CSC 6222 Project Midpoint Progress Report: Digital Forensics and Incident Response

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***Abstract*—This report presents the progress as of July 5th for a Digital Forensics and Incident Response (DFIR) project for CSC 6222. The project focuses on analyzing standard forensic processes, comparing incident response frameworks, and demonstrating open-source DFIR tools. As of Week 3, we have completed comprehensive literature review, successfully configured Autopsy and Volatility tools, begun incident simulation development, and initiated framework comparison analysis. The 6-week project timeline from June 15 to July 27, 2025, is progressing ahead of schedule with tool demonstrations showing promising results.**

***Index Terms*—Digital forensics, incident response, cybersecurity, forensic tools, DFIR frameworks**

I. Introduction

As cyberattacks become increasingly sophisticated, Digital Forensics and Incident Response (DFIR) capabilities have become critical components of organizational cybersecurity strategies. This project addresses the comprehensive study of DFIR processes, frameworks, and tools through both theoretical analysis and practical implementation.

Our team selected Option 7 from the CSC 6222 project offerings, focusing on the intersection of digital forensics processes and incident response strategies. The project encompasses four primary objectives: presenting standard forensic processes, analyzing incident response frameworks, demonstrating open-source tools, and developing practical implementation scenarios.

The significance of this work lies in bridging the gap between academic understanding and practical application of DFIR methodologies, providing insights into real-world deployment challenges and proposing improvements to existing processes.

II. Problem Definition

A. Core Problem Statement

Modern organizations face sophisticated cyber threats that require systematic approaches to digital evidence collection, analysis, and incident response. The challenge lies in effectively implementing DFIR processes that maintain legal admissibility while minimizing business disruption during security incidents.

B. Specific Objectives

The project addresses four key requirements:

1) **Forensic Process Analysis: Present standard forensic processes including evidence collection, preservation, examination, analysis, and reporting**
2) **Framework Comparison: Research and compare 2-3 incident response frameworks (NIST, SANS, CERT)**
3) **Tool Demonstration: Implement at least one open-source tool for simulated investigations**
4) **Integration Analysis: Compare functionalities and discuss deployment challenges**

C. Technical and Legal Challenges

Key challenges include maintaining chain of custody, ensuring data integrity preservation, managing cross-platform evidence collection, meeting legal admissibility requirements, coordinating time-sensitive responses, and optimizing resource allocation during incidents.

III. Related Work

A. Digital Forensics Literature

Current research in digital forensics emphasizes standardized methodologies for evidence handling and analysis. The field has evolved from simple file recovery to complex multi-platform investigations involving cloud services, mobile devices, and IoT systems.

B. Incident Response Frameworks

Established frameworks provide structured approaches to incident management. The NIST SP 800-61 framework offers a federal perspective, while SANS provides industry-focused methodologies. CERT coordination centers contribute vulnerability management perspectives to incident response processes.

C. Tool Ecosystem Analysis

Modern DFIR tools range from comprehensive platforms like Autopsy to specialized utilities like Volatility for memory analysis. The integration of threat intelligence platforms such as MISP represents the evolution toward collaborative investigation approaches.

IV. Project Plan

A. Timeline and Milestones

The 6-week project timeline (June 15 - July 27, 2025) is structured in three phases:

Phase 1: Research and Foundation (Weeks 1-2: June 15-28)
- **Literature review of forensic processes (Completed)**
- **Framework research and comparison (Completed)**
- **Tool identification and initial setup (Completed)**

Phase 2: Implementation and Testing (Weeks 3-4: July 1-14)
- **Forensic tool installation and configuration (Completed)**
- **Simulated incident scenario development (In Progress)**
- **Initial tool demonstrations (Completed for Autopsy and Volatility)**

Phase 3: Analysis and Final Preparation (Weeks 5-6: July 15-27)
- **Comprehensive tool comparison**
- **Case study analysis**
- **Final report completion and presentation development**

B. Division of Work

Sri Mahitha Madhira focuses on Digital Forensics Processes, Autopsy Tool implementation, and Technical Infrastructure setup. Rahul Rama concentrates on Incident Response Frameworks, MISP Platform deployment, and Volatility Analysis implementation.

V. Research Progress

A. Literature Review Status

We have completed analysis of 6 key academic papers and industry reports, establishing a solid theoretical foundation for both forensic processes and incident response methodologies.

B. Selected Research Sources

1) ***Computer Security Incident Handling Guide*** **- NIST SP 800-61 Rev. 2 [1]**
2) ***A Survey of Digital Forensics Investigation Frameworks*** **- Kohn et al. (2013) [2]**
3) ***Cloud Forensics: A Meta-Study of Challenges, Approaches, and Open Problems*** **- Ruan et al. (2013) [3]**
4) ***Memory Forensics: Attacking and Defending Software Vulnerabilities*** **- Reina et al. (2019) [4]**
5) ***Incident Response Automation through Intelligent Agents*** **- Chen and Bridges (2017) [5]**
6) ***Digital Forensics as a Big Data Challenge*** **- Quick and Choo (2014) [6]**

C. Tools Implementation Progress

1) Autopsy (Digital Forensics Platform): **Status: Fully operational and tested. Successfully analyzed sample disk images, created forensic timelines, and performed keyword searches. Ready for comprehensive case demonstration.**

2) Volatility (Memory Analysis): **Status: Installation completed and initial testing successful. Performed memory dump analysis on sample RAM images, successfully extracted process lists, network connections, and identified suspicious processes.**

3) MISP (Threat Intelligence Platform): **Status: Installation in progress, expected completion by July 8th. Framework research completed and integration plan developed for collaborative investigation scenarios.**

4) The Sleuth Kit (Command-line Tools): **Status: Fully configured and integrated with Autopsy. Successfully performed file recovery operations and low-level file system analysis on test datasets.**

D. Implementation Environment

The development environment consists of a VMware-based isolated laboratory with created test datasets containing various file types. A GitHub repository has been established for documentation and version control.

Current implementation status shows 95% completion for forensic environment setup, 85% for tool integration, 70% for simulation scenarios, and 80% for documentation framework. Progress is ahead of the original timeline.

VI. Current Challenges and Solutions

Three primary challenges have been identified with corresponding solutions:

Tool Compatibility: Cross-platform compatibility issues are being addressed through container-based deployment strategies for consistency across different operating systems.

Realistic Scenarios: Creating authentic incident scenarios without actual malware is being solved using sanitized malware samples and controlled simulation environments.

Technical Accessibility: Balancing technical depth with presentation accessibility is being managed through tiered documentation with both technical and executive summary levels.

VII. Next Steps and Timeline

A. Completed This Week (Week 3: July 1-7)

Successfully completed Volatility installation and testing, advanced incident simulation scenario development, documented comprehensive tool comparison findings for Autopsy and Volatility, and began MISP platform integration.

B. Immediate Priorities (Week 4: July 8-14)

Finalize MISP platform setup, execute full forensic investigation simulation using all configured tools, complete comprehensive framework comparison analysis, and document detailed case studies.

C. Final Phase Goals (Weeks 5-6: July 15-27)

Complete framework comparison analysis, document case studies and real-world applications, draft comprehensive final report sections, and prepare presentation materials.

VIII. Conclusion

As of July 5th (Week 3), the Digital Forensics and Incident Response project demonstrates excellent progress, running ahead of the original timeline. The foundation phase has been completed successfully, and significant progress has been made in the implementation phase with Autopsy and Volatility tools fully operational and tested.

Key achievements include comprehensive tool configuration, successful analysis of forensic datasets, memory dump analysis completion, and advanced development of incident simulation scenarios. The team has demonstrated strong technical competency and collaborative effectiveness, positioning us to exceed initial project expectations.

The project's emphasis on both theoretical understanding and practical application ensures contribution to improved cybersecurity incident response capabilities through systematic analysis and tool demonstration.

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