

THE SETUP PROGRAMMING LANGUAGE

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Overview and Motivation

Setup is a language for manipulating sets and tuples

Overview

- Uses *C-style* syntax
- Additional *tuple* and *set* objects
- Elementary operations on sets are supported (e.g., union, intersection, set-difference)

Motivation

- The language of set theory is widely-used in mathematics and science
- Programs can be written quickly without verbose code
- Natural and intuitive way to think about large data sets

Objectives

In creating Setup, we had three objectives in mind

Objectives

- 1 Create, modify and manipulate sets and tuples in a natural and intuitive way
- 2 Minimal code generation
- 3 Allow for both ordered and unordered collections of data

The Basics

Basic Elements of our Language

Primitives	Objects	Set Operators
int	set	union
string	tuple	intersect
double		cross
bool		minus
		#

- The usual arithmetic operations $+$, $-$, $*$, $/$ are provided
- The $+$ operator is overloaded for string concatenation

Sets and Tuples

Tuples

```
((1,"a"),2) //type: ((int,str),int)  
((1,2),3) //type: ((int,int),int)
```

Set Initialization

```
set A = {4, 5, 6};  
set B = {1 ... 6};  
set C = { (x,y) | x in A, y in B };
```

Example Functions

Functions

```
function main[] returns int { /* ... */ }  
function symDiff[set A, set B] returns set {  
    return (A union B) minus (A intersect B); }
```

- Execution begins with `main`
- Functions must be defined before they are called
- Function definition nesting is not permitted

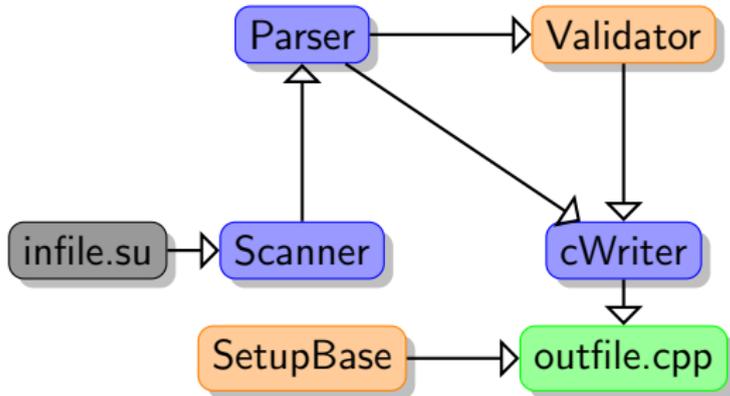


Figure: Overview of Setup Compiler

Implementation

Implementation

- Compiler can verify most type assignments by looking in a single frame of function context
- Setup supports a compact syntax we call the Set Builder expressions
- Set Builder has a lambda style syntax
- Variables are defined by the result of an expression evaluation

Lessons Learned

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- Do not underestimate the task of building a compiler
- Just because the road is at first downhill, does not mean it does not lead to a cliff