

Core-TyCO
Appendix to the Language
Definition,
yielding Version 0.2

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This is the third report on TyCO [2], a (still) experimental strongly and implicitly typed concurrent object based programming language based on a predicative polymorphic calculus of objects [1, 3], featuring asynchronous messages, objects, and procedures, together with a predicative polymorphic typing assignment system, assigning monomorphic types to variables and polymorphic types to procedures.

With respect to version 0.2, version 0.3 introduces

1. slight changes to the concrete syntax,
2. new derived constructors,
3. floating point numbers,
4. nested comments,
5. a means to split a program amongst different files, and
6. a clarification on the ambiguous nature of the syntax for processes.

Static and dynamic semantics of the language are not changed.

1 Syntax

1.1 Reserved words

Keywords `case`, `of`, and `/=` replace `switch`, `into`, and `<>`, respectively. New reserved words are: `tofloat`, `hd`, `tl`, `;`, and `..`.

1.2 Literals

An *integer constant* is given by the regular expression `0|[1-9]{digit}*`, where `{digit}` is the regular expression `[0-9]`.

Floating point constants are given by the regular expression `({integer}{digit}+)([eE][+-]?{digit}+)?`.

String constants are sequences of character enclosed between quotes (`"`). The following *escape sequences* are now supported: `\\`, `\'`, `\\\`, `\\n`, `\\t`, `\\a`, `\\b`, `\\f`, `\\r`, `\\v`.

1.3 Grammar

Different *binds* are now longer separated by reserved word **and**. Comma does not separate *methods*. Syntactic categories for *bind* and *method* are now as follows.

$$\begin{aligned} multbind & ::= bind \langle multbind \rangle && \text{multiple binding} \\ methrow & ::= method \langle methrow \rangle && \text{method row} \end{aligned}$$

1.4 Comments

TyCO now also permits *nested* comments, which start with `{-` and extend until the next unmatched `-}`.

1.5 Derived forms

The following syntactic category helps in defining the newly introduced derived constructors.

$$C ::= a!\langle l \rangle \quad | \quad X \quad \text{application}$$

Below variables z, z_1, \dots, z_n are taken freshly, and ($n \geq 1$).

$$\begin{aligned} app[\langle expseq \rangle] ; proc & \implies new\ z\ app[\langle expseq \rangle z] \mid proc\ new\ z \\ (\langle varseq \rangle) : proc & \implies (\langle varseq \rangle z) : z! [\] \mid proc \\ let\ varseq_1 = app_1[\langle expseq_1 \rangle] & \implies new\ z_1, app_1[\langle expseq_1 \rangle, z_1] \mid \dots \\ \dots varseq_n = app_n[\langle expseq_n \rangle] & \implies new\ z_n\ app_n[\langle expseq_n \rangle, z_n] \mid \\ in\ proc & \implies z_n?(\langle varseq_n \rangle) = \dots \\ & \implies z_1?(\langle varseq_1 \rangle) = proc \end{aligned}$$

The underscore may be used in any *varseq*, including, for example, `let` processes.

1.6 Syntactic restrictions for derived forms

1. In `let varseq1 = app1(expseq1) ... varseqn = appn(expseqn) in proc`, the sequence of bindings `varseq1 ... varseqn` may not contain the same variable twice.

1.7 File inclusion

The two tokens `include` `aFile` are replaced, at parsing time, by the contents of file `aFile`.

2 Static semantics

2.1 Types for primitive operations and objects

```
+      : float float → float
-      : float float → float
*      : float float → float
/      : float float → float
-      : float       → float

hd     : string      → string
tl     : string      → string

tofloat : int        → float
```

Equality/inequality $=$, \neq — are defined on all types. Relational operators $<$, \leq , $>$, \geq — available also for floating point numbers.

The basic stream based I/O primitive object gets a six new methods; three of them change type.

```
io : {getb : () → bool
      putb : bool → ()
      printb : bool
      geti : () → int
      puti : int → ()
      printi : int
      gets : () → string
      puts : string → ()
      prints : string
      getf : () → float
      putf : float → ()
      printf : float}
```

References

- [1] Vasco T. Vasconcelos. A predicative polymorphic type for a calculus of objects. In *Type Theory and its Applications to Computer Systems*, number 851 in RIMS Lecture Notes, pages 78–87. Kyoto University, July 1993.
- [2] Vasco T. Vasconcelos and Rui Bastos. Core-TyCO, the language definition, version 0.1. DI/FCUL TR 98-3, Department of Informatics, Faculty of Sciences, University of Lisbon, March 1998.
- [3] Vasco T. Vasconcelos and Mario Tokoro. A typing system for a calculus of objects. In *1st International Symposium on Object Technologies for Advanced Software*, volume 472 of *LNCS*, pages 460–474. Springer-Verlag, November 1993.