Final Project Requirements and Timeline

Charger Active Defense – G12

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## Marketing Requirements

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| # | Description |
| M1 | The ChAD fuzzing workflow must conduct network-based fuzzing to identify network responses, also known as Active Defense Responses, that can crash or hang adversarial attack tools. |
| M2 | The existing vulnerabilities of six well-known attack tools must be documented. |
| M3 | Down select to a single well-known attack tool for testing. |
| M4 | Must use two different AI/LLM models to generate additional attack tools. |
| M5 | Use each AI/LLM to generate three attack tools for fuzz testing. |
| M6 | Software fuzzing tools capable of testing the attack tools must be identified. |
| M7 | Demonstrate a fuzz testing workflow for Masscan and AI-generated attack tools. |
| M8 | The ChAD program must monitor incoming network traffic to the host machine. |
| M9 | All transaction history of incoming and outgoing response packets must be logged and recorded. |
| M10 | The ChAD program must provide an active defense response. |
| M11 | Evaluate the effectiveness of any active defense responses found. |
| M12 | Findings must be documented in an IEEE/ACM-style paper. |

## Engineering Requirements

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| Marketing Requirements | Engineering Requirements |
| M3 | E1: LDRA static analysis and Valgrind memory leak analysis must be used on both selected attack tools for present vulnerabilities or more favorable testing targets. |
| M6 | E2: Develop a fuzzing workflow using three fuzzing tools and approaches and rank them based on the probability of success with selected well-known attack tools. |
| M4, M5 | E3: Must use GitHub Copilot and Phind models to generate three types of attack tools each - a banner-grabber, password brute-force, and a simplistic multi-threaded banner-grabber. |
| M7 | E4: Must demonstrate fuzzing workflow on selected/generated attack tools |
| M1, M7, M10 | E5: The workflow must be capable of finding vulnerabilities (crashes or hangs) within attack tools, if any exist. |
| M11 | E6: We must document whether each network response crashes or hangs the attacking application and calculate and record the average hang time if it hangs the application. |
| M12 | E7: The rationale must be compiled for the selection of existing attack tools, fuzzing tools, compatibility results, and analysis for testing into an IEEE conference paper using proper formatting with font type, size, headers, and two columns per page. |
| M1, M2 | E8: Search MITRE CVE and Exploit-DB databases and compile known vulnerabilities for all six possible attack tools. |
| M8, M10 | E9: The ChAD service must send active defense responses within one minute of detection of an incoming attack. |

## Timeline

All course-defined due dates (briefings, proposal, interim design review, final presentation, demo, documentation, etc.) are highlighted in yellow. All milestones are highlighted purple for Noah S, pink for William L, and green for Adam B.



### Activities, Dates, Primary & Secondary Responsibilities, & Dependencies

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| # | Activity | Start | End | Primary | Secondary | Dependencies |
| 1.1 | Research Implementation of TSan into GCC compilers. | 1/20 | 1/24 | Will | Noah | - |
| 1.2 | Add integration hook into existing fuzzing workflow script. | 1/24 | 1/30 | Adam | Will | 1.1 |
| 1.3 | Begin fuzz testing on Masscan with AFLnet & Tsan hook. | 1/30 | 3/28 | Noah | Will | 1.2 |
| 2.1 | Develop Python service interactive UI module with Prompt\_Toolkit library. | 1/24 | 1/29 | Noah | Adam | - |
| 2.2 | Develop Python service CLI argument module with Argparse library. | 1/29 | 1/31 | Noah | Will | - |
| 2.3 | Develop Python service error logging module with Logging library wrapper. | 2/3 | 2/5 | Will | Noah | 2.1 |
| 2.4 | Develop Python service network traffic logging module with Logging library wrapper. | 2/5 | 2/7 | Adam | Noah | 2.3 |
| 3.1 | Prompt Phind model for banner-grabbing attack tool. | 2/7 | 2/13 | Adam | Noah | - |
| 3.2 | Debug Phind banner-grabbing tool until it compiles with afl-gcc. | 2/13 | 2/14 | Adam | Will | 3.1 |
| 3.3 | Prompt Copilot model for banner-grabbing attack tool. | 2/7 | 2/13 | Will | Noah | - |
| 3.4 | Debug Copilot banner-grabbing tool until it compiles with afl-gcc. | 2/13 | 2/14 | Will | Adam | 3.3 |
| 4.1 | Research & determine preferable method for storing active defense responses for the Python service. | 2/7 | 2/10 | Noah | Will | - |
| 4.2 | Write implementation of database handler based on selected storage method. | 2/10 | 2/12 | Noah | Adam | 4.1 |
| 4.3 | Write a skeleton for network connector with database handler. | 2/12 | 2/14 | Noah | Adam | 4.2 |
| 5.1 | Integrate Copilot & Phind banner-grabbing attack tools into fuzzing workflow script. | 2/14 | 2/19 | Noah | Will | 3.2, 3.4 |
| 5.2 | Debug AFLnet integration with banner-grabbing attack tools from both models. | 2/19 | 2/20 | Noah | Adam | 5.1 |
| 5.3 | Begin fuzz testing on banner-grabbing Gen-AI attack tool with fuzzing workflow. | 2/20 | 2/21 | Noah | Will | 5.2 |
| 6.1 | Perform LDRA static analysis on banner-grabbing set of Gen-AI attack tools using Testbed. | 2/14 | 2/21 | Adam | Noah | 3.1, 3.3 |
| 6.2 | Perform memory leak analysis on banner-grabbing set of Gen-AI attack tools using Valgrind. | 2/14 | 2/21 | Will | Noah | 3.1, 3.3 |
| 7.1 | Prompt Copilot model for password brute-forcing attack tool. | 2/21 | 2/26 | Will | Noah | - |
| 7.2 | Debug Copilot password brute-forcing attack tool until it compiles with afl-gcc. | 2/27 | 2/28 | Will | Noah | 7.1 |
| 7.3 | Prompt Phind model for password brute-forcing attack tool. | 2/21 | 2/26 | Adam | Noah | - |
| 7.4 | Debug Phind password brute-forcing attack tool until it compiles with afl-gcc. | 2/27 | 2/28 | Adam | Noah | 7.3 |
| 8.1 | Compare code structure & fuzzing results of banner-grabbing Gen-AI attack tools. | 2/21 | 2/26 | Noah | Will | 6.1, 6.2 |
| 8.2 | Compile analysis results into report. | 2/26 | 2/28 | Noah | Adam | 8.1 |
| 9.1 | Integrate Copilot & Phind brute-force attack tools into fuzzing workflow script. | 2/28 | 3/5 | Noah | Will | 7.2, 7.4 |
| 9.2 | Debug AFLnet integration with brute-force attack tools from both models. | 3/5 | 3/6 | Noah | Adam | 9.1 |
| 9.3 | Begin fuzz testing on brute-force Gen-AI attack tool with fuzzing workflow. | 3/6 | 3/7 | Noah | Will | 9.2 |
| 10.1 | Perform LDRA static analysis on the set of Gen-AI brute-force attack tools using TestBed. | 2/28 | 3/7 | Will | Noah | 7.1, 7.3 |
| 10.2 | Perform memory leak analysis on the set of Gen-AI brute-force attack tools using Valgrind. | 2/28 | 3/7 | Adam | Noah | 7.1, 7.3 |
| 11.1 | Prompt Phind model for multi-threaded banner-grabbing attack tool. | 3/7 | 3/13 | Will | Noah | 7.2, 7.4 |
| 11.2 | Debug Phind multi-threaded banner-grabbing attack tool until it compiles with afl-gcc. | 3/13 | 3/14 | Will | Noah | 11.1 |
| 11.3 | Prompt Copilot model for multi-threaded banner-grabbing attack tool. | 3/7 | 3/13 | Adam | Noah | 7.2, 7.4 |
| 11.4 | Debug Copilot multi-threaded banner-grabbing attack tool until it compiles with afl-gcc. | 3/13 | 3/14 | Adam | Noah | 11.3 |
| 12.1 | Compare code structure & fuzzing results of the Gen-AI brute-force attack tools. | 3/7 | 3/12 | Noah | Will | 11.1, 11.3 |
| 12.2 | Compile analysis & add results into existing report. | 3/12 | 3/14 | Noah | Adam | 12.1 |
| 13.1 | Integrate the Copilot & Phind multi-threaded banner-grabbing attack tools into fuzzing workflow script. | 3/14 | 3/19 | Noah | Adam | 11.2, 11.4 |
| 13.2 | Debug AFLnet integration with the multi-threaded banner-grabbing attack tools from both models. | 3/19 | 3/20 | Noah | Will | 13.1 |
| 13.3 | Begin fuzz testing on the Gen-AI multi-threaded banner-grabbing attack tool with fuzzing workflow. | 3/20 | 3/21 | Noah | Adam | 13.2 |
| 14.1 | Perform LDRA static analysis on the set of Gen-AI multi-threaded banner-grabbing attack tools using Testbed | 3/14 | 3/21 | Adam | Noah | 11.2, 11.4 |
| 14.2 | Perform memory leak analysis on the set of Gen-AI multi-threaded banner-grabbing attack tools using Valgrind. | 3/14 | 3/21 | Will | Noah | 11.2, 11.4 |
| 15.1 | Compare code structure & fuzzing results of the Gen-AI multi-threaded banner-grabbing attack tools. | 3/14 | 3/19 | Noah | Adam | 11.2, 11.4 |
| 15.2 | Compile analysis & add results into existing report. | 3/19 | 3/21 | Noah | Will | 15.1 |
| 16.1 | Develop network traffic receiver with Scapy or Pyshark libraries. | 3/21 | 3/28 | Noah | Adam | 2.2, 2.4, 4.1 |
| 16.2 | Develop network traffic sending module with Scapy or Pyshark libraries. | 3/21 | 3/28 | Will | Noah | 2.2, 2.4, 4.1 |
| 17.1 | Compile & analyze all LDRA & Valgrind results. | 3/29 | 3/30 | Adam | Noah | 6.1, 6.2, 10.1, 10.2, 14.1, 14.2 |
| 17.2 | Document results & add into comparison report. | 3/30 | 4/3 | Adam | Will | 17.1 |
| 17.3 | Finalize comparison report. | 4/3 | 4/4 | Adam | Noah | 17.2 |
| 18.1 | Unit tests on accuracy of network module of Python service. | 3/28 | 4/1 | Adam | Noah | 4.3, 16.1, 16.2 |
| 18.2 | Unit tests on Python service error handling capability. | 4/1 | 4/2 | Will | Noah | 2.4 |
| 18.3 | Unit tests on Python service logging module functionality. | 4/1 | 4/2 | Adam | Noah | 2.4 |
| 18.4 | Unit tests on Fuzzing workflow application to Masscan. | 4/2 | 4/3 | Noah | Adam | 1.3 |
| 18.5 | Unit tests on fuzzing workflow application to Gen-AI attack tools. | 4/3 | 4/4 | Noah | Will | 5.1, 9.1, 13.1 |
| 19.1 | Compile & analyze Masscan Tsan fuzzing results | 3/28 | 4/2 | Noah | Adam | 1.3, 17.2 |
| 19.2 | Write results report & add to existing Gen-AI comparison report. | 4/2 | 4/4 | Noah | Will | 17.2, 19.1 |
| 20.1 | Integration tests on fuzzing workflow application to attack tools for generating active defense responses. | 4/4 | 4/6 | Will | Noah | 1.3, 5.3, 18.5 |
| 20.2 | Integration tests for Python service retrieving, handling, & formatting responses from fuzz testing. | 4/4 | 4/11 | Adam | Noah | 18.1, 18.2, 18.3 |
| 20.3 | Integration tests on Python service network send & receive functionality to & from the attacking machine. | 4/6 | 4/8 | Will | Noah | 18.1, 18.2, 18.3 |
| 20.4 | Integration tests on the capability of Python service sending active defense responses to attacking machine. | 4/8 | 4/11 | Will | Noah | 20.3 |
| 21.1 | Acceptance tests with results compiled into IEEE paper | 4/11 | 4/25 | Noah | Adam | 20.4 |
| 21.2 | Acceptance tests that fuzzing workflow applies to multiple attack tools. | 4/11 | 4/16 | Adam | Will | 20.1 |
| 21.3 | Acceptance tests that Python service detects incoming network traffic from attacking machine to the victim. | 4/11 | 4/18 | Noah | Will | 20.4 |
| 21.4 | Acceptance tests that Python service sends active defense responses to counter the attacking tool. | 4/11 | 4/18 | Will | Adam | 20.4 |
| 21.5 | Acceptance test that offensive tool crashes or hangs from active defense response, if a vulnerability is found. | 4/16 | 4/18 | Adam | Noah | 20.4 |

### Milestones

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| # | Milestone | End Date |
| 1 | Masscan with ThreadSanitizer Integrated Into Fuzzing Workflow | 1/31 |
| 2 | Python Service User Interface Developed | 2/3 |
| 3 | Python Service Logger Module Developed | 2/7 |
| 4 | Gen-AI Attack Tools Banner-Grabber Developed | 2/14 |
| 5 | Python Service Response Handling Module Developed | 2/14 |
| 6 | Fuzzing Workflow Applied to Gen-AI Banner-Grabber Attack Tools | 2/21 |
| 7 | Static Analysis Performed on Gen-AI Banner-Grabber Attack Tools | 2/21 |
| 8 | Gen-AI Brute-Force Attack Tools Developed | 2/28 |
| 9 | Results of Analysis & Fuzzing on Gen-AI Banner-Grabber Attack Tools Compared | 2/28 |
| 10 | Fuzzing Workflow Applied to Gen-AI Brute-Force Attack Tools | 3/7 |
| 11 | Static Analysis Performed on Gen-AI Brute-Force Attack Tools | 3/7 |
| 12 | Gen-AI Multi-threaded Banner-Grabber Attack Tools Developed | 3/14 |
| 13 | Results of Analysis & Fuzzing on Gen-AI Brute-Force Attack Tools Compared | 3/14 |
| 14 | Fuzzing Workflow Applied to Gen-AI Multi-threaded Banner-Grabber Attack Tools | 3/21 |
| 15 | Static Analysis Performed on Gen-AI Multi-threaded Banner-Grabber Attack Tools | 3/21 |
| 16 | Results of Analysis & Fuzzing on Gen-AI Brute-Force Attack Tools Compared | 3/21 |
| 17 | Python Service Network Receiver Module Developed | 3/28 |
| 18 | Python Service Network Sender Module Developed | 3/28 |
| 19 | Gen-AI Comparison Report Complete | 4/4 |
| 20 | Unit Testing Complete | 4/4 |
| 21 | Masscan ThreadSanitizer Fuzz Results Analyzed | 4/4 |
| 22 | Integration Testing Complete | 4/11 |
| 23 | Acceptance Testing Complete | 4/18 |
| 24 | IEEE Conference Paper Written | 4/25 |
| 25 | Documentation & GitHub Repository Updated | 5/2 |