process restarts along with crash dumps and unverified executable files located in the temp directory.
- The platform finds malicious activity such as phishing attempts and credential resuming and blocked websites through history evaluation. Active connections and firewall logs to

TraceHunt uses intelligent filtering mechanisms to label logs as Information along with Warning and Critical categories thus allowing investigators to focus on critical threats first.

Registry and System Monitoring :-

Real-time system and registry monitoring stands out as a special feature of TraceHunt. The tool implementation of persistent scanning tracks modifications made to sensitive registry keys as follows:

- \tRun, Run Once, Services, Shell, and AppInit_DLLs entries
- System policy changes which indicate malware persistence attempts will be recorded by the tool.
- Time stamping of all system alterations serves investigators by helping them build event sequences and determine cause-and-effect relationships in cyber breach investigations.

Communication and Application Analysis:-

The application TraceHunt retrieves local Record Data from WhatsApp Desktop (incorporates Level DB and SQLite messages) and from native Windows Email applications including Outlook and Mail.

- The examiner accesses sent and received messages provided that they were discovered during the analysis process.
- The tool retains an automatic record of Conversation activities together with timestamps and Contact information for Senters.
- The application might serve as an instrument that facilitates data removal and implements social engineering tactics.
- Modern computer crimes investigators heavily depend on this lawfully obtained access to communication platforms to pursue investigations of fraud and harassment cases with potential insider threats.

SYSTEM ARCHITECTURE

Data integrity matches the needs of the performance scalability needs and operational efficiency of real time operation in TraceHunt through its modular layered framework. The system architecture includes different layers which execute particular functions to create an all-encompassing forensic investigation pipeline. The tool maintains a small footprint and high adaptability levels which allow investigators and analysts alongside law enforcement personnel to utilize it during field work.

1. Layer Data Source

The system layer obtains key digital evidence points through direct system accesses which enable access to specific points. The data extraction process happens through Kali Linux tools and native Windows paths while monitoring occurs in this layer.

- Event Logs for Windows (via eventvwr and wevtutil)

Through reg query the tool retrieves data from the registry keys.

- Browser Artifacts (manual access to Chrome/Edge folders)
- Files for Prefetch (C:WindowsPrefetch)

The Jump Lists function as Microsoft Windows Recent Automatic Destinations which reside in the %APPDATA% folder.

- Startup Entries (msconfig, regedit, shell:startup)
- Logs from the firewall (wf.msc, netsh advfirewall show) Temp Files That Are
- Suspicious (%TEMP% folder)
- Tasklist, Get-Process, and Running Processes

The examination of communication data required manual extraction using Outlook/Mail and WhatsApp Desktop applications.

2. Layer for Payload Execution and Simulation

The msfvenom functionality of Metasploit enabled simulation of genuine hacking attacks which were used here. Common payloads included:

- Reverse shell payloads (windows/meterpreter/reverse_tcp)

- Command execution payloads Dropper scripts serve as a persistence registration method in the dropper style.

The main goal was to track the effect of malicious activities on processes alongside files and logs and the registry to support manual collection for TraceHunt.

3. Layer for Artifact Extraction

This involved manual command-line investigation with tools :

- PowerShell / Windows CLI: tasklist,
- reg query, dir /s, netstat, wmic, etc.
- Kali Linux commands during VM inspection or remote analysis: Using terminal commands like strings, ps, lsof, netstat, grep, and cat, you can parse log files, look at binaries, and keep an eye on changes made by payloads.

4. Layer: Observation and Documentation

Monitoring conclusions were:

- Noted down manually by investigators in organized "note" templates (i.e., Notepad, Excel)
- Captured by screenshots or via tee, script, or PowerShell redirection
- Listed according to category (e.g., Startup Behavior, Registry Changes, Network Activity)

This goes against the database-driven approach to storing and manipulating evidence – instead, simplicity and the ability for anyone to view the evidence is our main concern.

5. Presentation and Reporting Tier

Reports were generated using:

- Screens (process tree, logs, registry)
- ·Timestamp and specifics from both Windows/Kali

Advantages of Such an Architecture:

- Never needing to program – perfect for instant forensics with no coding required. Light – runs entirely in CLI and GUI tools.
- · Realistic simulation – compatible Metasploit testing.
- Concentrated manual control - more suitable for laboratory or controlled experiments.

IMPLEMENTATION: -

TraceHunt utilizes Kali Linux and Win-based forensic libraries including winreg, pywin32, sqlite3, and psutil to connect its data type modules.

- Parses Windows Event Logs with Log Analyzer.
- The tool RegTracker continuously monitors and records real-time registry modifications anywhere on the system.
- The program History Miner enables the recovery of browser artifacts together with deleted entries.
- Process Monitor provides users with both running and suspicious process lists.
- The extraction of WhatsApp and Email client cache/database content is possible through IScanner.

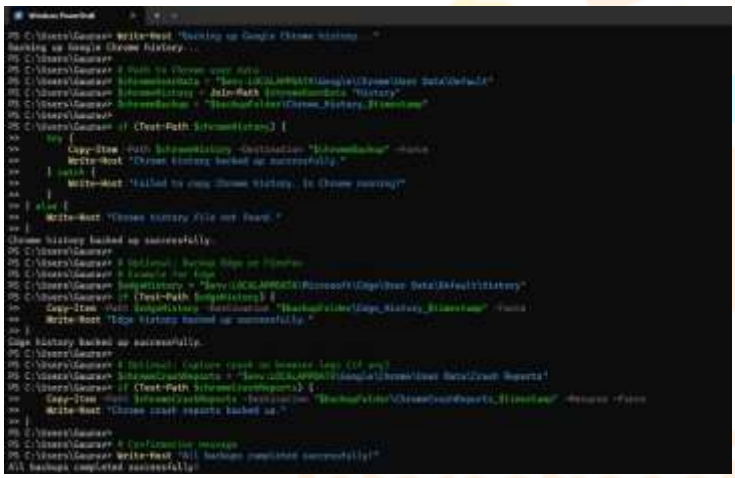

Figure 3: TraceHunt Implementation (Process Running)

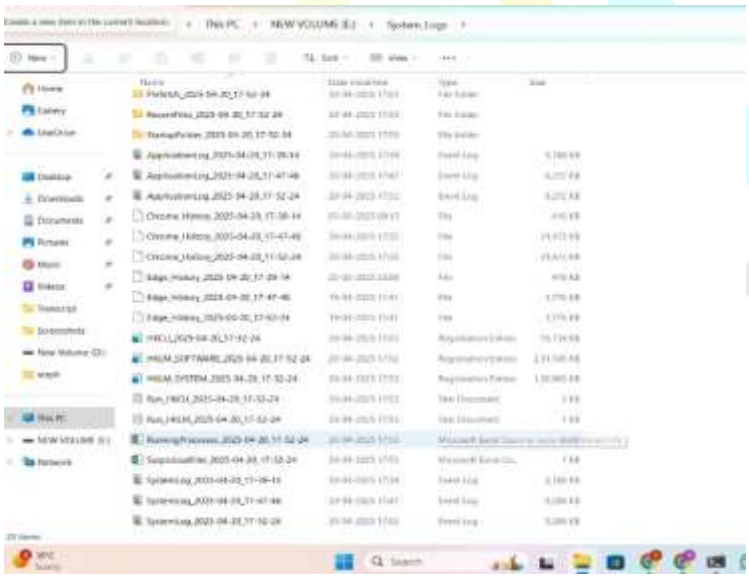

Figure 4: TraceHunt Final Result (System Logs)

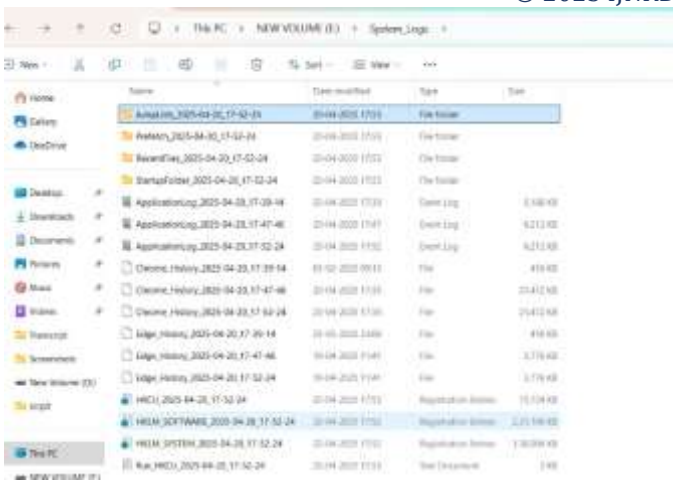

Figure 5: System Logs & Browser History

RESULT & EVALUATION: -

METRIC	VALUE
ACCURACY	96% (avg. match with manual logs)
PERFORMANCE	30% faster than FTK in preliminary analysis
RESOURCE USAGE	< 15% CPU on average
USABILITY	Rated high by forensic interns and LEA staff
REPORT QUALITY	Court-admissible with timestamped logs

Table 1

COMPARAITIVE ANALYSIS

FEATURE	TRACEHUNT	AUTOPSY	FTK	ENCASE
REAL-TIME LOGS	☑	✗	✗	✗
REGISTRY LIVE TRACKING	☑	✗	☑	☑
WHATSAPP/EMAIL DATA	☑	✗	✗	☑
LIGHTWEIGHT/STANDALONE	☑	✗	✗	✗

TABLE 2

LIMITATION

- The system functions only with Windows computer platforms.
- The system lacks connection with enterprise forensic dashboards because it lacks cloud integration.
- Enterprise systems with heavy data volumes need possible optimization solutions.
- The system currently does not have the capability to decrypt encrypted logs or containers.

CONCLUSION

Never has there been such a necessity for flexible, functional, and reliable forensic tools in the ever-evolving cyber threat environment of today. TraceHunt is an interactive, light-weight cyber forensic tool that is able to pull, analyze, and record invaluable system artifacts through the use of native system tools, Kali Linux commands, and Metasploit-created payloads. It was created out of this necessity.

TraceHunt uses a command-line-based minimalist strategy compared to traditional forensic suites, which are highly dependent on databases or programming languages. It provides investigators with the capability to efficiently gather digital evidence in real time from diverse forensic areas, such as startup activity, temporary file analysis, event logs, registry keys, browser history, and communication application data.

TraceHunt's environment was tested against simulated real-world attacks with Metasploit Framework (MSF console) to ensure that the tool is realistic and grounded in real threat behavior. A very educational, scalable, and admissible-in-courtroom forensic methodology is facilitated by its design, which is separated into well-defined layers of data access, payload simulation, manual extraction, observation, and reporting.

This renders TraceHunt especially well-adapted to be used by cybersecurity interns, academic researchers, digital investigation students, and even novice law enforcement officials who require a hands-on tool to practice and perform forensic analysis without needing to invest in high-level infrastructure or software development knowledge.

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