

# Chapter 1

## Table of contents

- 1 Introduction
  - 1.1 Motivation
  - 1.2 Problem Definition
  - 1.3 Research Questions
  - 1.4 Non-Goals
  - 1.5 Research Methodology
  - 1.6 Structure of the thesis
- 2 Background
  - 2.1 Language Server Protocol
    - \* 2.1.1 JSON-RPC
    - \* 2.1.2 Commands and Notifications
    - \* 2.1.3 Description of Key Methods
      - 2.1.3.1 Code Completion
      - 2.1.3.2 Hover
      - 2.1.3.3 Jump to Definition
      - 2.1.3.4 Find References
      - 2.1.3.5 Workspace/Document symbols
      - 2.1.3.6 Diagnostics
    - \* 2.1.4 File Processing
  - 2.2 Text based Configuration
    - \* 2.2.1 Common Configuration Languages
      - 2.2.1.1 JSON
      - 2.2.1.2 YAML
    - \* 2.2.2 Applications of Configuration Languages
    - \* 2.2.3 Configuration Programming Languages
    - \* 2.2.4 Infrastructure as Code
    - \* 2.2.5 Nickel
      - 2.2.5.1 Nickel AST
      - 2.2.5.2 Record Merging
      - 2.2.5.3 Gradual typing
      - 2.2.5.4 Contracts
- 3 Related work
  - 3.1 IDE Support

- \* 3.1.1 Native and Plugin Systems
  - \* 3.1.2 Server Client Abstractions
    - 3.1.2.1 Monto
    - 3.1.2.2 Merlin
- 3.2 Language Servers
  - \* 3.2.1 Integrating with the Compiler/Runtime
    - 3.2.1.1 HLS
    - 3.2.1.2 Ocaml LSP
    - 3.2.1.3 Rust-Analyzer
    - 3.2.1.4 Frege LSP
    - 3.2.1.5 Runtime-independent LSP implementations
    - 3.2.1.6 Language Server as an Interface to CLI tools
    - 3.2.1.7 CPAchecker
    - 3.2.1.8 CodeCompass
  - \* 3.2.2 Language Servers generation for Domain Specific Languages
- 3.3 Alternative approaches
  - \* 3.3.1 LSP Extensions
  - \* 3.3.2 Language Server Index Format
  - \* 3.3.3 Abstracting software development processes
- 3.4 References
- 4 Design and Implementation
  - 4.1 Key Objectives
    - \* 4.1.1 Performance
    - \* 4.1.2 Capability
    - \* 4.1.3 Flexibility
    - \* 4.1.4 Generalizability
  - 4.2 Design Decisions
    - \* 4.2.1 Programming language
    - \* 4.2.2 File processing
    - \* 4.2.3 Code Analysis
  - 4.3 High-Level Architecture
  - 4.4 Illustrative example
  - 4.5 Linearization
    - \* 4.5.1 States
    - \* 4.5.2 Transfer from AST
      - 4.5.2.1 Usage Graph
      - 4.5.2.2 Scopes
      - 4.5.2.3 Linearizer
      - 4.5.2.4 Linearization Process
    - \* 4.5.3 Post-Processing
      - 4.5.3.1 Sorting
      - 4.5.3.2 Resolving deferred access
      - 4.5.3.3 Resolving types
    - \* 4.5.4 Resolving Elements
      - 4.5.4.1 Resolving by position
      - 4.5.4.2 Resolving by ID
      - 4.5.4.3 Resolving by scope
  - 4.6 LSP Server Implementation
    - \* 4.6.1 Server Interface
    - \* 4.6.2 Diagnostics and Caching

- \* 4.6.3 Commands
      - 4.6.3.1 Hover
      - 4.6.3.2 Jump to Definition and Show references
      - 4.6.3.3 Completion
      - 4.6.3.4 Document Symbols
- 5 Evaluation
  - 5.1 Evaluation Considerations
  - 5.2 Methods
    - \* 5.2.1 Objectives
    - \* 5.2.2 Qualitative Evaluation Setup
      - 5.2.2.1 Pre-Evaluation
      - 5.2.2.2 Experience Survey
    - \* 5.2.3 Quantitative
  - 5.3 Results
    - \* 5.3.1 Qualitative
      - 5.3.1.1 Pre-Evaluation
      - 5.3.1.2 Experience Survey
    - \* 5.3.2 Quantitative
      - 5.3.2.1 Dataset
      - 5.3.2.2 Big Picture Latencies
      - 5.3.2.3 Special cases
  - 5.4 Discussion
    - \* 5.4.1 Diagnostics
    - \* 5.4.2 Cross File Navigation
    - \* 5.4.3 Autocompletion
    - \* 5.4.4 Performance
- 6 Discussion
  - 6.1 Project results
  - 6.2 Project shortcomings
  - Future Work

