

The Whiley Language Specification

David J. Pearce
School of Engineering and Computer Science
Victoria University of Wellington, New Zealand
djp@ecs.vuw.ac.nz

January 2, 2014

Contents

1	Introduction	3
1.1	Overview	3
1.2	Goals	3
1.3	History	3
2	Lexical Structure	4
2.1	Indentation	4
2.2	Blocks	4
2.3	Whitespace	4
2.4	Identifiers	4
3	Compilation Units	5
3.1	Type Declarations	5
3.2	Constant Declarations	5
3.3	Function & Method Declarations	5
3.4	Visibility Modifiers	5
3.5	Packages	5
3.6	Imports	5
4	Types	6
4.1	Overview	6
4.2	Primitives	6
4.2.1	Any Type	6
4.2.2	Void Type	7
4.2.3	Null Type	7
4.2.4	Bool Type	7
4.2.5	Char Type	8
4.2.6	Int Type	8
4.2.7	Real Type	8
4.3	Tuple Types	8
4.4	Record Types	9
4.5	Reference Types	9
4.6	Nominal Types	9
4.7	Collection Types	10
4.7.1	Set Type	10
4.7.2	Map Type	10
4.7.3	List Type	10
4.8	Union Types	10
4.9	Intersection Types	11
4.10	Negation Types	11
4.11	Subtyping	11

5	Expressions	12
5.1	Binary Expressions	12
6	Statements	14
6.1	Variable Declarations	14
6.2	Assign Statements	14
6.3	Return Statements	14
6.4	If/Else Statements	14
6.5	While Statements	14
6.6	Do/While Statements	14
6.7	For Statements	14
6.8	Switch Statements	14
6.9	Try/Catch Statements	14

Chapter 1

Introduction

1.1 Overview

1.2 Goals

1.3 History

Chapter 2

Lexical Structure

2.1 Indentation

2.2 Blocks

2.3 Whitespace

2.4 Identifiers

Chapter 3

Compilation Units

3.1 Type Declarations

3.2 Constant Declarations

3.3 Function & Method Declarations

3.4 Visibility Modifiers

3.5 Packages

3.6 Imports

Chapter 4

Types

4.1 Overview

Discuss syntactic versus semantic types.

```
Type ::=
| PrimitiveType
| TupleType
| RecordType
| ReferenceType
| NominalType
| CollectionType
| UnionType
| IntersectionType
| NegationType
```

4.2 Primitives

```
PrimitiveType ::=
| AnyType
| VoidType
| NullType
| BoolType
| CharType
| IntType
| RealType
```

4.2.1 Any Type

```
AnyType ::= any
```

Description.

Examples.

Semantics.

Notes.

4.2.2 Void Type

```
VoidType ::= void
```

Description. The **void** type represents the type whose variables cannot exist! That is, they cannot hold any possible value. Void is used to represent the return type of a function which does not return anything. However, it is also used to represent the element type of an empty list or set.

Examples.

Semantics.

Notes. The void type is a subtype of everything; that is, it is bottom in the type lattice.

4.2.3 Null Type

```
NullType ::= null
```

Description.

Examples.

Semantics.

Notes.

4.2.4 Bool Type

```
BoolType ::= bool
```

Description.

Examples.

Semantics.

Notes.

4.2.5 Char Type

```
CharType ::= char
```

Description.

Examples.

Semantics.

Notes.

4.2.6 Int Type

```
IntType ::= int
```

Description.

Examples.

Semantics.

Notes.

4.2.7 Real Type

```
RealType ::= real
```

Description.

Examples.

Semantics.

Notes.

4.3 Tuple Types

```
TupleType ::= ( Type ( , Type ) * )
```

Description.

Examples.

Semantics.

Notes.

4.4 Record Types

```
RecordType ::= { Type Identifier ( , Type Identifier ) * }
```

Description.

Examples.

Semantics.

Notes.

4.5 Reference Types

```
ReferenceType ::= & Type
```

Description.

Examples.

Semantics.

Notes.

4.6 Nominal Types

```
NominalType ::= Identifier
```

Description.

Examples.

Semantics.

Notes.

4.7 Collection Types

4.7.1 Set Type

```
SetType ::= { Type }
```

Description.

Examples.

Semantics.

Notes.

4.7.2 Map Type

```
MapType ::= { Type => Type }
```

Description.

Examples.

Semantics.

Notes.

4.7.3 List Type

```
ListType ::= [ Type ]
```

Description.

Examples.

Semantics.

Notes.

4.8 Union Types

```
UnionType ::= IntersectionType ( | IntersectionType )+
```

Description.

Examples.

Semantics.

Notes.

4.9 Intersection Types

$$\text{IntersectionType} ::= \text{TermType} (\boxed{\&} \text{TermType})^+$$

Description.

Examples.

Semantics.

Notes.

4.10 Negation Types

$$\text{NegationType} ::= \boxed{!} \text{Type}$$

Description.

Examples.

Semantics.

Notes.

4.11 Subtyping

Discussion or present subtyping algorithm?

Expr	::=	Cond [(&&) Expr]	// Expressions
Cond	::=	Append [Cop Expr]	// Condition Expressions
Append	::=	Range [++ Expr]	// Append Expressions
Range	::=	AddSub [.. Expr]	// Range Expressions
AddSub	::=	MulDiv [(+ -) Expr]	// Additive Expressions
MulDiv	::=	Index [(* / %) Expr]	// Multiplicative Expressions
Index	::=	???	// Index Expressions

Figure 5.1: Syntax for Binary Expressions

Chapter 5

Expressions

5.1 Binary Expressions

Term	::=	<i>// Terms</i>	
	<i>Constant</i>		<i>// Constant expressions</i>
	<i>Identifier</i>		<i>// Identifier expressions</i>
	$Expr_1 (, Expr_i)^+$		<i>// Tuple expressions</i>
	$(Expr)$		<i>// Bracketed expressions</i>
	$ Expr $		<i>// Size expressions</i>
	$Identifier ([Expr_1 (, Expr_i)^+])$		<i>// Invocation expressions</i>
	$([- ! \sim \& *] Expr)$		<i>// Unary expressions</i>
	$new Expr$		<i>// Allocation expressions</i>
	$\{ [Expr_1 (, Expr_i)^*] \}$		<i>// Set expressions</i>
	$\{ [Expr_1 \Rightarrow Expr'_1 (, Expr_i \Rightarrow Expr'_i)^*] \}$		<i>// Map expressions</i>
	$[[Expr_1 (, Expr_i)^*]]$		<i>// List expressions</i>
	$\{ [n_1 : Expr_1 (, n_i : Expr_i)^*] \}$		<i>// Record expressions</i>

Figure 5.2: Syntax for Term Expressions

Constant	::=	<i>// Constants</i>	
	$([0 1])^+ b$		<i>// Boolean constants</i>
	$([0-9])^+$		<i>// Integer constants</i>
	$([0-9])^+ . ([0-9])^+$		<i>// Decimal constants</i>
	$null$		<i>// Null constant</i>

Figure 5.3: Syntax for Constant Expressions

Identifier	::=	$([- a-z A-Z] ([- a-z A-Z 0-9])^*)$	<i>// Identifiers</i>
-------------------	------------	-------------------------------------------------------	-----------------------

Figure 5.4: Syntax for Identifiers

Chapter 6

Statements

6.1 Variable Declarations

6.2 Assign Statements

6.3 Return Statements

6.4 If/Else Statements

6.5 While Statements

6.6 Do/While Statements

6.7 For Statements

6.8 Switch Statements

6.9 Try/Catch Statements