**3-2 Milestone Two: Software Design and Engineering Narrative**

Corey Sampson

Southern New Hampshire University

CS499: Computer Science Capstone

Professor Jeff Phillips

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The artifact I selected for the enhancement is a C++ unit testing project titled “SecurityPolicyUnitTests”, originally developed in the CS 405 Secure Coding course. This project focused on writing unit tests to verify secure coding practices, including memory safety, string manipulation, SQL injection prevention, and cryptographic logic placeholders. It was originally created using Microsoft Visual Studio and utilized the CppUnitTestFramework. The code tested individual functions related to secure programming but lacked runtime interaction, file I/O, or a modular design architecture.

I selected this artifact for my ePortfolio because it presented a strong opportunity to demonstrate skills in object-oriented design, secure file handling, and modular software development. While the original project effectively tested small secure code functions, it did not implement or simulate a full application workflow. To enhance the artifact, I restructured the project into a working console-based encryption application in C++. I created and implemented three primary classes: **Encryptor** for handling encryption logic (XOR and simulated AES), **FileManager** for secure file input/output operations, and **Logger** for logging operations and errors. In addition to these classes, I also implemented an interactive user menu to select Encrypt, Decrypt, or Exit the program, input validation like handling empty keys and invalid file paths, exception handling for runtime safety, and a simulated AES encryption stub to demonstrate extensibility. This enhanced version is now a complete software tool that reflects professional-level design and demonstrates readiness for real-world software development.

This enhancement aligns with three of the CS 499 course outcomes. I demonstrated the ability to use well-founded and innovative techniques, skills, and tools in computing practices, which is evident in the use of object-oriented principles and modular class design. I developed a

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security mindset that anticipates adversarial exploits in software architecture by validating user input, handling errors securely, and designing extensible encryption methods. Lastly, I designed, developed, and delivered a professional-quality technical solution with a clean, modular project that includes user interaction, testability, and logging. This project shows how a basic unit test artifact can be transformed into a functional, secure, and professional-grade application.

Enhancing this project taught me the value of clean architecture, code reuse, and real-world extensibility. I practiced separating concerns into logical classes, maintaining readable and maintainable code, and simulating scalable components as seen in the AES encryption stub support. One major challenge was troubleshooting Visual Studio build errors, particularly precompiled header issues and duplicate main() symbol errors, after restructuring. I also had to resolve file path bugs and ensure the program could read and write reliably on Windows. Despite these technical hurdles, I successfully completed the enhancement while learning how to design software that not only works but is also robust, extensible, and secure. This experience directly prepared me to apply professional standards and practices in future software engineering roles.