Compilers Research

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1 Preface

This resource aims to document and formalize aspects of the compilers research project that I am undertaking. It will be regularly updated as the project evolves so as to reflect the most recent and relevant decisions.

2 Overview

This research project is an attempt to develop a programming language for describing hardware and an accompanying compiler. Currently, hardware description languages lack features that would improve ease of expression and modularity and reduce the potential for errors during execution, such as strongly typed systems, parametric polymorphism, and user-defined datatypes. Although there exist languages that strive to provide these primitives, they do not fully consider the semantics of hardware design. The compiler developed through this research project will use the newly developed language as the source and compile to Verilog as the target.

3 Formalizing the Dichotomy

As mentioned in Section 2, the dichotomy between the software and hardware components should be formalized so as to develop a language that respects both entities appropriately.

3.1 SW and HW types

We will first formalize the definitions of the two kinds of data types: software (SW) and hardware (HW):

```
hw = bit
   | hw[]
   | (hw * hw)
```

(a) HW types

```
sw = int
   | string
   | hw
   | sw list
   | (sw * sw)
   | sw -> sw
```

(b) SW types

Figure 1: Type definitions