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Project Title	Studying link-time optimizations in programming language development to facilitate the continuum of static and dynamic modules.		

1 Project Objectives

The goal of this project is to develop a proof-of-concept programming language that facilitates bespoke optimization techniques via novel language constructs. The specific objective is to research the continuum of static and dynamic modules in low-level software development. A module system will be designed to promote dispatch flexibility by abstracting away the underlying dispatch mechanism, enabling aggressive link-time optimizations when circumstances allow. The development of a prototype compiler will demonstrate the efficacy of the proposed solution.

Success will be evidenced by:

- (1) A functional compiler that implements the designed module system;
- (2) Documentation of the module system and other core language features;
- (3) A simple IDE extension that provides syntax highlighting to the programmer;
- (4) A body of research into the continuum of static and dynamic modules in software development, with kernel development as a case study;
- (5) An implementation of link-time optimization techniques that leverage the designed module system;
- (6) An evaluation of the effectiveness of these optimizations through the benchmarking of sample programs;
- (7) A monorepo containing extensive git history, demonstrating ongoing development progress.
- (8) A final written report detailing the research, design, implementation and evaluation of the project.

2 Description of Work Completed

2.1 Evidence of Work Completed

2.2 Literature Review

2.3 Use of GenAI and Tools

Two notable GenAI tools have been used to assist with the research and development of this project so far.

- (1) The first is [t3.chat](#), a web application that consolidates numerous large language models into a streamlined chat interface [1]. The user can experiment with different models to understand which models are best suited for the task at hand. Both research and programming tasks have benefited from the use of this tool. The tool was primarily used to steer the work in the right direction and to identify the concepts, libraries and resources through which further research could be conducted. For transparency, all LLM prompts have been included in **Appendix B**.
- (2) The second is the tab-complete feature of GitHub Copilot, which

3 Future Work

References

- [1] “Meet T3 Chat AI: Your All-in-One, Super-Fast AI Assistant,” DigiVirus. <https://digivirus.in/meet-t3-chat-ai-your-all-in-one-super-fast-ai-assistant/>

A Appendix: Source Code

B Appendix: LLM Prompts